Acoustic Telemetry Modems

User's Manual

P/N 003452, Rev. C

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Preface

Congratulations on your purchase of a Benthos Series Acoustic Telemetry Modem! The ATM-880 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 requirements.

This manual provides information on setting up, testing, and operating the ATM-880 Series Acoustic Telemetry Modems. It is divided into the following nine sections:

Section 1 - Overview reviews the different modem configurations available and describes the two advanced modulation techniques used by the modems.

Section 2 - Specifications lists the specifications for the modems, the modem transducers, and the modem battery packs.

Section 3 - Deployment Considerations reviews some important installation factors to ensure the best possible performance from the modems.

Section 4 - Setup and Test provides instructions for unpacking, setting up, and testing the modems, and includes some simple procedures to verify that commands and data are correctly transmitted and received.

Section 5 - Telesonar PC provides installation and operating instructions for Telesonar PC, a graphical users interface (GUI) that provides a user friendly means of configuring and operating the modems in a Windows environment.

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.

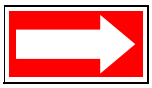
Section 7 - Modem Operating Parameters (S Registers) provides detailed descriptions of the modem operating parameters, or S Registers, and how to set them.

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

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

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 ATM-880 Series Acoustic Telemetry Modems.

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

Customer Service

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 ATM-880 Series Acoustic Telemetry Modems, or if you require service or support.

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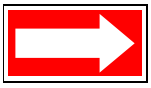
1 Overview

The Benthos acoustic telemetry modems include the Benthos ATM-880 Series Acoustic Telemetry Modems, along with remote transducers, printed circuit board sets, software, and other products in the Benthos "Telesonar" product line. The Benthos ATM-880 Series Acoustic Telemetry Modems provide wireless digital communications between deployed underwater instrument packages and surface or subsea platforms, or even shore-based stations, reliably exchanging data at baud rates as high as 2400 bits/sec. The ATM-880 Series Acoustic Telemetry Modems, which provide enhanced performance and additional features over that of the ATM-870 Series, are the latest addition to the Telesonar product line.



NOTE "Telesonar" is derived from the words telemetry and sonar, where telemetry is data transmission, and the word sonar, a general term for the applications of underwater sound, was derived many years ago from the acronym for *so*und *na*vigation and *r*anging. Benthos manufactures and markets the ATM-880 Series Acoustic Telemetry Modems worldwide under the Telesonar product line name. The Telesonar product line also includes Telesonar PC, a Windows based software program that provides a user friendly means of configuring and operating the modems.

Applications for the ATM-880 Series Acoustic Telemetry Modems include remote monitoring of oceanographic sensors, control of autonomous underwater vehicles (AUVs), control of wellhead and pipeline valves, and two-way communications between nodes in an undersea network. The ATM-880 Series Acoustic Telemetry Modems are the most advanced, the most multipath and noise tolerant, and the most cost efficient ever available. In addition, 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 independent multiple frequency shift keying (MFSK) modulation techniques: 1-of-4 MFSK for high speed communications generally required by commercial users, and Hadamard MFSK, which is slower but more reliable in a high multipath environment.

This section provides an overview of the ATM-880 Series Acoustic Telemetry Modems, reviews a few of their many applications, and describes the high performance modulation techniques that are used.

ATM-880 Series vs. ATM-870 Series Acoustic Telemetry Modems

Both the ATM-880 Series and the ATM-870 Series Acoustic Telemetry Modems provide the same reliable high speed data communications. The ATM-880 Series, however, employs a new digital signal processor (DSP) chip that greatly increases the available processing power over that of the ATM-870 Series. The additional processing power improves some of the existing features and adds additional capability.

Some of the additional features provided by the ATM-880 Series Acoustic Telemetry Modems include the following:

One power source. Only a single battery pack or a single power supply voltage is required to power a modem.

Narrow band filter. A narrow band filter has been added to increase the signal-to-noise ratio (SNR) for each frequency band to eliminate signal jamming from out of band acoustic noise.

Windows compatibility for Telesonar PC. Telesonar PC can now run on both the Windows 98® and the Windows NT® platform.

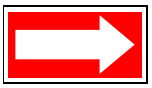
Provision for planned upgrades. The available processing power provides for planned future upgrades including 10,240-baud acoustic transmission rate.

Modem and Transducer Configurations

The ATM-880 Series Acoustic Telemetry Modems are organized into three main configuration groups: one group comprises the surface modems; another, the subsea modems; and a third, the remote transducers, which are used by both the surface and subsea modems.

The surface modems consist of three modem configurations: two deck boxes, where one is rack mountable, and a modem module. The subsea modems include modems with either built-in omnidirectional transducers or provisions for the use of any of the remote transducers. The remote transducers include three different types, each with unique beam patterns and available frequencies, and each with a built-in preamplifier and transmitter. In addition to the three main groups, two printed circuit board configurations are available for use in OEM applications. One configuration comprises a complete modem board set and a transducer. The other

configuration comprises a modem board set without the transmitter for use with one of the remote transducers.



NOTE The terms "remote modem" and "local modem" are used often in this manual, and their meaning is provided in several places. However, a "remote transducer" is a transducer that connects to a modem, whether it is considered to be a local modem or a remote modem.

Surface Modems

The surface modems consist of three configurations: an **ATM-881 Deck Box**, which connects to a surface host processor; an **ATM-881R Rack Mount Deck Box**, which is similar to the ATM-881 Deck Box but is rack mountable; and an **ATM-880 Module** which is designed for installation in surface buoys. Any of the modems can be used with any of the remote transducers.

ATM-881 Deck Box

The ATM-881 Deck Box is shown in Figure 1-1. The deck box, which is watertight with the cover closed, is used to communicate with any of the subsea modems—or another deck box—using one of the remote transducers as a dunking transducer. It is powered with 100–120 VAC, 50–60 Hz; 200–240 VAC, 50–60 Hz; or external 21–28 VDC, and includes AC and DC power cables and a 25-meter transducer cable. Optional 50-meter and 100-meter transducer cables are also available. In addition, the deck box can be connected to a host processor through its RS-232/422 serial port. The deck box also includes a keypad for entering commands and data, a display, and a speaker and volume control for audio verification of transmitted data.

ATM-881R Rack Mount Deck Box

The ATM-881R Rack Mount Deck Box is used to communicate with any of the subsea modems—or another deck box—using one of the remote transducers as a dunking transducer. However, the deck box is designed to be mounted in a standard 19-inch equipment rack. It is powered with 100–120 VAC, 50–60 Hz or 200–240 VAC, 50–60 Hz, and includes a 25-meter transducer cable. Optional 50-meter and 100-meter transducer cables are also available. In addition, the deck box can be connected to a host processor through its RS-232/422 serial port. The deck box also includes a speaker and volume control for audio verification of transmitted data, and provisions for the use or an external amplifier.

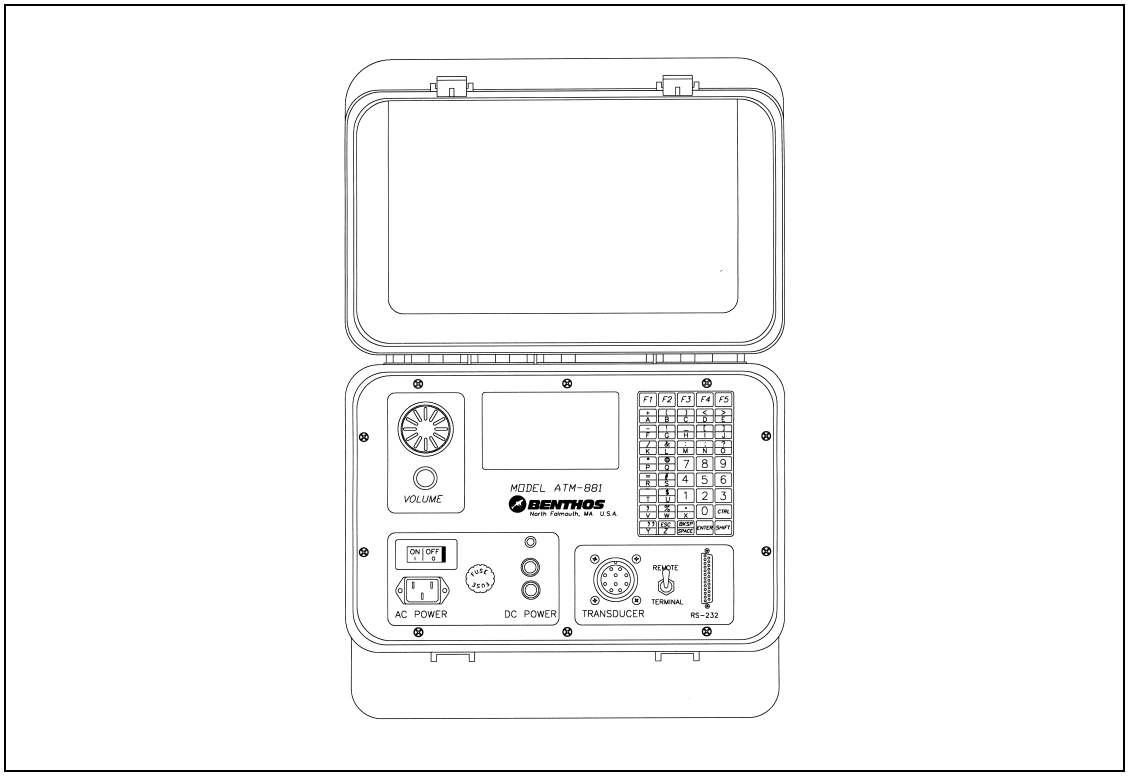


Figure 1-1 ATM-881 Deck Box

Model ATM-880 Module

The ATM-880 Module is designed to be installed in a surface buoy. It is housed in a NEMA weather resistant enclosure and includes a connector for one of the remote transducers, an RS-232 serial port connector for connecting to a host processor in the buoy, and an external DC power connector. When installed in a surface buoy and controlled by the host processor, the modem can communicate with other deployed modems. Information received from those modems is output to the host processor and can be transmitted over an RF link to a remote station. Similarly, the deployed modems can receive information from the remote station.

Subsea Modems

The subsea modems consist of four configurations: an **ATM-885 Acoustic Telemetry Modem**, which includes a built-in omnidirectional or directional transducer; an **ATM-885R Acoustic Telemetry Modem**, which connects to a remote transducer; an **ATM-887 Acoustic Telemetry Modem**, which is a full ocean depth modem; and an **ATM-887R Acoustic Telemetry Modem**, which is a full ocean depth modem that connects to a remote transducer. All the modems include an internal modem battery pack.

ATM-885 and ATM-885R Acoustic Telemetry Modems

The ATM-885 and ATM-885R Acoustic Telemetry Modems are shown in Figure 1-2. 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 transducer or a transmitter. Instead, a 2-meter cable pigtail is provided which connects from the transducer connector on the top end cap of the modem to any of the remote transducers.

Both the ATM-885 and the ATM-885R also include a power/serial connector that is installed on the bottom end cap. The connector is used to input external power for powering the modem instead of using its internal battery pack, and to connect to either an RS-232 or an RS-422 serial interface.

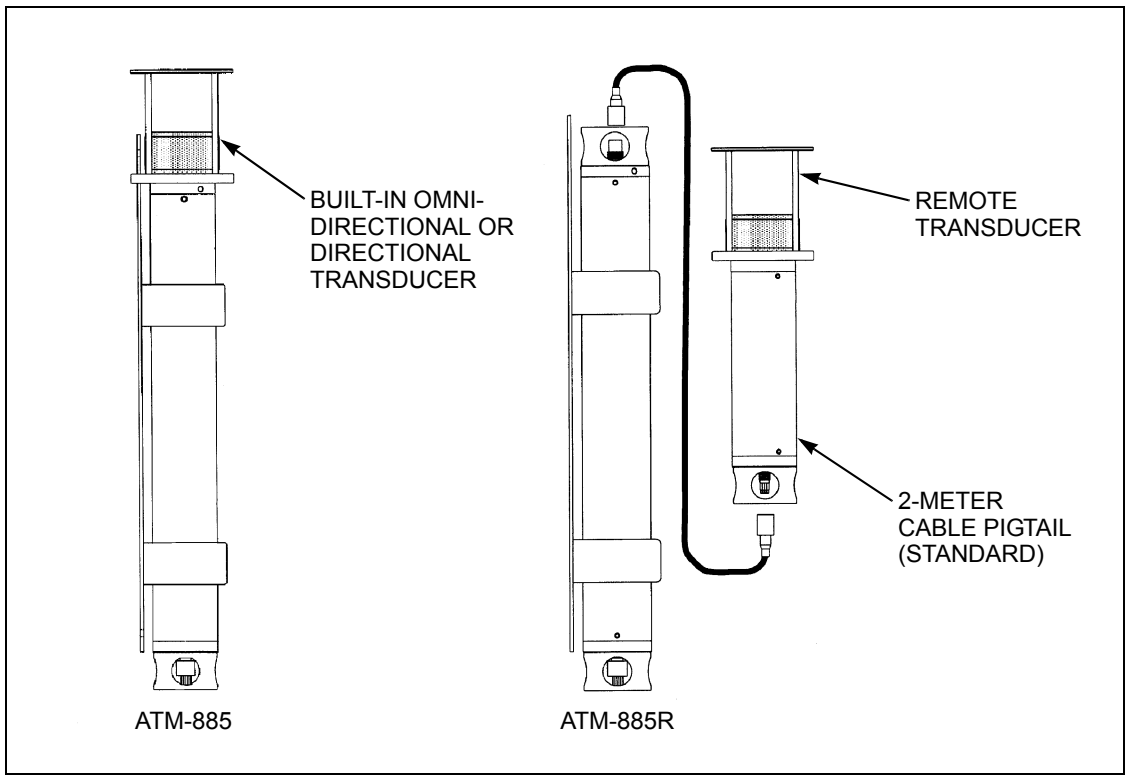


Figure 1-2 ATM-885 and ATM-885R Acoustic Telemetry Modems

ATM-887 and ATM-887R Acoustic Telemetry Modems

The ATM-887 and ATM-887R Acoustic Telemetry Modems are shown in Figure 1-3. The ATM-887 is completely self-contained and includes a modem battery pack and a built-in directional transducer that is specifically designed for full ocean depth applications. 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 transducer or a transmitter. Instead, a 2-meter cable pigtail is provided which connects from the transducer connector on the top end cap of the modem to an AT-421 remote transducer.

Both the ATM-887 and the ATM-887R also include power and serial connectors that are installed on the bottom end cap. The connectors are used to input external power for powering the modem instead of using its internal battery pack, and to connect to an RS-232 serial interface.

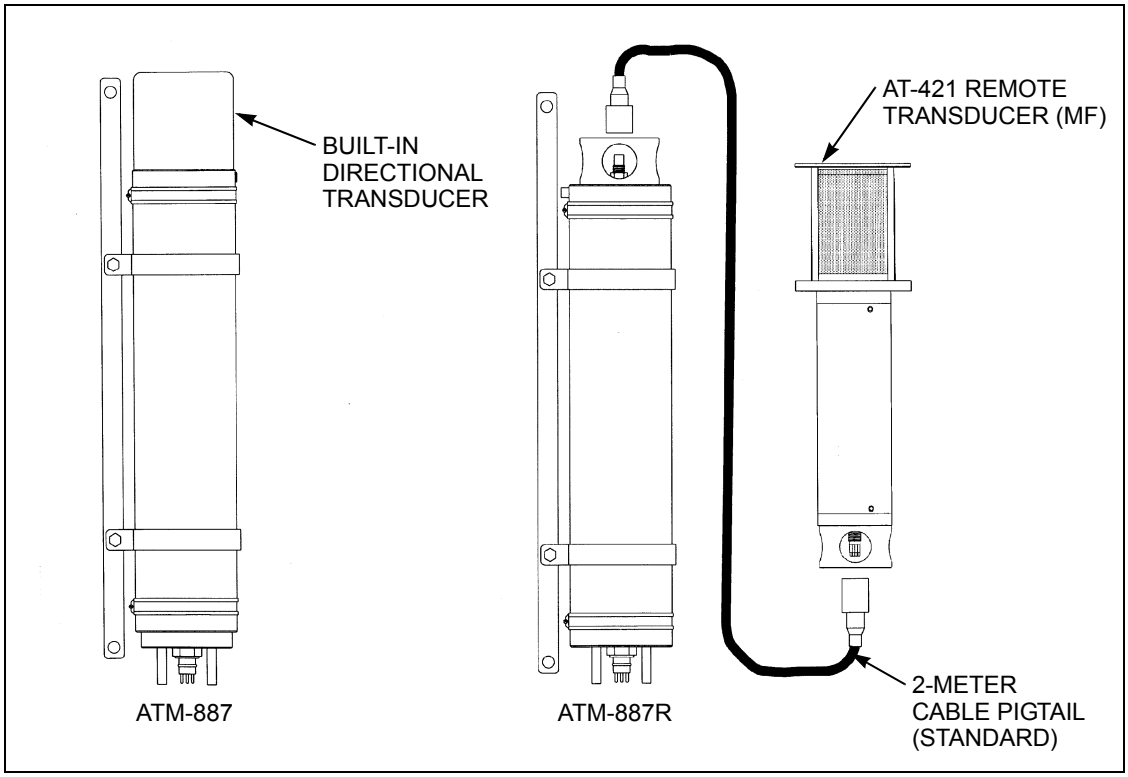


Figure 1-3 ATM-887 and ATM-887R Acoustic Telemetry Modems

Modem Board Sets

There are two modem printed circuit board (PCB) set configurations: the **ATM-885PCB** and **ATM-885PCB Modem Board Sets**, which include an omnidirectional transducer, and the **ATM-885RPCB** and **ATM-885RPCB Modem Board Sets**, which do not include a transmitter or a transducer.

ATM-885PCB Modem Board Set

The ATM-885PCB Modem Board Set is shown in Figure 1-4. The ATM-885PCB includes both a printed circuit board set mounted to a chassis and an omnidirectional transducer. It 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.

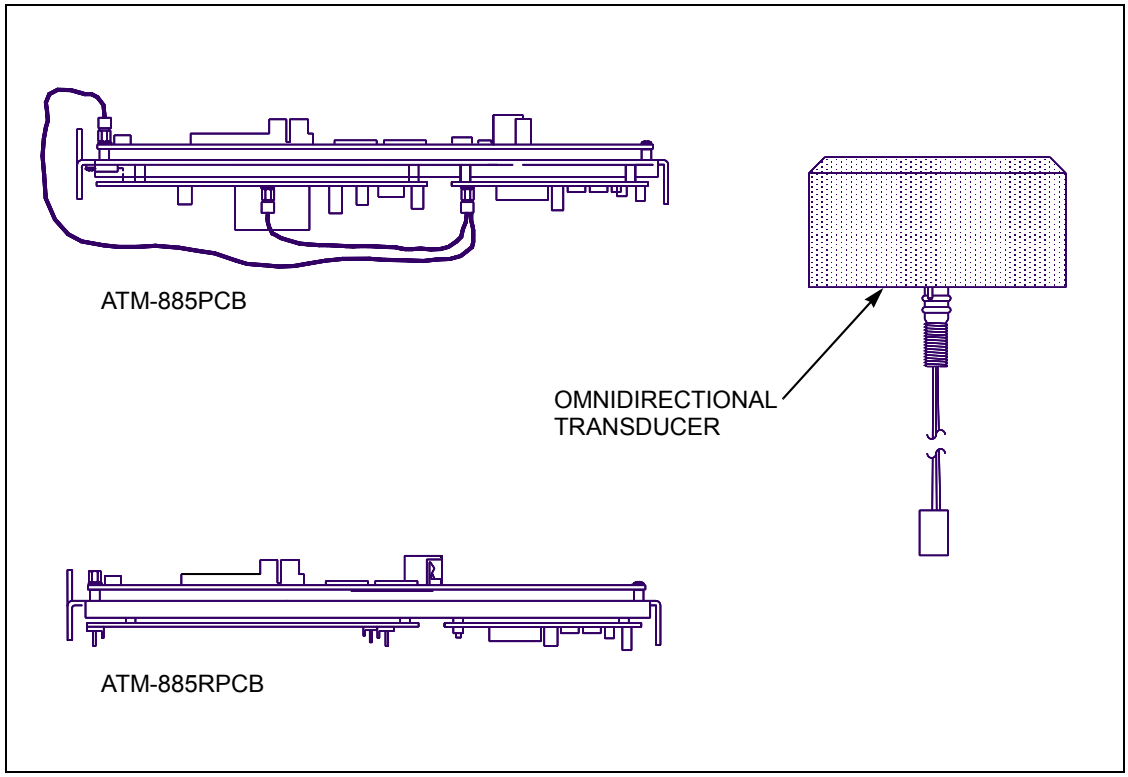


Figure 1-4 ATM-ATM-885PCB and ATM-885RPCB Modem Board Sets

ATM-885RPCB Modem Board Set

The ATM-885RPCB Modem Board Set is shown in Figure 1-4. The ATM-885RPCB is externally powered and is for OEM applications. However, the transmitter is not included, as the board set is specifically configured to connect directly to one of the remote transducers.

Remote Transducers

The remote transducers consist of three types: an **AT-408 Omnidirectional Transducer**, an **AT-409 Line Array Transducer**, and an **AT-421 Directional Transducer**. Each remote transducer includes a built-in preamplifier and transmitter.

AT-408 Omnidirectional Transducer

The AT-408 Omnidirectional Transducer is available in three frequency bands: 9–14 kHz (LF), 16–21 kHz (MF) and 25–30 kHz (HF). The AT-408 Omnidirectional Transducer provides omnidirectional 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 omnidirectional 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 AT-408 Omnidirectional Transducer and its typical vertical beam pattern is shown in Figure 1-5.

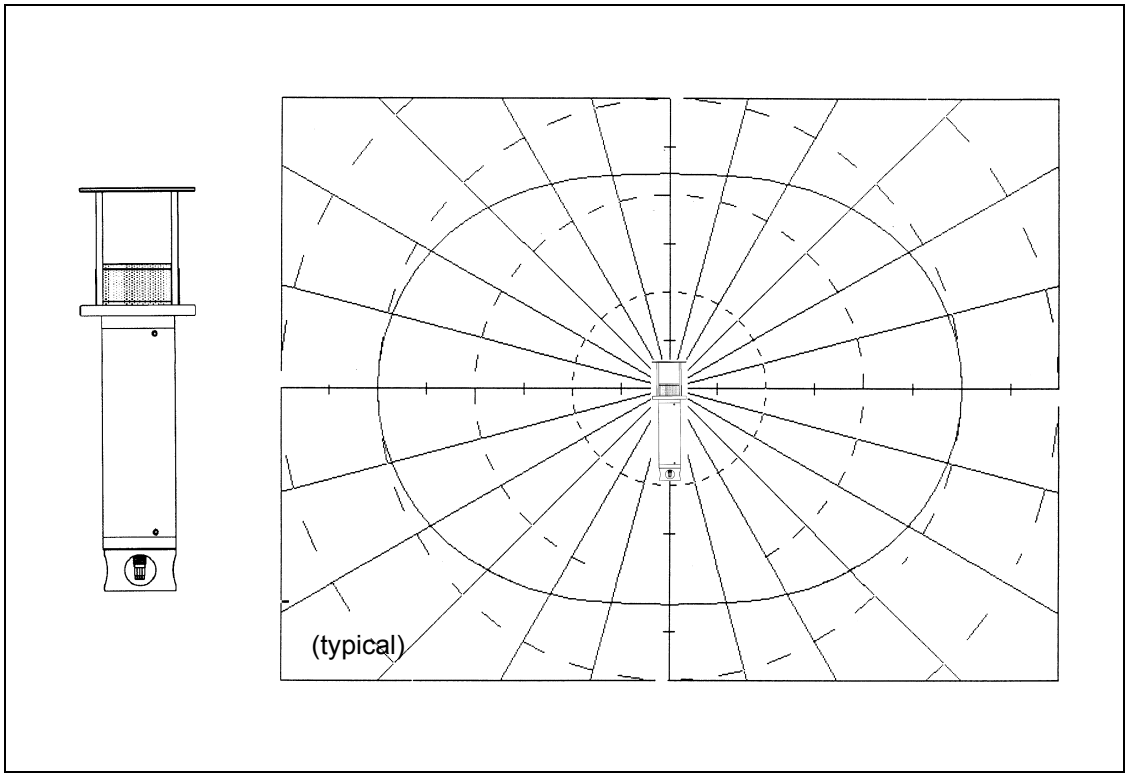


Figure 1-5 AT-408 Omnidirectional Transducer and Beam Pattern

AT-409 Line Array Transducer

The AT-409 Line Array Transducer is available in two frequency bands: 9–14 kHz (LF) and 16–21 kHz (MF). The AT-409 Line Array Transducer provides omnidirectional transmit and receive beam patterns in the horizontal plane, and directional transmit and receive beam patterns in the vertical plane. It is best used in applications where it can be installed at approximately the same depth as the receiving transducer, and where the bearing of the receiving transducer is unknown or is not fixed. Because of its narrow vertical beam, the AT-409 provides a larger directivity index than an omnidirectional transducer with the same input power level, as energy that would otherwise be directed vertically is instead applied horizontally. In addition, because less energy is directed vertically, multipath due to sea surface and sea floor reflections is minimized. However, because the AT-409 is omnidirectional in the horizontal plane, its source level is still less than a directional transducer with the same input power level, as the energy is more widely distributed. The AT-409 Line Array Transducer and its typical vertical beam pattern is shown in Figure 1-6.

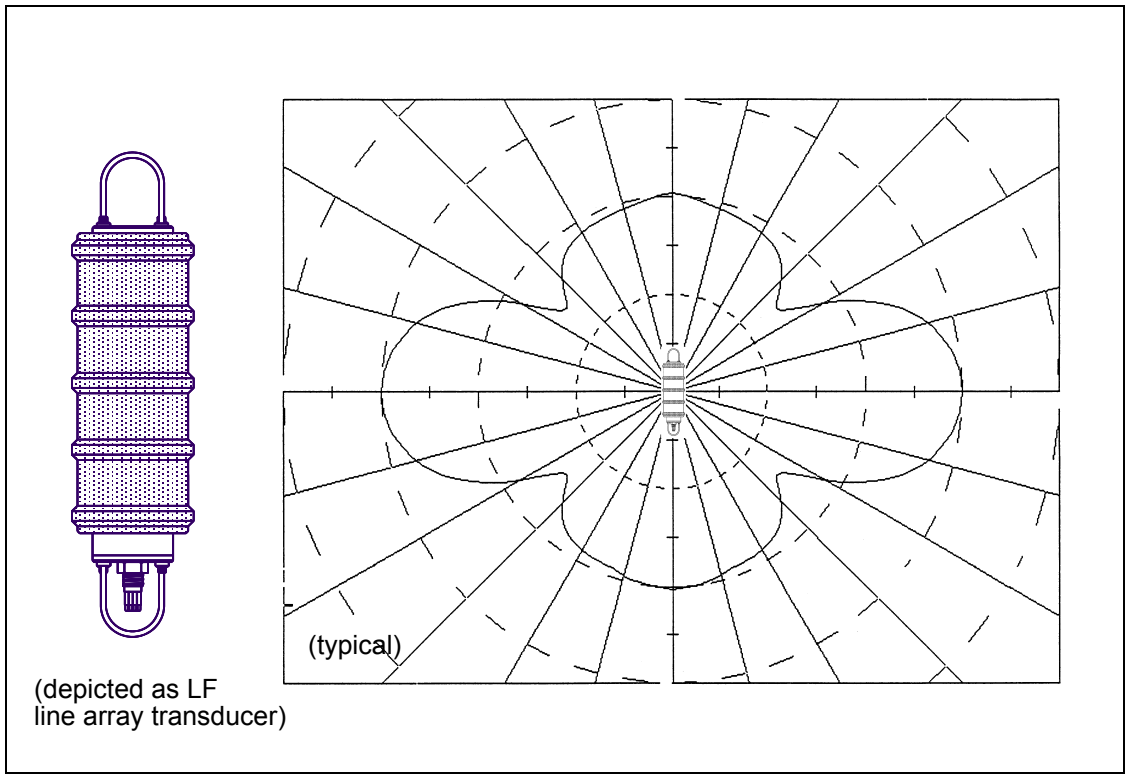


Figure 1-6 AT-409 Line Array Transducer and Beam Pattern

AT-421 Directional Transducer

The AT-421 Directional Transducer is available in two frequency bands: 9–14 kHz (LF) and 16–21 kHz (MF). Whenever possible, the AT-421 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 an omnidirectional or a line array transducer with the same input power level. The AT-421 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 AT-421 Directional Transducer and its typical vertical beam pattern is shown in Figure 1-7.

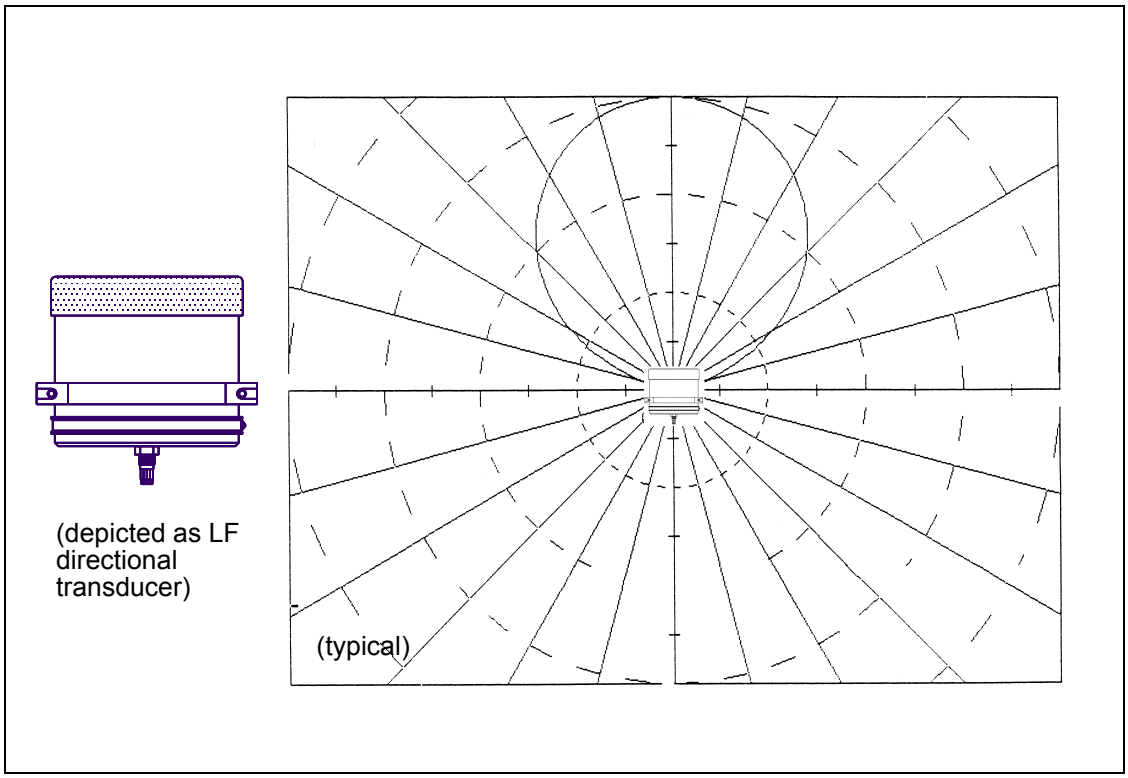


Figure 1-7 AT-421 Directional Transducer and Beam Pattern

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 Benthos for detailed specifications.

Typical Applications

The ATM-880 Series Acoustic Telemetry Modems are used in numerous applications. Typical uses include remote acquisition of real time or stored data from subsea instrument packages, command and control of an AUV, and two-way communications between nodes in an undersea network.

Remote Data Acquisition

A common application for the ATM-880 Series Acoustic Telemetry Modems is the acquisition of real time or stored data from deployed instruments. In this application a subsea modem is deployed with an instrument package, such as a current meter, a Conductivity/Temperature/Depth (CTD) instrument or a tide gauge. The modem receives data from the instrument over its RS-232/422 serial interface and either immediately transmits the data to a receiving modem or stores the data for transmission at another time. One

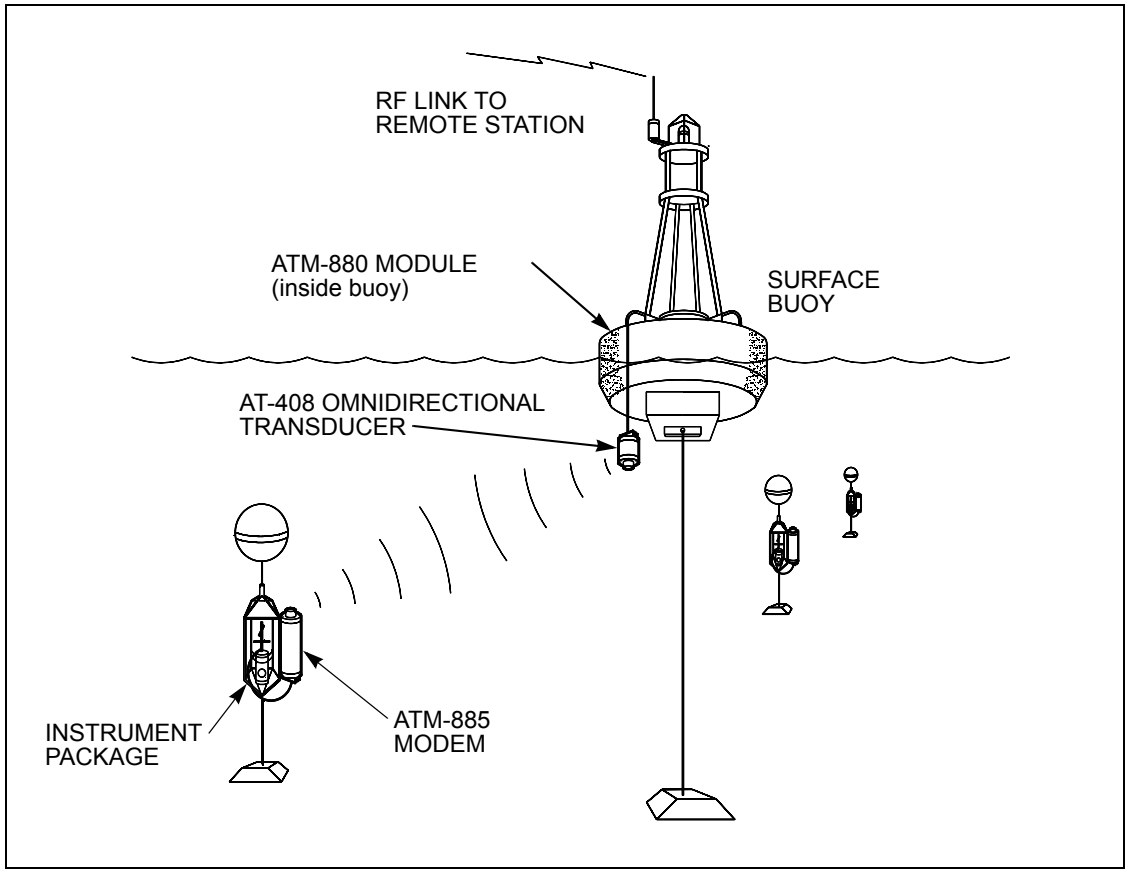


Figure 1-8 Data Acquisition and RF Link to Remote Station

example of this application is shown in Figure 1-8, where several ATM-885 Acoustic Telemetry Modems, each of which include a built-in omnidirectional transducer, are deployed with an instrument package. All the modems communicate with an ATM-880 Module installed in a surface buoy. The module connects to an onboard host processor and an AT-408 Omnidirectional Transducer, which is configured as a dunking transducer. Data that are received from the instrument packages are transmitted to a remote station receiver by way of an RF link such as a cellular phone or a satellite connection. Use of modems in this application eliminates the need to install expensive electrical cable between a deployed instrument and a surface buoy. This is especially advantageous when multiple instrumentation packages, which are deployed within the same general area, must communicate by way of the same RF channel.

The ATM-881 Deck Box can be used to retrieve data that have been collected by deployed instruments over a period of time and stored by the modems. An example of this is shown in Figure 1-9, where several deployed instrumentation packages are shown, each connected to an ATM-887 Acoustic Telemetry Modem, which has a built-in directional transducer and can be deployed in water depths up to 6000 meters. The data that are

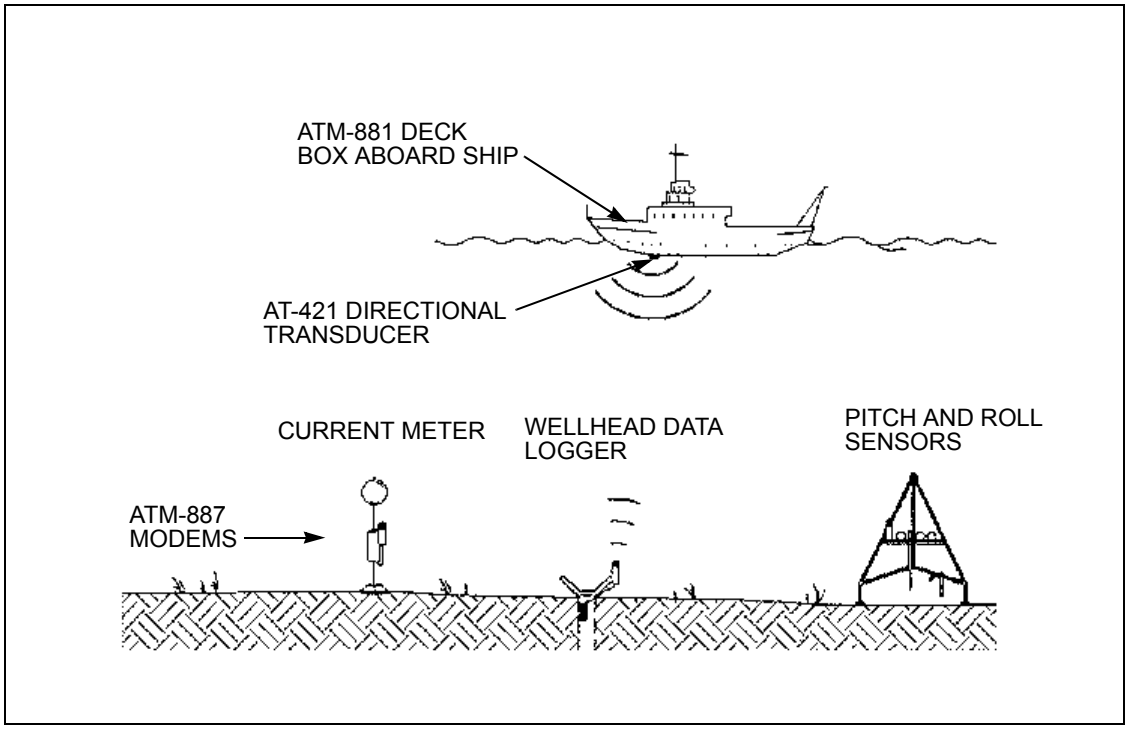


Figure 1-9 Periodic Acquisition of Stored Data

collected by the instruments are stored by the modems over long periods of time and then periodically retrieved. In this application, because directional transducers are used and the transmission medium is the vertical channel, reliable, higher speed communications can be obtained with minimum multipath from sea surface and sea floor reflections.

AUV Command and Control

AUVs can only be controlled by an acoustic link. The ATM-880 Series Acoustic Telemetry Modems provide this capability by allowing commands to be transmitted to an AUV. Furthermore, since the modems provide two-way communications capability, AUV position and status information, as well as other data can be received from the AUV. An example of this application is shown in Figure 1-10. In this example the modems provide the communications link between an under ice AUV and a surface station. The

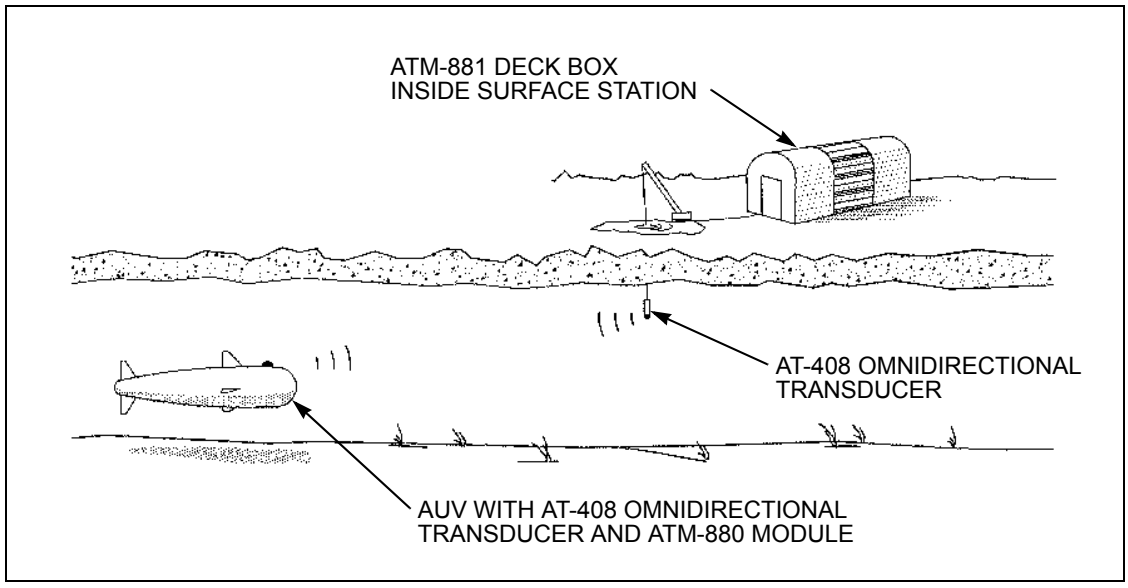


Figure 1-10 Command and Control of an AUV

AT-408 Omnidirectional Transducers used in this example provide a reliable acoustic link between the AUV and the surface station regardless of what depth or from what direction the AUV is located. An ATM-881 Deck Box connected to a host processor is used in the surface station, and an ATM-880 Module and host processor is used aboard the AUV.

Undersea Communications Network

The ATM-880 Series Acoustic Telemetry Modems provide two-way communications between nodes in an undersea network. The deployed instruments to which the modems are connected can communicate with each other as well as with shore based stations. In the example shown in Figure 1-11, AT-409 Line Array Transducers are used as remote transducers

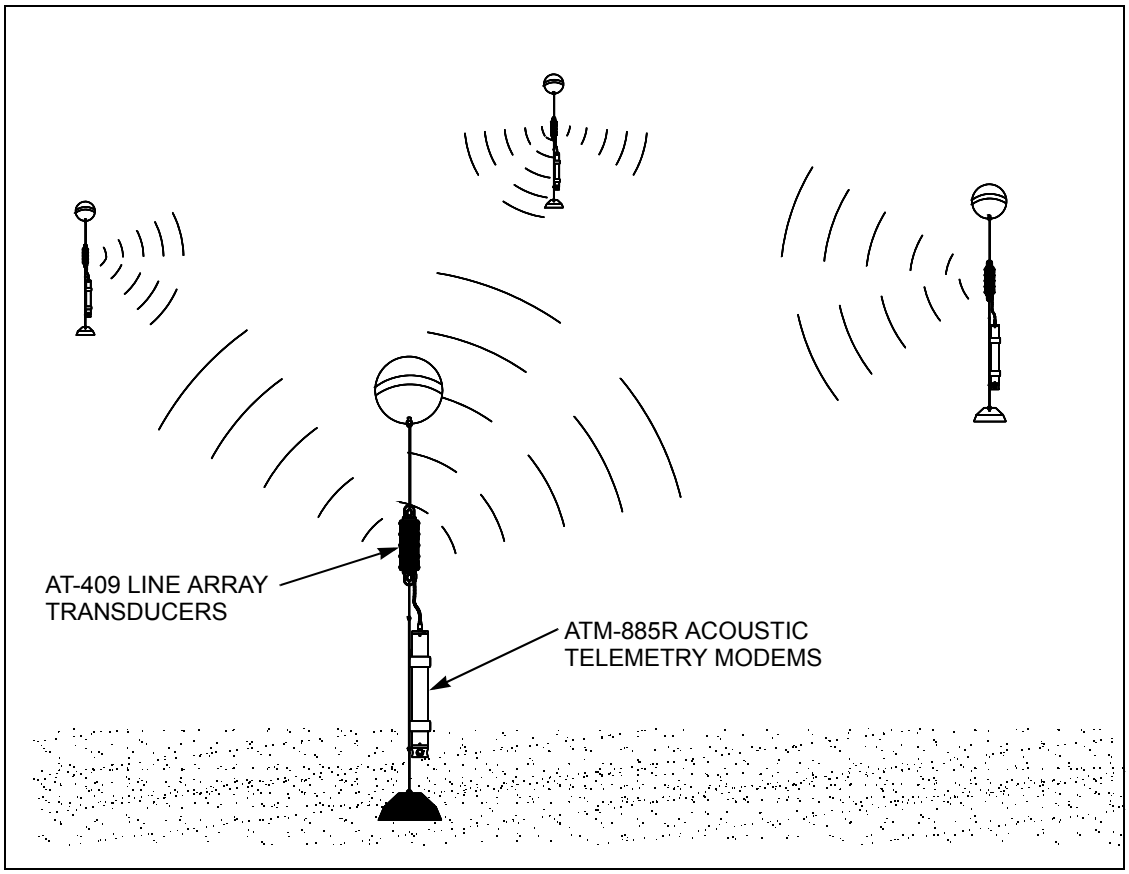


Figure 1-11 Network of Undersea Nodes

with ATM-885R Acoustic Telemetry Modems. The beam pattern of the AT-409 Line Array Transducer makes it a good choice for this application, as it transmits and receives equally well in all directions horizontally, yet provides good immunity from sea surface and sea floor multipath reflections.

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 or a microwave link. 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 baud 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 baud 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-880 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 baud 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 baud 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 modems.

High Performance Modulation Techniques

To reduce the effects of the physical barriers to underwater communications and provide high modem performance, the ATM-880 Series Acoustic Telemetry Modems employ two advanced MFSK modulation techniques. One is 1-of-4 MFSK, and the other is Hadamard MFSK. Although both modulation techniques use MFSK, which is a spread spectrum modulation process that uses digital processing algorithms to transmit many tones simultaneously, 1-of-4 MFSK, with a maximum baud rate of 2400 bits/sec,

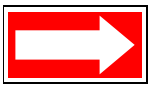
provides the highest baud rate. Hadamard MFSK provides higher reliability, even at lower source levels, but at a lower baud rate. Along with the MFSK modulation techniques, three additional methods for increasing reliability are provided as explained in "Methods for Increasing Reliability" below.

The primary advantage of 1-of-4 MFSK modulation over Hadamard MFSK modulation is its bandwidth efficiency; it is fast and relatively simple to encode. Therefore, when transmitting in the vertical channel, where multipath interference is generally minimal, 1-of-4 MFSK provides good reliability, even at the highest speed.

The Hadamard MFSK modulation technique provides two major benefits over 1-of-4 MFSK: the ability to minimize the effects of frequency dependent fading, which improves reliability, and the ability to operate at a lower SNR.

Methods for Increasing Reliability

Three methods are provided by the ATM-880 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 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.



NOTE Both the modulation technique and the method or combination of methods for increasing reliability are implemented automatically by the modems, depending the selected baud rate. To see which technique and method are selected for each of the available baud rates, refer to "Acoustic Baud Rate S4" on page 7-11. The selections are listed under "Available Settings." How to select the baud rate, both when using Telesonar PC and directly by using modem commands, is explained later in this manual.

Convolutional Coding

Convolutional coding is the most effective of the thee methods provided for increasing reliability. The convolutional coding method used is 1/2 rate convolutional coding. In 1/2 rate convolutional coding, every eight data bits are followed by eight additional bits, which are encoded from the data bits using a convolutional encoding algorithm. This convolutional code, when decoded by the receiving modem using a Viterbi decoding algorithm, is used

to correct at least one error bit—if there are any—in the eight bits of data. The *effective* baud rate—or throughput, however, is reduced by half since for every 16 bits transmitted, only eight are data bits.

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 baud rate is affected.

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 baud rate is reduced to half of what it is without the multipath guard period. For a multipath guard period of 12.5 milliseconds, the baud 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 baud rate is 600 bits/sec, a data redundancy of two reduces the effective baud rate to half this rate, or 300 bits/sec.

2 Specifications

This section provides the specifications for the Benthos ATM-880 Series Acoustic Telemetry Modems, including the remote transducers and the modem battery packs.

General

Frequency bands:	9–14 kHz (LF), 16–21 kHz (MF) and 25–30 kHz (HF)
Data modulation:	1-of-4 MFSK and Hadamard MFSK
Baud rate:	150–2400 bits/s with 1-of-4 MFSK 150–1200 bits/s with Hadamard MFSK
Addressable modems:	32
Processing features:	Data redundancy 1/2 rate convolutional coding 1/3 rate convolutional coding Multipath guard period
Data frame period:	25 ms
Data bits per frame:	60 with 1-of-4 MFSK—no data redundancy and no convolutional coding 30 with Hadamard MFSK—no data redundancy and no convolutional coding
Operating temperature:	-5°C to 50°C
Storage temperature:	-45°C to 85°C
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

ATM-881 Deck Box

The ATM-881 Deck Box connects to any of the remote transducers and 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:	Watertight with cover closed
Dimensions:	10 in. high by 14 in. wide by 6.5 in. deep
Weight:	11 lb
Transducer cable:	25 m length standard, 50 m and 100 m optional, 1200 lb breaking strength

Power Requirements

AC input power:	100–120 VAC, 50–60 Hz, 3.6 A typ, 200–240 VAC, 50–60 Hz, 2.0 A typ, auto sensing
External DC input power:	21–28 V
DC input current (when not transmitting):	160 mA typ, 250 mA max @ 21 V
DC input current (when transmitting)	1 A typical, 2 A maximum @ 21 V

Input/Output

Operator controls:	Keypad Speaker volume control Power on/off switch
Displays and indicators:	LCD display Power on/off indicator Speaker

Power:	AC power input DC power input
Signal:	RS-232/422 serial interface (data) Transducers (AT-408, AT-409, or AT-421)

Transducers

Available types:	AT-408 omnidirectional (LF, MF and HF) AT-409 line array (LF and MF) AT-421 directional (LF and MF)

ATM-881R Rack Mount Deck Box

The ATM-881R Rack Mount Deck Box is a rack mountable acoustic telemetry modem that connects to any of the remote transducers. Similar to the ATM-881 Deck Box, it is used to communicate with the subsea modems or another deck box. To send commands and to send and receive data, the ATM-881R must be connected to a host processor through its RS-232/422 serial interface. In addition, the ATM-881R can be connected to an optional external power amplifier.

Physical Characteristics

Case construction:	Aluminum
Dimensions:	3.5 in. high by 19 in. wide by 13.0 in. deep
Weight:	10 lb
Transducer cable:	25 m length standard, 50 m and 100 m optional, 1200 lb breaking strength

Power Requirements

AC input power:	100–120 VAC, 50–60 Hz, 3.6 A typ, 200–240 VAC, 50–60 Hz, 2.0 A typ, auto sensing

Input/Output

Operator controls:	Speaker volume control Power on/off switch Amplifier select switch
Displays and indicators:	Power on/off indicator Speaker
Power:	AC power input
Signal:	RS-232/422 serial interface (data) Transducers (AT-408, AT-409, or AT-421) Receiver out Transmit out Headphones External amplifier in Auxiliary

Transducers

Available types:	AT-408 omnidirectional (LF, MF and HF) AT-409 line array (LF and MF) AT-421 directional (LF and MF)

ATM-885 Subsea Modem

The ATM-885 Acoustic Telemetry Modem is a completely self contained subsea modem with a built-in omnidirectional or directional transducer and an internal modem battery pack. The modem can operate either on its internal battery pack or on external DC power.

Physical Characteristics

Housing construction:	Hard coat anodized aluminum
Dimensions:	3.5 in. max dia by 33.5 in. long
Mounting:	Stainless steel sidebar
Weight in air:	24 lb

Weight in water: 11 lb

Operating depth: 2000 m

Power Requirements

Modem battery pack: 21 V, 18 A·h

External DC input power: 14–28.0 V

Lowpower state current: 0.5 mA typical, 1.0 mA maximum

DSP/receiver current, active: 25 mA typical

Transmitter current, active: 1 A typical, 2 A maximum @ 21 V

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 80 mA. Maximum applied voltage is 40 VDC.

Transducers

Type: Built-in LF, MF or HF omnidirectional, or MF directional

Source level @ 21 V (typ.): 178 dB re 1 μPa @ 1 m for LF, MF and HF omnidirectional

190 dB re 1 μPa @ 1 m for MF directional

Source level @ 14 V (typ.): -3 dB down from source level at 21 V

ATM-885R Subsea Modem

The ATM-885R Acoustic Telemetry Modem is a 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 internal battery pack or on external DC power.

Physical Characteristics

Housing construction:	Hard coat anodized aluminum
Dimensions:	3.50 in. max dia by 29.75 in. long
Mounting:	Stainless steel sidebar
Weight in air:	24 lb
Weight in water:	11 lb
Operating depth:	2000 m

Power Requirements

Modem battery pack:	21 V, 18 A·h
External DC input power:	14–28.0 V
Lowpower state current:	0.5 mA typical, 1.0 mA maximum
DSP/receiver current, active:	25 mA typical
Transmitter current, active:	1 A typical, 2 A maximum @ 21 V

Input/Output

Operator controls:	Plunger type on/off switch
Power:	External DC power input
Signal:	RS-232/422 serial interface (data) Transducers (AT-408, AT-409, or AT-421)
Device enable:	Active low, open collector output. Maximum sink current is 80 mA. Maximum applied voltage is 40 VDC.

Transducers

Available types: AT-408 omnidirectional (LF, MF and HF)
AT-409 line array (LF and MF)
AT-421 directional (LF and MF)

ATM-887 Subsea Modem

The ATM-887 Acoustic Telemetry Modem is a completely self contained 6000-meter depth rated subsea modem with a built-in medium frequency (MF) directional transducer and an internal modem battery pack. The modem can operate either on its internal battery pack or on external DC power.

Physical Characteristics

Housing construction: Hard coat anodized and painted aluminum

Dimensions: 5.0 in. max dia by 33.5 in. long

Mounting: Stainless steel sidebar

Weight in air: 36 lb

Weight in water: 17 lb

Operating depth: 6000 m

Power Requirements

Modem battery pack: 21 V, 28 A·h

External DC input power: 14–28.0 V

Lowpower state current: 0.5 mA typical, 1.0 mA maximum

DSP/receiver current, active: 25 mA typical

Transmitter current, active: 1 A typical, 2 A maximum @ 21 V

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 80 mA. Maximum applied voltage is 40 VDC.

Transducers

Type:	Built-in MF directional
Source level @ 21 V (typ.):	190 dB re 1 μPa @ 1 m
Source level @ 14 V (typ.):	187 dB re 1 μPa @ 1 m

ATM-887R Subsea Modem

The ATM-887R Acoustic Telemetry Modem is a 6000-meter depth rated subsea modem that includes an internal modem battery pack and connects to an AT-421 directional transducer with a supplied 2-meter cable. The modem can operate either on its internal battery pack or on external DC power.

Physical Characteristics

Housing construction:	Hard coat anodized and painted aluminum
Dimensions:	5.00 in. max dia by 28.25 in. long
Mounting:	Stainless steel sidebar
Weight in air:	36 lb
Weight in water:	17 lb
Operating depth:	6000 m

Power Requirements

Modem battery pack:	21 V, 28 A·h
External DC input power:	14–28.0 V
Lowpower state current:	0.5 mA typical, 1.0 mA maximum

DSP/receiver current, active: 25 mA typical

Transmitter current, active: 1 A typical, 2 A maximum @ 21 V

Input/Output

Operator controls: Plunger type on/off switch

Power: DC power input

Signal: RS-232 serial interface (data)
Transducer (AT-421)

Device enable: Active low, open collector output. Maximum sink current is 80 mA. Maximum applied voltage is 40 VDC.

Transducers

Available types: AT-421 directional (LF and MF)

ATM-885PCB Modem Board Set

The ATM-885PCB Modem Board Set includes both a printed circuit board set mounted to a chassis and an omnidirectional transducer. It is externally powered and is designed for OEM applications.

Physical Characteristics

Chassis Dimensions: 2.81 in. wide by 1.5 in. high by 8.75 in. long

Mounting: Chassis mounting holes

Power Requirements

External DC input power: 14–28.0 V

Lowpower state current: 0.5 mA typical, 1.0 mA maximum

DSP/receiver current, active: 25 mA typical

Transmitter current, active: 1 A typical, 2 A maximum @ 21 V

Input/Output

Power: External DC power input

Signal: RS-232/422 serial interface (data)
Transducers (LF, MF or HF)

Device enable: Active low, open collector output. Maximum sink current is 80 mA. Maximum applied voltage is 40 VDC.

Transducers

Type: LF, MF or HF omnidirectional, or MF directional

Source level @ 21 V (typ.): 178 dB re 1 μPa @ 1 m for LF, MF and HF omnidirectional

190 dB re 1 μPa @ 1 m for MF directional

Source level @ 14 V (typ.): -3 dB down from source level at 21 V

ATM-885RPCB Modem Board Set

The ATM-885RPCB Modem Board Set includes a printed circuit board set mounted to a chassis and is specifically configured to connect directly to any of the remote transducers. It is externally powered and is designed for OEM applications.

Physical Characteristics

Chassis Dimensions: 2.81 in. wide by 1.5 in. high by 8.75 in. long

Mounting: Chassis mounting holes

Power Requirements

External DC input power: 14–28.0 V

Lowpower state current: 0.5 mA typical, 1.0 mA maximum

DSP/receiver current, active: 25 mA typical

Transmitter current, active: 1 A typical, 2 A maximum @ 21 V

Input/Output

Power: External DC power input

Signal: RS-232/422 serial interface (data)
Transducers (AT-408, AT-409, or AT-421)

Device enable: Active low, open collector output. Maximum sink current is 80 mA. Maximum applied voltage is 40 VDC.

Transducers

Available types: AT-408 omnidirectional (LF, MF and HF)
AT-409 line array (LF and MF)
AT-421 directional (LF and MF)

AT-408 Omnidirectional Transducer

The AT-408 is an omnidirectional transducer with a built-in preamp that can be used as a dunking transducer with the ATM-881 Deck Box or the ATM-881R Rack Mount Deck Box, or as a remote transducer with the ATM-885R Acoustic Telemetry Modem or the ATM-885RPCB Modem Board Set.

Frequency bands: 9–14 kHz (LF), 16–21 kHz (MF) or 25–30 kHz (HF)

Source level @ 21 V (typ.): 178 dB re 1 μPa @ 1 m

Source level @ 14 V (typ.): 175 dB re 1 μPa @ 1 m

Preamp gain: 35 dB

Radiation pattern: Omnidirectional

Housing construction: Anodized aluminum

Dimensions: 4.0 in. dia by 14.5 in. long

Weight in air: 8.5 lb

Weight in water: 2.5 lb

Operating depth: 2000 m (6000 m optional)

AT-409 Line Array Transducer

The AT-409 is a line array transducer with an omnidirectional beam pattern in the horizontal plane and a directional beam pattern in the vertical plane. It can be used as a dunking transducer with the ATM-881 Deck Box or the ATM-881R Rack Mount Deck Box, or as a remote transducer with the ATM-885R Acoustic Telemetry Modem or the ATM-885RPCB Modem Board Set.

Frequency bands:	9–14 kHz (LF) or 16–21 kHz (MF)
Source level @ 21 V (typ.):	185 dB re 1 μPa @ 1 m (LF) 183 dB re 1 μPa @ 1 m (MF)
Source level @ 14 V (typ.):	-3 dB down from source level at 21 V
Preamp gain:	35 dB
Radiation pattern:	Horizontal plane—omnidirectional Vertical plane—directional
Housing construction:	Anodized aluminum
Dimensions:	4.5 in. dia by 18.5 in. long (LF) 4.0 in. dia by 18.5 in. long (MF)
Weight in air:	10.5 lb (LF) 8.5 lf (MF)
Weight in water:	5.0 lb (LF) 2.5 lb (MF)
Operating depth:	1000 m (LF) 2000 m (MF), 6000 m optional

AT-421 Directional Transducer

The AT-421 is a directional transducer with a conical beam pattern. It can be used as a dunking transducer with the ATM-881 Deck Box or the ATM-881 Rack Mount Deck Box, or as a remote transducer with the ATM-885R Acoustic Telemetry Modem or the ATM-885RPCB Modem Board Set.

Frequency bands:	9–14 kHz (LF) or 16–21 kHz (MF)
Source level @ 21 V (typ.):	190 dB re 1 μPa @ 1m
Source level @ 14 V (typ.):	187 dB re 1 μPa @ 1m
Preamp gain:	35 dB
Radiation pattern:	40° conical (LF) 60° conical (MF)
Housing construction:	Anodized aluminum
Dimensions:	8.0 in. dia by 10 in. long (LF) 4.5 in. dia by 13.0 in. long (MF)
Weight in air:	26 lb (LF) 12 lb (MF)
Weight in water:	8 lb (LF) 5.5 lb (MF)
Operating depth:	6000 m (LF) 500 m (MF), 6000 m optional

Modem Battery Packs

Two 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 amp-hour capacity. Both packs use alkaline batteries.

Modem Battery Pack for ATM-885/885R Acoustic Telemetry Modems

Capacity: 18 A·h @ 21°C

Open circuit voltage: 21 V

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

Capacity: 28 A·h @ 21°C

Open circuit voltage: 21 V

3 Deployment Considerations

A number of factors must be considered before deploying an ATM-880 Series Acoustic Telemetry Modem. These include the choice of a remote transducer, the required operating depth, the required communications range, the multipath and noise conditions, and the physical protection of the modems. This section reviews these factors and also presents some typical installation configurations for the modems.

Remote Transducer Selection

When an ATM-885R, an ATM-887R, or an ATM-885RPCB 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 1-8 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 AT-408 Omnidirectional Transducer and its beam pattern are shown in Figure 1-5 on page 1-8. Its beam pattern shows that it transmits and receives signals equally well in a wide hemispherical 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 AT-409 Line Array Transducer and its beam pattern are shown in Figure 1-6 on page 1-9. Its beam pattern shows that it transmits and receives signals equally well from all directions around the transducer, but not as well directly above or below the transducer. This transducer is a good choice when the receiving modem is always at the same depth as the transmitting modem, but the horizontal direction of the receiving modem is not known or is not always the same. Less power is required compared to an omnidirectional transducer to produce an equivalent source level, and the effects of multipath are usually less.

The AT-421 Directional Transducer and its beam pattern are shown in Figure 1-7 on page 1-10. 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.

Battery Pack Currents

In the lowpower state, where the modem is switched on but is inactive, a very small amount of current is drawn from the modem battery pack, typically from 0.5 mA to a maximum of 1.0 mA. Therefore, the modem battery pack can provide power in the lowpower state for over 3 years. However, when the DSP and the receiver are active, hence not in the lowpower state, a relatively large amount of current is drawn from the modem battery pack while the modem receives data or commands, typically 25 mA. The most current is drawn when the modem is transmitting, typically 1 A to a maximum of 2 A. 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 is the entire contents of one of the four available internal 4-kbyte transmit data buffers, an additional 2 bytes are transmitted and the transmitter remains active an additional 1.2 seconds over that required to transmit the actual data. The same is true if only a partial packet is transmitted. Refer to "Transmit Data Buffers" on page 6-3 for information on the four 4-kbyte transmit data buffers. The additional bytes constitute the processing overhead and should be taken into account when transmitting a small amount of data many times.

NOTE Telesonar PC provides a convenient method for calculating the modem battery pack capacity required for various deployment conditions. Refer to "Battery Pack Capacity Calculations" on page 5-11 for more information.

Modem Battery Pack Capacity Calculations

The modem battery pack, which uses alkaline batteries, provides an output of 21 V and a capacity of either 18 A·h at 21°C for an ATM-885 or ATM-885R, or 28 A·h at 21°C 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 baud rate that is to be used. Then, referring to Section 2, "Specifications," determine the transmitter active current. For a short deployment the lowpower state current can be neglected. The the required capacity in amp-hours can be calculated by using the following equation:

$$\text{Amp-hours} = D \times A/(R \times 450)$$

Where

D = the amount of data to be transmitted in bytes

A = the transmitter active current in amperes

R = the baud rate in bits/second

The constant 450 is derived from the conversions 8 bits/byte and 3,600 seconds/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. Since the transmitter active current is 1 A, the capacity requirement of the modem battery pack is:

$$\text{Amp-hours} = (3\ \text{Mbytes})[(1\ \text{A}/(1200\ \text{bits/sec} \times 450)]$$
$$= 5.6\ \text{A·h}$$

Referring to "Modem Battery Packs" on page 2-14, it can be seen that a modem battery pack for an ATM-885R 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-885R Acoustic Telemetry modem can operate when it is required to transmit 500 bytes of data every 30 minutes and the modem is powered with a modem battery pack. The deployment conditions are the following:

Baud rate:	600 bits/sec
Temperature:	0°C
Modem battery pack capacity:	18 A·h
Transmitter current, active:	1 A
DSP/receiver current, active:	25 mA
Lowpower state current:	0.5 mA

The capacity of a modem battery pack is reduced by approximately 25% when exposed to a 0°C environment. Hence the capacity of an 18 A·h modem battery pack is reduced by 25% from 18 A·h to 13.5 A·h, and a 28 A·h modem battery pack provides 21 A·h at 0°C.

The calculation of the number of deployment days at the required transmission rate of 500 bytes every 30 minutes is performed as follows:

First, calculate the number of bytes that can be transmitted, assuming, for now, that the lowpower state current can be neglected.

From the equation

$$\text{Amp-hours} = D \times A/(R \times 450)$$

D becomes

$$D = [\text{amp-hours} \times (R \times 450)]/1\ A$$
$$= (13.5\ A{\cdot}h)(600\ \text{bits/sec} \times 450)/1\ A$$
$$= 3{,}645{,}000\ \text{bytes}$$

To account for the processing overhead when transmitting a packet of data, where in this case a single packet is 500 bytes, an additional 2 bytes of data per packet must be added along with 1.2 seconds of transmitter active time. However, to simplify the calculations, the 1.2 seconds can be converted into equivalent bytes using the 600 bits/second baud rate and the 8 bits/byte conversion:

$$\text{Equivalent bytes} = (1.2\ \text{sec} \times 600\ \text{bits/sec})/(8\ \text{bits/byte})$$
$$= 90\ \text{bytes}$$

Now, the total bytes to be transmitted per packet is

$$500 + 2 + 90 = 592\ \text{bytes/packet}$$

Hence the total number of packets that can be transmitted is

$$\text{Total number of packets} = (3{,}645{,}000\ \text{bytes})/(592\ \text{bytes/packet})$$
$$= 6{,}157\ \text{packets}$$

And since 1 packet of data transmitted every 30 minutes is equivalent to 48 packets transmitted per day, the total number of deployment days is

$$\text{Total deployment days} = (6{,}157\ \text{packets})/(48\ \text{packets/day})$$
$$= 128.3\ \text{days}$$

However, for long deployments the lowpower state current must be considered. Therefore, the modem battery pack capacity required for the lowpower state is

$$\text{Lowpower state amp-hours} = (\text{deployment time in hours})(500\ \mu A)$$
$$= (128.3\ \text{days})(24\ \text{hours/day})(500\ \mu A)$$
$$= 1.54\ A{\cdot}h$$

Hence the original 13.5 amp-hour calculation must now be reduced by 1.54 amp-hours to 11.96 amp-hours and the total number of days recalculated.

D = (11.96 A·h)(600 bits/sec x 450)/(1 A)

= 3,229,220 bytes

and the total number of packets is now

Total number of packets = (3,229,220 bytes)/(592 bytes/packet)

= 5,454 packets

And again, since 1 packet of data transmitted every 30 minutes is equivalent to 48 packets transmitted per day, the total number of deployment days is now

Total deployment days = (5,454 packets)/(48 packets/day)

= 113.6 days

Modem Operating Depth

The rated operating depth of the subsea modems and remote transducers is typically 2000 meters. However, the ATM-887 and ATM-887R Acoustic Telemetry Modems, and the AT-421 Directional Transducer (LF) are rated to 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 rating as damage or destruction of the modem could occur.

Modem Communications Range

The communications range between two ATM-880 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 schemes used by the ATM-880 Series Acoustic Telemetry Modems, reliable operation can be obtained even in relatively severe multipath and noise conditions, but usually at the expense of a reduced baud rate. Refer to "High Performance Modulation Techniques" on page 1-16 for an explanation of the modulation schemes. 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 addition, in some instances the use of acoustic baffles can further improve performance. And accounting for the operating frequencies of other acoustic equipment in the area is also important to obtain optimum performance from the modems.

Transducer Orientation

If possible, when using the AT-421 Directional Transducer, orient the transducer such that it is pointing toward the receiving modem. If an AT-409 Line Array Transducer, which has a relatively narrow vertical beam pattern and an omnidirectional horizontal beam pattern, is used, position the transducer at approximately the same depth as the receiving modem. When using an AT-408 Omnidirectional Transducer, which has an omnidirectional beam pattern, the potential for multipath is the greatest, yet it is not required to point the transducer at the receiving modem or position it at the same depth.

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 the 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 multipath from surface reflections, and reduce the effects of both ship noise and surface noise.

Other Acoustic Equipment

If there is other active acoustic equipment 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 of the ATM-880 Series Acoustic Telemetry Modems should take into account the required modem operating depth and communications range, and the multipath and noise 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.

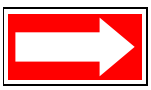
Each subsea modem is encased within an anodized aluminum housing. Each remote transducer is encapsulated in a protective urethane mold and mounted to an anodized aluminum housing, which contains a built-in preamplifier and transmitter. These configurations provide a high degree of protection from physical 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.

Dunking Transducer Deployment

Any of the remote transducers, namely, the AT-408 Omnidirectional Transducer, the AT-409 Line Array Transducer, or the AT-421 Directional Transducer, can be used as a dunking transducer with the ATM-881 Deck Box or the ATM-881R Rack Mount Deck Box. When a remote transducer is used as a dunking transducer, the 25-meter cable that is included with the deck box is used both to connect to the transducer and to lower it into 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 for an AT-408 Omnidirectional Transducer or to the mounting loop on the connector end of an AT-409 Line Array Transducer. 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. In addition, when using a remote transducer as a dunking transducer, it may be required to add weight to the transducer to ensure it remains vertical in the water column. For an AT-409 Line Array Transducer, the weight can be tied to the bail on the end opposite the connector end.

Subsea Modem Deployment

Any of the subsea modems, namely, the ATM-885, the ATM-885R, the ATM-887, or the ATM-887R Acoustic Telemetry Modems are 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. 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. An example is shown in Figure 3-1 where an ATM-885 Acoustic Telemetry Modem and an AT-409 Line Array Transducer are shown deployed with flotation. The side bar is used both to attach the flotation and to anchor the modem to a clump weight or to a structure.



NOTE When attaching flotation to a remote transducer that is attached to a modem, strain relive the transducer cable by ensuring that the line is shorter than the cable as shown in Figure 3-1.

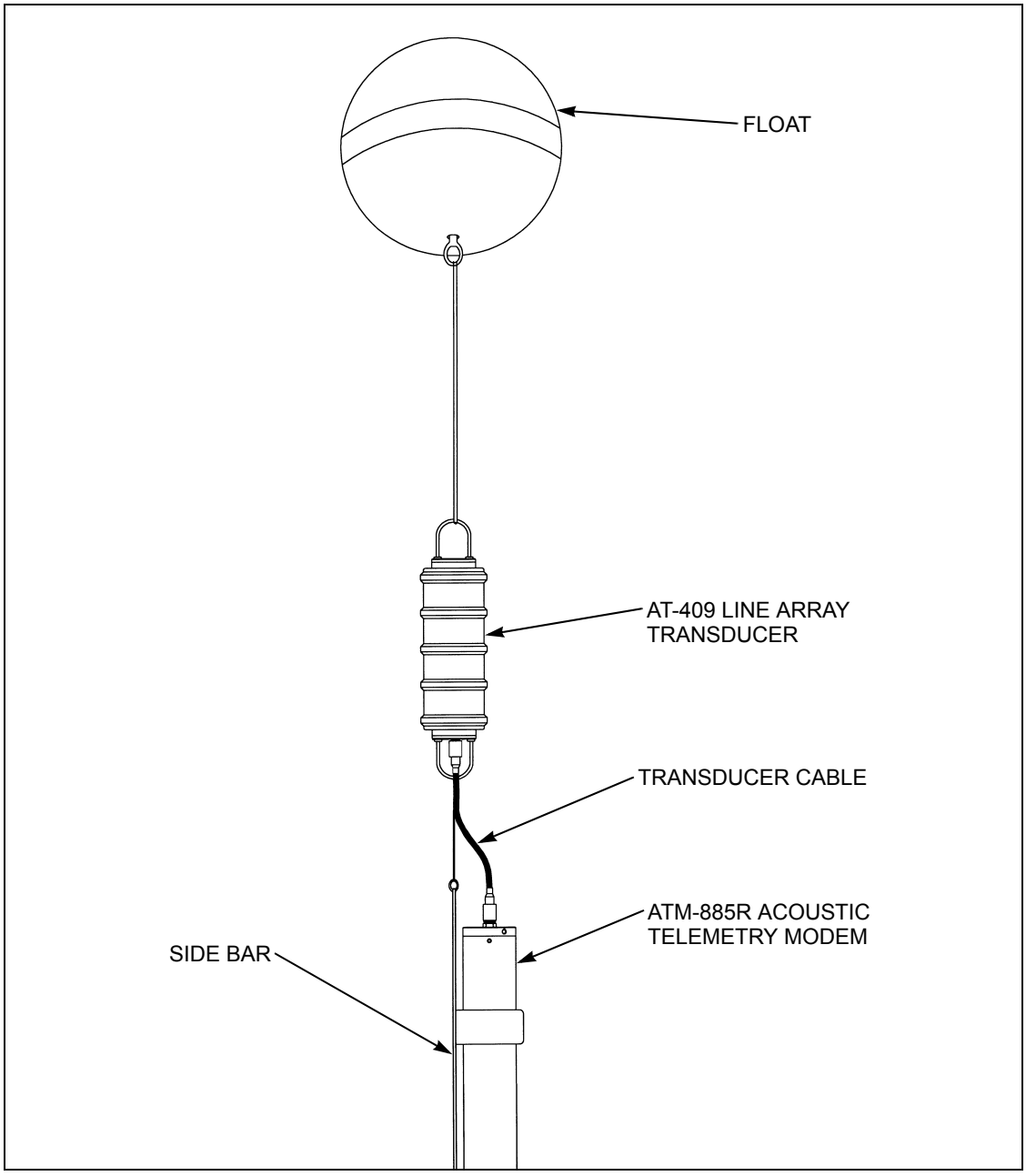
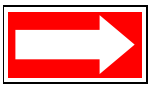


Figure 3-1 Deployed ATM-885R and AT-409 with Flotation

4 Setup and Test

This section provides instructions on how to unpack, set up and test the ATM-880 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. Specifically, the following topics are covered:

- ***Unpacking and inspection***
- ***Some typical modem configurations***
- ***Modem connector and pinout descriptions***
- ***Setting up and checking the modems***
- ***Verifying operation of the modems***



NOTE Once the modems are set up and are operating, refer to Section 5, "Telesonar PC," for instructions on how to easily configure and operate the modems using Telesonar PC. Also refer to Section 6, "Modem Operating Modes and Commands," for detailed information on the modem commands and how to enter them.

Unpacking and Inspection

The ATM-880 Series 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 Benthos and to the freight carrier.

After inspecting the boxes, locate and remove the packing list, which is on the outside of one of the boxes. 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 Benthos and to the freight carrier.

Typical Setup Configurations

There are a number of different possible setup configurations for the ATM-880 Series Acoustic Telemetry Modems. However, in most cases the modems connect to a host processor through an RS-232 or an RS-422 serial interface. The ATM-887 and ATM-887R Acoustic Telemetry Modems provide an RS-232 interface only. The host processor can be a PC, an embedded processor, an instrument, or any other device that can act as a data terminal.

In a typical setup there is always a *local modem*, which connects to a *local host processor,* and at least one *remote modem*, which connects to a *remote host processor*. This configuration is only a matter of reference; their roles can be reversed. Typically, however, the local modem is the modem to which commands and data are input over the serial interface from the local host processor, usually a PC. And the remote modem is the modem to which acoustic commands are transmitted and from which data and acknowledgments are received by the local modem over the acoustic link.

A typical configuration is shown in Figure 4-1. Here the local modem is the ATM-881 Deck Box, which is connected to a local host processor, a PC, through its RS-232 serial port. The remote modem is an ATM-885, which is connected to an instrument through its RS-232 serial port. Alternatively, the ATM-881 Deck Box can be used as the host processor instead of the PC as it has its own built-in keypad and display.

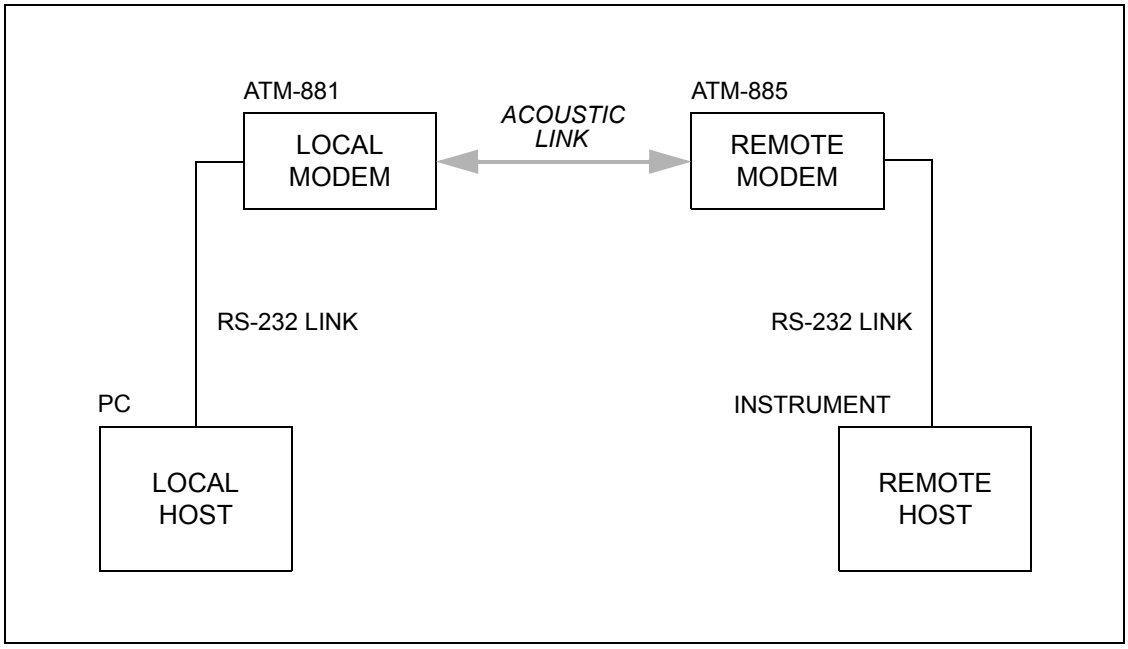


Figure 4-1 Setup with ATM-881 Deck Box as the Local Modem

In another typical configuration, the local modem is one of the subsea modems, which is connected to a host processor. An example of this is shown in Figure 4-2, where an ATM-885 is the local modem. In this setup the local modem communicates with three remote modems, which are also ATM-885 modems, and where each is connected to an instrument.

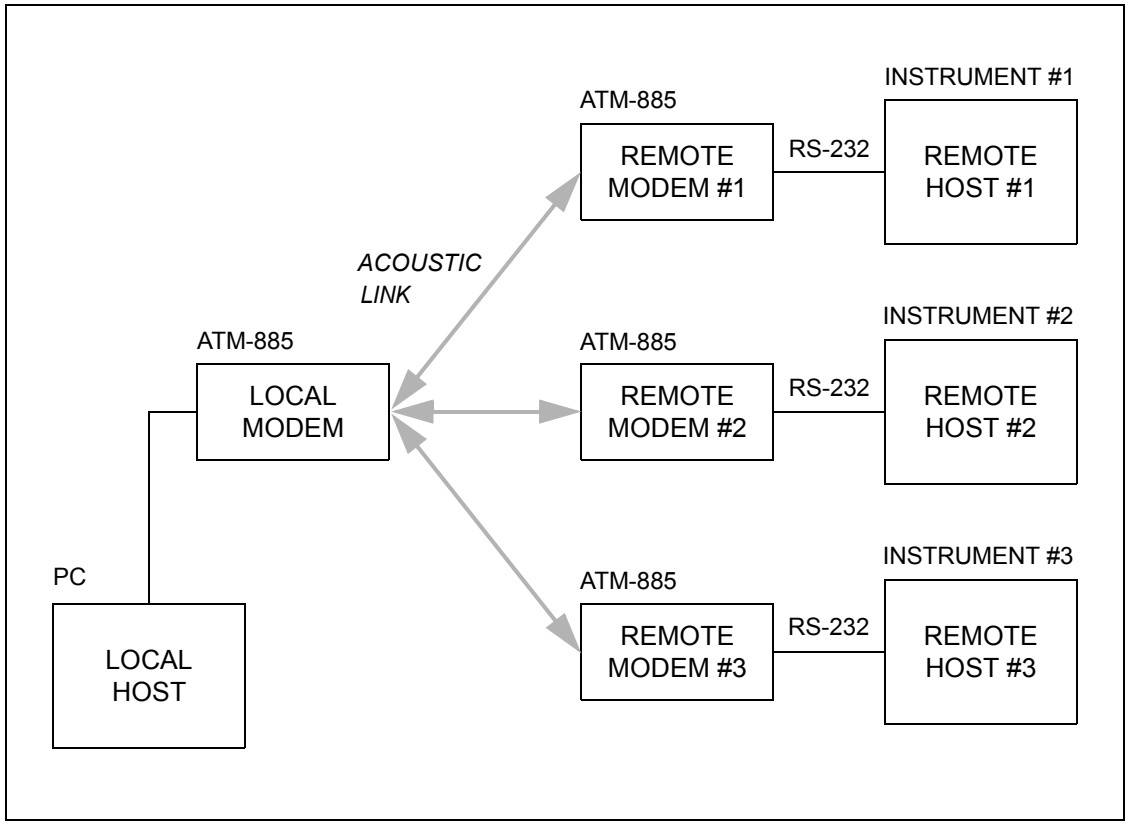


Figure 4-2 Setup with ATM-885 as Local and Remote Modems

Modem Connections

Although cables are supplied, special installations might require customer supplied cables and connectors. For this purpose complete connector and pinout descriptions are provided in the following pages.

ATM-881 Deck Box Front Panel Connectors

The ATM-881 Deck Box front panel connectors and their description and use are listed below and are shown in Figure 4-3.

Connector	Description and Use
AC POWER:	CEE-type AC input connector that connects to the AC power source.
DC POWER:	(2) banana jacks/binding posts, red (+) and black (-), that connect to the DC power source (21–28 VDC)
SERIAL I/O:	DB-25S, RS-232/422 female serial port connector that connects to the host processor.
TRANSDUCER:	10-pin MS3102A18-1S female connector that connects to the remote transducer.

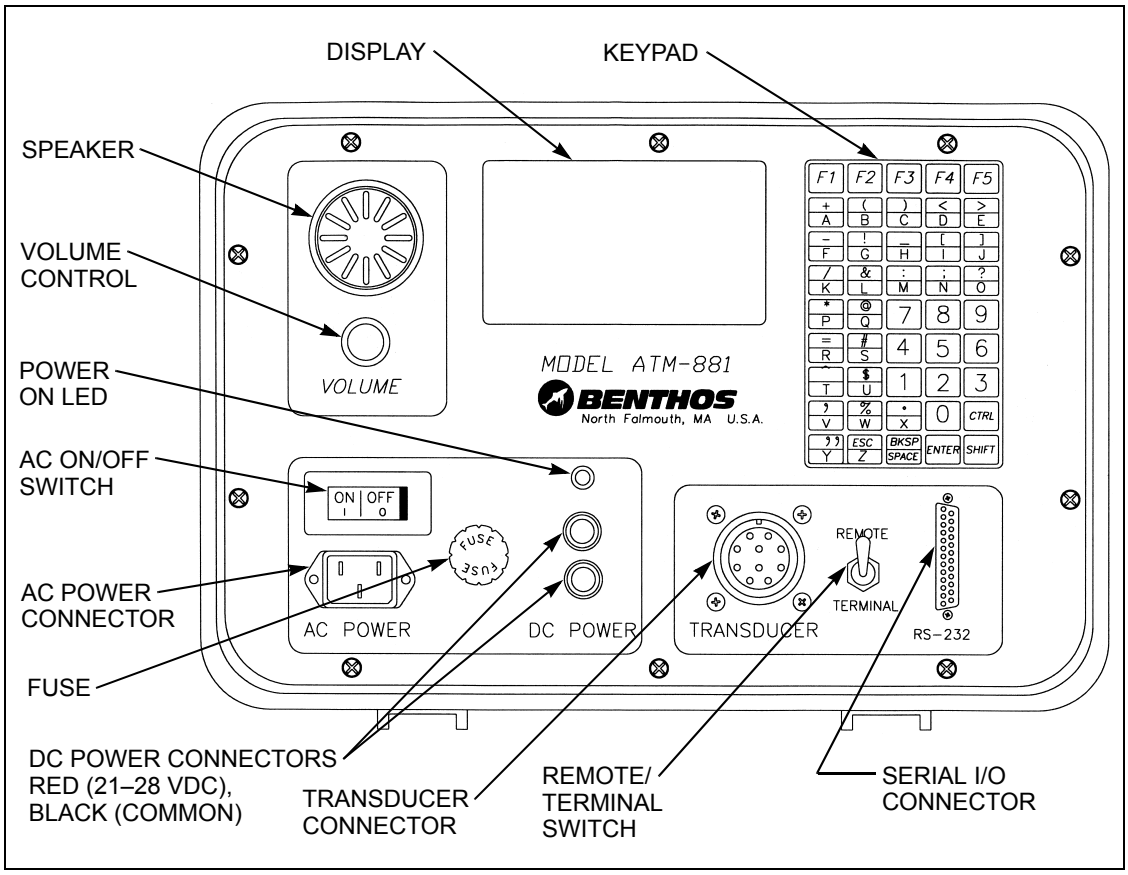


Figure 4-3 ATM-881 Deck Box Front Panel

ATM-881R Rack Mount Deck Box Front and Rear Panel Connectors

The ATM-881 Rack Mount Deck Box front panel connectors and their description and use are listed below and are shown in Figure 4-4.

Connector	Description and Use
PHONES:	1/4" phone jack that connects to a pair of headphones. The speaker is disabled when the headphones are connected.
SERIAL I/O:	DB-25S, RS-232/422 female serial port connector that connects to the host processor. For convenience a similar connector is available on the back panel which serves the same purpose; either connector, but not both, can be used.

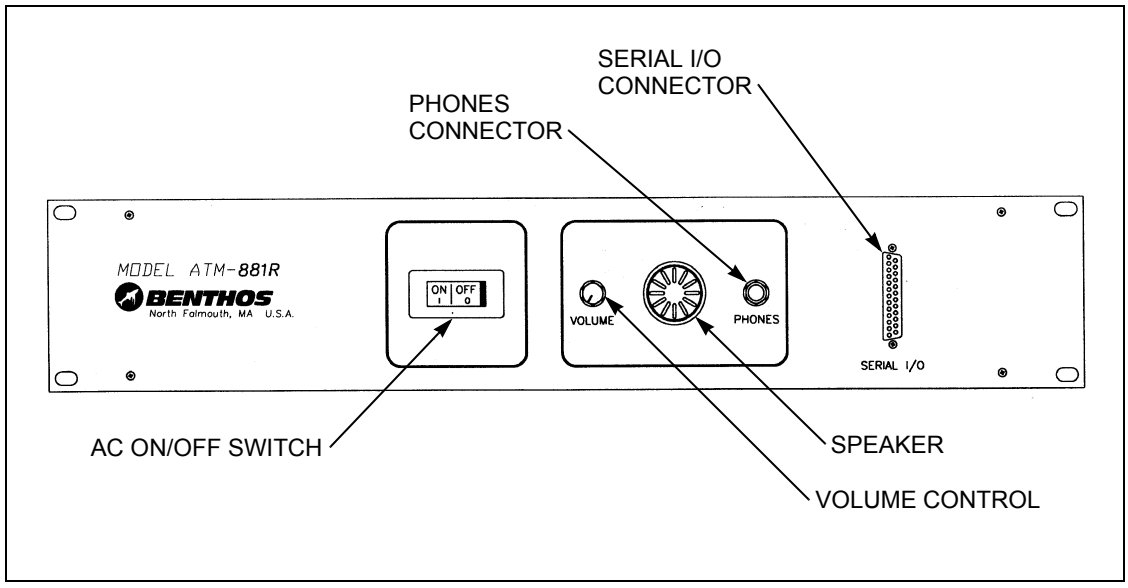


Figure 4-4 ATM-881R Rack Mount Deck Box Front Panel

The ATM-881R Rack Mount Deck Box rear panel connectors and their description and use are listed below and are shown in Figure 4-5.

Connector	Description and Use
TRANSDUCER:	10-pin MS3102A18-1S female connector that connects to the remote transducer.

SERIAL I/O: DB-25S, RS-232/422 female serial port connector that connects to the host processor. For convenience a similar connector is available on the front panel which serves the same purpose; either connector, but not both, can be used.

RCVR OUT: BNC connector that outputs the raw acoustic receive signals.

XMIT OUT: BNC connector that connects to the input of an optional external amplifier.

EXT AMP IN: BNC connector that connects to the output of an optional external amplifier.

NOTE When an external amplifier is used, specially designed transducers are required. Refer to "Customer Service" on page vi for information on how to contact Benthos for details.

AUX: BNC connector that is available for custom applications.

AC POWER: CEE-type AC input connector that connects to the AC power source.

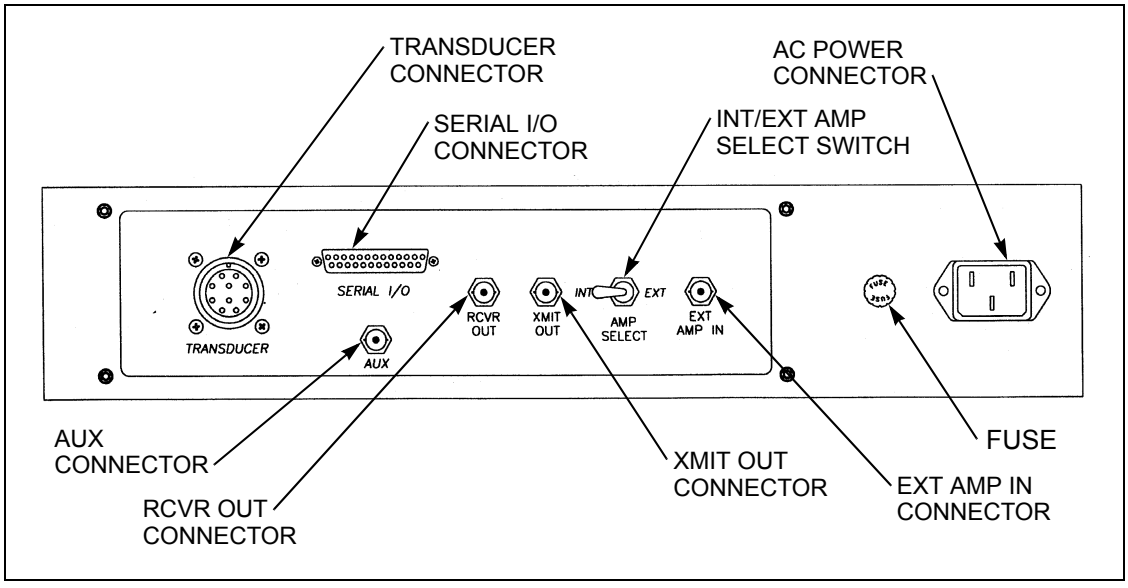


Figure 4-5 ATM-881R Rack Mount Deck Box Rear Panel

Subsea Modem Connectors

The ATM-885 and ATM-885R Acoustic Telemetry Modems include a POWER/SERIAL connector on the bottom end cap for the external power and RS-232/422 connections. The ATM-885R also includes a TRANSDUCER connector on the top end cap for connecting to a remote transducer. The ATM-887 and ATM-887R Acoustic Telemetry Modems include separate POWER and SERIAL connectors, and the ATM-887R also includes a TRANSDUCER connector. A 2-meter cable is supplied with the ATM-885R and ATM-887R for connecting to a remote transducer.

Modem Operator Functions

Typically, most of the modem functions are controlled directly through the keyboard of a PC if a PC is used as the host processor. However, a number of operator functions are provided on the front panels of the ATM-881 Deck Box and the ATM-881R Rack Mount Deck box. The subsea modems have only one operator function, an on/off switch that powers up and powers down the modem.

ATM-881 Deck Box Operator Functions

The ATM-881 Deck Box operator functions and their descriptions and use are listed below and are shown in Figure 4-3 on page 4-4.

Function	Description and Use
AC ON/OFF switch:	An AC circuit breaker/rocker switch that turns the deck box AC power on or off.
POWER ON LED:	A red indicator that is illuminated when power is applied.
SPEAKER:	Provides an audio verification of transmitted and received data.
VOLUME control:	A single turn potentiometer that controls the volume level of the speaker.
DISPLAY:	Displays commands and acoustic data, providing the same indication as the monitor of a PC if a PC is used as the host processor.

KEYPAD:	Allows operator input of commands and data when the REMOTE/TERMINAL switch is switched to TERMINAL.
REMOTE/TERMINAL switch:	A toggle switch that allows operator input of commands and data from the keyboard of a connected PC when switched to REMOTE, or from the deck box keypad when switched to TERMINAL.
FUSE:	A 4-amp slo-blow fuse that protects both the internal and, if used, the external DC power supply.

ATM-881R Rack Mount Deck Box Operator Functions

The ATM-881R Rack Mount Deck Box operator functions and their descriptions and use are listed below and are shown in Figure 4-4 on page 4-5 and Figure 4-5 on page 4-6.

Function	Description and Use
AC ON/OFF switch:	An AC circuit breaker/rocker switch that turns the deck box AC power on or off.
SPEAKER:	Provides an audio verification of transmitted and received data.
VOLUME control:	A single turn potentiometer that controls the volume level of the speaker.
FUSE:	A 4-amp slo-blow fuse that protects the internal DC power supply.
INT/EXT AMP SELECT switch:	A toggle switch that selects the internal or optional external power amplifier. In the INT position, the internal amplifier is selected; in the EXT position, the external amplifier is selected.

NOTE Always leave the INT/EXT AMP SELECT switch in the INT position unless an optional external amplifier is connected to the XMIT OUT and EXT AMP IN connectors.

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 end cap as shown in Figure 4-6 for the ATM-885 and ATM-885R Acoustic Telemetry Modems. A similar configuration is provided for the ATM-887 and ATM-887R Acoustic Telemetry Modems. To turn on the subsea 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.

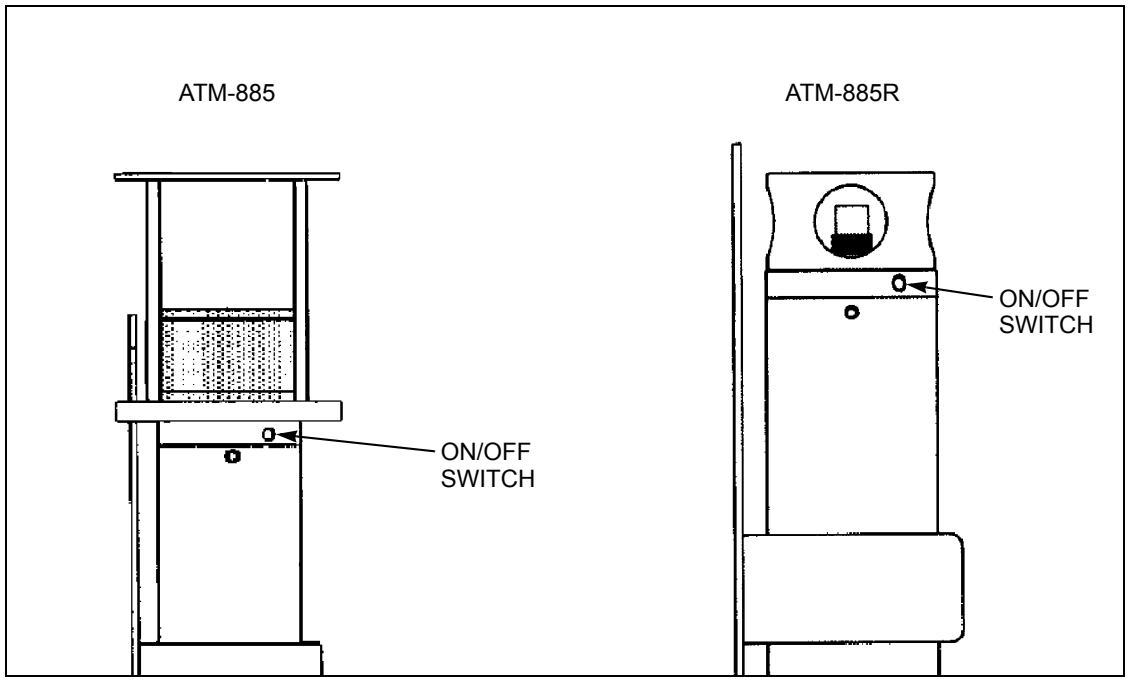


Figure 4-6 Subsea Modem On/Off Switches

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 ATM-881 and ATM-881R Modems

Setting up the ATM-881 Deck Box or the ATM-881R Rack Mount Deck Box requires making the power and serial interface connections and connecting a remote transducer as a dunking transducer. When connecting a deck box to a PC, refer to Figure 4-7 for the SERIAL I/O connector pin orientation and to Table 4-1 for the pinout information.

Perform the steps listed in the following page to connect a remote transducer and a PC to an ATM-881 Deck Box or an ATM-881R Rack Mount Deck Box. Refer to "ATM-881 Deck Box Front Panel Connectors" on page 4-4 or to "ATM-881R Rack Mount Deck Box Front and Rear Panel Connectors" on page 4-5 for information on the deck box connectors and their locations.

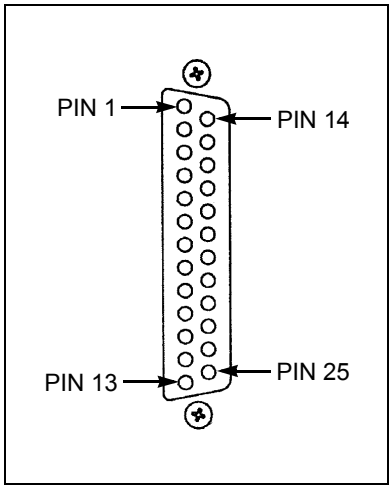


Figure 4-7 ATM-881 and ATM-881R SERIAL I/O Connector

Table 4-1 ATM-881 and ATM-881R SERIAL I/O Connector Pinouts

PIN	LABEL	FUNCTION	SIGNAL DIRECTION
2	RXD	RS-232 Receive	Host to Modem
3	TXD/RX(-)	RS-232 Transmit/RS-422 Receive(-)	Modem to Host/ Host to Modem
5	RTS/RX(+)	Request to Send/RS-422 Receive(+)	Modem to Host/ Host to Modem
7	GND	Common Ground	
11	TX(-)	RS-422 Transmit(-)	Modem to Host
25	TX(+)	RS-422 Transmit(+)	Modem to Host

NOTE It is not necessary to connect the ATM-881 Deck Box to a PC for checking the modem's operation, as commands can be entered from the keypad on the deck box. However, the REMOTE/TERMINAL switch on the deck box must be switched to TERMINAL.

1. Connect the supplied 25-meter transducer cable from the TRANSDUCER connector on the deck box to the bulkhead connector on the remote transducer that is to be used as the dunking transducer.
2. If AC power is to be used, connect the supplied AC power cable to the AC POWER connector on the deck box.

   For the ATM-881 Deck box only, if DC power is to be used, connect the supplied DC power cable to the banana jack/binding posts, connecting 21–28 VDC to red and common to black.
3. For the ATM-881 Deck Box only, switch the REMOTE/TERMINAL switch on the deck box to REMOTE.
4. Connect an RS-232 serial cable from the SERIAL I/O connector on the deck box to an available serial COM port on the PC. Refer to Table 4-1 on page 4-10 for the connector pinout information. A straight wire, pin for pin connection to the PC's serial COM port is what is required. Refer to Table 4-2 for the pin-to-pin connections for PC's that have 9-pin DB-9 serial port connectors. For those computers—usually laptops—a DB-25P (male) to DB-9S (female) cable is required.

Table 4-2 ATM-881 and ATM-881R SERIAL I/O Connector to DB-9 Pin-to-Pin Connections

ATM-881, ATM-881R SERIAL I/O CONNECTOR			SIGNAL DIRECTION	HOST PC DB-9 CONNECTOR		
PIN	LABEL	FUNCTION		PIN	LABEL	FUNCTION
2	RXD	Receive	Host to Modem	3	TXD	Transmit
3	TXD	Transmit	Modem to Host	2	RXD	Receive
5	RTS	Request to Send	Modem to Host	8	CTS	Clear to Send
7	GND	Ground	—	5	GND	Ground

Setting up the ATM-885 and ATM-885R Modems

Setting up the ATM-885 and ATM-885R Acoustic Telemetry Modems requires making the power and serial interface connections and the transducer connection.

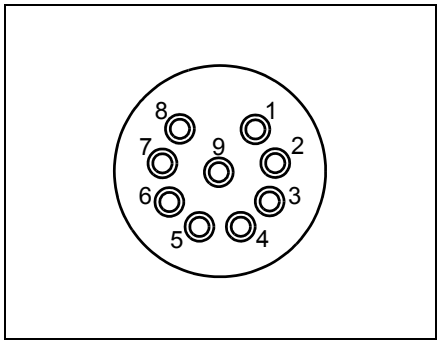


Figure 4-8 ATM-885 and ATM-885R POWER/SERIAL Connector

Power and Serial Interface Connections. The power and serial interface connections are made with a single POWER/SERIAL connector located on the bottom end cap of the modem. Either an RS-232 or an RS-422 serial interface connection can be made. When connecting an ATM-885 or an ATM-885R to a PC or to an instrument, refer to Figure 4-8 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 ATM-885 and ATM-885R 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 a logic low when the modem is in Online Mode. 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 4-12 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 an ATM-885 or ATM-885R 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 conductors 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 and connect the DC power and ground conductors to the DC power source if one is used.

Table 4-4 ATM-885 and ATM-885R POWER/SERIAL Connector to DB-9 Pin-to-Pin Connections

ATM-885, ATM-885R 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. A transducer cable is supplied with an ATM-885R Acoustic Telemetry Modem. Connect the transducer cable to the TRANSDUCER connector on the modem and to the bulkhead connector on the remote transducer.

Setting up the ATM-887 and ATM-887R Modems

Setting up the ATM-887 and ATM-887R Acoustic Telemetry Modems requires making the power and serial interface connections and the transducer connection.

Power and Serial Interface Connections. The power and serial interface connections are made with separate POWER and SERIAL connectors located on the bottom end cap of the modem. Only an RS-232 serial interface connection is available. When connecting an ATM-887 or an ATM-887R to a PC or to an instrument, refer to Figure 4-9 for the POWER and SERIAL connector pin orientations, and to Table 4-5 and Table 4-6 for the connector pinout information. The POWER connector is a 3-pin Impulse XSK-3-BCL bulkhead connector that requires an Impulse RMK-3-FS mating connector pigtail, and the SERIAL connector is a 6-pin XSK-6-BCL bulkhead connector that requires an RMK-6-FS mating connector pigtail.

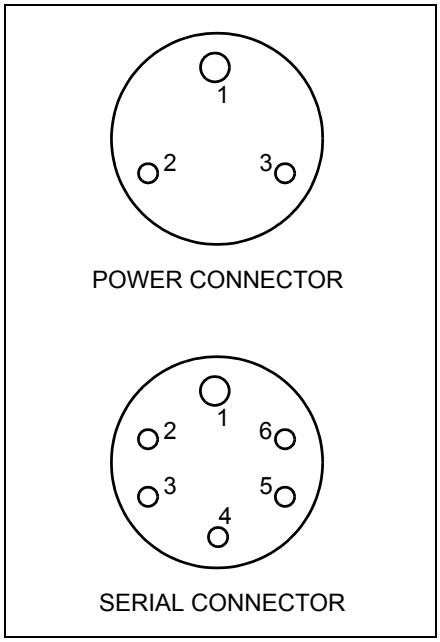


Figure 4-9 ATM-887 and ATM-887R POWER and SERIAL Connectors

Table 4-5 ATM-887 and ATM-887R SERIAL Connector Pinouts

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

NOTE The Device Enable output is a logic low when the modem is in Online Mode. 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-887 and ATM-887R POWER Connector Pinouts

PIN	FUNCTION
1	External Power Input (21–28 VDC)
2	Ground
3	Reserved

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 interface, refer to the pinout information provided in Table 4-5 on page 4-14 and in Table 4-6 for the SERIAL and POWER connectors, and to the connector information provided with the instrument. Mating connector pigtails are provided for this purpose.

To connect an ATM-887 or ATM-887R to a power supply and to a PC, perform the steps listed below.

1. Connect the connector pigtails to the SERIAL and POWER connectors.
2. Refer to Table 4-7 and connect the conductors 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 4-6 and connect the DC power and ground conductors to the DC power source if one is used.

Table 4-7 ATM-887 and ATM-887R SERIAL Connector to DB-9 Pin-to-Pin Connections

ATM-887, ATM-887R SERIAL CONNECTOR			SIGNAL DIRECTION	HOST PC DB-9 CONNECTOR		
PIN	LABEL	FUNCTION		PIN	LABEL	FUNCTION
1	GND	Common Ground		5	GND	Ground
2	TXD	Transmit	Modem to Host	2	RXD	Receive
3	RTS	Request to Send	Modem to Host	8	CTS	Clear to Send
4	RXD	Receive	Host to Modem	3	TXD	Transmit

Transducer Connections. A transducer cable is supplied with an ATM-887R Acoustic Telemetry Modem. Connect the transducer cable to the TRANSDUCER connector on the modem and to the bulkhead connector on the remote transducer.

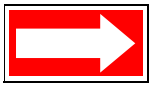
Setting up the ATM-885PCB and ATM-885RPCB Board Sets

The ATM-885PCB and ATM-885RPCB Board Sets are set up with all 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 boards of the ATM-885PCB and ATM-885RPCB Board Sets. When connecting an ATM-885PCB to a PC or to an instrument, power is connected to J4 of the Transmitter Board. For an ATM-885RPCB, power is connected to J4 of the Interface Board. For both modems, the serial interface connection is made to J2 of the DSP Board. The location of the J4 and J2 connectors is shown in Drawing B875-08659 for an ATM-885PCB and in Drawing B875-08693 for an ATM-885RPCB. The drawings are included in Section 9, "Drawings." Refer to Table 4-8 and Table 4-9 for the pinout information.

Table 4-8 ATM-885PCB and ATM-885RPCB DSP Board Serial Connector J2 Pinouts

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



NOTE The Device Enable output is a logic low when the modem is in Online Mode. Refer to "Device Enable" on page 6-3 for more information. Refer also to Section 2, "Specifications," for the electrical specifications.

Table 4-9 ATM-885PCB Transmitter Board and ATM-885RPCB Interface Board Power Connector J4 Pinouts

PIN	FUNCTION
1	Reserved
2	Ground
3	External Power Input (21–28 VDC)
4	No Connection
5	No Connection

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 4-8 on page 4-16 for the DSP Board Serial connector J2 and Table 4-9 for the Transmitter or Interface Board Power connector J4, and to the connector information provided with the instrument.

To connect an ATM-885PCB or ATM-885RPCB to a power supply and to a PC, perform the steps listed below.

1. Refer to Table 4-10 and connect the conductors 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.
2. Refer to Table 4-9 and connect the DC power and ground conductors to the DC power source.

Table 4-10 ATM-885PCB and ATM-885RPCB DSP Board Serial Connector J2 to DB-9 Pin-to-Pin Connections

ATM-885PCB, ATM-885RPCB DSP BOARD SERIAL CONNECTOR J2			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
5	RTS	Request to Send	Modem to Host	8	CTS	Clear to Send
7	GND	Common Ground		5	GND	Ground

ATM-885PCB Transducer Connections. The ATM-885PCB includes an omnidirectional transducer and connector. Connect the transducer to J2 of the Transmitter Board. Table 4-11 shows the pinout information for J2 should a cable of a different length be required.

Table 4-11 ATM-885PCB Transmitter Board Transducer Connector J2 Pinouts

PIN	FUNCTION
1	Transducer (+)
2	No Connection
3	Transducer (-)

ATM-885RPCB Transducer Connections. The ATM-885RPCB connects to any of the remote transducers—an AT-408 Omnidirectional Transducer, an AT-409 Line Array Transducer, or an AT-421 Directional Transducer. A bulkhead connector wiring assembly is supplied for connecting to the ATM-885RPCB. The bulkhead connector is a Subcon MCBH8F, which connects to the transducer cable supplied with the remote transducer. Refer to Table 4-12 and connect the bulkhead connector wiring assembly to J7 on the Interface Board and to J7 on the DSP Board. Connect the remote transducer cable to the bulkhead connector wiring assembly and to the bulkhead connector on the remote transducer.

Table 4-12 ATM-885RPCB Bulkhead Connector Wiring

INTERFACE BOARD J7	DSP BOARD J7	FUNCTION	BULKHEAD CONNECTOR WIRING ASSEMBLY
PIN	PIN		
1	—	Transmit Power (+)	**8**
2	—	Transmit Power (-)	**7**
3	—	Transmit On/Off	**6**
4	—	Transmit Signal	**5**
5	—	Power Control	**4**
6	—	Analog Ground	**3**
—	**1**	Receiver input (RG 174 shield)	**2**
—	**2**	Receiver Input (RG 174 center conductor)	**1**

Setting up the ATM-880 Module

Setting up the ATM-880 Module requires making the power and serial interface connections and the transducer connection.

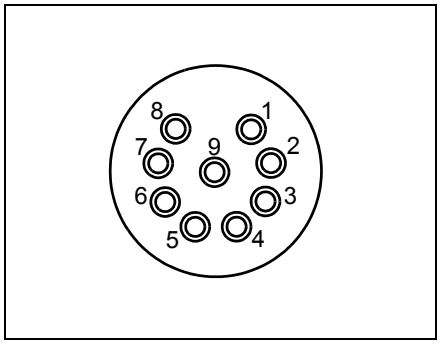
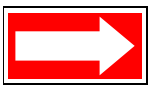


Figure 4-10 ATM-880 POWER/SERIAL Connector

Power and Serial Interface Connections. The power and serial interface connections are made with a single POWER/SERIAL connector located on the side of the modem. Either an RS-232 or an RS-422 serial interface connection can be made. When connecting an ATM-880 to a PC or to an instrument, refer to Figure 4-10 for the POWER/SERIAL connector pin orientation, and to Table 4-13 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 4-13 ATM-880 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 a logic low when the modem is in Online Mode. Refer to "Device Enable" on page 6-3 for more information. Refer also to Section 2, "Specifications," for the electrical specifications.

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 4-13 on page 4-19 for the POWER/SERIAL connector, and the connector information provided with the instrument. A mating connector pigtail is provided for this purpose.

To connect an ATM-880 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 4-14 and connect the conductors 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 4-13 on page 4-19 and connect the DC power and ground conductors to the DC power source if one is used.

Table 4-14 ATM-880 POWER/SERIAL Connector to DB-9 Pin-to-Pin Connections

ATM-880 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

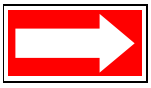
Transducer Connections. A transducer cable is supplied with an ATM-880 Module. Connect the transducer cable to the TRANSDUCER connector on the modem and to the bulkhead connector on the remote transducer.

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 or Windows Terminal. DumbTerm, which is available from RDI Instruments, can also be used for this purpose. 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.

For a convenient, user friendly means of configuring and operating the modems without using a terminal program, Telesonar PC can be used. For instructions on how to install and start Telesonar PC, refer to "Installing and Starting Telesonar PC" on page 5-1.



NOTE If Telesonar PC is installed and will be used to operate the modem, it is not necessary to set up the PC as instructed below. Instead, refer to "Selecting and Configuring the Local Modem's Serial Communications Port" on page 5-14 to select the COM port, the baud rate, the serial interface, and the handshaking to be used by the modem.

After connecting the modem to the PC as described in "Setting Up the Modems" on page 4-10, 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 bits/sec**
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.

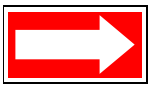
Verifying Operation of the ATM-881 and ATM-881 Modems

If an ATM-881 Deck Box or an ATM-881R Rack Mount Deck Box is set up, perform the steps listed below to check its operation.

1. Connect the AC power cable to an available 100–120 VAC, 50–60 Hz or 200–240 VAC, 50–60 Hz power source, or the DC power cable to a 21–28 VDC power source.
2. Switch the AC ON/OFF switch on the front panel of the deck box to ON, or switch on the DC power supply.
3. Rub the remote transducer head to check the connection between the transducer and the modem. When rubbing the transducer, sounds should be heard coming from the speaker on the front panel of the deck box. If the sounds cannot be heard, increase the speaker volume by adjusting the VOLUME control.
4. Switch the AC ON/OFF switch on the front panel of the deck box to OFF, or switch off the DC power supply.

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 baud 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. If the ATM-881 Deck Box is being used as a modem, they can also be changed from the keypad on the front panel. 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)."



NOTE The keypad on an ATM-881 Deck Box can be used to enter the commands below. However, the REMOTE/TERMINAL switch must be switched to TERMINAL.

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 ATM-881 Deck Box or the ATM-881R Rack Mount Deck Box is being used as the modem, switch the AC ON/OFF switch on the front panel to ON, or switch on the DC power supply. 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.

   For the ATM-881 Deck Box, the banner message followed by the command prompt (>) is displayed on the display. If a PC is being used as the host processor, the message is displayed on the monitor. The message includes the frequency band (LF, MF, HF, or Nonstandard) the firmware version, and the command prompt as shown in the following example:

   Benthos ATM-88X
   MF Frequency Band
   Acoustic Modem Version 4.1
   >

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=042 S01=001 S02=000 S03=001 S04=005 S05=000 S06=008

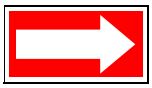
   S07=015 S08=060 S09=000 S10=255 S11=001 S12=000 S13=002

   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 baud rate of the modem to 1200 baud.

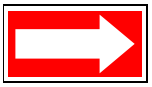
2. Type AT&W, and then press Enter. The command is executed and the command prompt is once again displayed:

   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

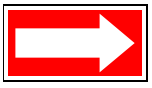
To check the acoustic link between two modems in air, both modems must be set up with at least one modem connected to a host processor, or at least one modem being an ATM-881 Deck Box.



NOTE The keypad on an ATM-881 Deck Box can be used to enter the commands below. However, the REMOTE/TERMINAL switch must be switched to TERMINAL.

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.

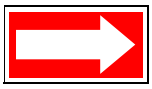
3. If the ATM-881 Deck Box or the ATM-881R Rack Mount Deck Box is being used as the modem, switch the AC ON/OFF switch on the front panel to ON, or switch on the DC power supply. If a subsea modem is being used as the modem, switch on the modem by pushing in the switch on the side of the end cap.

   For the ATM-881 Deck Box, the banner message followed by the command prompt (>) is displayed on the display. If a PC is being used as the host processor, the message is displayed on the monitor. The message includes the frequency band (LF, MF, HF, or Nonstandard) the firmware version, and the command prompt as shown in the following example:

   Benthos ATM-88X
   MF Frequency Band
   Acoustic Modem Version 4.1
   >

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, as performance may depend on the type of material, such as a hard table top or rug, in the vicinity of the transducers. In addition, it may be required to change the transmit power level, usually to a lower level. The transmit power level is set by using the Remote Power command (AT$pn,m). For instructions on how to use the Remote Power command, refer to "Remote Power AT$Pn,m" on page 6-29.

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 6-27 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=041 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 Telesonar PC

Telesonar PC, which runs on the Windows 98® and the Windows NT® platform, is a graphical users interface (GUI) software program that provides a user friendly means of configuring and operating the ATM-880 Series Acoustic Telemetry Modems without having to enter specific commands.

NOTE When using Telesonar PC, any reference to a local modem refers to the modem to which commands and data are input from the PC 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.

This section provides instructions on how to install and start Telesonar PC and describes its many features and how to use them.

Installing and Starting Telesonar PC

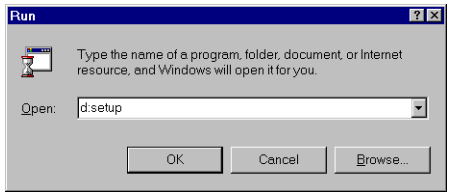
Telesonar PC is installed using the Telesonar PC Setup program, which is started by choosing Run in the Start menu. After installation, Telesonar PC can be started. Instructions on how to install, start, check the version number, exit from, and uninstall Telesonar PC are provided below.

Installing Telesonar PC

To install Telesonar PC:

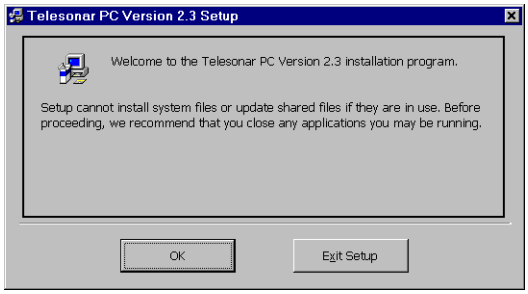
1. Exit all programs and turn off any virus protection or screen saver software.
2. Insert the Telesonar PC for Windows CD into the CD-ROM drive.
3. Select Start ➤ Run.

   The Run dialog box opens:



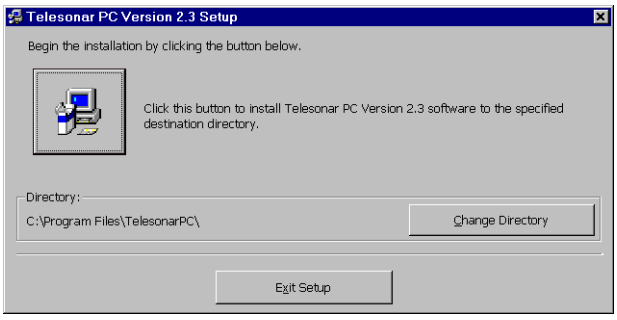
4. Enter d:setup in the Open text box, where "d" is the drive letter of the CD-ROM drive, and then click OK.

   The first Telesonar PC Version 2.3 Setup dialog box opens:



5. Click OK.

   The second Telesonar PC Version 2.3 Setup dialog box opens:



6. Click the Install button ( ) to install Telesonar PC in the specified destination directory. Or instead, click Change Directory and follow the instructions to select a different directory, and then click the Installation button.

   Telesonar PC is installed and ready to be started.

Starting Telesonar PC

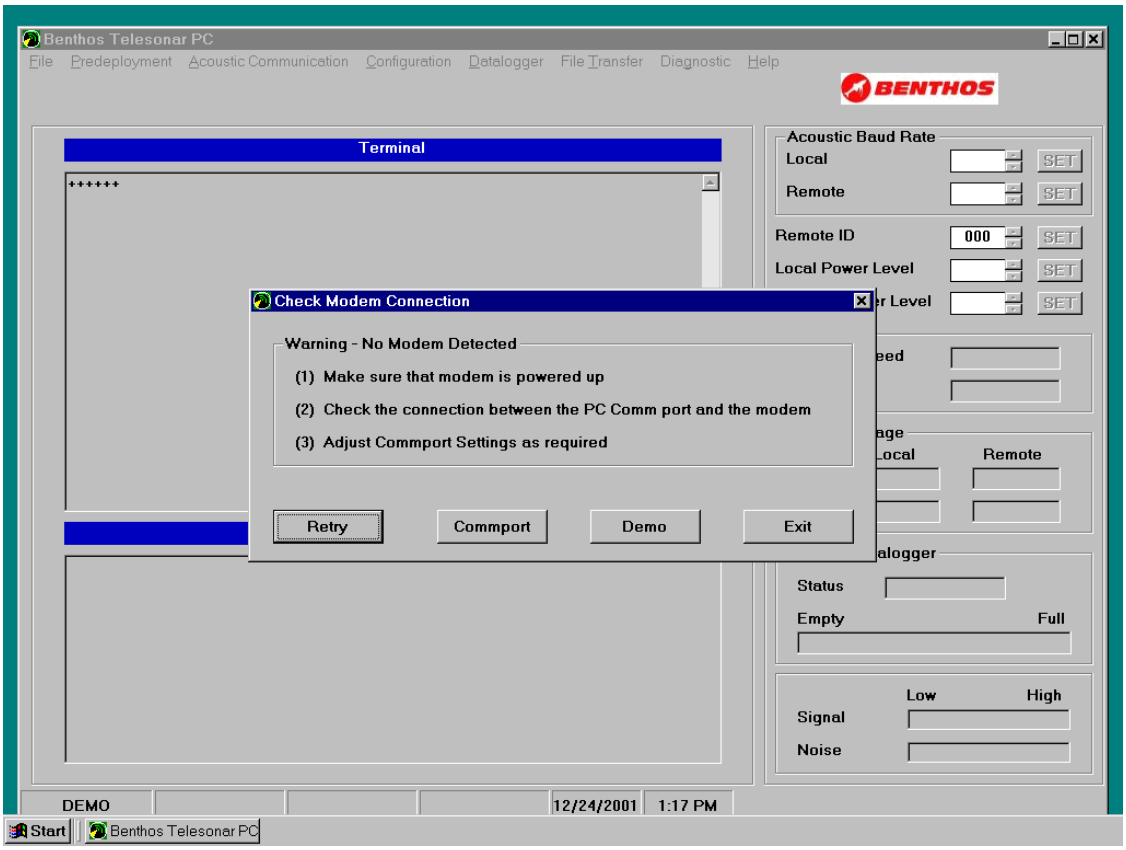
To start Telesonar PC:

1. Select Start ➤ Programs ➤ Telesonar PC Version 2.3.

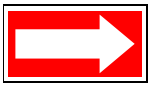
   The Telesonar PC Version 2.3 applications menu opens:

2. Choose Telesonar PC Version 2.3.

Telesonar PC starts and the Main window opens as it appears when no modem is connected to the PC:



Telesonar PC can also be started by clicking the Telesonar PC icon () on the Windows desktop.



NOTE If a modem has been connected to the PC as described in "Setting Up the Modems" on page 4-10 and the Check Modem Connection dialog box appears, the serial communications port may not be configured correctly. Click Commport in the Check Modem Connection dialog box, select the correct baud rate and COM port in the PC Communications dialog box that opens, and then click SET to save the new selections and close the dialog box.

When the Main window opens, and if a modem is connected to the PC and the correct baud rate and COM port is set, the modem has automatically gone online with the remote modem whose address is displayed in the Remote ID Status display of the Main window. However, if there is no remote modem, or

the address of the remote modem is incorrect or not known, the Remote Modem window shown in Figure 5-1 also opens.

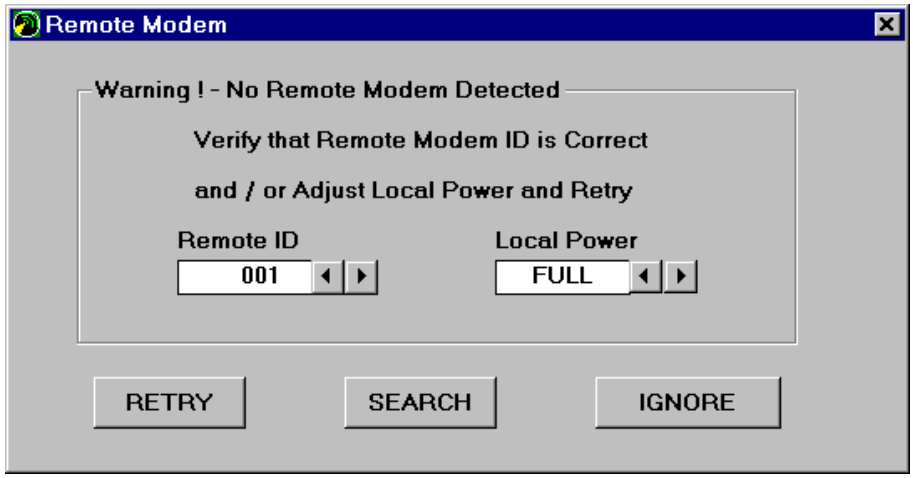


Figure 5-1 The Remote Modem Window

In the Remote Modem window, verify the address of the remote modem. If the address is wrong, select the correct address using the left or right arrow in the Remote ID scroll box, and then click RETRY. If the address is correct, try changing the transmit power level using the left or right arrow in the Local Power scroll box, and then click RETRY.

If the address of the remote modem is not known, click SEARCH to have Telesonar PC find a remote modem.

If there is no remote modem, the Main window can be accessed and the Remote Modem dialog box closed by clicking IGNORE. However, some of the items on the Menu bar will be dimmed and therefore unavailable.

Checking the Telesonar PC Version Number

To check the Telesonar PC version number, choose Help ➤ About. The About Telesonar PC window opens with the version number displayed.

Exiting Telesonar PC

To exit Telesonar PC:

1. Select File from the Menu bar in the Main window.

   The File menu opens.

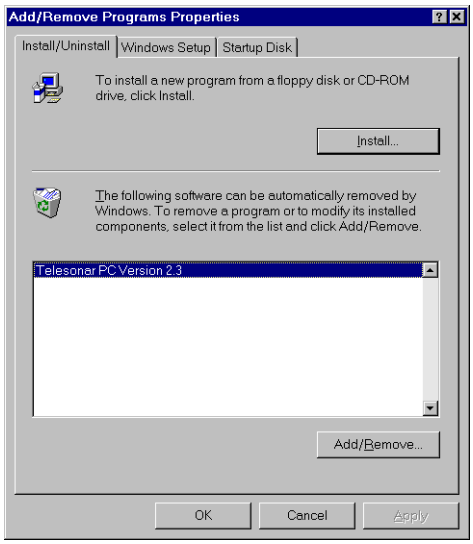
2. Choose Exit.

Uninstalling Telesonar PC

To uninstall Telesonar PC:

1. Exit from Telesonar PC.
2. Select Start ➤ Settings ➤ Control Panel to open the Control Panel.
3. Choose Add/Remove Programs in the Control Panel.

   The Add/Remove Programs Properties dialog box opens:



4. Select Telesonar PC Version 2.3, and then Click Add/Remove.
5. Click Yes when asked to confirm the removal of the program and all of its components.

   Telesonar PC is uninstalled.

The Main Window

The Main window, which opens when Telesonar PC is started, is shown in Figure 5-2 as it appears when a modem, the local modem, is connected to the PC and is online with a remote modem. Access to all of the commands for the local modem and all of the remote modems is available from the Main window. In addition, the Main window includes Status displays, a Status bar, Terminal and Input displays, and standard Windows features, such as the Menu bar, the Title bar, and the Maximize, Minimize, and Close buttons.

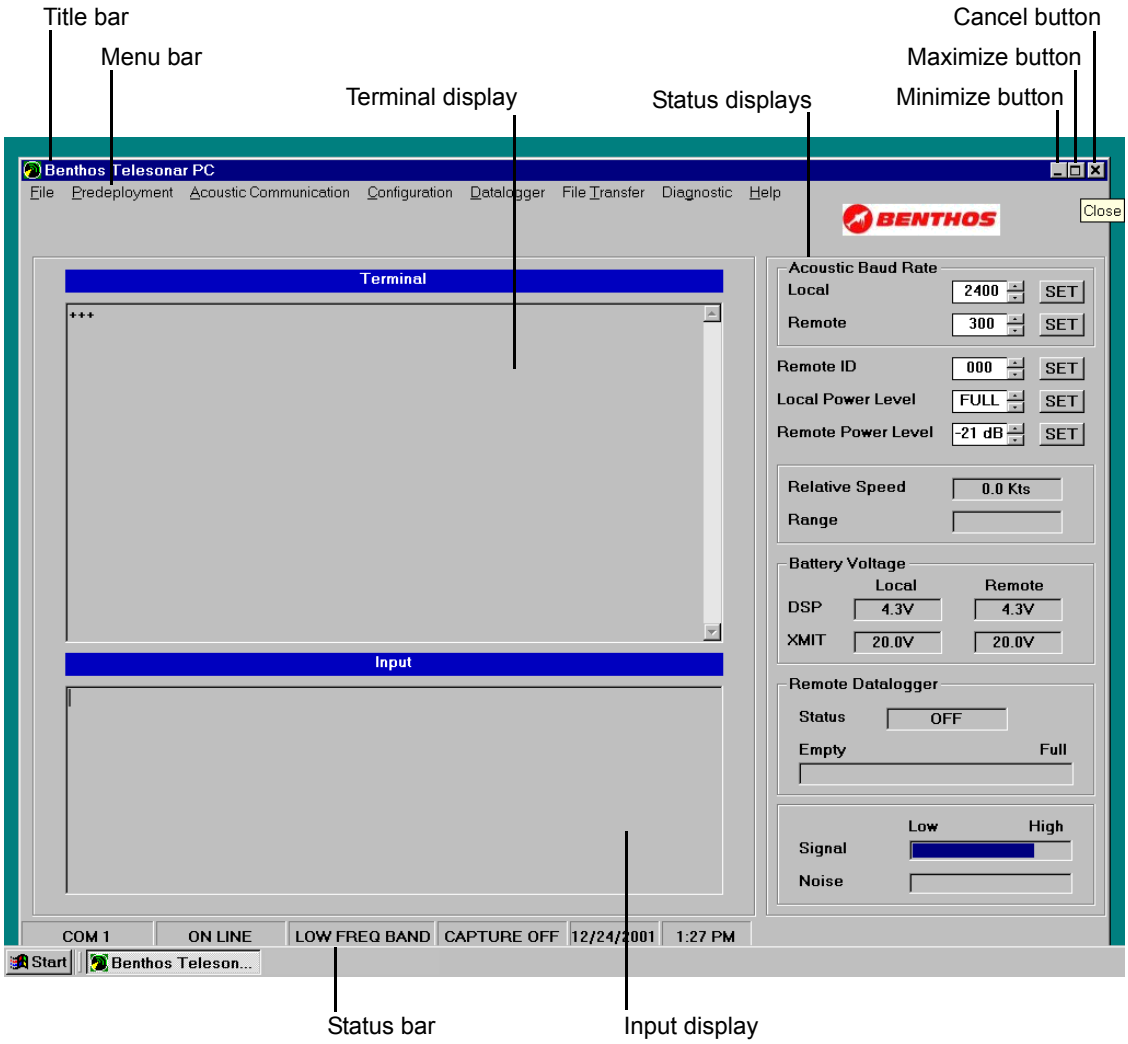


Figure 5-2 The Main Window

Menu Bar

The Menu bar provides access to all of the modem commands through pull-down menus. To open a menu from the Menu bar, place the mouse pointer on the menu name to select it, and then click the left mouse button. The menu opens as shown in Figure 5-3, which shows the opened Datalogger menu. To choose an item from an open menu, place the mouse pointer on the item to select it and then click the left mouse button. Although most of the items in a menu are commands or options, some may be the names of submenus, in which case a triangle (▶) follows the item. Selecting the item opens the submenu.

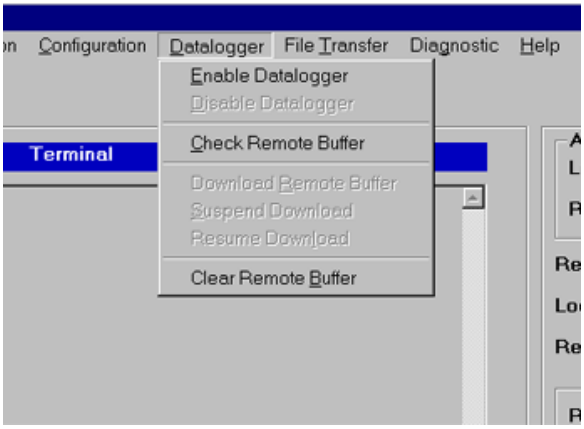


Figure 5-3 The Opened Datalogger Menu

Some menu items, when chosen, open a window or a dialog box, which may include many of the standard Windows features: check boxes, option buttons, drop-down list boxes, command buttons, and text boxes. Some menu items are options that can be enabled or disabled. When enabled, a check mark (✔) precedes Enabled; when disabled, the check mark precedes Disabled. To enable the function, place the mouse pointer on Enable and click the left mouse button; to disable the function, do the same for Disable. Some menu items may be dimmed, such as the Disable Datalogger command and several others in the Datalogger menu shown in Figure 5-3. This signifies the item cannot be chosen at the current time. When the item is available, it is displayed normally.

NOTE To close a menu without choosing a menu item, click anywhere outside the menu.

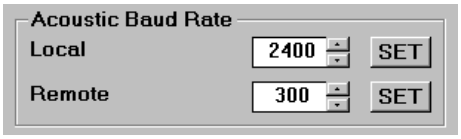
Status Bar

The Status bar is located at the bottom of the Main window as shown in Figure 5-2 on page 5-6. The Status bar provides information about the local modem, including the COM port of the PC that it is connected to, whether the modem is initializing, is online with another modem, is waiting for a response, or is in some other operating state. The Status bar also indicates the frequency band selected for the modem, whether Capture is on or off, and the current time and date.

For information on Capture, refer to "Uploading Data from a File to the Remote Modem" on page 5-34.

Status Displays

The Status displays provide information about the local and remote modems. Some of the Status displays, such as the Acoustic Baud Rate, the Remote ID, and the Power Level Status displays can also be used to send commands to the local modem and to the remote modem that is online with the local modem. The Status displays are shown in the Main window in Figure 5-2 on page 5-6 and are described below.



Acoustic Baud Rate. Displays and selects the acoustic baud rate in bits/second of the local modem and the online remote modem.

To select the baud rate for either modem, click the up or down arrow in the corresponding drop-down list box until the desired setting is displayed. When changed, the display turns blue. Then click SET. When the new baud rate is set, the display turns back to black.

Remote ID. Displays and selects the address of the remote modem to which commands and data can be sent. Any address from 00 to 32 can be selected.

To select the address, click the up or down arrow in the scroll box until the desired setting is displayed. When changed, the display turns blue. Then click SET. When the new address is set, the display turns back to black.

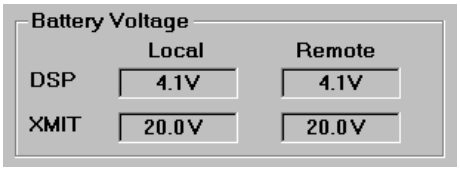
Local and Remote Power Levels. Displays and selects the transmit power level in decibels of the local modem and the online remote modem.

To select the power level for either modem, click the up or down arrow in the corresponding drop-down list box until

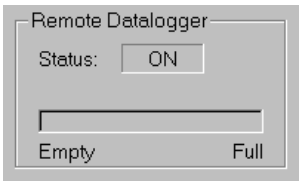
the desired setting is displayed. When changed, the display turns blue. Then click SET. When the new power level is set, the display turns back to black.

Relative Speed. Displays the relative speed in knots between the local and remote modems. To select the units of relative speed, select Configuration from the Menu bar, and then choose Speed Units. A positive number indicates the modems are moving closer together; a negative number indicates the modems are moving farther apart.

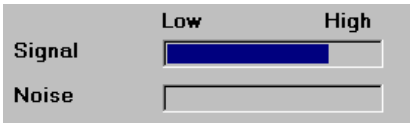
Range. Displays the range between the local and the online remote modem's transducers. To select the units of range and the sound velocity used in the calculation of range, select Configuration from the Menu bar, and then choose Range Options. To display the range, select Acoustic Communication from the Menu bar, and then choose Get Range.



Local and Remote Battery Voltages. Displays the local and the online remote modem's DSP/receiver and transmitter power supply voltages.



Remote Datalogger. Indicates whether the online remote modem is in Datalogger mode, and displays the relative amount of data stored in its data logger memory, from empty to full.



Signal and Noise Levels. Displays the relative levels of the received signal and noise, from low to high.

Data Displays

As shown in Figure 5-2 on page 5-6, there are two data displays: a Terminal display and an Input display. The Terminal display displays data and commands that are input to the local modem over the serial interface or received from a remote modem over the acoustic link. The Input display displays messages that are to be transmitted from the local modem to the online remote modem. These messages can be typed directly from the keyboard of the PC that is running Telesonar PC.

Viewing of commands in the Terminal display can be enabled or disabled. In addition, the Terminal display can be cleared at any time. Messages viewed in the Input display are typed with Chat mode enabled or disabled. When enabled, the messages are transmitted only after pressing Enter. When disabled, transmission of all characters, including backspaces, begins after typing has stopped for a period equal to the forwarding delay, or after one of the modem's four 4-kbyte transmit buffers is full. Refer to "Forwarding Delay S8" on page 7-19 for information on the forwarding delay.

Clearing the terminal display. To clear the Terminal display, choose File ➤ Clear Display.

Enabling and disabling viewing of commands. To enable viewing of all commands in the Terminal display, choose Diagnostic ➤ View Modem Commands ➤ Enable. To disable viewing, choose Disable.

Enabling and disabling Chat mode. To enable Chat mode, choose File ➤ Enable Chat Mode. To disable, choose Disable.

Displaying Warning Messages

A warning message is displayed only when the condition requiring the warning is detected. The warnings are shown in separate windows which can be closed by clicking OK to acknowledge the warning. In addition, the display of some of the warning messages can be enabled or disabled.

To enable the display of all warning messages choose Diagnostic ➤ Warning Messages ➤ Enable. To disable, choose Disable.

Updating the Status Displays for the Remote Modem

To update the Status displays for the online remote modem, choose Acoustic Communication ➤ Get Remote Status.

Battery Pack Capacity Calculations

Telesonar PC provides a convenient tool for calculating the required modem battery pack capacity based on the length of deployment and the amount of data to be transmitted. Two basis are provided: one calculates the required capacity for a short deployment of 30 days or less and where a relatively large data file of 4 kbytes or more is to be transmitted; the other, the required capacity for a long deployment of more than 30 days where relatively small data files of less than 4 kbytes are to be transmitted periodically. Both basis take into account the expected ambient temperature.

Transmitting a Relatively Large Data File—Short Deployment

Transmitting a relatively large data file over a short deployment quickly uses a large portion of the modem battery pack capacity that is available for the transmitter, and a small portion of the battery pack capacity that is available for the DSP/receiver.

To calculate the battery pack capacity required to transmit a relatively large data file over a short deployment:

1. Choose Predeployment ➤ Battery Capacity.

   The Battery Capacity Calculation dialog box shown in Figure 5-4 opens.

2. Select the acoustic baud rate in bits/sec from the Acoustic Baud Rate drop-down list box.
3. Enter the expected length of deployment in days in the Length of Deployment text box.
4. Select the One Large File option for the basis.
5. Enter the expected number of bytes that will be uploaded in the Number of Bytes to Upload text box.
6. Select the expected ambient temperature in degrees Celsius using the Water Temperature slider.

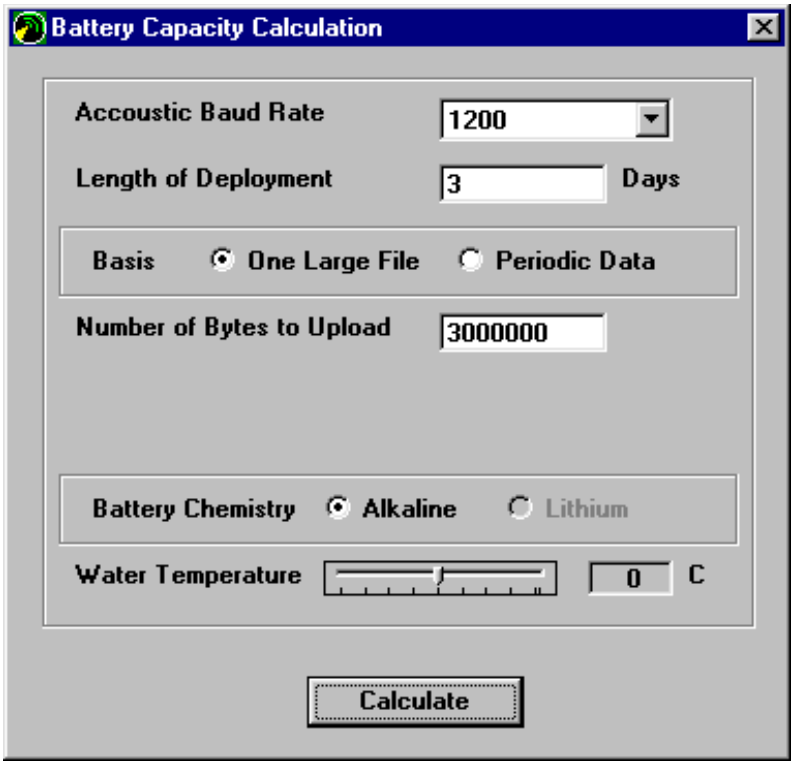


Figure 5-4 The Battery Capacity Calculation Dialog Box—Set up for when Transmitting One Large Data File

7. Click Calculate to calculate and display the required battery capacity and close the Battery Capacity Calculation dialog box.

The Battery Calculation window opens with the battery pack capacity requirements displayed and a notification indicating whether a standard 18 A·h modem battery pack is adequate:

Transmitting Relatively Small Data Files Periodically—Long Deployment

Transmitting relatively small data files periodically over a long deployment uses a large portion of the modem battery pack capacity that is available for the DSP/receiver, and a small portion of the battery pack capacity that is available for the transmitter.

To calculate the battery pack capacity required to transmit relatively small data files over a long deployment:

1. Choose Predeployment ➤ Battery Capacity, and then select the Periodic Data option for the basis when the Battery Capacity Calculation dialog box opens.

   The Battery Capacity Calculation dialog box appears as shown in Figure 5-5.

2. Select the acoustic baud rate in bits/sec from the Acoustic Baud Rate drop-down list box.

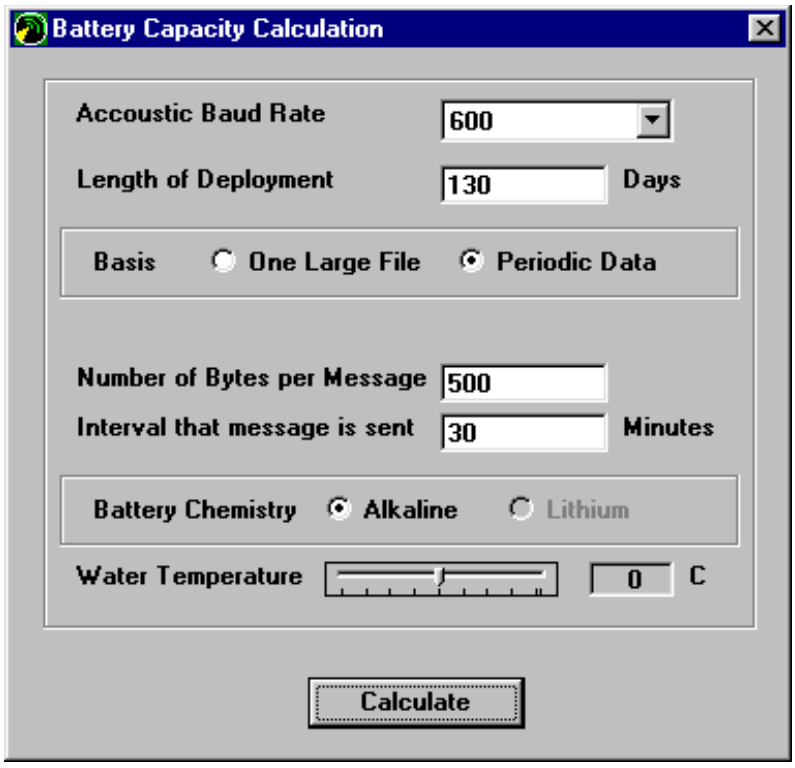
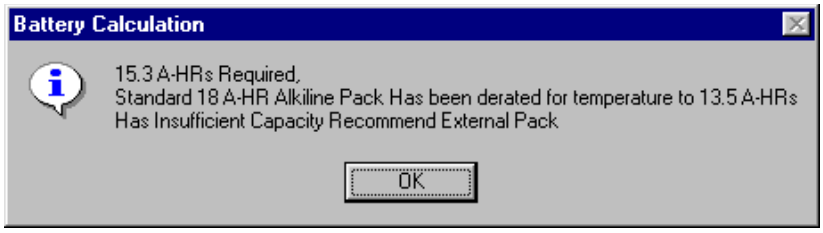


Figure 5-5 The Battery Capacity Calculation Dialog Box—Set up for when Transmitting Data Periodically

3. Enter the expected number of bytes that will be transmitted for each message in the Number of Bytes per Message text box.
4. Enter the interval in minutes between transmissions in the Interval that Message is Sent text box.
5. Select the expected ambient temperature in degrees Celsius using the Water Temperature slider.
6. Click Calculate to calculate and display the required battery capacity and close the Battery Capacity Calculation dialog box.

   The Battery Calculation window opens with the battery pack capacity requirements displayed and a notification indicating whether a standard 18 A·h modem battery pack is adequate:



Configuring the Local and Remote Modems

To configure an ATM-880 Series Acoustic Telemetry Modem, the modem must first be connected to an available COM port on a PC. Refer to "Setting Up the Modems" on page 4-10 for instructions on how to connect the modem to a PC. When connected, the local and the remote modem's serial communications port and its operating parameters, or S Registers, can be configured. Refer to Section 6, "Modem Operating Modes and Commands," for information on the S Registers.

Selecting and Configuring the Local Modem's Serial Communications Port

To select and configure the local modem's serial communications port:

1. Connect the local modem to the PC.
2. Choose Configuration ➤ PC Communications.

   The PC Communications dialog box shown in Figure 5-6 opens.
3. In the Baud Rate area of the PC Configuration dialog box, select the baud rate.

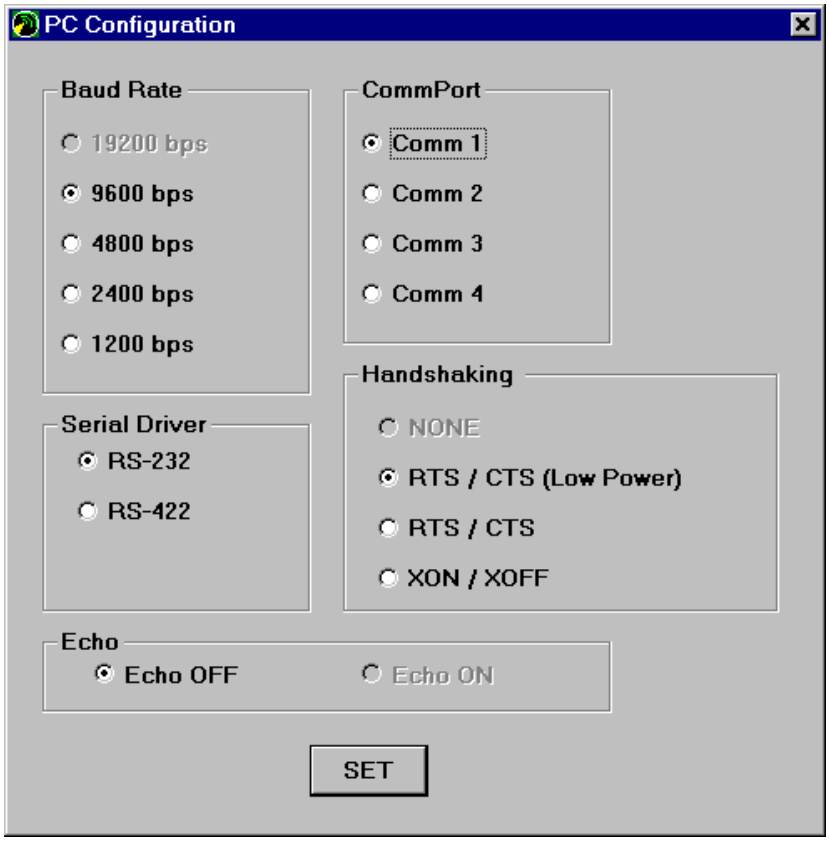


Figure 5-6 The PC Configuration Dialog Box

WARNING If the serial interface is changed from RS-232 to RS-422, an RS-422 serial interface connection to the modem is required to switch back to RS-232. The opposite applies after changing from RS-422 to RS-232.

4. In the Serial Driver area select the serial interface.

NOTE Selecting RTS/CTS (Low Power) turns off the RS-232 driver when the modem is in the lowpower state. Therefore, when making this selection, be sure hardware RTS/CTS handshaking at the host processor is disabled when the modem goes into the lowpower state, otherwise the modem will not input data over its serial interface. Selecting RTS/CTS maintains the driver on even when the modem is in the lowpower state but draws an additional 2 mA of current. Make this selection or use software XON/OFF handshaking if hardware RTS/CTS handshaking cannot be disabled. Refer to "RS-232 Driver/Flow Control S11" on page 7-25 for more information.

5. In the Handshaking area select the required handshaking.
6. Click SET to save the new selections and close the PC Configuration dialog box.

Selecting the Range Options

Telesonar PC calculates and displays the range from the local modem's transducer to the online remote modem's transducer in units of kilometers, meters, statute miles, feet, or nautical miles. The range is displayed in the Range Status display in the Main window when selecting Acoustic Communication from the Menu bar and then choosing Get Range. The range calculation is based on the default value of the speed of sound in water of 1500 meters per second. However, the units of range are selectable, and the speed of sound used in the calculation of range can be changed.

To select the units of range or to change the speed of sound in water used in the calculation of range, or both:

1. Choose Configuration ➤ Range Options.

   The Range Options dialog box shown in Figure 5-7 opens.

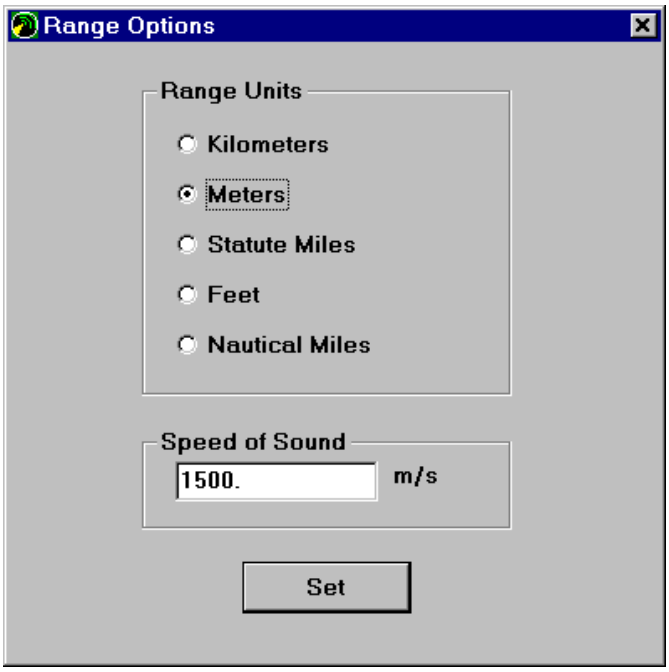


Figure 5-7 The Range Options Dialog Box

2. In the Range Units area of the Range Options dialog box, select the units of range.
3. Select the speed of sound in meters/sec in the Speed of Sound area.
4. Click OK to save the new settings and close the Range Options dialog box.

Selecting Units of Relative Speed

Telesonar PC calculates and displays the relative speed between the local and remote modem's transducers in units of knots or kilometers/hour. The relative speed is displayed in the Relative Speed Status display in the Main window, and the units of relative speed can be selected.

To select the units of relative speed:

1. Choose Configuration ➤ Speed Units.

   The Relative Speed Units dialog box shown in Figure 5-8 opens.

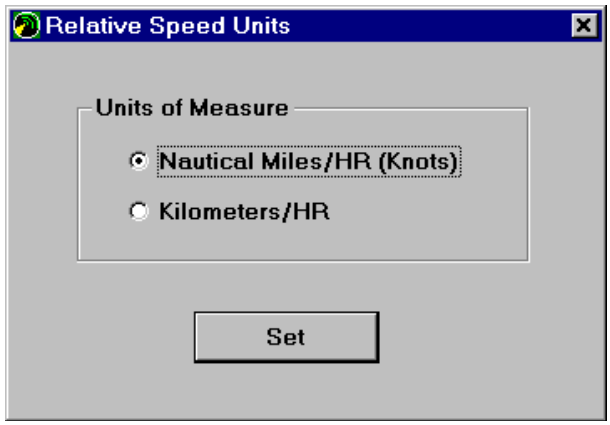


Figure 5-8 The Relative Speed Units Dialog Box

2. In the Units of Measure area of the Relative Speed Units dialog box, select the units of relative speed.
3. Click OK to save the new settings and close the Relative Speed Units dialog box.

Configuring the Local Modem's Operating Parameters (S Registers)

To configure the local modem's operating parameters:

1. Connect the local modem to the PC.
2. Choose Configuration ➤ Local Modem.

   The Local Modem Configuration dialog box shown in Figure 5-9 opens.

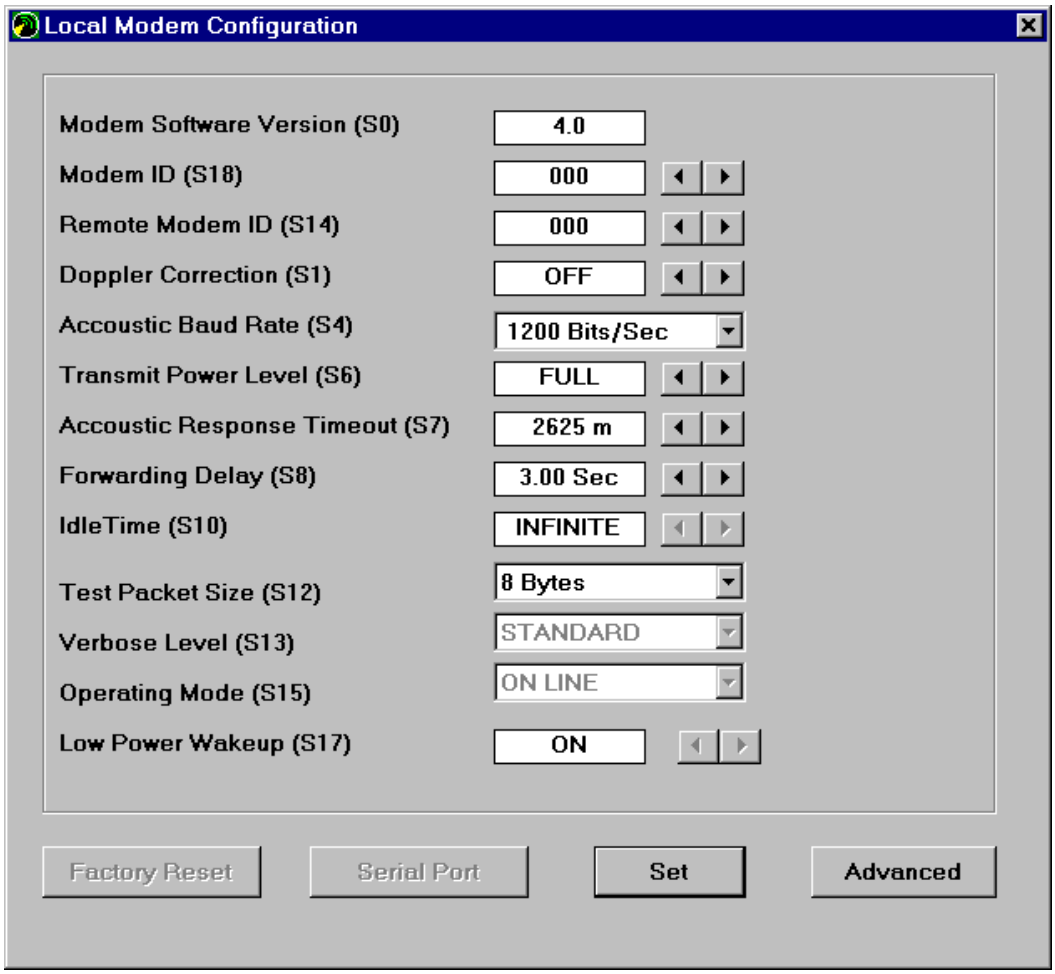
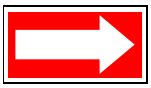
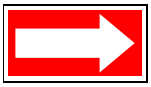


Figure 5-9 The Local Modem Configuration Dialog Box

The Local Modem Configuration dialog box is used to configure the local modem's operating parameters, which are controlled by its S Register settings.



NOTE For detailed information on the S Registers, refer to Table 7-1 on page 7-2, which lists all of the available S Registers and the page references to where detailed descriptions and available settings are provided.



NOTE In the Local Modem Configuration dialog box, arrows and entries in drop-down list boxes that are dimmed, are not available. In addition, the entry in the Modem Software Version (S0) text box cannot be changed.

3. In the Local Modem Configuration dialog box, select the address of this modem using the left or right arrow for the Modem ID (S18) scroll box.
4. In the Remote Modem ID (S14) scroll box, select the address of the remote modem that this modem will go online with when it is powered up or is awakened from its lowpower state.

   This setting applies only when Operating Mode (S15) is set to ONLINE, which is the default setting in the Local Modem Configuration dialog box and cannot be changed.
5. Select ON in the Doppler Correction (S1) scroll box to enable doppler correction, or OFF to disable doppler correction.

   Select OFF if the local and remote modems are a fixed distance apart.
6. Select the acoustic baud rate in bits/sec from the Acoustic Baud Rate (S4) drop-down list box.
7. Select the transmit power level in decibels in the Transmit Power Level (S6) scroll box.
8. Select the Acoustic Response Time-out in milliseconds in the Acoustic Response Timeout (S7) scroll box.
9. Select the forwarding delay in seconds in the Forwarding Delay (S8) scroll box.
10. From the Test Packet Size (S12) drop-down list box, select the test packet size in bytes that this modem will command a remote modem to send when the Acoustic Link Test command (ATXn) is sent to the remote modem. Refer to "Acoustic Link Test ATXn" on page 6-27 for information on the ATXn command.
11. Click Set to output the new settings to the modem and close the Local Modem Configuration dialog box.

Advanced Local Modem Configuration Settings

The advanced local modem configuration settings determine the local modem's frequency and bandwidth. Typically, these settings are made at the factory and do not require changing.

To change the local modem's frequency and bandwidth:

1. Choose Configuration ➤ Local Modem.

   The Local Modem Configuration dialog box shown in Figure 5-9 on page 5-18 opens.

2. Click Advanced.

   The Advanced Modem Settings dialog box shown in Figure 5-10 opens.

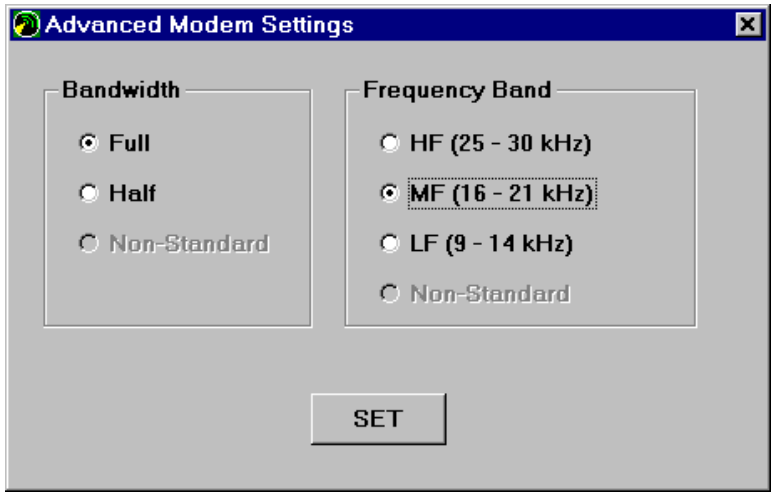


Figure 5-10 The Advanced Modem Settings Dialog Box

3. In the Bandwidth area of the Advanced Modem Settings dialog box, select the Full or Half option for the frequency bandwidth.

WARNING Selecting a frequency band that does not correspond to the frequency band of the modem's transducer may result in damage to the transmitter.

4. In the Frequency Band area, select the frequency band.
5. Click SET to save the new settings and close the Advanced Modem Settings dialog box, and then click Set or the Cancel button in the Local Modem Configuration dialog box.

Configuring the Remote Modem's Operating Parameters (S Registers)—before Deployment

To configure a remote modem's operating parameters before deployment:

1. Connect the remote modem to the PC.
2. Choose Predeployment ➤ Configure Modem.

   The Predeployment Modem Configuration dialog box shown in Figure 5-11 opens.

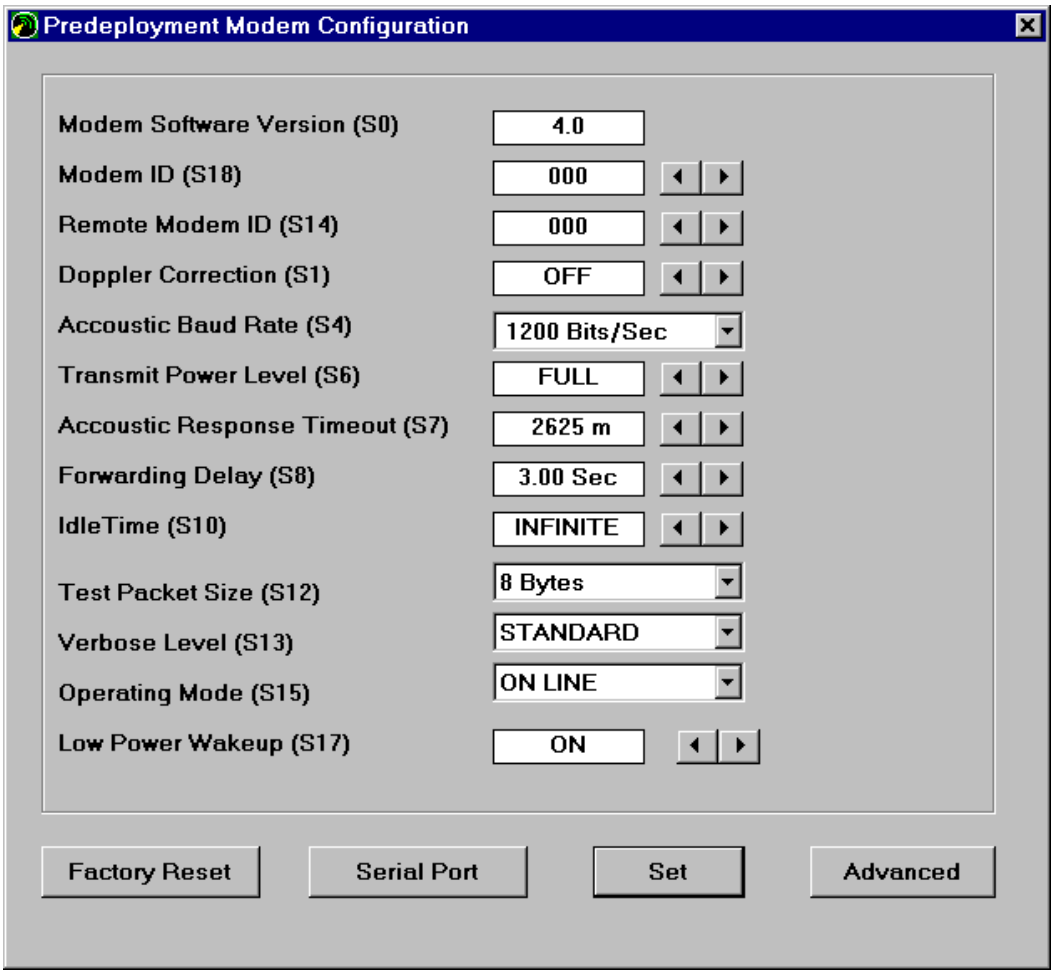


Figure 5-11 The Predeployment Modem Configuration Dialog Box

The Predeployment Modem Configuration dialog box is used to configure the remote modem's operating parameters, which are controlled by its S Register settings. It can also be used to configure the modem's serial communications port, reset its factory settings and, using the advanced setup, set its frequency and bandwidth.

NOTE For detailed information on the S Registers, refer to Table 7-1 on page 7-2, which lists all of the available S Registers and the page references to where detailed descriptions and available settings are provided.

NOTE The entry in the Modem Software Version (S0) text box cannot be changed.

3. In the Predeployment Modem Configuration dialog box, select the address of this modem using the left or right arrow for the Modem ID (S18) scroll box.
4. In the Remote Modem ID (S14) scroll box, select the address of the modem that this modem will go online with when it is powered up or is awakened from its lowpower state.

   This setting applies only when Operating Mode (S15) is set to ONLINE.
5. Select ON in the Doppler Correction (S1) scroll box to enable doppler correction, or OFF to disable doppler correction.

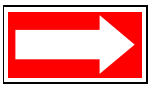
   Select OFF if this modem and the modem it will be online with are a fixed distance apart.
6. Select the acoustic baud rate in bits/sec from the Acoustic Baud Rate (S4) drop-down list box.
7. Select the transmit power level in decibels in the Transmit Power Level (S6) scroll box.
8. Select the Acoustic Response Time-out in milliseconds in the Acoustic Response Timeout (S7) scroll box.
9. Select the forwarding delay in seconds in the Forwarding Delay (S8) scroll box.
10. From the Test Packet Size (S12) drop-down list box, select the test packet size in bytes that this modem will command another modem to send when the Acoustic Link Test command (ATXn) is sent to that modem. Refer to "Acoustic Link Test ATXn" on page 6-27 for information on the ATXn command.
11. Select the level of messaging that this modem will provide from the Verbose Level (S13) drop-down list box.

12. Select the operating mode from the Operating Mode (S15) drop-down list box.

    For this modem to go online with the modem whose address is the setting of Remote Modem ID (S14) when this modem is powered up or awakened from the lowpower state, select ONLINE.

13. Select ON in the Low Power Wakeup (S17) scroll box to enable transmission of the lowpower wakeup signal, or OFF to disable the lowpower wakeup signal.

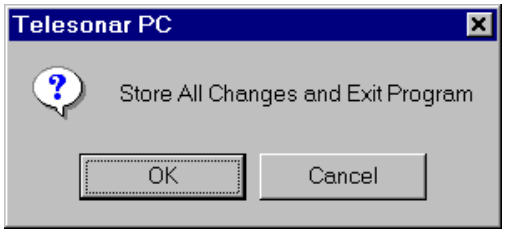
    Select OFF if the receiving modem will never be in the lowpower state.



NOTE To reset all the settings to their factory default settings, click Factory Reset.

14. Click Set to close the Predeployment Modem Configuration dialog box.

    A Telesonar PC window opens asking whether to store the changes and exit the program:



15. Click OK to store the changes and exit Telesonar PC, or click Cancel to close the window without saving any changes and leave Telesonar PC running.

Advanced Remote Modem Configuration Settings

The advanced remote modem configuration settings determine the remote modem's frequency and bandwidth. Typically, these settings are made at the factory and do not require changing. In addition, these settings can only be made with the modem connected to the PC. They cannot be set remotely.

To change the remote modem's frequency and bandwidth:

1. Connect the modem to the PC.
2. Choose Predeployment ➤ Configure Modem.

   The Predeployment Modem Configuration dialog box shown in Figure 5-11 on page 5-21 opens.
3. Click Advanced.

   The Advanced Modem Settings dialog box shown in Figure 5-10 on page 5-20 opens.
4. In the Bandwidth area of the Advanced Modem Settings dialog box, select the Full or Half option for the frequency bandwidth.

WARNING Selecting a frequency band that does not correspond to the frequency band of the modem's transducer may result in damage to the transmitter.

5. In the Frequency Band area, select the frequency band.
6. Click SET to save the new settings and close the Advanced Modem Settings dialog box, and then click Set or the Cancel button in the Predeployment Modem Configuration dialog box.

Configuring the Remote Modem's Operating Parameters (S Registers)—after Deployment

A remote modem's operating parameters can also be configured remotely over the acoustic link after deployment. The procedure is similar to that provided for configuring the modem before deployment.

To configure a remote modem's operating parameters after deployment:

1. Select the address of the remote modem in the Remote ID Status display, and then click SET.

   The Local modem goes online with the remote modem.

2. Choose Configuration ➤ Remote Modem.

   The Remote Modem Configuration dialog box shown in Figure 5-12 opens.

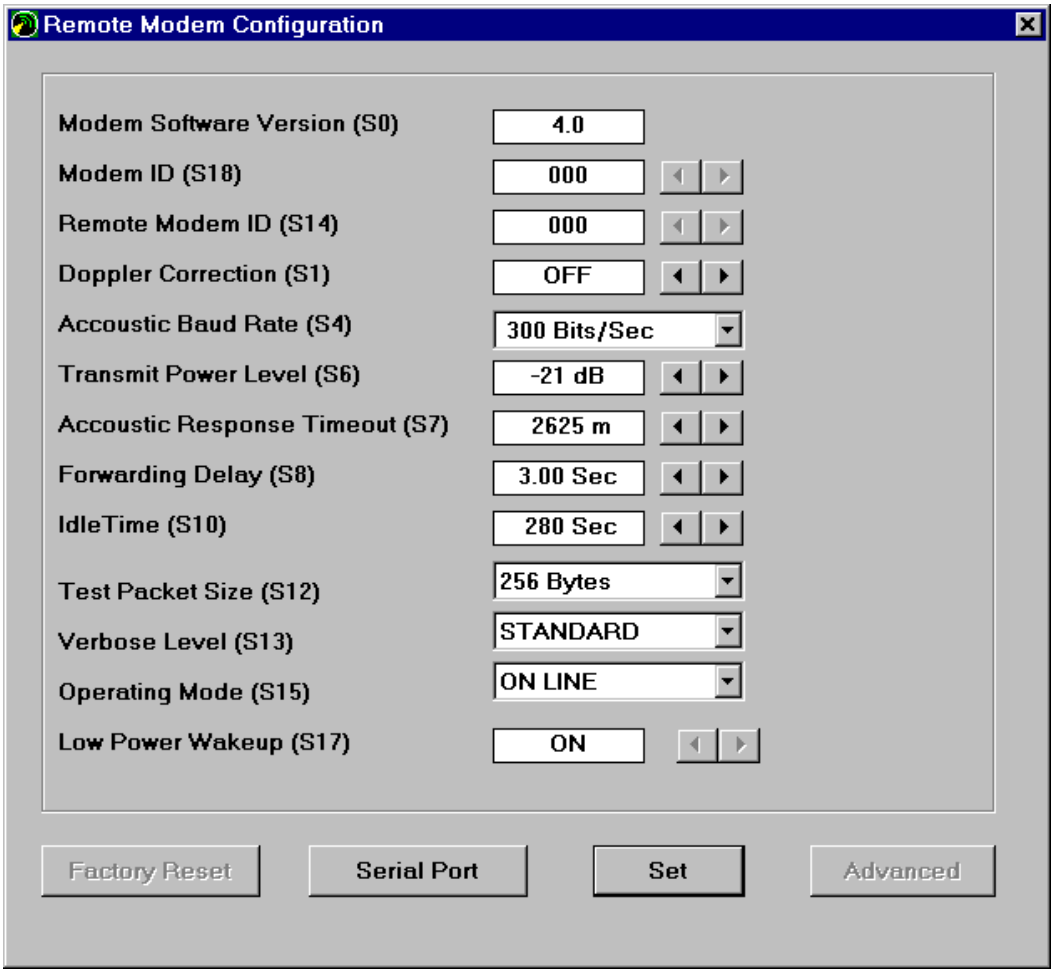


Figure 5-12 The Remote Modem Configuration Dialog Box

NOTE The Modem ID (S18) and Remote Modem ID (S14) settings cannot be changed in the Remote Modem Configuration dialog box. In addition, the Advanced and Factory Reset buttons are also unavailable.

3. Select ON in the Doppler Correction (S1) scroll box to enable doppler correction, or OFF to disable doppler correction.

   Select OFF if the local and remote modems are a fixed distance apart.

4. Select the acoustic baud rate in bits/sec from the Acoustic Baud Rate (S4) drop-down list box.

5. Select the transmit power level in decibels in the Transmit Power Level (S6) scroll box.

6. Select the Acoustic Response Time-out in milliseconds in the Acoustic Response Timeout (S7) scroll box.

7. Select the forwarding delay in seconds in the Forwarding Delay (S8) scroll box.

8. From the Test Packet Size (S12) drop-down list box, select the test packet size in bytes that this modem will command another modem to send when the Acoustic Link Test command (ATXn) is sent to that modem. Refer to "Acoustic Link Test ATXn" on page 6-27 for information on the ATXn command.

9. Select the level of messaging that this modem will provide from the Verbose Level (S13) drop-down list box.

10. Select the operating mode from the Operating Mode (S15) drop-down list box.

    For this modem to go online with the modem whose address is the setting of Remote Modem ID (S14) when this modem is powered up or awakened from the lowpower state, select ONLINE.

11. Select ON in the Low Power Wakeup (S17) scroll box to enable transmission of the lowpower wakeup signal, or OFF to disable the lowpower wakeup signal.

    Select OFF if the receiving modem will never be in the lowpower state.

12. Click Set to close the Predeployment Modem Configuration dialog box and save the changes, or click the Cancel button to close the dialog box without saving any changes.

Configuring the Remote Modem's Serial Communications Port—after Deployment

A remote modem's serial communications port can also be configured remotely over the acoustic link after deployment. The procedure is similar to that provided for configuring the serial port before deployment.

To configure a remote modems serial port after deployment:

1. Select the address of the remote modem in the Remote ID Status display, and then click SET.

   The local modem goes online with the remote modem.

2. Choose Configuration ➤ Remote Modem.

   The Remote Modem Configuration dialog box shown in Figure 5-12 on page 5-25 opens.

3. Click Serial Port. The Serial Port Configuration dialog box shown in Figure 5-13 opens.

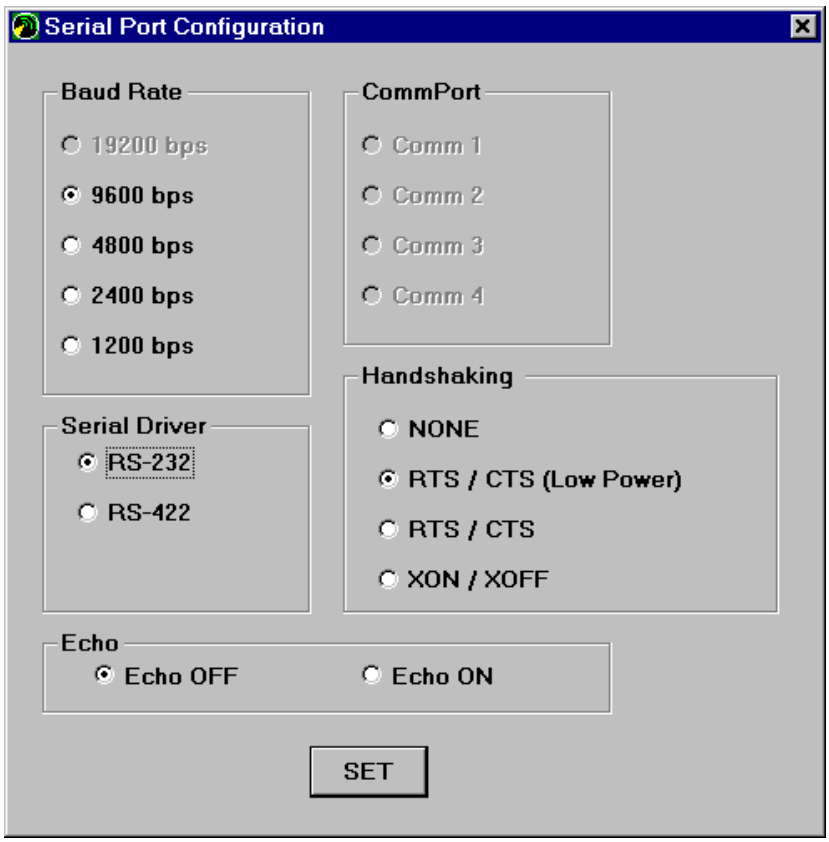


Figure 5-13 The Serial Port Configuration Dialog Box

NOTE The COM port setting in the CommPort area of the Serial Port Configuration dialog box cannot be changed remotely and therefore is unavailable.

4. In the Baud Rate area of the PC Configuration dialog box, select the baud rate.
5. In the Serial Driver area select the serial interface.

NOTE Selecting RTS/CTS (Low Power) turns off the RS-232 driver when the modem is in the lowpower state. Therefore, when making this selection, be sure hardware RTS/CTS handshaking at the host processor is disabled when the modem goes into the lowpower state, otherwise the modem will not input data over its serial interface. Selecting RTS/CTS maintains the driver on even when the modem is in the lowpower state but draws an additional 2 mA of current. Make this selection or use software XON/OFF handshaking if hardware RTS/CTS handshaking cannot be disabled. Refer to "RS-232 Driver/Flow Control S11" on page 7-25 for more information.

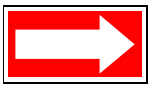
6. In the Handshaking area select the required handshaking.
7. In the Echo area select the Echo ON or Echo OFF option.
8. Click SET to close the Serial Port Configuration dialog box.
9. Click Set to close the Remote Modem Configuration dialog box and save the changes, or click the Cancel button to close the dialog box without saving any changes.

Operating the Modems after Deployment

Telesonar PC provides a simple user interface for operating the ATM-880 Series Acoustic Modems after they have been deployed. The operator functions include going online with different remote modems; checking the acoustic link and measuring the range between the local and a remote modem; changing the local and a remote modem's transmit power level and acoustic baud rate; enabling and disabling a remote modem's data logger; and checking, downloading, and clearing the contents of a remote modem's data logger memory. In addition, data received from a remote modem can be captured, or saved, to a file in real time, and data from a file can be uploaded to a remote modem.

Going Online with a Different Remote Modem

To go online with a different remote modem, the address of the remote modem must be selected. Once selected, it remains selected until changed. To select the address of the remote modem, click the up or down arrow in the scroll box in the Remote ID Status display in the Main window until the desired address is displayed. When changed, the display turns blue. Then click SET. When the new address is set, the display turns back to black, and the local modem is online with the new remote modem.



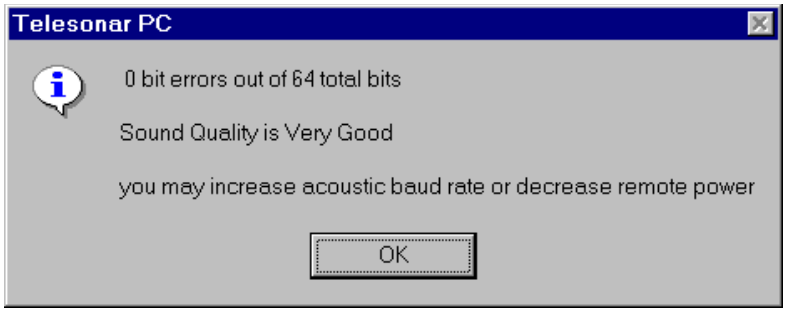
NOTE If the remote modem cannot be detected, the Remote Modem window shown in Figure 5-1 on page 5-4 opens. Follow the instructions in the window to try to detect the remote modem.

Checking the Acoustic Link between the Local and Remote Modems

To check the acoustic link between the local and remote modems:

1. Choose Acoustic Communications ➤ Test.

   The local modem commands the online remote modem to transmit a test message and the test message is evaluated with the results displayed in a Telesonar PC window:



2. Click OK to close the window.

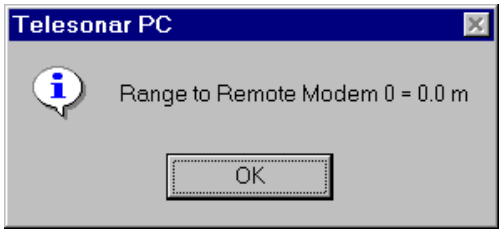
NOTE When checking the acoustic link in air, be sure to vary the separation of the transducers and the transmit power levels of either one or both of the modems as necessary to establish good communications. Refer to "Changing the Transmit Power Levels of the Local and Remote Modems" on page 5-31 for instructions on how to change the transmit power levels.

Checking the Range between the Local and Remote Modems' Transducers

To check the range between the transducers of the local modem and the online remote modem:

1. Choose Acoustic Communications ➤ Get Range.

   The local modem acquires the range to the remote modem and a window opens with the range information displayed:



2. Click OK to close the window.

   The range is displayed in the Range Status display in the Main window.

Changing the Transmit Power Levels of the Local and Remote Modems

To change the transmit power level of the local modem, click the up or down arrow in the drop-down list box in the Local Power Level Status display in the Main window until the desired setting is displayed. When changed, the display turns blue. Then click SET. When the new power level is set, the display turns back to black.

To change the transmit power level of the online remote modem, click the up or down arrow in the drop-down list box in the Remote Power Level Status display in the Main window until the desired setting is displayed. Then click SET.

Changing the Acoustic Baud Rate of the Local and Remote Modems

To change the acoustic baud rate of the local modem, click the up or down arrow in the Local drop-down list box in the Acoustic Baud Rate Status display in the Main window. When changed, the display turns blue. Then click SET. When the new baud rate is set, the display turns back to black.

To change the baud rate of the online remote modem, click the up or down arrow in the Remote drop-down list box in the Acoustic Baud Rate Status display in the Main window. Then click SET.

Hanging up with the Remote Modem

To hang up with the online remote modem, choose Acoustic Communications ➤ Hangup. The remote modem goes into the lowpower state, but the local and remote modems remain online.

Enabling and Disabling the Data Logger of the Remote Modem

The data logger of the online remote modem can be enabled or disabled. When the data logger is enabled, the modem is in Datalogger mode, and input from its host processor over the serial interface is treated as data and stored in the modem’s data logger memory.

To enable the data logger of the remote modem, choose Datalogger ➤ Enable Datalogger.

The data logger of the remote modem is enabled, and the Remote Datalogger Status display in the Main window indicates ON and displays the relative amount of data stored in its data logger memory.

To disable the data logger of the remote modem, choose Datalogger ➤ Disable Datalogger.

The data logger of the remote modem is disabled and the Remote Datalogger Status display indicates OFF.

Checking the Data Logger Memory of the Remote Modem

To check the data logger memory of the online remote modem:

1. Choose Datalogger ➤ Check Remote Buffer.

   The local modem commands the remote modem to transmit the number of bytes stored in its data logger memory, and the Remote Datalogger window opens with the number of bytes displayed:

   The relative amount of data stored in the remote modem's data logger memory is also displayed in the Remote Datalogger Status display in the Main window.

2. Click OK to close the Remote Datalogger window.

Downloading the Contents of the Remote Modem's Data Logger Memory

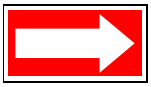
Although not available for Telesonar PC Version 2.3, future revisions of Telesonar PC will include the ability to download the contents of a remote modem's data logger memory to a file.

Clearing the Contents of the Remote Modem's Data Logger Memory

The contents of the data logger of the online remote modem can be cleared.

WARNING The command to clear the contents of the remote modem's data logger memory executes immediately after choosing it. Do not choose this command unless it is desired to clear the memory.

To clear the contents of the data logger memory of the remote modem, choose Datalogger ➤ Clear Remote Buffer.



NOTE To verify that the data logger memory of the remote modem is cleared, check the data logger memory by choosing Datalogger ➤ Check Remote Buffer as described in "Checking the Data Logger Memory of the Remote Modem" on page 5-32.

Capturing Received Data from the Remote Modem

When receiving data from a remote modem, the data can be captured, or saved, to a file in real time.

To capture the received data:

1. Choose File Transfer ➤ Capture.

   The Capture File dialog box shown in Figure 5-14 opens.

2. Click the arrow in the Save in drop-down list box and select the folder in which to save the data file.
3. In the File name text box enter the name of the file in which to save the data.
4. Click Save to save the data to the specified file and close the Capture File dialog box.

   CAPTURE ON is displayed on the Status bar, and the received data are saved to the file.

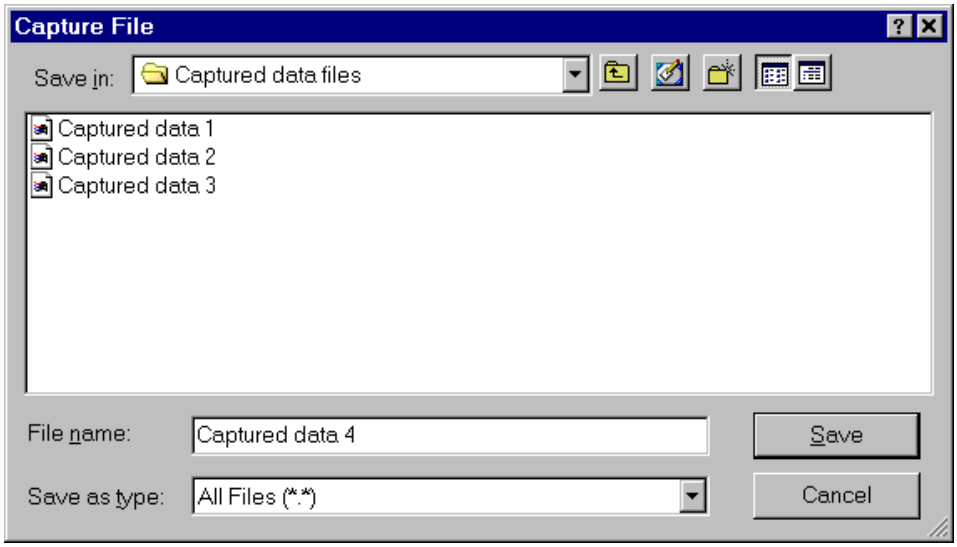


Figure 5-14 The Capture File Dialog Box

5. To stop the capture of received data, Choose File Transfer ➤ Capture.

   CAPTURE OFF is displayed on the Status bar and the received data are no longer saved.

Uploading Data from a File to the Remote Modem

Data from a file can be uploaded to the online remote modem. The data are transferred directly from a file on the PC to the remote modem, and from the remote modem to its host over the serial interface.

To upload data from a file to a remote modem:

1. Choose File Transfer ➤ Send File.

   The Open File to Upload dialog box in Figure 5-15 opens.

   If the data file is not listed, it may be in a different folder than the one shown. If this is the case, click the arrow in the Look in drop-down list box and select the folder in which the file is located.

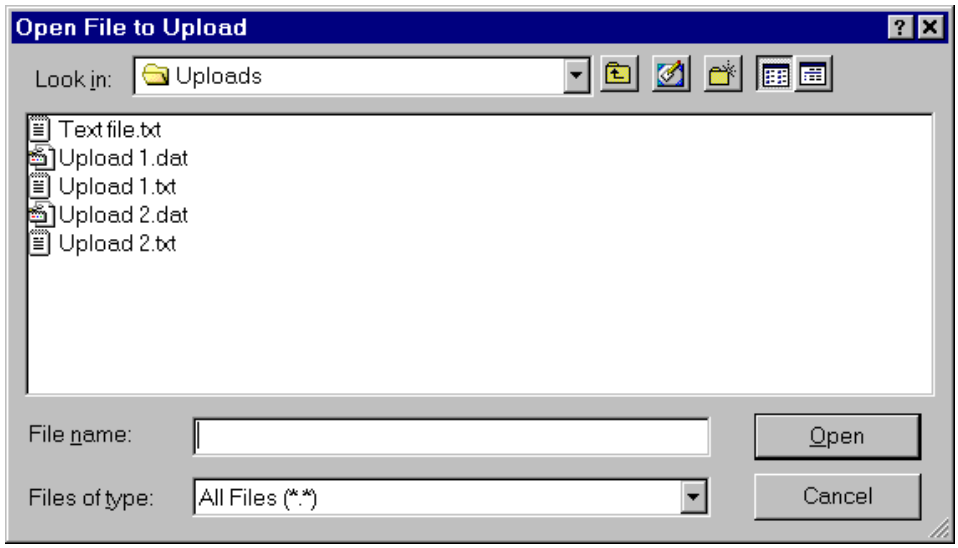
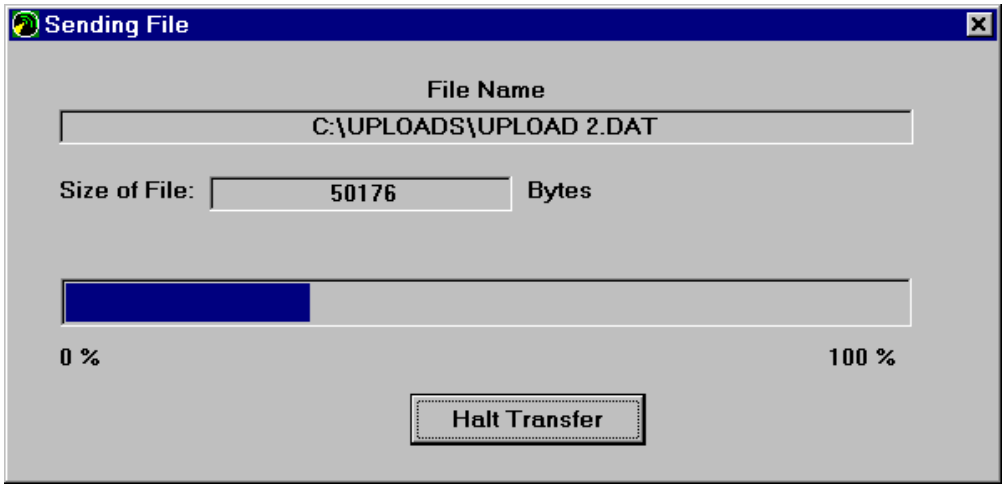


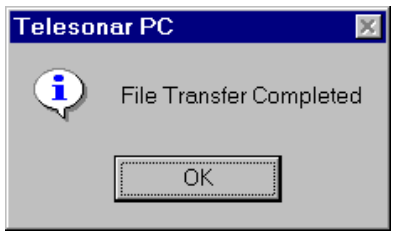
Figure 5-15 The Open File to Upload Dialog Box

2. Click the file name of the file to be opened, and then click Open.

   The Sending File window opens and the data are uploaded:



After the uploading is complete, the Sending File window closes and a Telesonar PC window opens acknowledging the file transfer:



3. Click OK to close the window.

The uploading of data can be stopped by clicking Halt Transfer. However, data will be uploaded until all data received by the modem over the serial interface has been transmitted.

Sending a Break to the Remote Modem

The local modem that is connected to a PC will detect a break if it is sent over the serial interface from the PC. The local modem will send a command to the online remote modem which will cause 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 meter (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.

To have the remote modem send a break on its serial interface, choose Acoustic Communication ➤ Send RDI Break.

Modem Diagnostics

Telesonar PC provides several diagnostic functions which help to evaluate modem performance. These diagnostic functions allow viewing the local and remote modem battery voltages, viewing the background noise detected by the local modem's receiver, and commanding the local modem to ping continuously to verify that its transmitter is functioning. In addition, the local modem's firmware version number can be checked.

Checking the Battery Voltages

To check the local modem's battery voltages, choose Diagnostic ➤ Local Battery Check. The voltages of the local modem's transmitter and DSP/receiver power supply voltages are displayed in the Battery Voltage Status display. If the voltages are too low, a Warning window also opens with the voltages displayed.

To check the battery voltages of the online remote modem, choose Diagnostic ➤ Remote Battery Check. The voltages of the remote modem's transmitter and DSP/receiver power supplies are displayed in the Battery Voltage Status display. If the voltages are too low, a Warning window also opens with the voltages displayed.

Viewing the Background Noise Level of the Local Modem

The relative background noise level detected by the local modem's receiver can be viewed in real time in continuous one second intervals. However, when the noise test is being performed, data transmitted by a remote modem will be indicated as noise in the display, and the data will not be received or displayed by Telesonar PC.

To view the background noise level:

1. Choose Diagnostic ➤ Noise Test.

   The Noise Test window shown in Figure 5-16 opens.

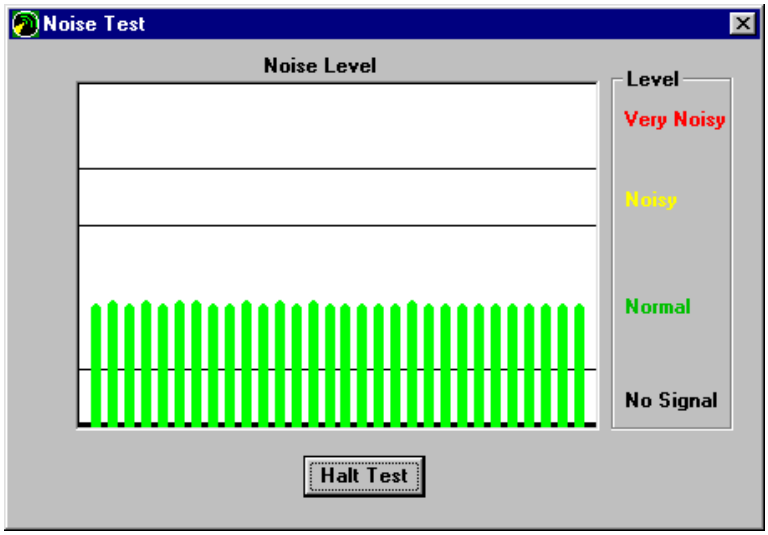


Figure 5-16 The Noise Test Window

   The noise profile begins scrolling from the left to the right of the display. Profiles in green indicate a normal level of noise. Yellow and red indicate high and very high levels of background noise, respectively. Generally, an acceptable level of background noise is present when the maximum amplitude of the noise profile is below the bottom two thirds of the display.

   If the noise profile is black, there is no signal, which could mean there is no transducer connected or there is a problem with the transducer or modem receiver.

2. Click Halt Test or the Cancel button to stop the test close the Noise Test window.

Performing the Ping Test

The ping test verifies that the local modem's transmitter is functioning.

To perform the ping test:

1. Choose Diagnostic ➤ Ping Test.

   The Ping Test dialog box shown in Figure 5-17 opens. In addition, PING TEST is displayed on the Status bar.

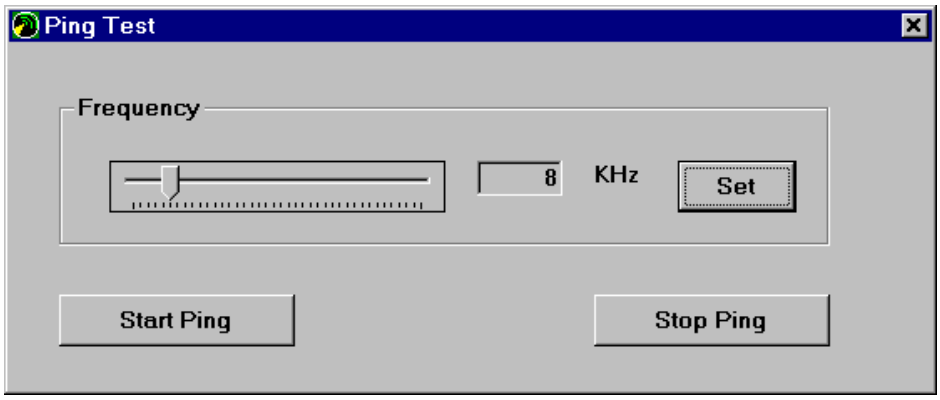


Figure 5-17 The Ping Test Dialog Box

WARNING Selecting a frequency that is not in the frequency band of the modem's transducer may result in damage to the transmitter.

2. Select the frequency in kilohertz using the Frequency slider.

   When changed, the displayed frequency turns from black to blue.

3. Click SET.

   The new frequency is set and the display turns back to black.

4. Click Start Ping.

   The local modem is commanded to ping at a 0.800-ms rate (1.25 Hz) at the selected frequency, and with a pulse width of 3.125 ms.

WARNING If the modem is left pinging for an extended period, the modem battery pack will be depleted.

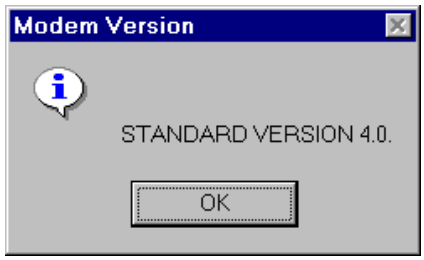
5. To stop the ping test and leave the Ping Test dialog box open, click Stop Ping; to stop the ping test and close the dialog box, click the Cancel button.

Checking the Local Modem's Firmware Version Number

To check the local modem's firmware version number:

1. Choose Diagnostic ➤ Version.

   The Modem Version window opens:



2. To close the Modem Version window, click OK.

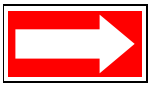
NOTE The local modem's firmware version number is not the Telesonar PC version number. To check the Telesonar PC version number, choose Help ➤ About Telesonar PC.

6 Modem Operating Modes and Commands

This section provides an overall description of the ATM-880 Series Acoustic Telemetry Modem operating modes, along with detailed 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 6-12. 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 Telesonar PC cannot be used to enter modem commands. The modem must be connected to a computer that is set up to run a terminal program such as ProComm or Windows Terminal. DumbTerm, which is available from RDI Instruments, can also be used for this purpose. Refer to "Setting Up the Modems" on page 4-10 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-880 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 active low output provided by all the modems except the ATM-881 Deck Boxes and the ATM-881R Rack Mount Deck Boxes. Refer to Section 2, "Specifications," for the electrical specifications and to "Setting Up the Modems" on page 4-10 for connection information. Device Enable is used to activate a host processor when the modem is in Online mode.

Transmit Data Buffers

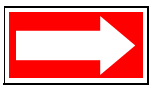
Each modem includes four internal 4-kbyte transmit data buffers for a total buffer size of 16 kbytes. This allows data that are input to the modem over the serial interface to be organized into four packets of 4 kbytes. After a transmit data buffer has filled, the modem immediately transmits the data. 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 baud rate. For example, the serial interface baud rate can be 9600 bits/sec while the acoustic baud rate is 600 bits/sec. However, when the serial interface baud rate is faster than the acoustic baud 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. 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 4-10 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

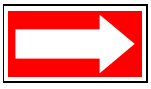
A local modem that is connected to a PC will detect a break if it is sent over the serial interface from the PC. If the local modem is online with a remote modem, it will command the remote modem to send the equivalent break on its serial interface. If the remote modem is connected to an RD Instruments acoustic doppler current meter (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 6-27 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, the resulting ATM-881 Deck Box display, or the display on the monitor of a PC if a PC is used as the host processor, will show the banner message. The message includes the frequency band (LF, MF, HF, or Nonstandard), the firmware version, and the command prompt (>) as shown in the following example:

```
Benthos ATM-88X
MF Frequency Band
Acoustic Modem Version 2.4
>
```

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.

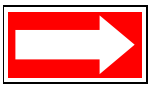
Allowing the idle time to expire—S Register 15 set to 00. If S Register 15 is set to 00, allowing the idle time to expire will place the modem into Command mode and into the lowpower state. Refer to "Lowpower State" below for information on the lowpower state and the idle time.

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 ATM-881 Deck Box display, or 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.

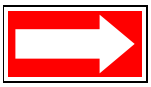
WARNING Although the idle time can be set to prevent the modem from going into the lowpower state for an indefinite time, if the modem is being powered by batteries, this setting will rapidly deplete the capacity of the modem battery pack. Hence if batteries are being used to power the modem, it is important 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—typically for the ATM-881 Deck Box and the ATM-881R Rack Mount Deck Box only—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. This is the same forwarding delay that is used for the four 4-kbyte transmit data buffers and 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.

When more than 8 kbytes of data are to be stored, the use of handshaking, which uses the RS-232 signal RTS, should be used to ensure there is no loss of data.

WARNING If handshaking is *not* used and data are input to the modem when the 8-kbyte temporary data buffer is full, or while 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 the data logger memory, the data will be ignored, hence lost.

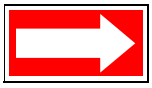
Handshaking will ensure there is no loss of data, as when the 8-kbyte temporary data buffer is full, or when data is being transferred to or transmitted from the data logger memory, or the contents of the data logger memory is being cleared, handshaking will not allow the host processor to output data to the modem.

Refer to "Setting Up the Modems" on page 4-10 for information on how to set up the modems. The recommended setup uses the RS-232 handshaking signal RTS when connecting the modems.

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 4-10. 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 6-12. 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 the ATM-881 Deck Box is used as the local modem, commands can be entered from its keypad and data and messages displayed on its display, but only when the REMOTE/TERMINAL switch is switched to TERMINAL. If an external PC is used as the host processor for the deck box, commands can be entered from the keyboard and data and messages displayed on the monitor, but only when the REMOTE/TERMINAL switch is switched to REMOTE. In either case the 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:

- 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-880 Series Acoustic Telemetry Modem 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
ATDn [Enter]	Dial	Causes the local modem to go into Online mode and to go online with the remote modem at address n.	6-19
AT&F [Enter]	Factory Reset	Resets the local modem's S Register settings to their factory default settings.	6-21
ATH [Enter]	Hang Up	Causes all the remote modems to go into the lowpower state.	6-23
ATO [Enter]	Online	Causes the local modem to go into Online mode from Command mode.	6-25
ATXn [Enter]	Acoustic Link Test	Tests the acoustic link with the modem at address n.	6-27
AT$Pn,m [Enter]	Remote Power	Sets the transmit power level of the remote modem at address n to level m.	6-29
AT$An,m [Enter]	Remote Baud Rate	Sets the transmitting acoustic baud rate of the remote modem at address n to m.	6-31
ATSn? [Enter]	Read Register	Displays the setting of the local modem's S Register n.	6-33
AT$Sn [Enter]	Read Remote Registers	Displays the S Register settings of the remote modem at address n.	6-35
ATSn=n [Enter]	Set Register	Sets the local modem's S Register number n to the value entered following "=."	6-37
AT&W [Enter]	Write	Saves the local modem's S Register settings as the new startup configuration.	6-39
ATL [Enter]	Lowpower State	Forces the idle time of the local modem to expire, which in turn causes the modem to go into the lowpower state	6-41
ATRn [Enter]	Range	Displays the range from the local modem to the remote modem at address n.	6-43

Table 6-1 ATM-880 Series Acoustic Telemetry Modem Command Set

Command Syntax	Command Name	Result	Page
AT$Dn,m [Enter]	Remote Doppler Correction	Enables or disables Doppler correction of the remote modem at address n.	6-45
ATV [Enter]	Local Battery Voltage	Displays the DSP/receiver and transmitter power supply voltages of the local modem.	6-47
AT$Vn [Enter]	Remote Battery Voltage	Displays the DSP/receiver and transmitter power supply voltages of the remote modem at address n.	6-49
AT$BEn [Enter]	Remote Data Logger Enable	Causes the remote modem at address n to go into Datalogger mode.	6-51
AT$BDn [Enter]	Remote Data Logger Disable	Causes the remote modem at address n to go into Command mode if it is in Datalogger mode.	6-53
AT$BTn [Enter]	Read Remote Data Logger	Displays the contents of the data logger memory of the remote modem at address n.	6-55
AT$BCn [Enter]	Clear Remote Data Logger	Clears the contents of the data logger memory of the remote modem at address n.	6-57
AT$BNn [Enter]	Remote Bytes Stored	Displays the number of bytes of data stored in the data logger memory of the remote modem at address n.	6-59
ATBC [Enter]	Clear Local Data Logger	Clears the contents of the data logger memory of the local modem.	6-61
ATBN [Enter]	Local Bytes Stored	Displays the number of bytes of data stored in the data logger memory of the local modem.	6-63
ATBT [Enter]	Output Local Data Logger	Outputs the contents of the data logger memory of the local modem over the serial interface.	6-65
ATBPn [Enter]	Output Local Page	Outputs the contents of page n of the data logger memory of the local modem over the serial interface.	6-67
ATTNn [Enter]	AGC Diagnostic	Enables or disables the display of the automatic gain control (AGC) output of the local modem.	6-69

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.

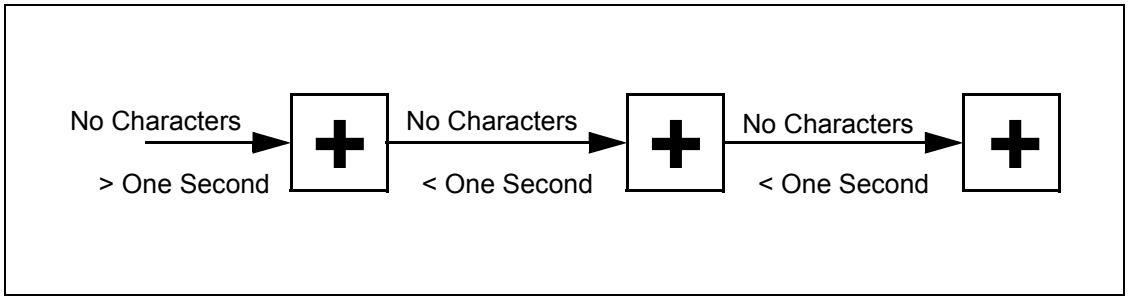


Figure 6-1 Conditions for Recognizing an Online Interrupt Command

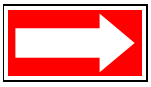
Attention AT

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 6-11 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.

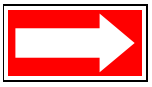
Dial ATDn

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 6-11 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 baud 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 acoustic baud 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 time-out, 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.
- 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.

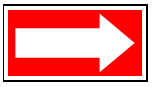
Factory Reset AT&F

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 6-11 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).

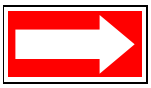
Hang Up ATH

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 6-11 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.

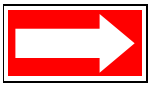
Online ATO

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 1. 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 6-11 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 baud 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 baud 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.

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. Which preset 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 hexadecimal 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 5F.

CCERR: Corrected Channel Errors—the number of errors corrected by the convolutional decoder.

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 6-11 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, 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 also display the preset message, which comprises part of, or multiple cycles of, the alphanumeric characters in the ASCII 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 time-out, 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$Pn,m) and use the Acoustic Link Test command to verify a low error rate—8 or less. Also consider increasing the remote modem's acoustic baud rate by changing the setting of its S Register 4 with the Remote Baud Rate command (AT$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 acoustic baud 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

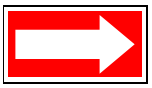
04: -12 dB

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 6-11 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 time-out, which is determined by the setting of S Register 7. If an acknowledgment is not received, "Response Not Received" will be displayed.

Remote Baud Rate AT$An,m

Syntax

AT$An,m [Enter]

Definition

The Remote Baud Rate command sets the transmitting acoustic baud rate of the remote modem at address n to m. The range of settings for m is from 02 to 08 as follows:

02: 150 bits/sec Hadamard

03: 300 bits/sec 1-of-4, repeated twice with rate 1/2 convolutional coding and 25-ms multipath guard period

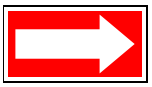
04: 600 bits/sec 1-of-4, with rate 1/2 convolutional coding and 25-ms multipath guard period

05: 800 bits/sec 1-of-4, with rate 1/2 convolutional coding and 12.5-ms multipath guard period

06: 1066 bits/sec 1-of-4, with rate 1/2 convolutional coding and 3.125-ms multipath guard period

07: 1200 bits/sec 1-of-4, with rate 1/2 convolutional coding

08: 2400 bits/sec 1-of-4



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 6-11 for instructions on how to place the modem into Command mode.

How to Use

To use the Remote Baud 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 baud rate, and then press Enter.

The remote modem will set its transmitting acoustic baud 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 time-out, which is determined by the setting of S Register 7. If an acknowledgment is not received, "Response Not Received" will be displayed.
- The Remote Baud Rate command sets S Register 4 of the remote modem to the selected value.

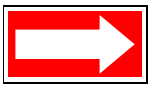
Read Register ATSn?

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 6-11 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 on page 7-2, which includes page references to where detailed descriptions are provided.

```
>ATS?

Local Registers
S00=042  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

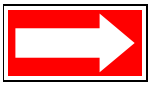
Read Remote Registers AT$Sn

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 6-11 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 time-out, 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 on page 7-2, which includes page references to where detailed descriptions are provided.

```
>AT$S1

Remote Registers
S00=041  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

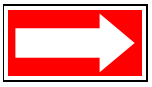
Set Register ATSn=n

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 6-11 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.

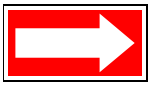
Write AT&W

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 6-11 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.

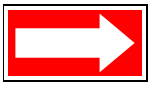
Lowpower State ATL

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 6-11 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 7-25 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.

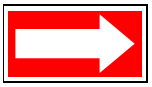
Range ATRn

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 6-11 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 time-out, which is determined by the setting of S Register 7. If an reply is not received, "Response Not Received" will be displayed.

Remote Doppler Correction AT$Dn,m

Syntax

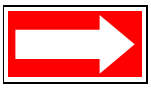
AT$Dn,m [Enter]

Definition

The Remote Doppler Correction command enables or disables Doppler correction for the remote modem at address n. The settings for m are 00 and 01 as follows:

00: Disable Doppler correction.

01: Enable Doppler correction.



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 6-11 for instructions on how to place the modem into Command mode.

How to Use

To use the Remote Doppler Correction command, type AT$D followed by the address of the remote modem, a comma character (,), and the value of m as determined by the required setting.

The remote modem will enable or disable its Doppler correction, and then the local modem will respond with the message "OK."

Special Considerations

When using the Remote Doppler Correction 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 time-out, which is determined by the setting of S Register 7. If an acknowledgment is not received, "Response Not Received" will be displayed.

- Doppler correction is effective to five knots of relative speed between two modems communicating over the acoustic link.
- Doppler correction should be disabled if the two modems are a fixed distance apart such that there is no relative speed. Otherwise it is possible to obtain a false Doppler correction in a low signal-to-noise environment.

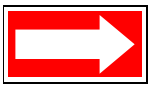
Local Battery Voltage ATV

Syntax

ATV [Enter]

Definition

The Local Battery Voltage command causes the local modem to display the DSP/receiver and transmitter power supply voltages which are supplied from the modem battery pack.



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 6-11 for instructions on how to place the modem into Command mode.

How to Use

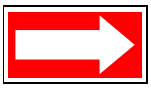
To use the Local Battery Voltage command, type ATV, and then press Enter.

The local modem will display its DSP/receiver and transmitter power supply voltages.

Special Considerations

When using the Local Battery Voltage command, take note of the following:

- The accuracy of the DSP/receiver power supply voltage measurement is ±0.2 V; the transmitter power supply voltage measurement, ±1.0 V.
- While the voltages are being measured, the DSP/receiver power supply is under load and the transmitter power supply is open circuited.



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

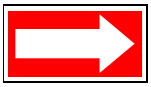
Remote Battery Voltage AT$Vn

Syntax

AT$Vn [Enter]

Definition

The Remote Battery Voltage command causes the local modem to display the DSP/receiver and transmitter power supply voltages of the remote modem at address n. Both supply voltages are supplied from the modem battery pack.



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 6-11 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.

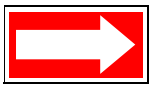
The local modem will display the DSP/receiver and transmitter power supply voltages of the remote modem.

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 time-out, 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 DSP/receiver power supply voltage measurement is ±0.2 V; the transmitter power supply voltage measurement, ±1.0 V.

- While the voltages are being measured, the DSP/receiver power supply is under load and the transmitter power supply is open circuited.



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

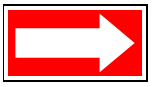
Remote Data Logger Enable AT$BEn

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 6-11 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 time-out, 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.

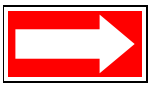
Remote Data Logger Disable AT$BDn

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 6-11 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 time-out, 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.

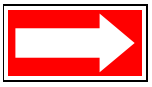
Read Remote Data Logger AT$BTn

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 6-11 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.

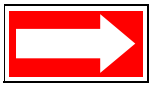
The local modem will display the contents of the remote modem's data logger memory.

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 time-out, 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 baud rate set by S Register 4 of the remote modem. If the 704-kbyte data logger memory is full, downloading its contents at a baud rate of 1200 bits/second will take a minimum of 1.3 hours. Slower baud rates will increase the time.

- When 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, the remote modem will not accept any input over the serial interface or over the acoustic link.
- 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 modem 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 6-65 for instructions.

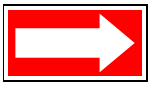
Clear Remote Data Logger AT$BCn

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 6-11 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 time-out, 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.

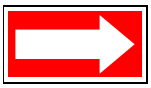
Remote Bytes Stored AT$BNn

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 6-11 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 time-out, 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, the remote modem will not accept any input over the serial interface or over the acoustic link.

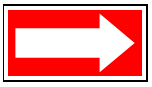
Clear Local Data Logger ATBC

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 6-11 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.

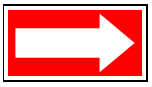
Local Bytes Stored ATBN

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 6-11 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.

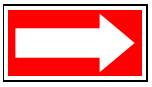
Output Local Data Logger ATBT

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 6-11 for instructions on how to place the modem into Command mode.

How to Use

To use the Output Local Data Logger command, type ATBT.

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.

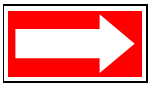
Output Local Page ATBPn

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 6-11 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.

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 67 dB:	No signal. Indicates a problem with the transducer or preamplifier. Ensure that the transducer is connected.
30–67 dB:	Normal range. Indicates quiet conditions.
15–30 dB:	Some background noise. Although communications over the acoustic link is possible, the range will be reduced.
Less than 15 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 6-11 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.

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."

7 Modem Operating Parameters (S Registers)

The ATM-880 Series Acoustic Telemetry Modem operating parameters are determined from settings that are stored in 21 nonvolatile memory locations called S Registers, S0–S20. The modem operating parameters include the serial interface and acoustic baud 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 4-10.

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:

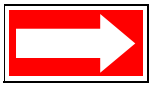
- Enter +++ rapidly.
- If S Register 15 is set to 00, power down and then power up the modem.
- If S Register 15 is set to 00, wait for the idle time to expire.

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-880 Series Acoustic Telemetry Modem S Registers

S Register	Name	Factory Default Setting	Page
S0	Software Version Number	<Version>	7-3
S1	Doppler Correction	00	7-5
S2	Reserved	***	7-7
S3	Serial Baud Rate	02	7-9
S4	Acoustic Baud Rate	05	7-11
S5	Reserved	***	7-13
S6	Transmit Power Level	08	7-15
S7	Acoustic Response Time-out	15	7-17
S8	Forwarding Delay	60	7-19
S9	Reserved	***	7-21
S10	Idle Time	36	7-23
S11	RS-232 Driver/Flow Control	00	7-25
S12	ATX Test Message Length	00	7-27
S13	Verbose Level	01	7-29
S14	Remote Address	00	7-31
S15	Operating Mode	01	7-33
S16	Reserved	***	7-35
S17	Lowpower Wakeup	01	7-37
S18	Modem Address	00	7-39
S19	Reserved	***	7-41
S20	Reserved	***	7-43



NOTE The factory settings for all reserved S Registers (***) should not be altered.

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.

Doppler Correction S1

Default Setting

00	Doppler correction is disabled.

Definition

The setting of S Register 1 determines whether Doppler correction is disabled or enabled.

Available Settings

There are two available settings for S Register 1 as listed below.

00: Disables Doppler correction.

01: Enables Doppler correction.

Special Considerations

When setting S Register 1, take note of the following:

- Doppler correction is effective to five knots of relative speed between two modems communicating over the acoustic link.
- Doppler correction should be disabled if the two modems are a fixed distance apart such that there is no relative speed. Otherwise it is possible to obtain a false Doppler correction in a low signal-to-noise environment.
- Doppler correction can be enabled or disabled remotely with the Remote Doppler Correction command (AT$Dn,m).

Reserved S2

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:

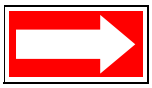
  Baud rate: 9600 baud

  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.



NOTE The ATM-881 Deck Box display will remain blank for all settings that use RS-422.

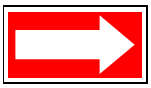
Acoustic Baud Rate S4

Default Setting

05	The transmitting acoustic baud rate of the modem is 800 bits/second 1-of-4, with rate 1/2 convolutional coding and 12.5-ms multipath guard period.

Definition

The setting of S Register 4 determines the transmitting acoustic baud rate, the modulation scheme—Hadamard MFSK or 1-of-4 MFSK—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 baud rate only. The receiving modem will receive data and commands from the transmitting modem regardless of the baud rate of the transmitting modem. Therefore the baud rates can be different in each direction for an asymmetrical acoustic link.

Available Settings

The range of settings for S Register 4 is from 02 to 08 as follows:

02: 150 bits/sec Hadamard

03: 300 bits/sec 1-of-4, repeated twice with rate 1/2 convolutional coding and 25-ms multipath guard period

04: 600 bits/sec 1-of-4, with rate 1/2 convolutional coding and 25-ms multipath guard period

05: 800 bits/sec 1-of-4, with rate 1/2 convolutional coding and 12.5-ms multipath guard period

06: 1066 bits/sec 1-of-4, with rate 1/2 convolutional coding and 3.125-ms multipath guard period

07: 1200 bits/sec 1-of-4, with rate 1/2 convolutional coding

08: 2400 bits/sec 1-of-4

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 baud rate that yields good results.
- When selecting a baud 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).

Reserved S5

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.

Acoustic Response Time-out 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 time-out, 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.”

Available Settings

The range of settings for S Register 7 is from 07 to 140, where each increment represents 0.5 seconds for a time range of 3.5 to 70.0 seconds.

Special Considerations

The acoustic response time-out 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 two-way distance of 6000 meters, for example, is about 4 seconds. The time it takes for a modem to receive and respond to a command must also be considered. This time, however, will always be approximately 1.75 seconds. Therefore, the default 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.

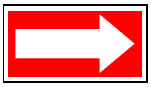
Forwarding Delay S8

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 completely 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.

Reserved S9

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 7-25 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:

- 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, as is typically the case for an ATM-881 Deck Box or an ATM-881R Rack Mount Deck Box, 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, such as on the ATM-881 Deck Box display, or on the monitor of the host PC if a PC is used as the host processor.

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)

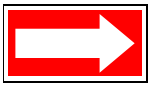
Verbose Level S13

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, such as on the ATM-881 Deck Box display, or on the monitor of the host PC if a PC is used as the host processor



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 hexadecimal 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 5F.

CCERR: Corrected Channel Errors—the number of errors corrected by the convolutional decoder.

Special Considerations

When setting S Register 13, take note of the following:

- When the keypad and display of an ATM-881 Deck Box is used to enter commands and display messages, or 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 31.

Special Considerations

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

Operating Mode S15

Default Setting

01	When the modem is powered up or when 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

Reserved S16

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 31. This provides a total of 32 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.

Reserved S19

Reserved S20

8 Maintenance and Troubleshooting

This section encompasses the recommended care and maintenance procedures for the subsea modem components of the ATM-880 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 some of the operational problems that could occur during setup or deployment.

The care and maintenance of the modems involve two areas: general cleaning and inspection, and changing the modem battery packs. The tools required to perform 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

Alcohol wipes

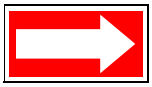
Paper towels

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 4-6 on page 4-9 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.

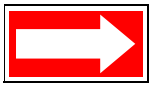
4. Lubricate the POWER/SERIAL connector pins with a light coat of silicone lubricant and install the dummy connector supplied with the modem.



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 the remote transducer with a light coat of silicone lubricant.
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 have an internal battery pack which will occasionally require changing. To change the modem 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.

Checking the Modem Battery Pack

The capacity of the modem battery pack can be estimated by measuring the battery pack voltage—either open circuited or under load. A more meaningful measurement, however, is obtained when the battery pack is under load. To check the modem battery pack 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 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	100
18	95
17	75
16	50
15	25
14	10
13	1

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 4-6 on page 4-9 for the location of the modem on/off switch.
2. For an ATM-885 Acoustic Telemetry Modem only, use a 5/32 Allen wrench to remove the four socket head screws and four washers that attach the transducer guard to the housing clamp and remove the guard.

3. 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.
4. Carefully pull the end cap straight out from the housing. If required, rotate the end cap slightly while pulling.
5. Disconnect the in-line connector that connects the battery pack to the connector on the POWER/SERIAL connector end cap.
6. 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.
7. 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.
8. Disconnect the 5-pin power connector.
9. 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.
10. Place the end cap assembly on a clean, flat surface.
11. Remove the modem battery pack by first pushing it out from the POWER/SERIAL connector end cap end and then removing it from the opposite end.
12. Inspect the O-rings on both end caps. They should be free of any scratches, nicks or dirt. Inspect the O-ring surfaces on the housing. They should also be free of any scratches, nicks or dirt.

    Wipe the O-rings clean with an alcohol wipe and apply a light coat of silicone lubricant. Replace any O-ring that appears cracked or nicked.

    When replacing an O-ring, first clean the O-ring surface on the housing with a clean, lint-free cloth or paper towel, and then apply a thin coat of silicone lubricant to the new O-ring before installing it onto the end cap.
13. Insert the new modem 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.

14. Connect the 10-pin serial connector to the circuit board and secure it with the locking sleeve.
15. Connect the 5-pin serial connector to the circuit board.
16. Use a wire tie to secure the wire harness to the wire tie block. 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.
17. 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.
18. Connect the in-line connector that connects the modem 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.
19. 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.
20. For an ATM-885 Acoustic Telemetry Modem only, install and secure the transducer guard using the four 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 4-6 on page 4-9 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 batteries from the housing. If required, rotate the end cap slightly while pulling.
7. Remove the tape that holds the batteries in the battery tray.
8. One at a time remove the two batteries from the battery tray, and then remove the tape that secures the in-line connectors and disconnect the packs.
9. Connect the in-line connectors of the new batteries and secure the connectors with tape.
10. Install the batteries into the battery tray one at a time, label side out, tucking the battery wires out of the way, one between the battery pack and the battery tray bulkhead, and the other between the two packs.
11. Tape the batteries in place using packing or electrical tape.
12. Inspect the O-rings on both end caps. They should be free of any scratches, nicks or dirt. Inspect the O-ring surfaces on the housing. They should also be free of any scratches, nicks or dirt.

    Wipe the O-rings clean with an alcohol wipe and apply a light coat of silicone lubricant. Replace any O-ring that appears cracked or nicked.

    When replacing an O-ring, first clean the O-ring surface on the housing with a clean, lint-free cloth or paper towel, and then apply a thin coat of silicone lubricant to the new O-ring before installing it onto the end cap.
13. 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.
14. 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.
15. Slide the stainless steel band clamp back into position between the end cap and the housing and tighten the clamp.

16. Connect the 5-pin power and 10-pin serial cable connectors to the circuit board.
17. 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
18. 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.
19. Slide the stainless steel band clamp back into position between the end cap and the housing and tighten the clamp.

Troubleshooting

If during the setup or deployment of the modems, an ATM-880 Series Acoustic Telemetry 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 some 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 of the problem.

When turning on the ATM-881 Deck Box, the POWER ON LED does not illuminate.

A. If AC power is being used to power the deck box, verify that the AC power cable is connected to the deck box and is plugged into a 100–120 VAC, 50–60 Hz or 200–240 VAC, 50–60 Hz power source.

B. If DC power is being used to power the deck box, verify that the DC power cable is connected to the deck box, and is plugged into a 21–28 VDC power source.

C. Verify that the AC or DC voltage of the power source is correct.

D. Check the fuse.

If the fuse is blown, replace it with a 4-amp slo-blow type.

E. If AC power is being used to power the deck box, check the ON/OFF circuit breaker/rocker switch to see if the circuit breaker has tripped.

The POWER ON LED illuminates when turning on the ATM-881 Deck Box, but there is no banner message displayed.

A. Verify that the AC or DC voltage of the power source is correct.

B. Turn the deck box off and then on again.

The ATM-881 Deck Box displays the banner message, but there is no response on the display when entering commands from the keypad.

A. Verify that the REMOTE/TERMINAL switch is switched to TERMINAL.

B. Verify that the AC or DC voltage of the power source is correct.

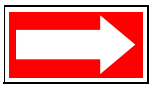
C. Turn the deck box off and then on again.

The ATM-881 Deck Box displays the banner message, but there is no banner message displayed on the monitor of a connected host PC.

A. Verify that the RS-232 serial cable is configured correctly and is connected to the correct serial port on the host PC. Refer to "Setting up the ATM-881 and ATM-881R Modems" on page 4-10.

B. Verify that the terminal program communications software is running.

C. 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 4-21.



NOTE The ATM-880 Series Acoustic Telemetry Modems are shipped with the serial baud rate of the RS-232/422 serial interface set to 9600 baud (no echo) as determined by the setting of S Register 3.

D. Switch the REMOTE/TERMINAL switch to TERMINAL and use the keypad on the deck box to 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 the same as that configured for the host PC. Refer to "Serial Baud Rate S3" on page 7-9 for information on S Register 3.

E. Switch the REMOTE/TERMINAL switch back to REMOTE after verifying the setting of S Register 3.

The ATM-881 Deck Box displays the banner message, and the monitor of the host PC connected to the deck box displays the banner message, but there is no displayed response to commands entered from the keyboard of the host PC.

A. Verify that the REMOTE/TERMINAL switch is switched to REMOTE.

B. Verify that the terminal program communications software is running and, if the program has an echo feature, that it is turned on.

If the terminal program communications software does not have an echo feature, switch the REMOTE/TERMINAL switch to TERMINAL and use the keypad on the deck box to 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 7-9 for information on S Register 3.

Switch the REMOTE/TERMINAL switch back to REMOTE after verifying the setting of S Register 3.

There is no banner message displayed on the monitor of the host PC connected to a subsea 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 4-21.

B. Verify that the terminal program communications software is running.

A. Switch the REMOTE/TERMINAL switch to TERMINAL and use the keypad on the deck box to enter +++ to place the modem into Command mode. Then type AT. The message “OK” should be displayed.

B. 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 7-29 for information on S Register 13.

C. Verify that the modem battery pack has not been depleted.

D. Verify that the RS-232 serial cable is configured correctly and is connected to the correct serial port on the host PC. Refer to "Setting up the ATM-881 and ATM-881R Modems" on page 4-10.

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, switch the REMOTE/TERMINAL switch to TERMINAL and use the keypad on the deck box to 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 7-9 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 ATM-881 Deck Box is the local modem, increase the volume setting using the VOLUME control.

B. If the local modem is an ATM-881 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 7-29 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 6-12 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 drawings for the ATM-880 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

B871-08594 Outline, ATM-881 Deck Box

Subsea Modems

A875-08446 Outline, ATM-885 Modem

A875-08676 Outline, ATM-885R Modem

B845-08339 Outline, ATM-887 Modem

B877-08723 Outline, ATM-887R Modem

Modem Board Sets

B875-08659 Outline, ATM-885, PCB, OEM Board Set

B875-08693 Outline, ATM-885R, PCB, OEM Board Set

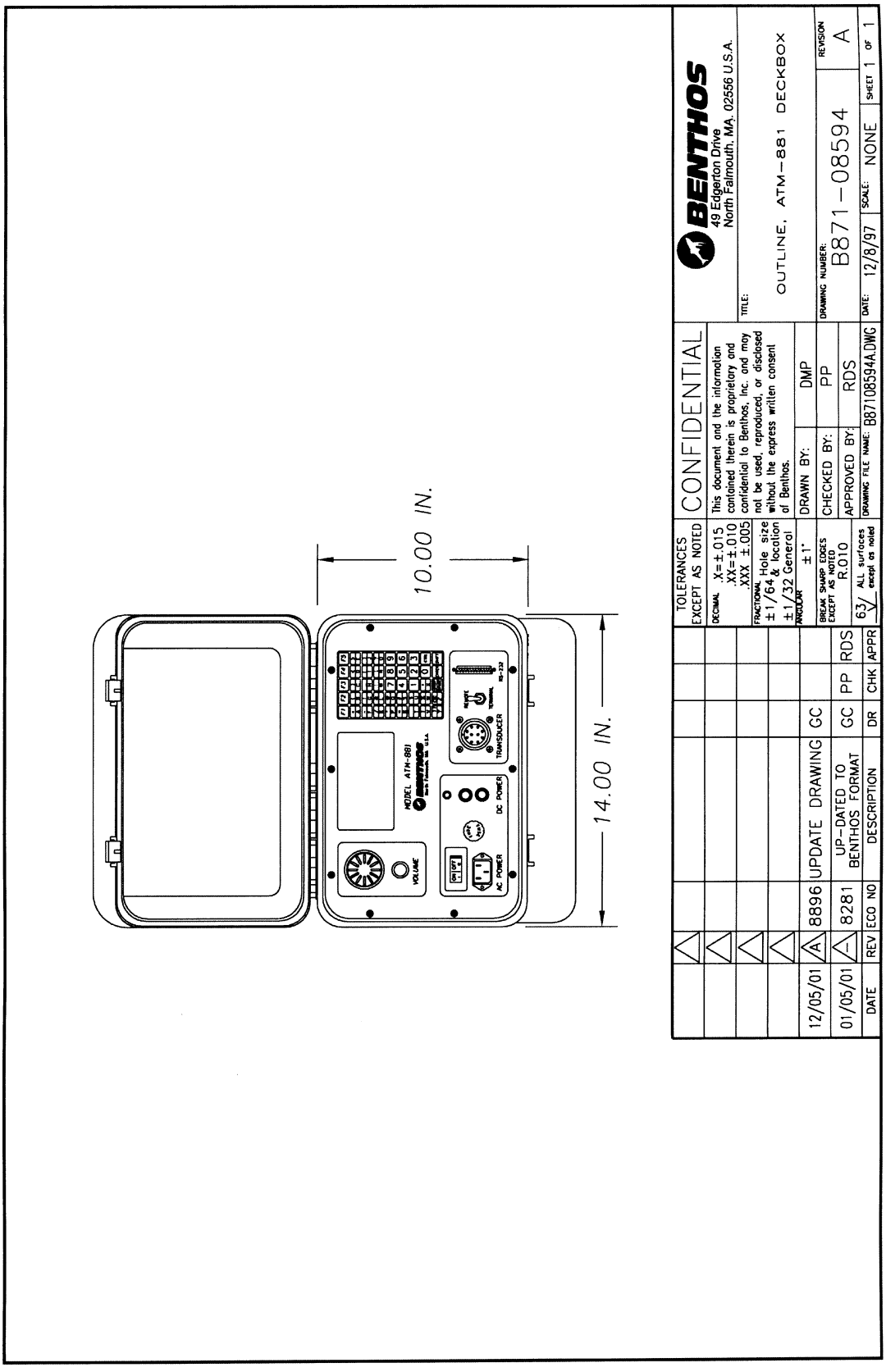
Remote Transducers

A875-08689 Outline, ATM-408 Transducer (LF)

A875-08690 Outline, ATM-409 Transducer (LF)

B421-08716 Outline, ATM-421 Transducer (LF)

A875-09248 Outline, ATM-421 Transducer (MF)


10.00 IN.
14.00 IN.
MODEL ATM-881
VOLUME
AC POWER
DC POWER
TRANSDUCER
RS-232
TOLERANCES
EXCEPT AS NOTED
DECIMAL .X=±.015 XX=±.010 XXX ±.005
FRACTIONAL ±1/64 & location ±1/32 General
ANGULAR ±1°
BREAK SHARP EDGES EXCEPT AS NOTED R.010
63 ALL surfaces except as noted
CONFIDENTIAL
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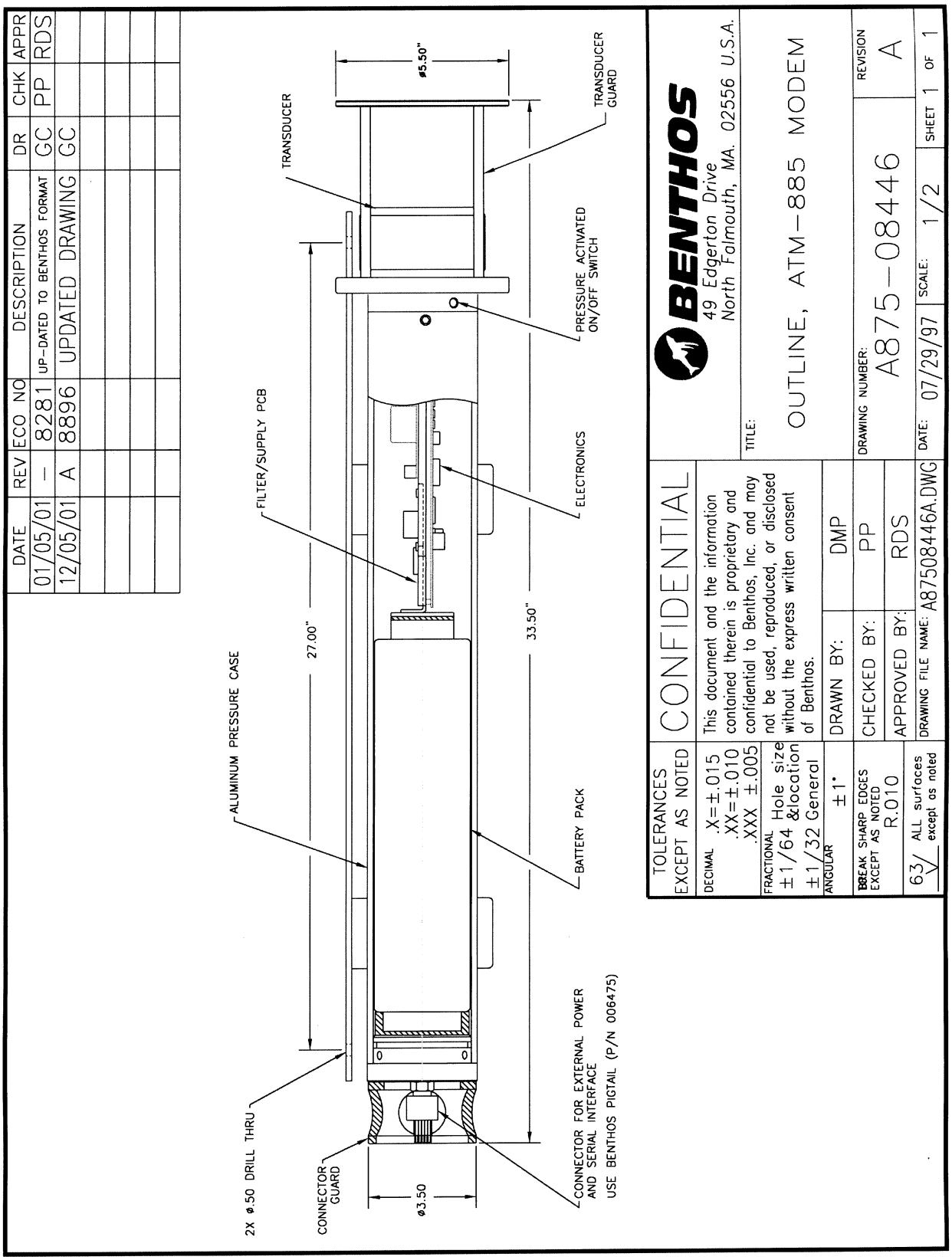
CHECKED BY: PP
APPROVED BY: RDS
DRAWING FILE NAME: B87108594A.DWG
BENTHOS
49 Edgerton Drive
North Falmouth, MA. 02556 U.S.A.
TITLE:
OUTLINE, ATM-881 DECKBOX
DRAWING NUMBER: B871-08594
REVISION A
DATE: 12/8/97
SCALE: NONE
SHEET 1 OF 1
REV ECO NO DESCRIPTION DR CHK APPR
A 8896 UPDATE DRAWING GC
- 8281 UP-DATED TO BENTHOS FORMAT GC PP RDS
DATE
12/05/01
01/05/01


DATE | REV | ECO NO | DESCRIPTION | DR | CHK | APPR
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12/05/01 | A | 8896 | UPDATED DRAWING | GC
ALUMINUM PRESSURE CASE
FILTER/SUPPLY PCB
TRANSDUCER
TRANSDUCER GUARD
PRESSURE ACTIVATED ON/OFF SWITCH
ELECTRONICS
BATTERY PACK
CONNECTOR FOR EXTERNAL POWER AND SERIAL INTERFACE
USE BENTHOS PIGTAIL (P/N 006475)
2X ø.50 DRILL THRU
CONNECTOR GUARD
ø3.50
27.00"
33.50"
ø5.50"
TOLERANCES EXCEPT AS NOTED
DECIMAL .X=±.015 .XX=±.010 .XXX ±.005
FRACTIONAL ±1/64 &location ±1/32 General
ANGULAR ±1°
BREAK SHARP EDGES EXCEPT AS NOTED R.010
63 ALL surfaces except as noted
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CHECKED BY: PP
APPROVED BY: RDS
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49 Edgerton Drive
North Falmouth, MA. 02556 U.S.A.
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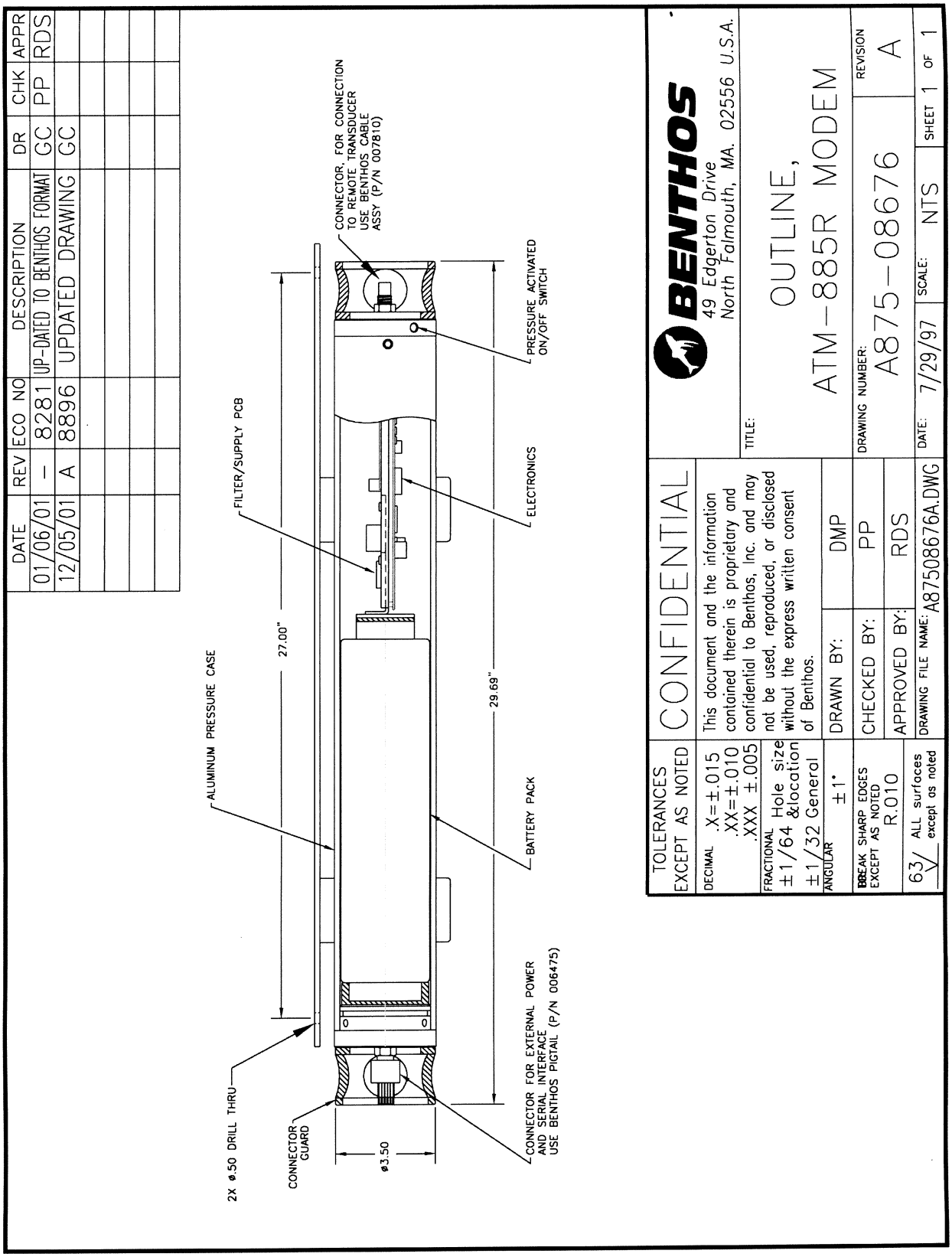
OUTLINE, ATM-885 MODEM
DRAWING NUMBER: A875-08446
REVISION A
DATE: 07/29/97
SCALE: 1/2
SHEET 1 OF 1


DATE | REV | ECO NO | DESCRIPTION | DR | CHK | APPR
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12/05/01 | A | 8896 | UPDATED DRAWING | GC
ALUMINUM PRESSURE CASE
FILTER/SUPPLY PCB
CONNECTOR, FOR CONNECTION TO REMOTE TRANSDUCER USE BENTHOS CABLE ASSY (P/N 007810)
PRESSURE ACTIVATED ON/OFF SWITCH
ELECTRONICS
BATTERY PACK
CONNECTOR FOR EXTERNAL POWER AND SERIAL INTERFACE USE BENTHOS PIGTAIL (P/N 006475)
27.00"
29.69"
2X ø.50 DRILL THRU
CONNECTOR GUARD
ø3.50
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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CHECKED BY: PP
APPROVED BY: RDS
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BENTHOS
49 Edgerton Drive
North Falmouth, MA. 02556 U.S.A.
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OUTLINE,
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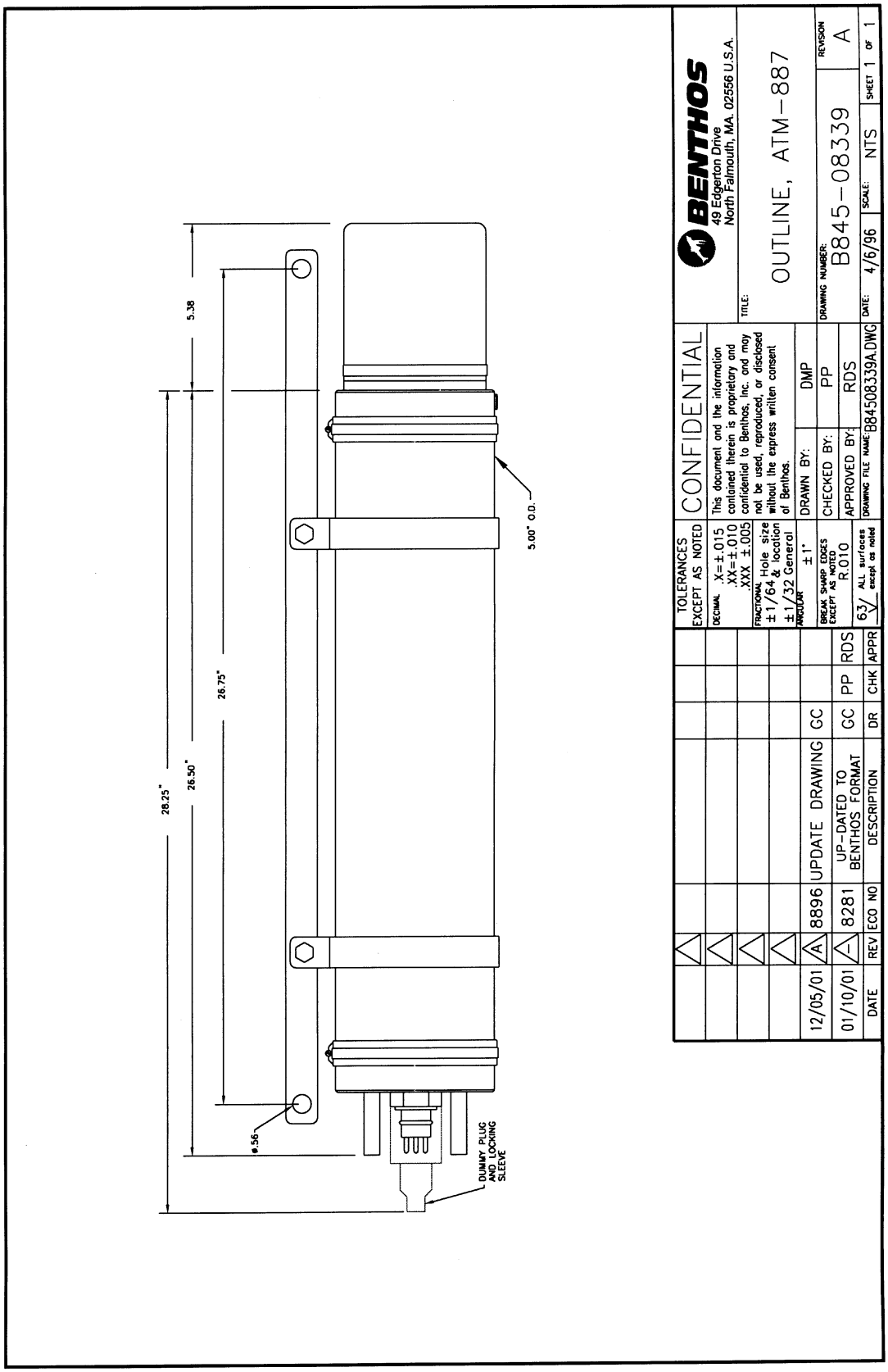
DRAWING NUMBER: A875-08676
REVISION A
DATE: 7/29/97
SCALE: NTS
SHEET 1 OF 1


28.25"
26.50"
26.75"
5.38
5.00" O.D.
.56
DUMMY PLUG AND LOCKING SLEEVE
BENTHOS
49 Edgerton Drive
North Falmouth, MA. 02556 U.S.A.
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TOLERANCES EXCEPT AS NOTED
DECIMAL X=±.015 XX=±.010 XXX ±.005
FRACTIONAL Hole size ±1/64 & location ±1/32 General
ANGULAR ±1°
BREAK SHARP EDGES EXCEPT AS NOTED R.010
63 ALL surfaces except as noted
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CHECKED BY: PP
APPROVED BY: RDS
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REVISION A
DATE: 4/6/96
SCALE: NTS
SHEET 1 OF 1
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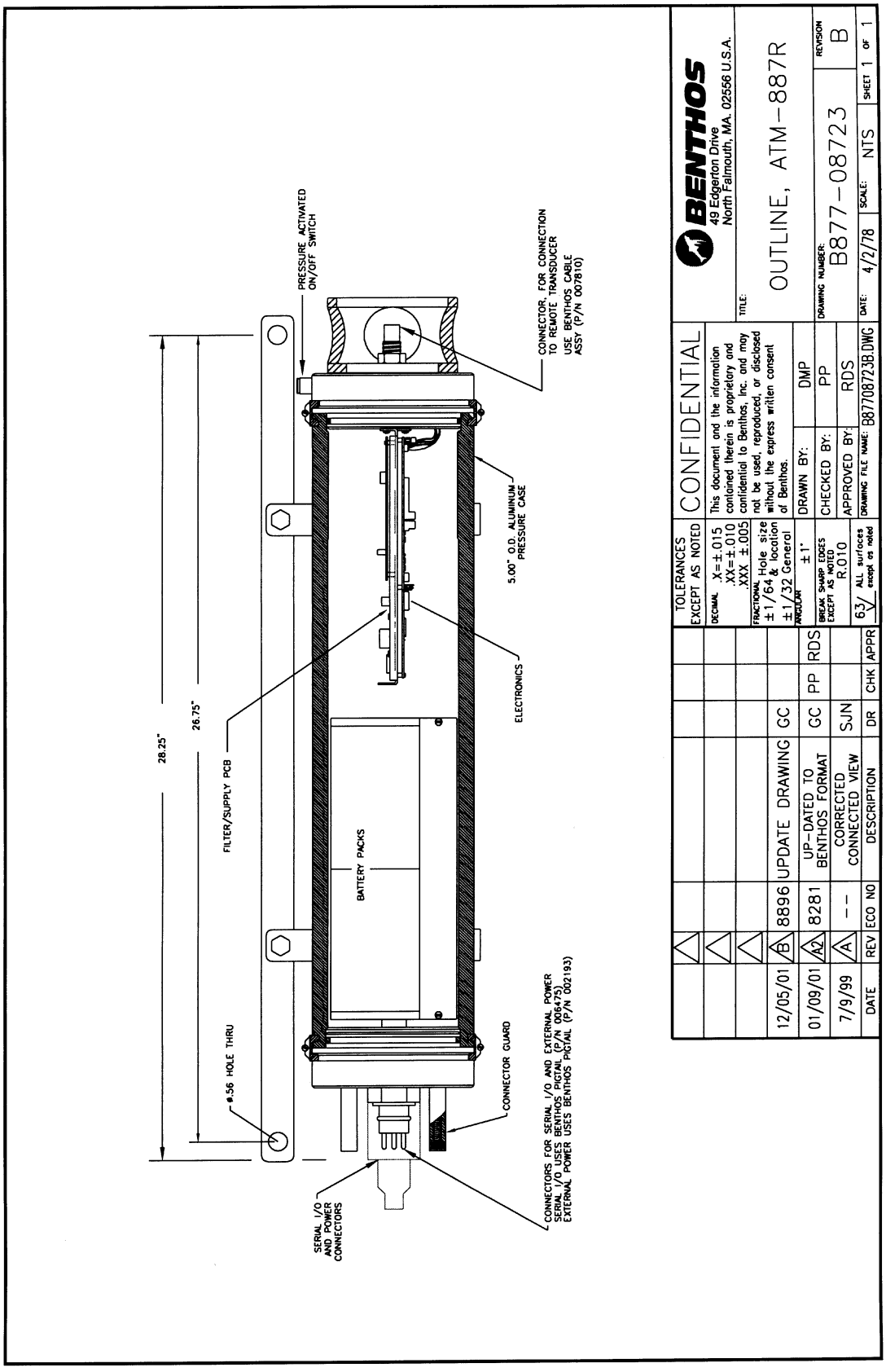
01/10/01 - 8281 UP-DATED TO BENTHOS FORMAT GC PP RDS
DATE REV ECO NO DESCRIPTION DR CHK APPR


PRESSURE ACTIVATED ON/OFF SWITCH
CONNECTOR, FOR CONNECTION TO REMOTE TRANSDUCER USE BENTHOS CABLE ASSY (P/N 007810)
5.00" O.D. ALUMINUM PRESSURE CASE
ELECTRONICS
BATTERY PACKS
FILTER/SUPPLY PCB
28.25"
26.75"
Ø.56 HOLE THRU
CONNECTOR GUARD
SERIAL I/O AND POWER CONNECTORS
CONNECTORS FOR SERIAL I/O AND EXTERNAL POWER
SERIAL I/O USES BENTHOS PIGTAIL (P/N 006475)
EXTERNAL POWER USES BENTHOS PIGTAIL (P/N 002193)
DATE 12/05/01 01/09/01 7/9/99
REV B A2 A
ECO NO 8896 8281 --
DESCRIPTION UPDATE DRAWING; UP-DATED TO BENTHOS FORMAT; CORRECTED CONNECTED VIEW
DR GC GC SJN
CHK PP PP
APPR RDS RDS
TOLERANCES EXCEPT AS NOTED
DECIMAL X=±.015 .XX=±.010 .XXX ±.005
FRACTIONAL Hole size ±1/64 & location ±1/32 General
ANGULAR ±1°
BREAK SHARP EDGES EXCEPT AS NOTED R.010
63 ALL surfaces except as noted
CONFIDENTIAL
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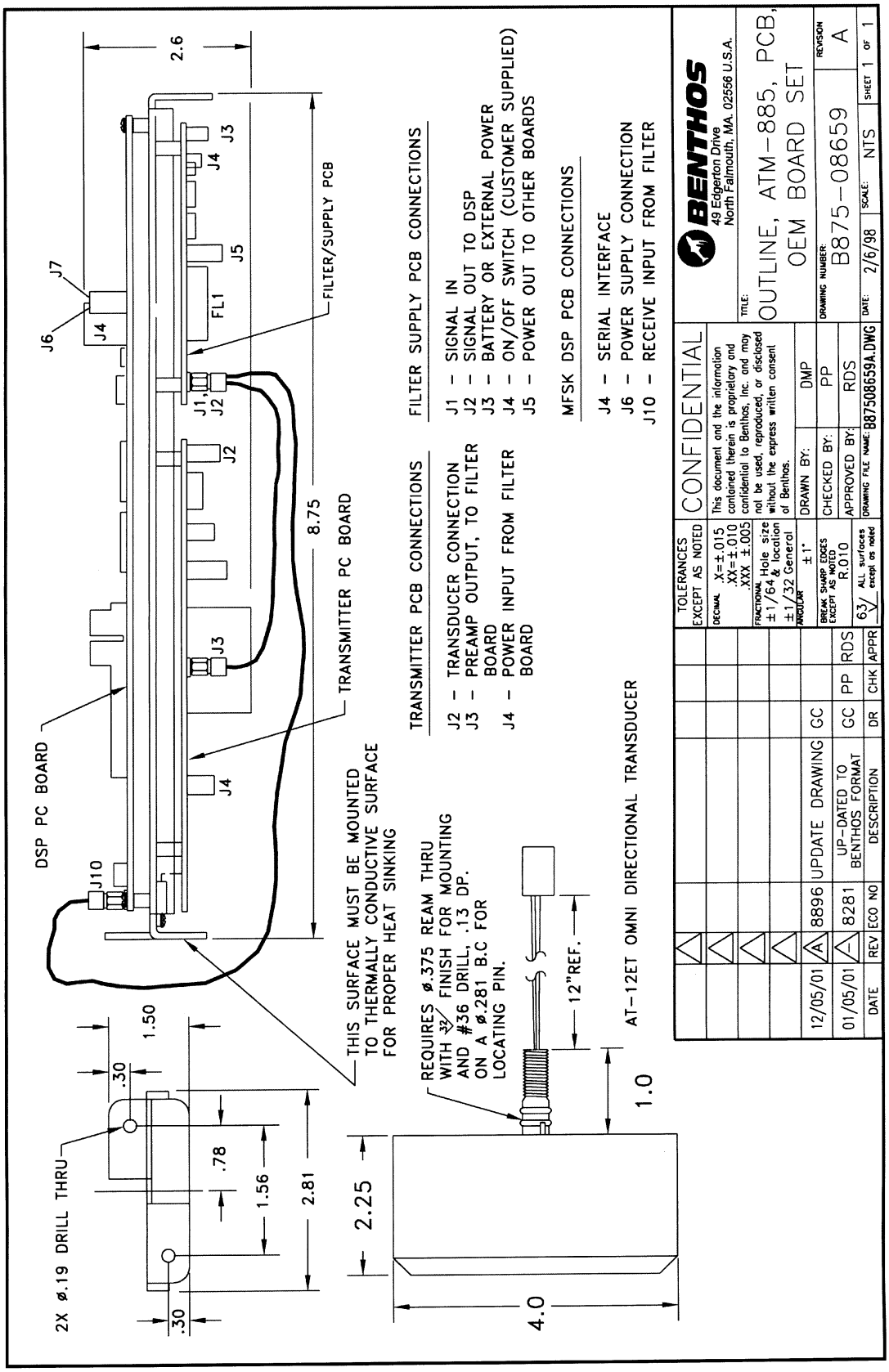
DRAWN BY: DMP
CHECKED BY: PP
APPROVED BY: RDS
DRAWING FILE NAME: B87708723B.DWG
BENTHOS
49 Edgerton Drive
North Falmouth, MA. 02556 U.S.A.
TITLE:
OUTLINE, ATM-887R
DRAWING NUMBER: B877-08723
REVISION B
DATE: 4/2/78
SCALE: NTS
SHEET 1 OF 1


DSP PC BOARD
TRANSMITTER PC BOARD
FILTER/SUPPLY PCB
THIS SURFACE MUST BE MOUNTED TO THERMALLY CONDUCTIVE SURFACE FOR PROPER HEAT SINKING
REQUIRES ø.375 REAM THRU WITH 32/ FINISH FOR MOUNTING AND #36 DRILL, .13 DP. ON A ø.281 B.C FOR LOCATING PIN.
2X ø.19 DRILL THRU
AT-12ET OMNI DIRECTIONAL TRANSDUCER
12"REF.
TRANSMITTER PCB CONNECTIONS
J2 - TRANSDUCER CONNECTION
J3 - PREAMP OUTPUT, TO FILTER BOARD
J4 - POWER INPUT FROM FILTER BOARD
FILTER SUPPLY PCB CONNECTIONS
J1 - SIGNAL IN
J2 - SIGNAL OUT TO DSP
J3 - BATTERY OR EXTERNAL POWER
J4 - ON/OFF SWITCH (CUSTOMER SUPPLIED)
J5 - POWER OUT TO OTHER BOARDS
MFSK DSP PCB CONNECTIONS
J4 - SERIAL INTERFACE
J6 - POWER SUPPLY CONNECTION
J10 - RECEIVE INPUT FROM FILTER
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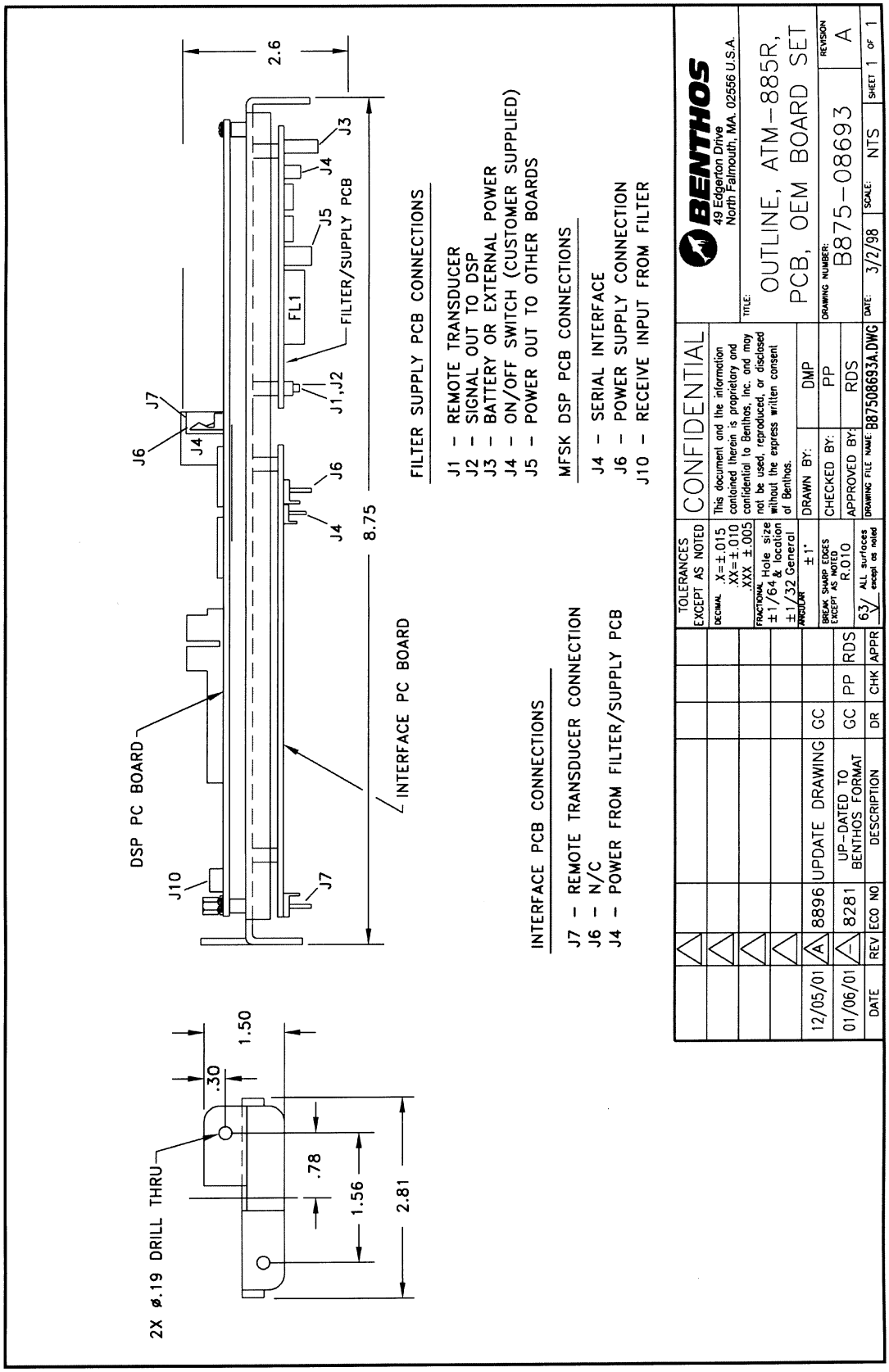
BENTHOS
49 Edgerton Drive
North Falmouth, MA. 02556 U.S.A.
TITLE: OUTLINE, ATM-885, PCB, OEM BOARD SET
DRAWING NUMBER: B875-08659
REVISION: A
SHEET 1 OF 1
SCALE: NTS
DATE: 2/6/98
DRAWING FILE NAME: B875086S9A.DWG
DRAWN BY: DMP
CHECKED BY: PP
APPROVED BY: RDS
TOLERANCES EXCEPT AS NOTED
DECIMAL .X=±.015 .XX=±.010 .XXX ±.005
FRACTIONAL ±1/64 Hole size ±1/32 General
ANGULAR ±1°
BREAK SHARP EDGES EXCEPT AS NOTED R.010
63/ ALL surfaces except as noted
DATE REV ECO NO DESCRIPTION DR CHK APPR
12/05/01 A 8896 UPDATE DRAWING GC
01/05/01 8281 UP-DATED TO BENTHOS FORMAT GC PP RDS


DSP PC BOARD
INTERFACE PC BOARD
FILTER/SUPPLY PCB
J10
J7
J6
J4
J5
J3
J1,J2
FL1
2.6
8.75
2X ø.19 DRILL THRU
.30
1.50
.78
1.56
2.81
FILTER SUPPLY PCB CONNECTIONS
J1 - REMOTE TRANSDUCER
J2 - SIGNAL OUT TO DSP
J3 - BATTERY OR EXTERNAL POWER
J4 - ON/OFF SWITCH (CUSTOMER SUPPLIED)
J5 - POWER OUT TO OTHER BOARDS
MFSK DSP PCB CONNECTIONS
J4 - SERIAL INTERFACE
J6 - POWER SUPPLY CONNECTION
J10 - RECEIVE INPUT FROM FILTER
INTERFACE PCB CONNECTIONS
J7 - REMOTE TRANSDUCER CONNECTION
J6 - N/C
J4 - POWER FROM FILTER/SUPPLY PCB
DATE REV ECO NO DESCRIPTION DR CHK APPR
12/05/01 A 8896 UPDATE DRAWING GC
01/06/01 - 8281 UP-DATED TO BENTHOS FORMAT GC PP RDS
TOLERANCES EXCEPT AS NOTED
DECIMAL X=±.015 XX=±.010 XXX ±.005
FRACTIONAL Hole size ±1/64 & location ±1/32 General
ANGULAR ±1°
BREAK SHARP EDGES EXCEPT AS NOTED R.010
63 ALL surfaces except as noted
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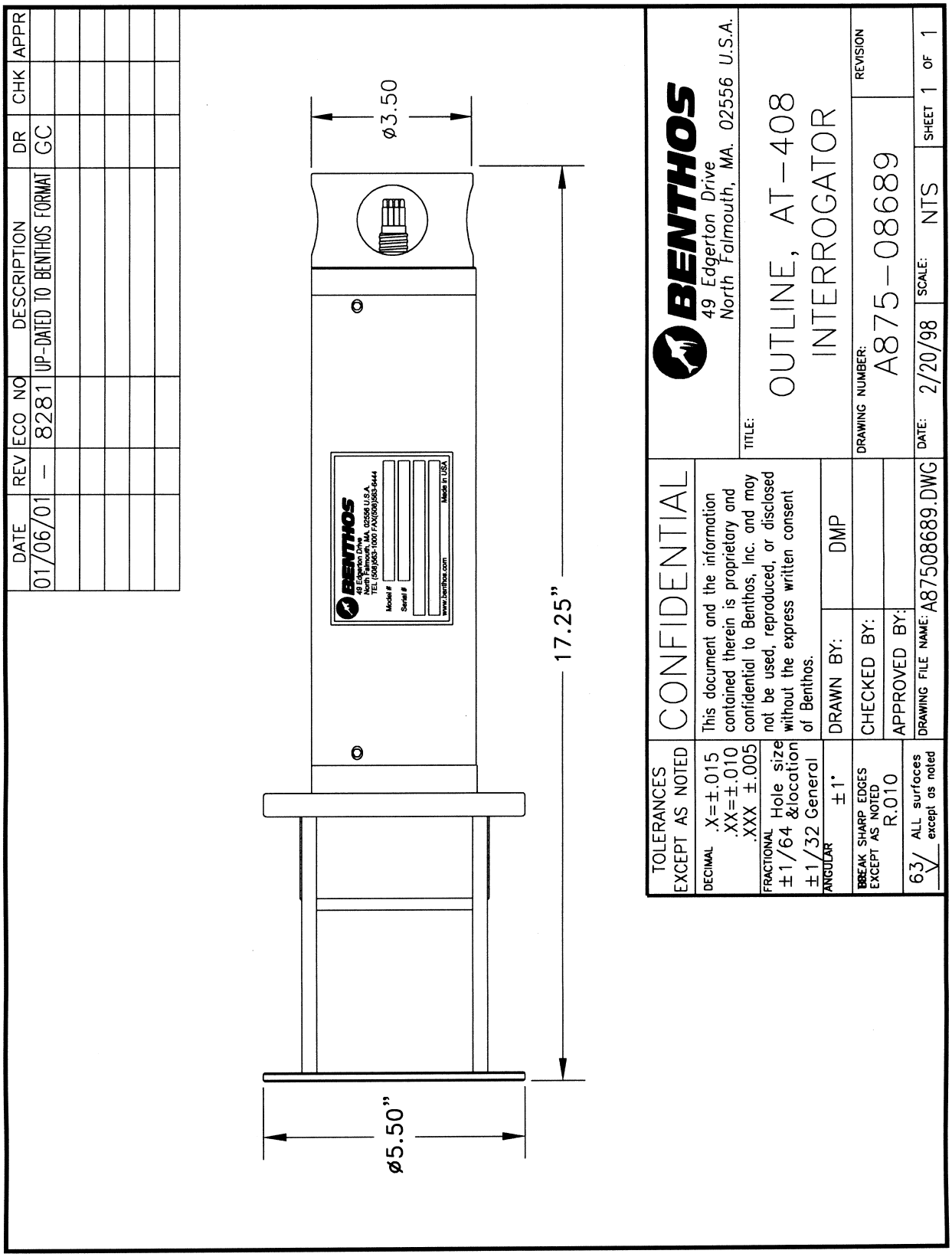
CHECKED BY: PP
APPROVED BY: RDS
DRAWING FILE NAME: B87508693A.DWG
BENTHOS
49 Edgerton Drive
North Falmouth, MA. 02556 U.S.A.
TITLE:
OUTLINE, ATM-885R, PCB, OEM BOARD SET
DRAWING NUMBER: B875-08693
REVISION A
DATE: 3/2/98
SCALE: NTS
SHEET 1 OF 1


DATE
REV
ECO NO
DESCRIPTION
DR
CHK
APPR
01/06/01
—
8281
UP-DATED TO BENTHOS FORMAT
GC
ø3.50
17.25"
ø5.50"
BENTHOS
49 Edgerton Drive
North Falmouth, MA 02556 U.S.A.
TEL (508)563-1000 FAX(508)563-6444
Model #
Serial #
Made in USA
www.benthos.com
TOLERANCES
EXCEPT AS NOTED
DECIMAL .X=±.015
.XX=±.010
.XXX ±.005
FRACTIONAL ±1/64 &location
±1/32 General
ANGULAR ±1°
BREAK SHARP EDGES
EXCEPT AS NOTED
R.010
63 ALL surfaces
except as noted
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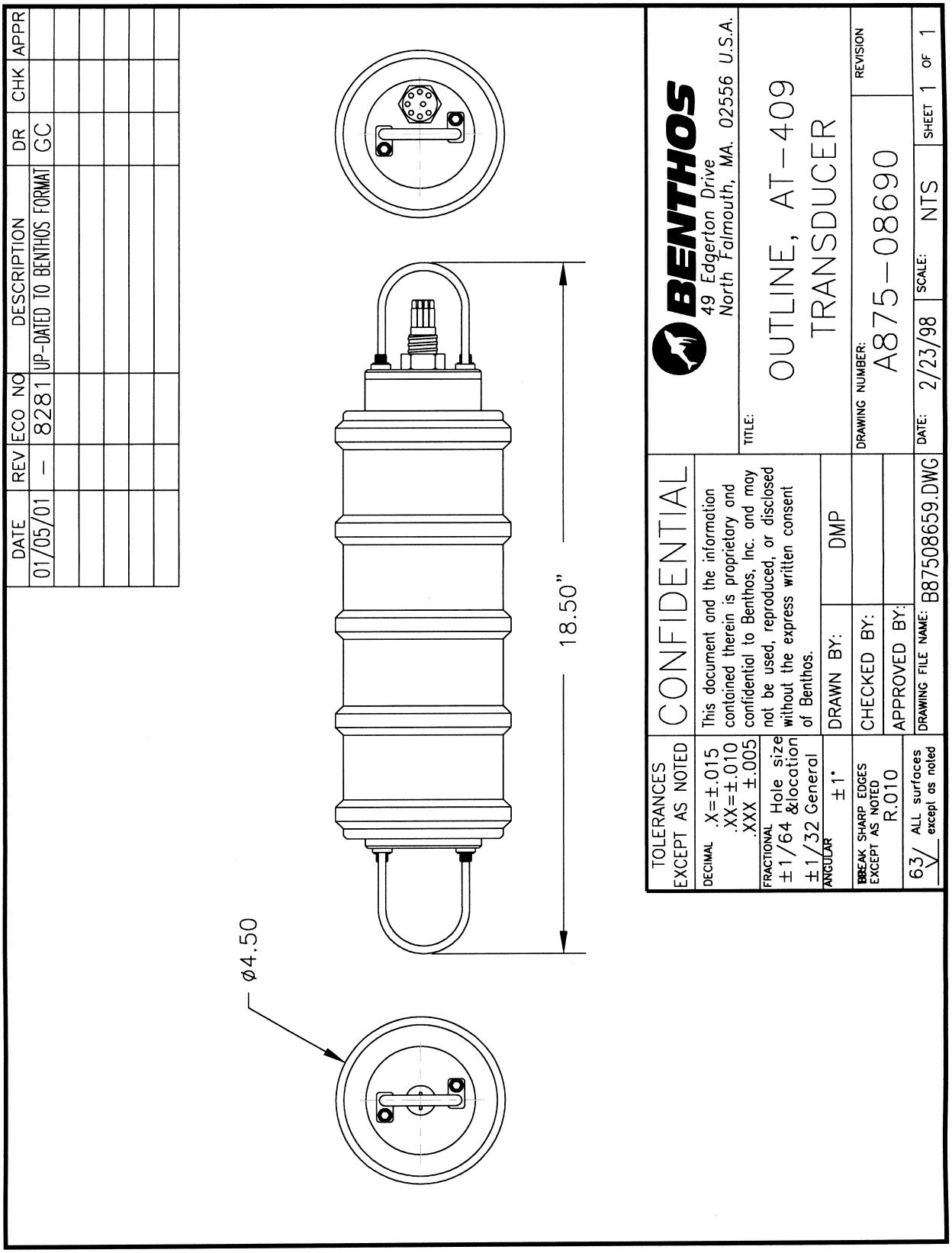
DRAWN BY: DMP
CHECKED BY:
APPROVED BY:
DRAWING FILE NAME: A87508689.DWG
BENTHOS
49 Edgerton Drive
North Falmouth, MA. 02556 U.S.A.
TITLE:
OUTLINE, AT-408
INTERROGATOR
DRAWING NUMBER:
A875-08689
REVISION
DATE: 2/20/98
SCALE: NTS
SHEET 1 OF 1


DATE
REV
ECO NO
DESCRIPTION
DR
CHK
APPR
01/05/01
–
8281
UP-DATED TO BENTHOS FORMAT
GC
ø4.50
18.50"
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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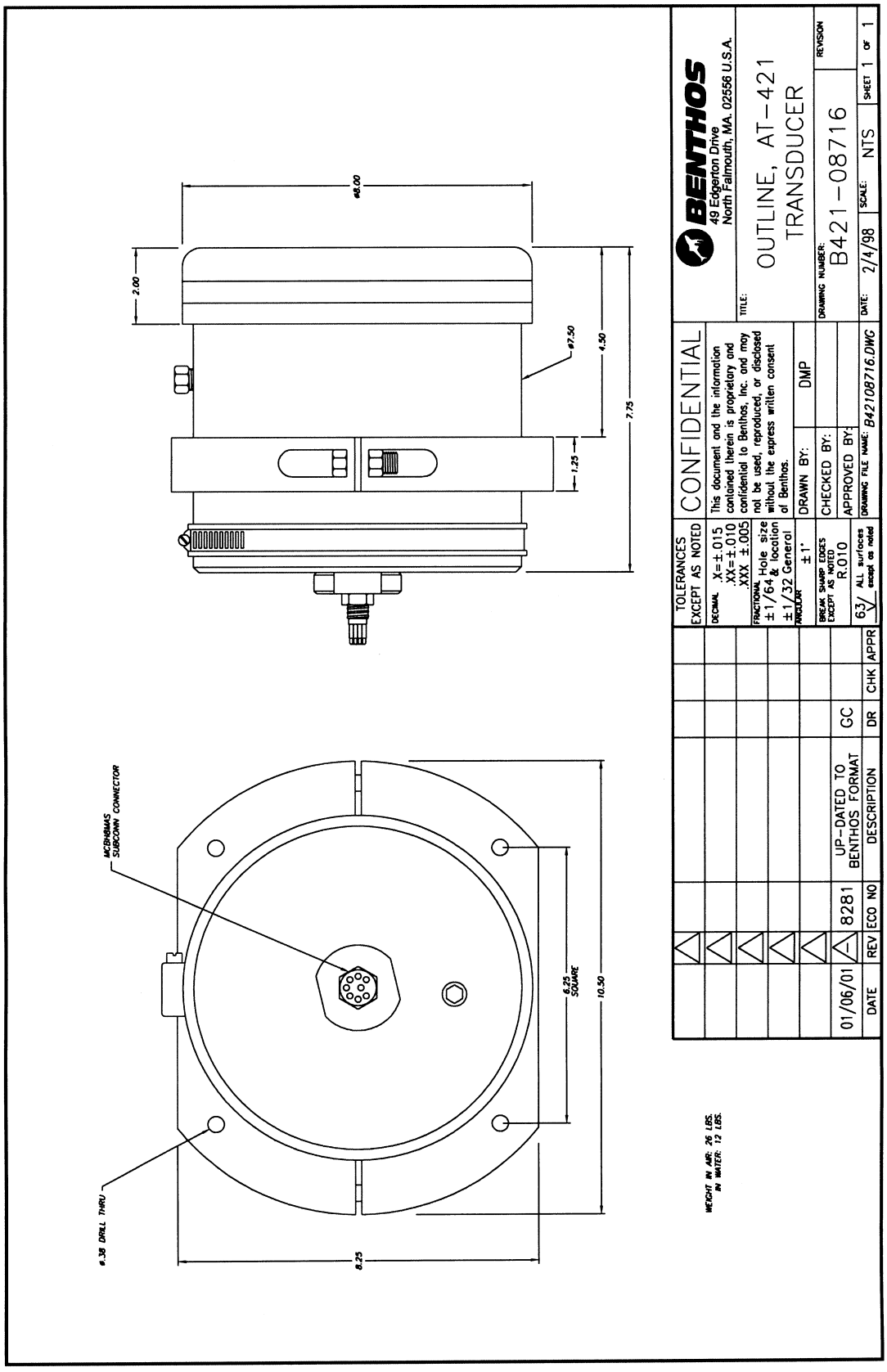
CHECKED BY:
APPROVED BY:
DRAWING FILE NAME: B87508659.DWG
BENTHOS
49 Edgerton Drive
North Falmouth, MA. 02556 U.S.A.
TITLE:
OUTLINE, AT–409
TRANSDUCER
DRAWING NUMBER:
A875–08690
REVISION
DATE: 2/23/98
SCALE: NTS
SHEET 1 OF 1


ø8.00
2.00
ø7.50
4.50
1.25
7.75
MCBH8MAS
SUBCONN CONNECTOR
ø.38 DRILL THRU
8.25
6.25
SQUARE
10.50
WEIGHT IN AIR: 26 LBS.
IN WATER: 12 LBS.
TOLERANCES
EXCEPT AS NOTED
DECIMAL X=±.015
.XX=±.010
.XXX ±.005
FRACTIONAL Hole size ±1/64 & location ±1/32 General
ANGULAR ±1°
BREAK SHARP EDGES EXCEPT AS NOTED R.010
63/ ALL surfaces except as noted
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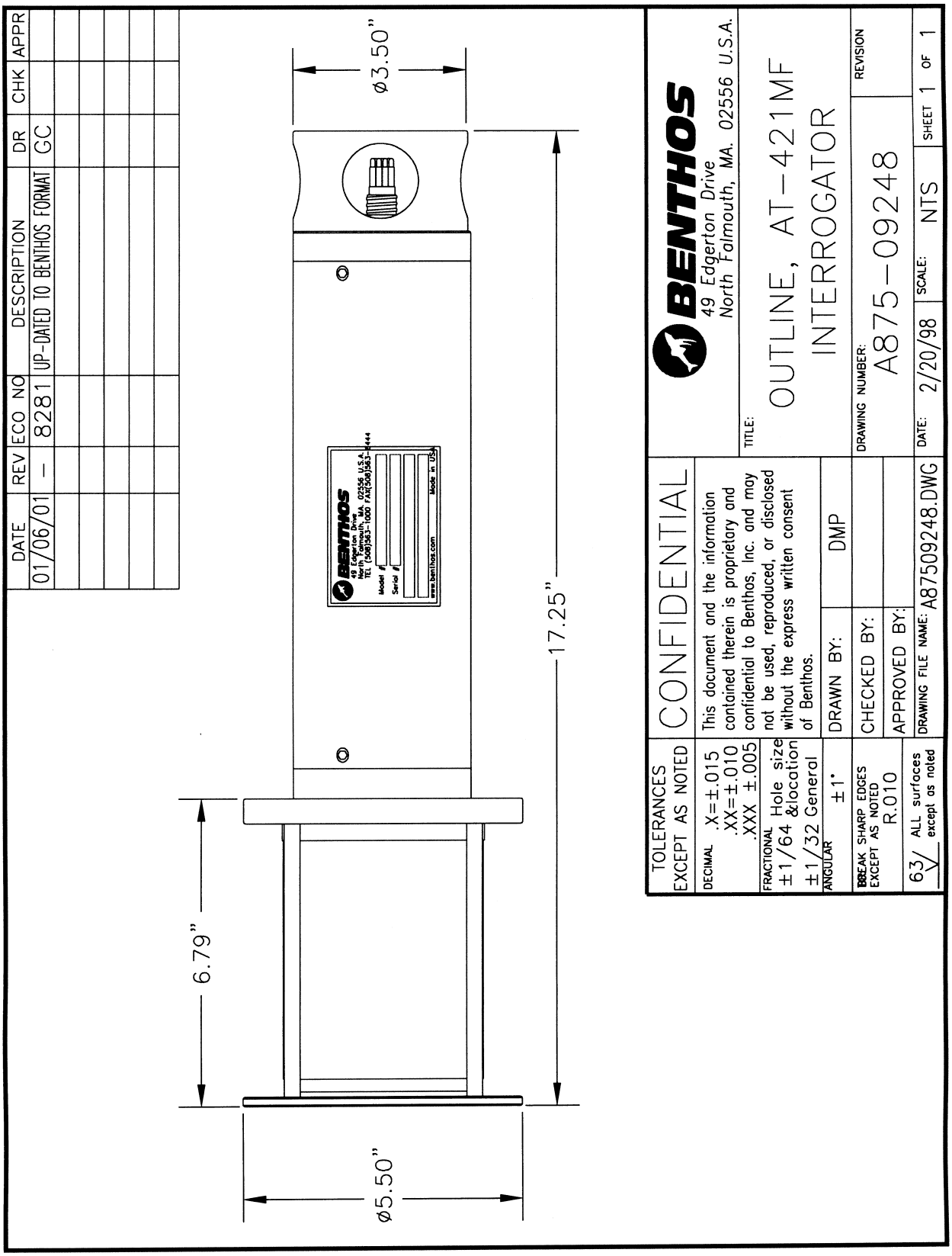
CHECKED BY:
APPROVED BY:
DRAWING FILE NAME: B42108716.DWG
BENTHOS
49 Edgerton Drive
North Falmouth, MA. 02556 U.S.A.
TITLE:
OUTLINE, AT-421
TRANSDUCER
DRAWING NUMBER:
B421-08716
REVISION
DATE: 2/4/98
SCALE: NTS
SHEET 1 OF 1
DATE REV ECO NO DESCRIPTION DR CHK APPR
01/06/01 A 8281 UP-DATED TO BENTHOS FORMAT GC


DATE
REV
ECO NO
DESCRIPTION
DR
CHK
APPR
01/06/01
–
8281
UP-DATED TO BENTHOS FORMAT
GC
ø3.50"
6.79"
17.25"
ø5.50"
BENTHOS
49 Edgerton Drive
North Falmouth, MA 02556 U.S.A.
TEL (508)563-1000 FAX(508)563-1444
Model #
Serial #
www.benthos.com
Made in USA
TOLERANCES
EXCEPT AS NOTED
DECIMAL .X=±.015
.XX=±.010
.XXX ±.005
FRACTIONAL ±1/64 &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: DMP
CHECKED BY:
APPROVED BY:
DRAWING FILE NAME: A87509248.DWG
BENTHOS
49 Edgerton Drive
North Falmouth, MA. 02556 U.S.A.
TITLE:
OUTLINE, AT-421MF
INTERROGATOR
DRAWING NUMBER:
A875-09248
REVISION
DATE: 2/20/98
SCALE: NTS
SHEET 1 OF 1