

ATM-900 Series Acoustic Telemetry Modems

User's Manual

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



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

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

www.benthos.com

Notices

Proprietary Information

The information, descriptions, photos and illustrations in this manual are the property of Teledyne Benthos Materials may not be reproduced or disseminated without the prior written consent of Teledyne Benthos.

Warranty, Limitation of Liability, and Proprietary Rights Statement

This Statement applies to the products of Teledyne Benthos, a Business Unit of Teledyne Instruments, Inc. Approved 05/08/13.

LIMITED WARRANTY. Teledyne Benthos warrants that all Goods delivered under Buyer's Order shall be free from defects in material and workmanship, and conform to Teledyne Benthos's specifications for a period of twelve (12) months from the date of original shipment. The warranty period for spare parts is ninety (90) days from the date of original shipment. The warranty period for repair work performed on Goods that are not covered by the original warranty is ninety (90) days from the date of return shipment and applies only to that portion of the Goods that was repaired. Teledyne Benthos warrants all Services for ninety (90) days after completion unless otherwise mutually agreed under a separate Service contract. This warranty does not apply to any Goods that, upon examination by Teledyne Benthos, are found to have been (a) mishandled, misused, abused, or damaged by Buyer or Buyer's customer, (b) altered from their original state, (c) repaired without Teledyne Benthos's prior written approval, or (d) improperly stored, installed, operated, or maintained in a manner inconsistent with Teledyne Benthos's instructions. This warranty does not apply to defects attributed to normal wear and tear. Teledyne Benthos, at its sole option, shall either repair or replace defective Goods, or issue Buyer a credit for the original price of the defective Goods. In the case of defective Services, Teledyne Benthos shall re-perform such Services. Such repair, replacement, credit, and re-performance by Teledyne Benthos shall be Buyer's sole remedy for defective Goods and Services. Under no circumstances is Teledyne Benthos liable for recall, retrieval, removal, dismantling, re-installation, redeployment, or re-commissioning of any defective Goods or any costs associated therewith including, but not limited to, any subsea work performed below the waterline, heavy lift operations, or the transportation to or from offshore locations. Consumables obtained from third parties shall bear the warranty of their manufacturer. The warranty period for repaired or replaced Goods or re-performed Services shall be the unexpired portion of the original warranty

period. THESE EXPRESS WARRANTIES, INCLUDING THE REMEDIES SET FORTH HEREIN, ARE EXCLUSIVE AND ARE IN LIEU OF ANY AND ALL OTHER WARRANTIES, EXPRESS OR IMPLIED. NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE IS INTENDED OR GIVEN. IN THE CASE OF GOODS OTHER THAN THOSE OF TELEDYNE BENTHOS'S OWN MANUFACTURE, TELEDYNE BENTHOS MAKES NO WARRANTIES, EXPRESS, STATUTORY, OR IMPLIED.

LIMITATION OF LIABILITY. Notwithstanding any other provision herein, under no circumstances shall either Party be liable to the other for any consequential, special, incidental, indirect, multiple, administrative, or punitive damages, or any damage of an indirect or consequential nature arising out of or related to its performance under Buyer's Order, including, without limitation, loss of use, loss of revenues, loss of anticipated profits, and cost of capital, whether based upon breach of Buyer's Order, warranty, negligence, or any other type of claim, and whether grounded in tort, contract, civil law, or other theories of liability, including strict liability, even if advised in advance of the possibility of such damages. Each Party's total liability to the other Party arising from or related to Buyer's Order, including, but not limited to, its liability for indemnity, defense, and hold harmless obligations, is limited to no more than the amount paid by Buyer to Teledyne Benthos under Buyer's Order. To the extent that this limitation of liability conflicts with any other Section or provision herein, such provision shall be regarded as amended to whatever extent required to make such provision consistent with this clause.

PROPRIETARY RIGHTS. Teledyne Benthos shall retain all right, title, and interest in and to any data, information, software programs, tools, specifications, templates, scripts, ideas, concepts, inventions, works of authorship, products, know-how, processes, techniques, and the like used or developed by Teledyne Benthos, its employees, and its subcontractors in connection with Buyer's Order. Buyer agrees that Teledyne Benthos retains all proprietary rights in and to all products, specifications, designs, discoveries, inventions, patents, copyrights, trademarks, trade secrets, and other proprietary rights relating to Goods or Services. Unless otherwise identified in writing to Teledyne Benthos, no information or knowledge heretofore or hereafter disclosed to Teledyne Benthos in the performance of, or in connection with, the terms hereof, shall be deemed to be confidential or proprietary and any such information or knowledge shall be free from restrictions, other than a claim for patent infringement, as part of the consideration hereof.

Title

Title shall pass to the Buyer on delivery to the carrier at North Falmouth, Massachusetts, U.S.A. Risk of damage or loss following such delivery shall be the Buyer's, and Teledyne Benthos shall in no way be responsible for safe arrival of the shipment. Title shall so pass to the Buyer regardless of any provision for payment of freight or insurance by Teledyne Benthos, and regardless of the form of the shipping documents. If shipment is consigned to Teledyne Benthos, it shall be for the purpose of securing the Buyer's obligations under contract.

Changes

Teledyne Benthos reserves the right to make changes to the design or specifications at any time without incurring any obligation to modify previously installed units. In addition, while considerable effort has been made to ensure that the information in this manual is accurate and complete, Teledyne Benthos assumes no liability for any errors or omissions.

Preface

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

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

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

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

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

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

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

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

Section 7 - Modem AT Command Set provides descriptions of each of the acoustic telemetry modem AT commands supported by the CLAM shell user interface and how to enter and use them.

Section 8 - Modem Configuration Parameters provides descriptions of each of the available acoustic telemetry modem configuration parameters and how to set them.

Section 9 - Maintenance and Troubleshooting provides instructions for cleaning and inspecting the acoustic telemetry modems, changing the modem battery packs and troubleshooting operational problems that might occur.

Section 10 - Drawings includes outline drawings of the acoustic telemetry modems to assist in their installation and setup.

Section 11 - Modem Spares, Accessories and Part Designator
Includes lists of spares and accessories for the acoustic telemetry modems along with a part designator for simplified ordering.

Notes and Warnings

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



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



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

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 Teledyne Benthos acoustic telemetry modems, or if you require service or support.

Please contact us at:

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

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

www.benthos.com

Contents

Notices	ii
Proprietary Information	ii
Warranty, Limitation of Liability, and Proprietary Rights Statement	ii
Title	iv
Changes	iv
Preface	v
Notes and Warnings	vi
Customer Service	vi
Contents	vii
List of Figures	xxii
List of Tables	xxv

1 Overview 1-1

Wireless Underwater Communications	1-1
Commands and Data	1-3
Acoustic Bit Rates	1-3
Modulation Techniques	1-3
Typical Applications	1-4
Remote Data Acquisition	1-4
AUV Command and Control	1-6
Underwater Local Area Networks	1-7
Release of Moored Instrument Arrays	1-7
Modem Performance Factors	1-8
Barriers to Underwater Communications	1-8
Sound Speed in Seawater	1-8
Signal Fading	1-9
Multipath Interference and Reflections	1-9
Methods for Increasing Reliability	1-9
Convolutional Coding	1-10
Multipath Guard Period	1-10
Data Redundancy	1-10
Modem and Remote Transducer Types	1-11
Surface Modems	1-12
Subsea Modems	1-13
<i>ATM-915 and ATM-914 Acoustic Telemetry Modems</i>	1-14
<i>ATM-916 Acoustic Telemetry Modem</i>	1-14
<i>ATM-925 and ATM-924 Acoustic Telemetry Modems</i>	1-15

<i>ATM-926 Acoustic Telemetry Modem</i>	1-15
<i>ATM-965 and ATM-964 Acoustic Telemetry Modems</i>	1-16
<i>ATM-966 Acoustic Telemetry Modem</i>	1-16
SMART Releases	1-17
<i>SR-50 SMART Release</i>	1-17
<i>SR-9100 SMART Release</i>	1-18
<i>SM-975/976 SMART Modem</i>	1-18
ATM-903 and ATM-900 Modem Board Sets	1-19
Optional Features	1-19
Compact Modems	1-21
Remote Transducers	1-22
<i>Remote Omnidirectional Transducer</i>	1-22
<i>Remote Directional Transducer</i>	1-22
<i>Acoustic Baffles</i>	1-26

2 Specifications 2-1

General	2-1
Real-Time Clock	2-3
ATM-914 Subsea Modem	2-3
ATM-915 Subsea Modem	2-4
ATM-916 Subsea Modem	2-5
ATM-924 Subsea Modem	2-6
ATM-925 Subsea Modem	2-6
ATM-926 Subsea Modem	2-7
ATM-964 Subsea Modem	2-8
ATM-965 Subsea Modem	2-8
ATM-966 Subsea Modem	2-9
ATM-900 Modem Board Set	2-10
ATM-903 Modem Board Set	2-10
Remote Omnidirectional Transducer	2-10
Remote Directional Transducer	2-11
Modem Battery Pack Capacities	2-12
Modem Battery Pack Capacity for ATM-914/915/924/925 Acoustic Telemetry Modems	2-12
Modem Battery Pack Capacity for ATM-964/965 Acoustic Telemetry Modems	2-13

3	Deployment Considerations	3-1
	Remote Transducer Selection	3-1
	Modem Battery Pack	3-2
	Battery Pack Power Usage	3-2
	Processing Overhead	3-2
	Modem Battery Pack Capacity Calculations	3-3
	<i>Verifying the Modem Battery Pack Capacity for a Short</i> <i>Deployment</i>	3-3
	<i>An Example Deployment Calculation</i>	3-4
	Modem Operating Depth	3-6
	Modem Communications Range	3-6
	Multipath and Noise	3-6
	Transducer Orientation	3-7
	Use of an Acoustic Baffle	3-7
	Height Above the Bottom and Distance Below the Surface	3-7
	Other Acoustic Devices	3-8
	Typical Deployment Configurations	3-8
	UDB-9400 Universal Deck Box Transducer Deployment	3-8
	Subsea Modem Deployment	3-9
	Corrosion Protection	3-9
	O-Ring Inspection	3-9
4	Setup and Test	4-1
	Unpacking and Inspection	4-1
	UDB-9400 Universal Deck Box Components	4-1
	ATM-914 Components	4-2
	ATM-915 Components	4-2
	ATM-916 Components	4-2
	ATM-924 Components	4-3
	ATM-925 Components	4-3
	ATM-926 Components	4-3
	ATM-964 Components	4-4
	ATM-965 Components	4-4
	ATM-966 Components	4-4
	ATM-900 Components	4-5
	ATM-903 Components	4-5
	Modem Connections	4-6
	UDB-9400 Universal Deck Box Connections	4-6
	Subsea Modem Connections	4-6

Modem Operator Functions	4-7
UDB-9400 Universal Deck Box Operator Functions	4-7
Subsea Modem Operator Functions	4-8
Setting Up the Modems	4-9
Setting up the UDB-9400 Universal Deck Box	4-9
Setting up the Subsea Modems	4-11
Setting up the ATM-900 and ATM-903 Board Sets	4-14
Connecting External Sensors to the Optional Analog Input Board	4-20
Setting up the Host Processor	4-21
Checking the Modems and Host Processors	4-22
Turning on a Modem and Entering Command Mode	4-22
Verifying the Acoustic Operation of a Modem's Receiver	4-23
Checking the Acoustic Link between a Pair of Modems in Air ..	4-23
Preparing a Pair of Modems for Real-Time Data Transfer	4-24
Preparing a Modem for Data Logging	4-25
Reloading Software Applications	4-26

5 Modem Operation 5-1

Online Mode	5-2
Transmit Data Buffers	5-3
Data Format	5-4
Online Break	5-4
Error Checking	5-4
Command Mode	5-5
Acoustic Command Execution	5-6
Entering Commands	5-7
<i>Command Line Shortcuts</i>	5-7
<i>Tab Completion</i>	5-8
<i>Command Prompts</i>	5-8
<i>Strict AT</i>	5-9
<i>Command Numbers and History</i>	5-9
<i>Privilege Levels</i>	5-9
<i>Command Aliases</i>	5-10
<i>Command Syntax</i>	5-10
Parser Commands	5-11
<i>alias</i>	5-11
<i>unalias</i>	5-12
<i>help</i>	5-12
<i>hist</i>	5-13
<i>setpriv</i>	5-13
<i>strictat</i>	5-14
<i>nostrictat</i>	5-14

Datalogger Mode	5-15
6-MB Internal Memory	5-16
SDHC Card Memory and Formatting	5-16
Record Parceling	5-17
Search and Retrieval	5-17
Data Logger Commands	5-18
<i>dlfind</i>	5-18
<i>dllist</i>	5-21
<i>dlrecs</i>	5-22
<i>rdlfind</i>	5-22
<i>rdllist</i>	5-23
<i>rdlrecs</i>	5-23
<i>dldump</i>	5-24
<i>rdldump</i>	5-25
<i>rdlblk</i>	5-25
<i>dlclear</i>	5-26
<i>rdlclear</i>	5-26
<i>ATBC</i>	5-26
<i>AT\$BCn</i>	5-27
<i>AT\$BEn</i>	5-27
<i>AT\$BDn</i>	5-27
Dual Serial Port Option	5-28
InputMode Configuration Parameter	5-29
<i>Dual Serial Port Data Logging</i>	5-29
<i>Dual Online Mode</i>	5-30
TPortMode Configuration Parameter	5-31
<i>TportMode=InpMode</i>	5-31
<i>TportMode=AlwaysOn</i>	5-32
SrcP1 and SrcP2 Configuration Parameters	5-32
Dst1, Dst2, Dst3, and Dst4 Configuration Parameters	5-32
Flow Control	5-32
Default Transport Addressing	5-33
<i>Default Transport Addressing—Topside and Subsea</i>	
<i>Modems</i>	5-33
<i>Default Transport Addressing—UDB-9400 and Subsea</i>	
<i>Modems</i>	5-34
Backward Compatibility	5-35
Lowpower State	5-36
Waking up a Modem	5-37
Lowpower State Commands	5-37
<i>ATL</i>	5-38
<i>ATH</i>	5-38

File System	5-39
Flash File System	5-39
External SDHC Card	5-39
System Devices	5-39
File Attributes	5-40
Directories	5-40
8-Bit Versus 16-bit Wide Files	5-40
Redirection	5-41
Tab Completion for File System Names	5-41
File System Commands	5-42
<i>format</i>	5-42
<i>mount</i>	5-43
<i>umount</i>	5-44
<i>cat</i>	5-44
<i>cp</i>	5-45
<i>df</i>	5-46
<i>ls</i>	5-46
<i>mkdir</i>	5-47
<i>mv</i>	5-47
<i>rm</i>	5-47
<i>rmdir</i>	5-48
<i>chown</i>	5-48
<i>chmod</i>	5-48
<i>echo</i>	5-49
<i>rb</i>	5-49
<i>rx</i>	5-50
<i>rz</i>	5-50
<i>sb</i>	5-51
<i>sx</i>	5-51
<i>sz</i>	5-52
Configuration System	5-53
Configuration Files	5-53
<i>Standard.ini File</i>	5-53
<i>Factcfg.ini File</i>	5-54
Configuration Parameter Sections	5-54
Tab Completion for Configuration System	5-56
Configuration System Commands	5-56
@	5-56
<i>cfg all</i>	5-57
@<section name>	5-57
@<parameter name>	5-57
@<parameter name>=<value>	5-58
<i>cfg load</i>	5-58

<i>cfg store</i>	5-59
<i>factory_reset</i>	5-59
#<address> @ <parameter name>=<value>	5-60
#<address> <i>cfg store</i>	5-60
Transponder Operation	5-61
Required Configuration Parameter Settings	5-61
Transponder Operation Commands	5-63
<i>ATNm</i>	5-63
LBL/Multi-Receive Option	5-65
Long Baseline Acoustic Positioning Concept	5-65
Broadband Triggered LBL Configuration	5-65
Configuring a Modem as a Remote Modem Transponder	5-67
Broadband Triggered LBL Configuration Commands	5-68
<i>ATNL</i>	5-68
<i>rxadj</i>	5-69
All-Tonal Based LBL Configuration	5-70
All-Tonal Based LBL Configuration Commands	5-70
Analog Input Option	5-71
Polling	5-71
Analog Input Commands	5-72
<i>analogin</i>	5-72
Depth Sensor Option	5-73
Depth Sensor Commands	5-73
<i>ATRDn</i>	5-73
Acoustic Recorder Option	5-74
Generating Basebanded Signals	5-74
Acoustic Recorder Commands	5-78
<i>Record</i>	5-78
<i>Record on</i>	5-78
<i>Record off</i>	5-79
Setting up for Data Recording	5-79
Removing an SDHC Card with Recorded Acoustic Recorder	
Data	5-80
Reading Recorded Files Using Matlab Utilities	5-80
<i>Reading Individual .WAV Files</i>	5-80
<i>Reading .WAV Files as a Batch</i>	5-81
Waveform Play Option	5-83
Creating a Basebanded Waveform	5-83
Uploading a Basebanded Waveform	5-84
Waveform Play Commands	5-84
<i>play</i>	5-84

SMART Releases and Modems	5-85
SR-50 and SR-9100 SMART Releases	5-85
SM-975 SMART Modem	5-85
SMART Release and Modem Commands	5-85
<i>getcurrent</i>	5-86
<i>AT\$Tn</i>	5-86
<i>AT\$Rn,m</i>	5-86
<i>AT\$Nn,m</i>	5-87
<i>#n getcurrent</i>	5-87
Navigation	5-88
Speed of Sound	5-88
Navigation Commands	5-88
<i>gpsd</i>	5-89
<i>tcm5d</i>	5-91
<i>Compass</i>	5-91
Real-Time Clock	5-92
SyncPPS Configuration Parameter	5-92
Synchronizing a Modem to an External 1PPS Signal	5-93
Inputting Time and Date from an External Time Source	5-94
Real-Time Clock Commands	5-95
<i>date</i>	5-95
<i>uptime</i>	5-96
<i>rtc_battery</i>	5-96
<i>sync</i>	5-97
Device Enable	5-98
Automatic Device Enable Output Setting	5-98
Manual Device Enable Output Settings	5-98
Device Enable Commands	5-98
<i>ATTDm,p</i>	5-99
<i>AT\$Xn,m,p</i>	5-99
Acoustic Test	5-100
Background Noise Interpretations	5-100
Acoustic Test Commands	5-101
<i>spectrum</i>	5-101
<i>autobaud</i>	5-101
<i>xmittime</i>	5-103
<i>ATTNn</i>	5-103
<i>ATT2</i>	5-104
<i>ATT1</i>	5-104
<i>AT\$G</i>	5-104

6	Modem CLAM Shell Command Set	6-1
	@	6-2
	#	6-2
	addkey	6-2
	alarm	6-2
	alias	6-3
	autobaud	6-3
	bats	6-4
	calc	6-4
	cat	6-4
	cfg all	6-5
	cfg load	6-5
	cfg store	6-5
	char	6-5
	chmod	6-6
	chown	6-6
	clearkeys	6-6
	compass	6-6
	cp	6-7
	date	6-7
	delkey	6-7
	df	6-7
	dlclear	6-8
	dldump	6-8
	dlfind	6-8
	dlist	6-9
	dlrecs	6-9
	echo	6-9
	factory_reset	6-10
	format	6-10
	getcurrent	6-10
	gpsd	6-11
	grep	6-12
	help	6-12
	hist	6-12
	ls	6-12
	mdm_battery	6-13
	mkdir	6-13
	mmpd	6-13
	more	6-13
	mount	6-14
	mv	6-14
	nostrictat	6-14

pinger	6-14
play	6-15
post	6-15
rb	6-15
rdlblk	6-15
rdlclear	6-16
rdldump	6-16
rdlfind	6-16
rdllist	6-17
rdlrecs	6-17
reboot	6-17
record	6-18
rm	6-18
rmdir	6-18
rtc_battery	6-18
rundiag	6-19
rx	6-19
rxadj	6-19
rz	6-20
sb	6-20
set	6-20
setpriv	6-20
showkeys	6-21
sleep	6-21
spectrum	6-21
strictat	6-21
sync	6-22
sx	6-22
sz	6-22
tcm5d	6-22
umount	6-23
unalias	6-23
update	6-23
uptime	6-23
verify	6-24
version	6-24
wc	6-24
xmittime	6-24

7	Modem AT Command Set	7-1
Online Interrupt.	+++	7-7
Attention	AT	7-9
Check Mode.	ATC	7-10
Version.	ATI	7-11
Reboot	ATES	7-12
Remote Acoustic Reset	AT\$ESn	7-13
Update Firmware.	ATEU	7-14
Dial	ATDn	7-16
Factory Reset	AT&F	7-18
Hang Up.	ATHn	7-19
Online.	ATO	7-20
Remote Break	AT\$Kn,p	7-22
Acoustic Link Test	ATXn	7-24
Multiple Bit Rate Test	ATYn	7-28
Remote Power.	AT\$Pn,m	7-31
Remote Bit Rate	AT\$An,m	7-33
Read Register	ATSn?	7-35
Read Remote Registers	AT\$Sn	7-37
Set Register.	ATSn=n	7-39
Write.	AT&W	7-41
Lowpower State	ATL	7-42
Local Device Enable.	ATTDm,p	7-44
Remote Device Enable	AT\$Xn,m,p	7-45
Range.	ATRn	7-47
Fast Range	ATRFn	7-49
Range and Depth	ATRDn	7-51
Range and Location	ATRXn	7-53
Local Battery Voltage	ATV	7-55
Remote Battery Voltage	AT\$Vn	7-56
Remote Data Logger Enable	AT\$BEn	7-58
Remote Data Logger Disable.	AT\$BDn	7-59
Clear Remote Data Logger.	AT\$BCn	7-60
Remote Bytes Stored	AT\$BNn	7-61
Clear Local Data Logger	ATBC	7-62
Local Bytes Stored	ATBN	7-63
Output Local Data Logger	ATBT	7-64
Output Local Page	ATBPn	7-66
AGC Diagnostic	ATTNn	7-68
Output Remote AGC.	AT\$Gn	7-70

AGC Diagnostic Enable	ATT2	7-73
AGC Diagnostic Disable	ATT1	7-75
Release Status	AT\$Tn	7-76
Release	AT\$Rn,m	7-78
Burn Wire Release	AT\$Nn,m	7-79
Compact Modem Wakeup	ATWn,m	7-80
Transpond	ATNm	7-81
Broadband Chirp Interrogate	ATNL	7-82
Compass and Tilt	ATRCn	7-83
Pitch and Roll	ATRTn	7-85
Compass	ATRCHn	7-87
Pitch	ATRCpN	7-89
Roll	ATRCRn	7-91
Local Charge Percentage	ATCP	7-93
Remote Charge Percentage	AT\$CPn	7-94

8 Modem Configuration Parameters 8-1

P1Baud	8-9
P1EchoChar	8-10
P1FlowCtl	8-11
P1Protocol	8-12
P1StripB7	8-14
P2Baud	8-15
P2EchoChar	8-17
P2FlowCtl	8-18
P2Protocol	8-19
P2StripB7	8-21
LPFlowCtl	8-22
SyncPPS	8-24
IdleTimer	8-25
Verbose	8-27
Prompt	8-29
CMWakeHib	8-30
CMFastWake	8-31
MinOpVolt	8-32
CPBoard	8-33
RecMode	8-35
NameFormat	8-36
AcData	8-37
AcStats	8-38

RingBuf	8-39
LogMode	8-40
Sentinel	8-41
ChrCount	8-42
LogStore	8-43
DataRetry	8-44
AcRspTmOut	8-45
OpMode	8-47
DevEnable	8-48
FwdDelay	8-49
LocalAddr	8-50
RemoteAddr	8-51
ShowBadData	8-52
StartTones	8-53
TxRate	8-54
TxPower	8-56
WakeTones	8-58
PrintHex	8-59
StrictAT	8-60
InputMode	8-61
SmartRetry	8-62
TimedRelease	8-64
TPortMode	8-65
SrcP1	8-67
SrcP2	8-68
Dst1	8-69
Dst2	8-70
Dst3	8-71
Dst4	8-72
SimAcDly	8-73
PktEcho	8-74
PktSize	8-75
RcvAll	8-76
RxFreq	8-77
RxThresh	8-78
RxToneDur	8-79
RxLockout	8-80
TxToneDur	8-81
TAT	8-82
LBLmode	8-83

RespFreq	8-84
Latitude	8-85
Longitude	8-86
GPSAlt	8-87
Altitude	8-88
Depth	8-89
Compass	8-90
HeadOffset	8-91
Pitch	8-92
Roll	8-93
SpeedOfSound	8-94
ReplyData	8-95
Ain1Type	8-96
Ain2Type	8-97
AinPollRate	8-98
Ain<Channel No.>Nmeas	8-99
Ain<Channel No.>RptDly	8-100
Ain<Channel No.>StrtDly	8-101
PressureChnl	8-102
MetersPerPSI	8-103
ATMOffset	8-104
PSI	8-105

9 Maintenance and Troubleshooting 9-1

General Cleaning and Inspection	9-1
Changing the Modem Battery Packs	9-2
Checking the Modem Battery Pack	9-3
Changing the ATM-914, ATM-915, ATM-924, or ATM-925 Modem Battery Pack	9-3
Changing the ATM-964 or ATM-965 Modem Battery Pack	9-5
Changing the Real-Time Clock Battery	9-7
Changing the ATM-914, ATM-915, ATM-924, or ATM-925 Real-Time Clock Battery	9-7
Changing the ATM-916 or ATM-926 Real-Time Clock Battery	9-9
Changing the ATM-964, ATM-965 or ATM-966 Real-Time Clock Battery	9-10
Changing the SDHC Card	9-11
Changing the ATM-914, ATM-915, ATM-924, or ATM-925 SDHC Card	9-11
Changing the ATM-964 or ATM-965 SDHC Card	9-12

Cleaning or Replacing an O-ring	9-14
Troubleshooting	9-15
10 Drawings	10-1
Surface Modems	10-1
Subsea Modems	10-1
Modem Board Sets	10-1
Remote Transducers	10-1
11 Modem Spares, Accessories and Part	
Number Designator	11-1
Modem Spares and Accessories	11-1
Modem Part Number Designation	11-3

List of Figures

Figure 1-1	<i>Wireless Underwater Communications System Block Diagram</i>	1-2
Figure 1-2	<i>Wireless Underwater Communications, Multiple Remote Modems Block Diagram</i>	1-2
Figure 1-3	<i>Data Acquisition and RF Link to Remote Station</i>	1-4
Figure 1-4	<i>Periodic Acquisition of Stored Data</i>	1-5
Figure 1-5	<i>Command and Control of an AUV</i>	1-6
Figure 1-6	<i>Wellhead Command and Control and Data Acquisition</i> ..	1-7
Figure 1-7	<i>The UDB-9400 Universal Deck Box—Portable and Rack Mount Configurations</i>	1-12
Figure 1-8	<i>The ATM-915 Acoustic Telemetry Modem (Shown with Omnidirectional LF Transducer)</i>	1-14
Figure 1-9	<i>The ATM-916 Acoustic Telemetry Modem (Shown with Omnidirectional LF Transducer)</i>	1-14
Figure 1-10	<i>The ATM-925 Acoustic Telemetry Modem (Shown with Omnidirectional LF Transducer)</i>	1-15
Figure 1-11	<i>The ATM-926 Acoustic Telemetry Modem (Shown with Omnidirectional LF Transducer)</i>	1-15
Figure 1-12	<i>The ATM-965 Acoustic Telemetry Modem (Shown with Omnidirectional LF Transducer)</i>	1-16
Figure 1-13	<i>The ATM-966 Acoustic Telemetry Modem (Shown with Omnidirectional LF Transducer)</i>	1-16
Figure 1-14	<i>The SR-50 SMART Release</i>	1-17
Figure 1-15	<i>The SR-9100 SMART Release</i>	1-18
Figure 1-16	<i>The SM-975/976 SMART Modem</i>	1-18
Figure 1-17	<i>The ATM-903 Modem Board Set (Shown with Omnidirectional LF Transducer)</i>	1-19
Figure 1-18	<i>Remote Omnidirectional Transducer, LF and MF Vertical Beam Patterns</i>	1-23
Figure 1-19	<i>Remote Omnidirectional Transducer, Band C Vertical Beam Pattern</i>	1-24

Figure 1-20	Remote Directional Transducer, LF and MF Vertical Beam Patterns	1-25
Figure 4-1	UDB-9400 Front Panel Operator Functions and Connectors	4-7
Figure 4-2	Subsea Modem On/Off Switch	4-8
Figure 4-3	UDB-9400 COM1 Connector, Face View	4-9
Figure 4-4	UDB-9400 COM1 Connector RS-485 Connections	4-10
Figure 4-5	Subsea Modem POWER/SERIAL Connector, Face View	4-11
Figure 4-6	Subsea Modem POWER/SERIAL Connector Serial Port 1 RS-485 Connections	4-13
Figure 4-7	ATM-900 and ATM-903 DSP Board Serial Connector J7, Face View	4-14
Figure 4-8	ATM-900 and ATM-903 DSP Board Serial Connector 8, Face View	4-14
Figure 4-9	ATM-900 and ATM-903 DSP Board Serial Port 1 Connector J7 RS-485 Connections	4-18
Figure 4-10	ATM-903 Transducer Cable Wiring Diagram	4-18
Figure 4-11	ATM-900 and ATM-903 I/O Connector J3, Face View ...	4-19
Figure 4-12	Analog Input Board Connector J6, Face View	4-21
Figure 5-1	Default Transport Addressing—Topside and Subsea ATM-900 Series Acoustic Telemetry Modems	5-33
Figure 5-2	Default Transport Addressing—Topside ATM-900 Series and Subsea ATM-900 Series Acoustic Telemetry Modems	5-34
Figure 5-3	List of Configuration Parameters for the Modem Section of the Standard.ini File	5-55
Figure 5-4	Example List of Receive Threshold Adjustments	5-70
Figure 5-5	Spectral Plot $S(F)$ of Waveform $s(t)$	5-75
Figure 5-6	Spectral Plot $X(F)$ of Baseband Waveform $x(t)$	5-76
Figure 5-7	Low Pass Filtered Spectral Plot $X(F)$ of Baseband Waveform $x(t)$	5-77
Figure 5-8	1PPS Input Signals	5-93

Figure 5-9 Example of Spectral Frequency Graph 5-102

*Figure 7-1 Conditions for Recognizing an Online Interrupt
 Command 7-8*

Figure 7-2 Read Register Command and Resulting Display 7-36

*Figure 7-3 Read Remote Registers Command and Resulting
 Display 7-38*

*Figure 7-4 Output Remote AGC Command and Resulting
 Display 7-71*

*Figure 7-5 Output AGC Diagnostic Command and Resulting
 Display for an ATM-900 Series Acoustic Telemetry
 Modem 7-74*

Figure 11-1 ATM-900 Series Part Number Designator Legend 11-4

List of Tables

Table 4-1	<i>UDB-9400 COM1 Connector Pinouts</i>	4-9
Table 4-2	<i>UDB-9400 COM1 Connector to DB-9 Pin-to-Pin Connections</i>	4-10
Table 4-3	<i>Subsea Modem POWER/SERIAL Connector Pinouts</i> . . .	4-11
Table 4-4	<i>Subsea Modem POWER/SERIAL Connector to DB-9 Pin-to-Pin Connections</i>	4-13
Table 4-5	<i>ATM-900 and ATM-903 DSP Board Serial Port 1 Connector J7 Pinouts</i>	4-15
Table 4-6	<i>ATM-900 and ATM-903 DSP Board Serial Port 2 Connector J8 Pinouts</i>	4-15
Table 4-7	<i>ATM-900 and ATM-903 Transmit/Receive Board Power Connector J3 Pinouts</i>	4-16
Table 4-8	<i>ATM-900 and ATM-903 DSP Board Serial Port 1 Connector J7 to DB-9 Pin-to-Pin Connections</i>	4-17
Table 4-9	<i>ATM-900 and ATM-903 DSP Board Serial Port 2 Connector J8 to DB-9 Pin-to-Pin Connections</i>	4-17
Table 4-10	<i>ATM-903 Transducer Cable Wiring</i>	4-18
Table 4-11	<i>DSP Board I/O Connector J3 Pinouts</i>	4-19
Table 4-12	<i>Analog Input Board J6 Pinouts</i>	4-20
Table 5-1	<i>Analogin Command Ranges for Optional Modifiers</i>	5-72
Table 7-1	<i>ATM-900 Series Acoustic Telemetry Modem and UDB-9400 Universal Deck Box AT Command Set</i>	7-2
Table 7-2	<i>Guide for Obtaining the Optimum SNR</i>	7-25
Table 7-3	<i>Guide for Obtaining the Optimum AGC</i>	7-25
Table 8-1	<i>ATM-900 Series Acoustic Telemetry Modem and UDB-9400 Universal Deck Box Configuration Parameters</i>	8-2
Table 8-2	<i>ATM-900 Series Acoustic Telemetry Modem and UDB-9400 Universal Deck Box Factory Default Configuration Parameters</i>	8-8

Table 8-3	<i>UDB-9400 Universal Deck Box, Standard Modem and Compact Modem Firmware Versions Versus Slow and Fast Wakeup Schemes</i>	8-31
Table 9-1	<i>Modem Battery Pack Capacity vs. Voltage</i>	9-3
Table 11-1	<i>UDB-9400 Universal Deck Box</i>	11-1
Table 11-2	<i>ATM-910 Series Acoustic Telemetry Modem Spares</i>	11-2
Table 11-3	<i>ATM-920 Series Acoustic Telemetry Modem Spares</i>	11-2
Table 11-4	<i>ATM-960 Series Acoustic Telemetry Modem Spares</i>	11-2
Table 11-5	<i>ATM-900 Series Acoustic Telemetry Modem Spares</i>	11-2
Table 11-6	<i>Cables</i>	11-3
Table 11-7	<i>Upgrade Kits and Feature Keys</i>	11-3

1 Overview

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



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

Wireless Underwater Communications

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

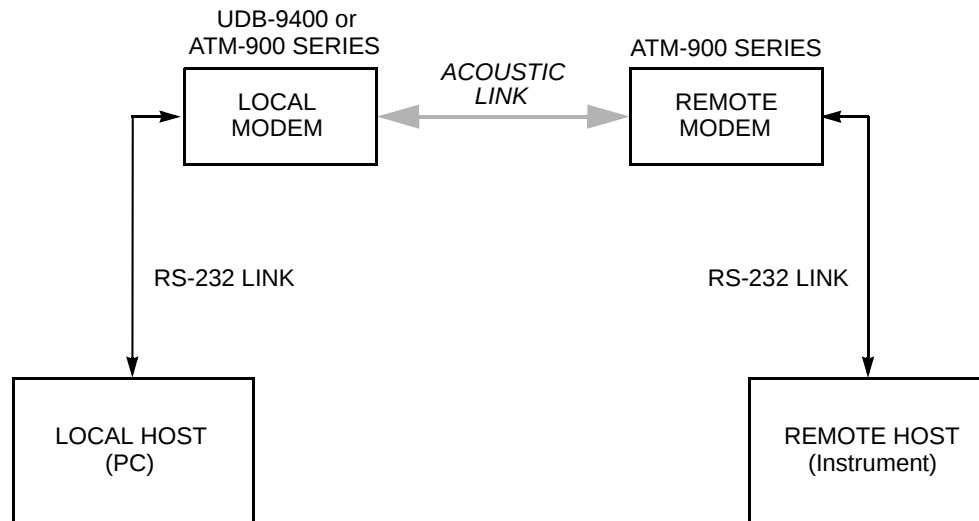


Figure 1-1 Wireless Underwater Communications System Block Diagram

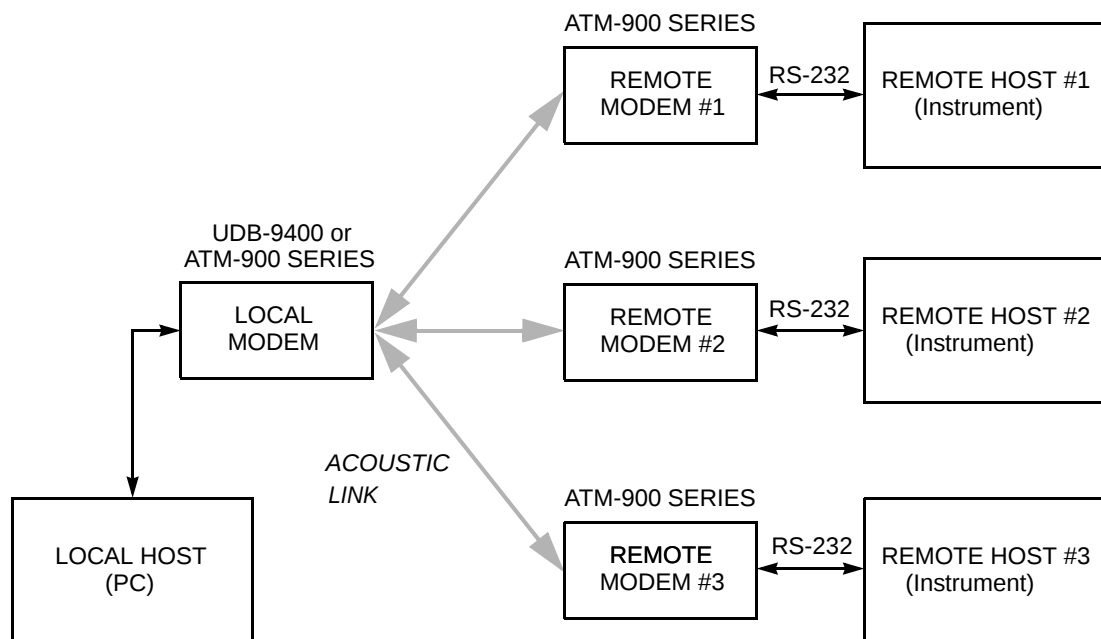


Figure 1-2 Wireless Underwater Communications, Multiple Remote Modems Block Diagram

Commands and Data

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

Acoustic Bit Rates

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

Modulation Techniques

The ATM-900 Series Acoustic Telemetry Modems and the UDB-9400 Universal Deck Box are designed for both high bit rate and high reliability, lower bit rate applications. Hence the modems employ three modulation techniques: phase shift keying (PSK), which provides the highest bit rate; multiple frequency shift keying (MFSK), which provides good reliability in a multipath environment or when the modems are required to operate in a low signal-to-noise (SNR) environment; and frequency hopping (FH), which enables operation in a very low SNR environment where reliability is also very important. PSK modulation allows the modems to operate at up to 15,360 bits/sec. It also has high bandwidth efficiency and is primarily used when multipath interference is generally minimal, such as in the vertical channel. The UDB-9400 Series uses PSK modulation to both transmit and receive data. The ATM-900 Series can transmit data using PSK modulation, but receives data using MFSK modulation only. However, with the optional Coprocessor board installed, some of the ATM-900 Series can both transmit and receive using PSK modulation and achieve the same higher bit rates. MFSK modulation is a spread spectrum modulation process that transmits multiple tones simultaneously. MFSK has a maximum bit rate of 2400 bits/sec and has good reliability even in a high multipath environment. FH uses a bit rate of 80 bits/sec and is therefore good for short messages.

Typical Applications

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

Remote Data Acquisition

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

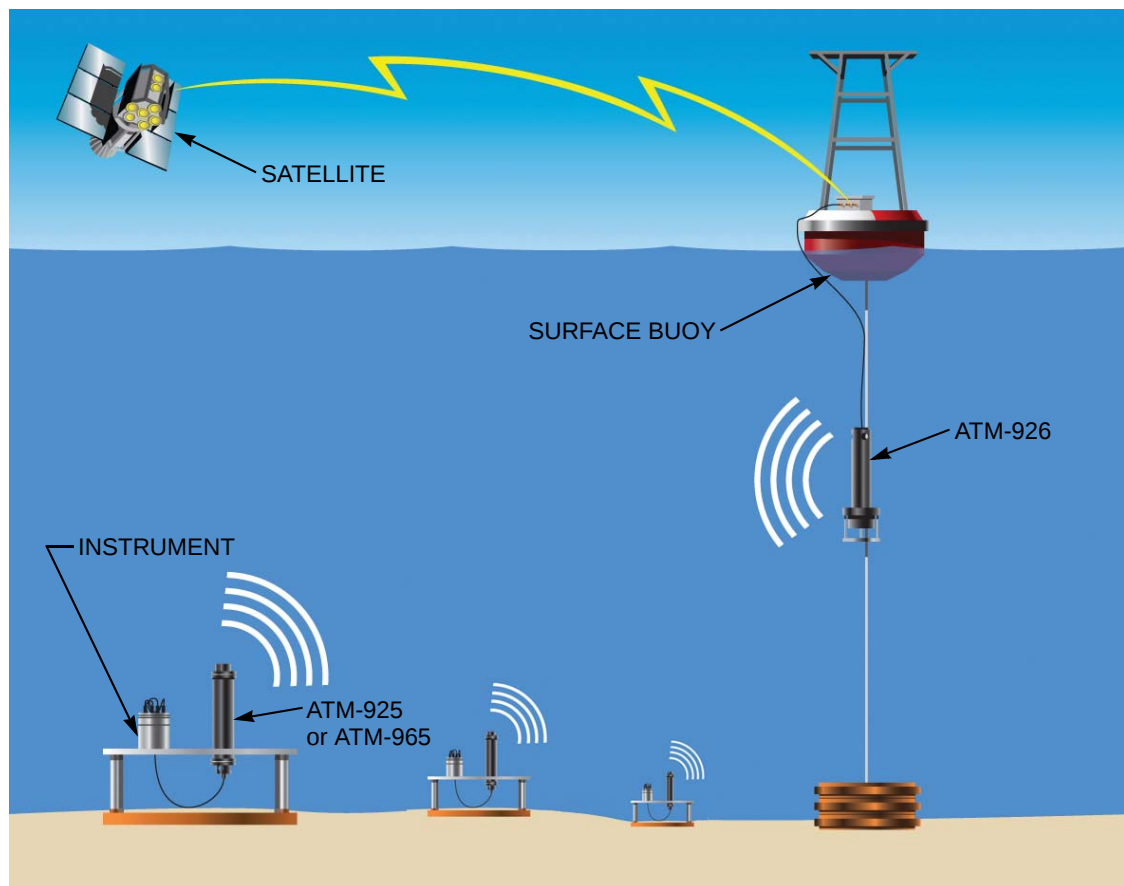


Figure 1-3 Data Acquisition and RF Link to Remote Station

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

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

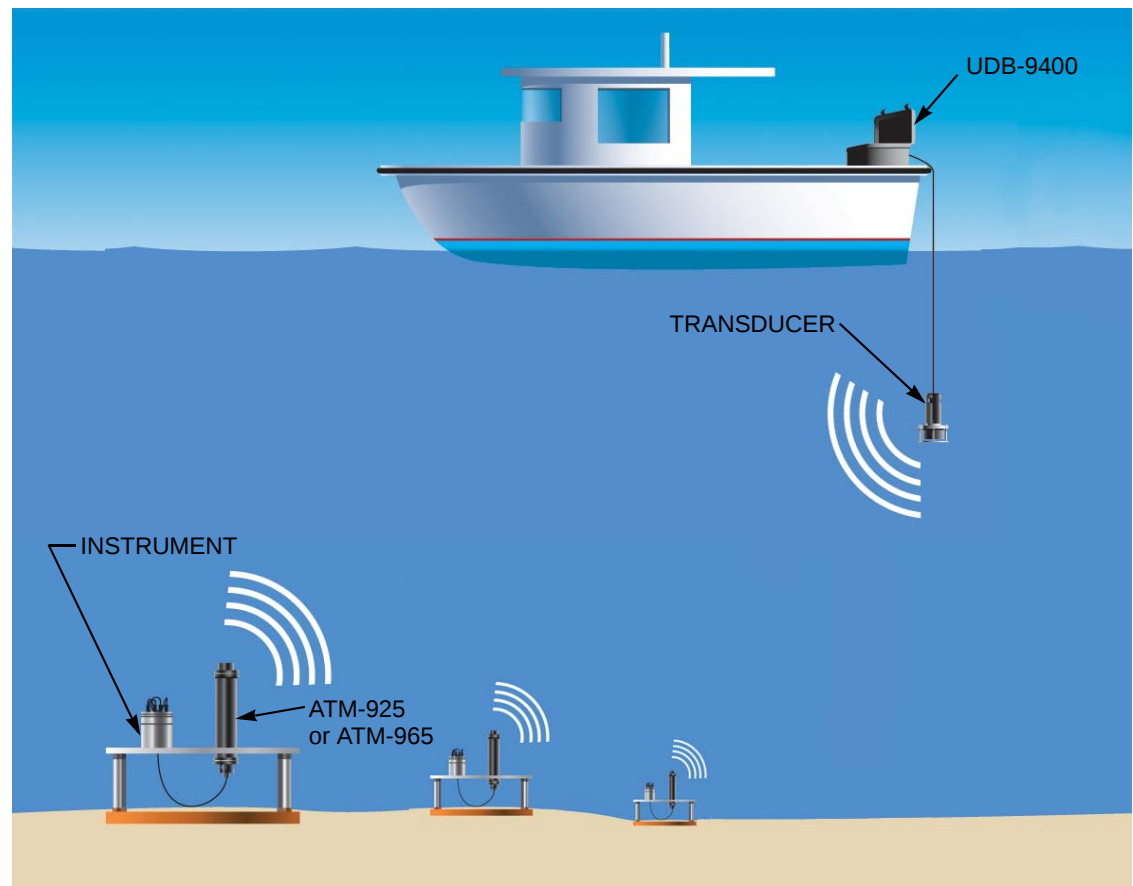


Figure 1-4 Periodic Acquisition of Stored Data

AUV Command and Control

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

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

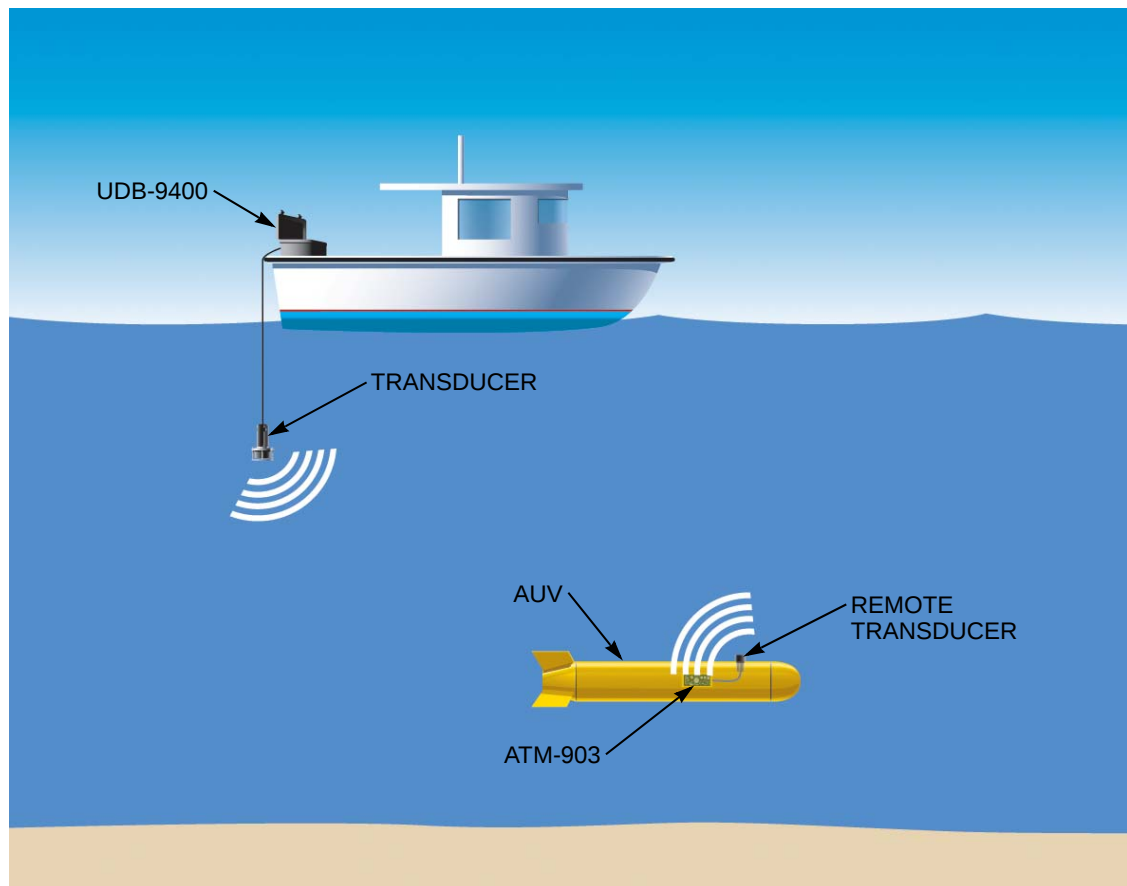


Figure 1-5 Command and Control of an AUV

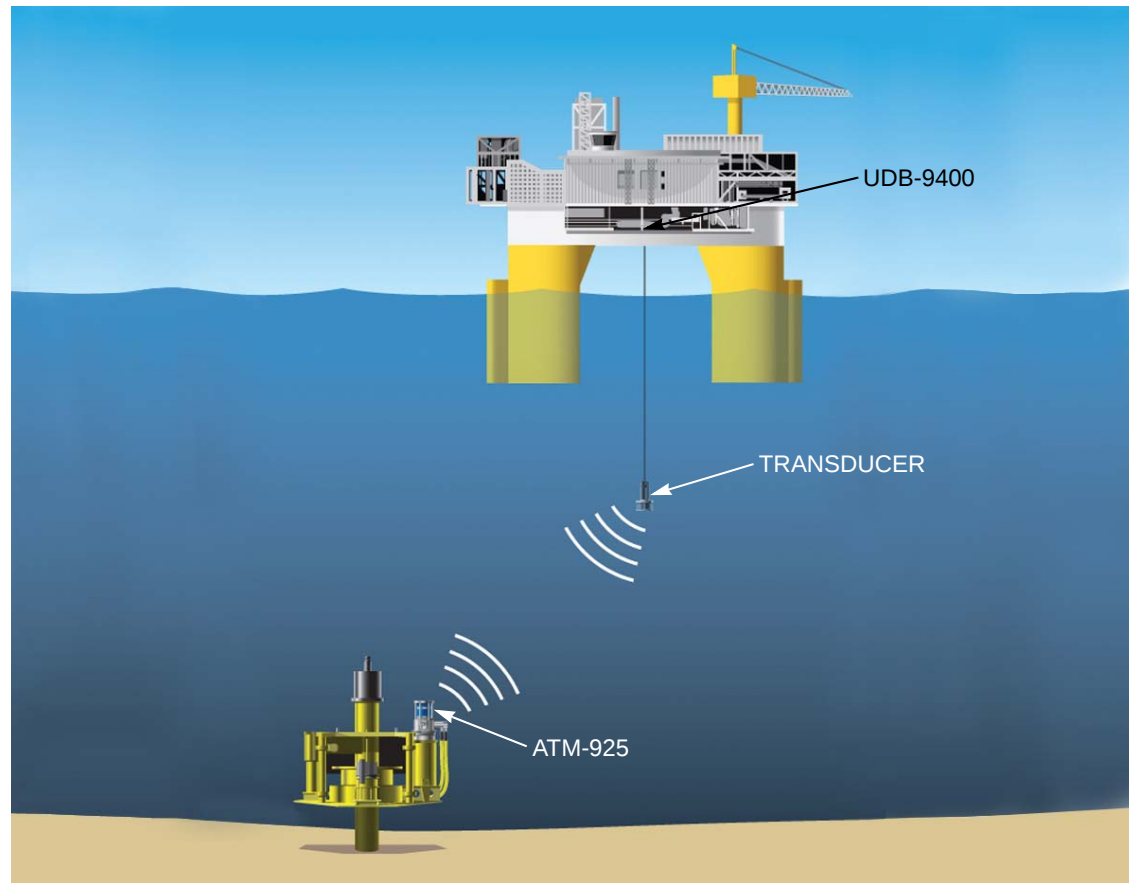


Figure 1-6 Wellhead Command and Control and Data Acquisition

Underwater Local Area Networks

The SM-975 SMART Modem is ideally suited as a network repeater in underwater local area networks. The SMART Modem can also be commanded to operate as a transponder for easy relocation. The combined modem and release functions, along with built-in flotation makes the SMART Modem easy to deploy and recover, and upon recovery, it can be easily re-armed and redeployed.

Release of Moored Instrument Arrays

An SR-50 or SR-9100 SMART Release can be used to release moored instrument arrays. The SMART Release also functions to assist in the relocation of the array as it can be commanded to operate as a transponder for measuring slant range. Upon recovery, it can be easily re-armed and redeployed. The battery life is up to two years, depending on the number of transponder replies and the amount of data transmitted and received.

Modem Performance Factors

The primary function of modems is to both transmit and receive signals that represent digital data—binary ones and zeros—over what usually is a hard wired link such as a telephone line. In fact, the word modem is derived from the terms modulation and demodulation, which refer to the coding and transmission, and the receiving and decoding of digital data, respectively. Two key factors measure a modem's performance: speed and reliability. Speed is measured by determining the number of bits transmitted per second, which is referred to as the bit rate. Reliability is measured by determining the bit error rate, which is the ratio of the number of bits received in error to the total number of bits transmitted. Except when noise interference is high, modems that transmit and receive data over phone lines or microwave links typically function nearly error free, and at bit rates of 128,000 bits/sec or more. In addition, repeater systems allow virtually unlimited transmission ranges. Those same performance factors are also used to measure the capabilities of the ATM-900 Series Acoustic Telemetry Modems and the UDB-9400 Universal Deck Box. 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 comparatively very slow speed of sound in seawater has no direct effect on the bit rate of the modems; it affects only the time period between the transmission of a signal and its reception. In most applications this delay is not of much concern, as the alternative is to use a hard wired connection, which is sometimes prohibitively expensive or not feasible.

Signal Fading

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

Multipath Interference and Reflections

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

Methods for Increasing Reliability

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

Convolutional Coding

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

Multipath Guard Period

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

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

Data Redundancy

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

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

Modem and Remote Transducer Types

The ATM-900 Series Acoustic Telemetry Modems and the UDB-9400 Universal Deck Box are composed of five different types, each with available optional features:

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

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

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

- Omnidirectional LF
- Omnidirectional MF
- Directional LF
- Directional MF
- Omnidirectional Band C

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

Surface Modems

The surface modems consist of a portable and a rack mount UDB-9400 Universal Deck Box. Each is shown along with a transducer in Figure 1-7. The UDB-9400 Universal Deck Box connects to a surface host processor and can transmit and receive data at bit rates as high as 15,360 bits/sec. It is used to communicate with any of the subsea modems, the SMART releases or other deck boxes, and it can activate the release mechanism of a SMART release. The UDB-9400 Universal Deck Box is powered with 85–264 VAC, 47–63 Hz or 21–28 VDC and includes the transducer, a transducer cable, an AC power cable, and an accessories case. The deck box can be connected to a host processor through its RS-232/422 serial port and includes a speaker and volume control for audio verification of transmitted data. The deck box is configured to operate in the wide low frequency 7–16 kHz (WLF), medium frequency 16–21 kHz (MF) or 22–27 kHz (Band C) band and is available in both portable and rack mount configurations.



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



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

Subsea Modems

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

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

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

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

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

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

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

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

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

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

ATM-915 and ATM-914 Acoustic Telemetry Modems

The ATM-915 Acoustic Telemetry Modem is shown in Figure 1-8. The ATM-915 is completely self contained in a PVC housing and includes a modem battery pack and a built-in omnidirectional or directional transducer. The ATM-914 is similar to the ATM-915 but does not include a built-in transducer. Instead, a 2-meter cable is provided which connects from the modem to a remote transducer. Both modems also include a power/serial connector which is used to input external power instead of using the internal battery pack, and to connect to either an RS-232 or an RS-422 serial interface.



Figure 1-8 The ATM-915 Acoustic Telemetry Modem (Shown with Omnidirectional LF Transducer)

ATM-916 Acoustic Telemetry Modem

The ATM-916 Acoustic Telemetry Modem, which is shown in Figure 1-9, is externally powered only. It is contained in a PVC housing and includes a built-in omnidirectional or directional transducer. The ATM-916 also includes a power/serial connector. The connector is used to input external power and to connect to either an RS-232 or an RS-422 serial interface.



Figure 1-9 The ATM-916 Acoustic Telemetry Modem (Shown with Omnidirectional LF Transducer)

ATM-925 and ATM-924 Acoustic Telemetry Modems

The ATM-925 Acoustic Telemetry Modem is shown in Figure 1-10. The ATM-925 is completely self contained in a hard coat anodized aluminum housing and includes a modem battery pack and a built-in omnidirectional or directional transducer. The ATM-924 is similar to the ATM-925 but does not include a built-in transducer. Instead, a 2-meter cable is provided which connects from the modem to a remote transducer. Both modems also include a power/serial connector which is used to input external power instead of using the internal battery pack, and to connect to either an RS-232 or an RS-422 serial interface.



Figure 1-10 The ATM-925 Acoustic Telemetry Modem (Shown with Omnidirectional LF Transducer)

ATM-926 Acoustic Telemetry Modem

The ATM-926 Acoustic Telemetry Modem, which is shown in Figure 1-11, is externally powered only. It is contained in a hard coat anodized aluminum housing and includes a built-in omnidirectional or directional transducer. The ATM-926 also includes a power/serial connector. The connector is used to input external power and to connect to either an RS-232 or an RS-422 serial interface.



Figure 1-11 The ATM-926 Acoustic Telemetry Modem (Shown with Omnidirectional LF Transducer)

ATM-965 and ATM-964 Acoustic Telemetry Modems

The ATM-965 Acoustic Telemetry Modem is shown in Figure 1-12. The ATM-965 is completely self contained and includes a modem battery pack and a built-in omnidirectional or directional transducer. The ATM-965 modem functions the same as all the other modems. However, the housing, which is constructed of thick-walled hard coat anodized aluminum, is designed for deployment to full ocean depth. The ATM-964 is similar to the ATM-965 but does not include a built-in transducer. Instead, a 2-meter cable is provided which connects from the modem to a remote transducer that is also included. Both modems also include a power/serial connector which is used to input external power instead of using the internal battery pack, and to connect to either an RS-232 or an RS-422 serial interface.



Figure 1-12 The ATM-965 Acoustic Telemetry Modem (Shown with Omnidirectional LF Transducer)

ATM-966 Acoustic Telemetry Modem

The ATM-966 Acoustic Telemetry Modem, which is shown in Figure 1-13, is externally powered only. It is contained in a thick-walled hard coat anodized aluminum housing which is designed for deployment to full ocean depth and includes a built-in omnidirectional or directional transducer. The ATM-966 also includes a power/serial connector. The connector is used to input external power and to connect to either an RS-232 or an RS-422 serial interface.



Figure 1-13 The ATM-966 Acoustic Telemetry Modem (Shown with Omnidirectional LF Transducer)

SMART Releases

The SMART releases include the following:

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

SR-9100 SMART Release. Designed for long range, heavy duty, deep or shallow water applications and operates to a depth of 12,000 m (39,360 ft).

SM-975 SMART Modem. Designed for long range, deep or shallow water applications and operates to a depth of 6700 m (22,000 ft).



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

SR-50 SMART Release

The SR-50 SMART Release is shown in Figure 1-14. The SR-50 combines the same reliable motorized release mechanism used in the Teledyne Benthos 867-A Shallow Water Acoustic Transponding Release with the same modem technology provided by the ATM-900 Series Acoustic Telemetry Modems. It is completely self contained in a PVC housing and includes a modem battery pack and a built-in or remote omnidirectional transducer. The SR-50 is designed for short range, light load, shallow water release of moored instrument arrays. It can support a static or dynamic load of 455 kg (1000 lb) and can be operate as a transponder.



Figure 1-14 The SR-50 SMART Release

SR-9100 SMART Release

The SR-9100 SMART Release is shown in Figure 1-15. The SR-9100 combines the same reliable high torque motorized release mechanism used in the Benthos 865-A Deep Sea Acoustic Release with the same modem technology provided by the ATM-900 Series Acoustic Telemetry Modems. It is completely self contained in a stainless steel housing and includes a modem battery pack and a built-in omnidirectional transducer. The SR-100 is designed for long range, heavy duty, full ocean depth or shallow water release of moored instrument arrays. It can support a static load of 4540 kg (10,000 lb) and operate as a transponder.



Figure 1-15 The SR-9100 SMART Release

SM-975/976 SMART Modem

The SM-975/976 SMART Modem is shown in Figure 1-16. The SM-975 and SM-976 SMART Modems combine the same reliable electrolytic dissolving wire ("burn wire") type release mechanism used in the Benthos Model TR-6000 Series Recoverable Acoustic Transponder with the same modem technology provided by the ATM-900 Series Acoustic Telemetry Modems. They are self buoyant and completely self contained in a 13 or 17-inch glass sphere housing that is encapsulated in a yellow ribbed hard hat. They also include an internal battery pack and a built-in omnidirectional transducer. The primary difference between the SM-975 and the SM-976 is the internal power source. The SM-975 uses one or two



Figure 1-16 The SM-975/976 SMART Modem

alkaline battery packs for the power source, and the SM-976 uses two rechargeable lithium ion battery packs. In addition, the SM-976 is available with an optional depth sensor. The SM-975 is specifically suited for long term, infrequent deployment cycles. The SM-976 is best used in applications where short term but frequent deployment cycles are used. The SM-975 and SM-976 SMART Modems are designed for long range, deep or shallow water applications and can release loads as heavy as 227 kg (500 lb). They can also operate as a transponder.

ATM-903 and ATM-900 Modem Board Sets

The ATM-903 Modem Board Set is shown in Figure 1-17. The ATM-903 includes a circuit board set mounted to a chassis and an omnidirectional or directional transducer. The modem is externally powered and is designed for original equipment manufacture (OEM) applications, where the modem is integrated into a housing or chassis of another manufacturer's design. The ATM-900 Board Set includes the board set only. No transducer is supplied.



Figure 1-17 The ATM-903 Modem Board Set (Shown with Omnidirectional LF Transducer)

Optional Features

A number of factory installed optional features are available for most of the ATM-900 Series Acoustic Telemetry Modems and UDB-9400 Universal Deck Boxes. One or more of these features can be ordered:

Dual Serial Port. The Dual Serial Port option is a firmware only feature that is available for ATM-900 Series Acoustic Telemetry Modems and is already included in all UDB-9400 Universal Deck Boxes. This feature allows two instruments to be connected to the modem for the purpose of transmitting the data to a remote modem or storing the data in the modem's data logger memory. Although all the modems include two serial ports, the Dual Serial Port feature requires the purchase and installation of a feature key to enable it. To order the Dual Serial Port feature, add a "-B" at the end of the modem part number.

SD Datalogger. The SD Datalogger option expands the available datalogger storage by adding a 32-GB secure digital high capacity (SDHC) card and its carrier board to the modem; however, the limit on the datalogger memory is 4 GB. This feature is available only with modems with internal battery packs and with the modem board sets. When ordered with a modem board set, a longer chassis is used. To order the SD datalogger feature, add a "-D" at the end of the modem part number.

PSK Coprocessor. The PSK Coprocessor option adds a coprocessor to the modem, enabling it to receive PSK modulated data over the acoustic link at bit rates as high as 15,360 bits/sec. This feature is available only with the modem board sets and is already included in all UDB-9400 Universal Deck Boxes. To order the PSK Coprocessor feature, add a "-P" at the end of the modem part number.



NOTE The SD Datalogger and PSK Coprocessor options cannot be combined.

LBL/Multi-Receive. The LBL/Multi-Receive option is a firmware only feature that enables multiple modems to be operated as a long baseline (LBL) acoustic positioning system. Two system configurations are possible. One is a broadband triggered LBL based system which uses broadband chirp transmissions to trigger other modems which in turn provide tonal responses. The other allows a modem to function as the interrogator in an all tonal LBL system where the modem transmits a tone to multiple transponders and receives the multiple tonal replies. This feature requires the purchase and installation of a feature key to enable it. However, it is already included in the UDB-9400-M Universal Deck Box. It is not included and is not optionally available for the UDB-9400-E Universal Deck Box. To order the LBL/Multi-Receive feature, add a "-M" at the end of the modem part number.

Acoustic Recorder. The Acoustic Recorder option enables the recording of received signals that are within the modem's operating frequency band. The signals are base banded and stored as WAV files on two 32-GB SDHC cards. This feature, which requires the installation of a feature key to enable it, is available for ATM-900 Series Acoustic Telemetry Modems only and *includes* the SD Datalogger option. To order the Acoustic Recorder feature, add a "-I" at the end of the modem part number.

Waveform Play. The Waveform Play option is a firmware only feature that is available for ATM-900 Series Acoustic Telemetry Modems, SM-975 SMART Modems and UDB-9400 Universal Deck Boxes. This feature, which requires the installation of a feature key to enable it, enables transmission of waveforms using the modem's transmitter and transducer. It requires that base banded waveforms be built using an external program and loaded into the modem's memory. A feature key is required. To order the Waveform Play feature, add a "-W" at the end of the modem part number.

Analog Input. The Analog Input option is available for the ATM-903 and ATM-900 Board Sets only. This option provides six analog inputs by adding an Analog Input board to the modem. The input types are a mix of 4–20 mA current, 0–5 VDC, 0–10 VDC, and bridge sensing. All the inputs are protected against ESD, reverse voltage, overvoltage, and overcurrent. To order the Analog Input option, add a "-N" at the end of the modem part number.

Depth Sensor. The Depth Sensor option is available for the SM-976 SMART modem only. This option includes a factory calibrated and installed pressure transducer which measures the depth of the modem and transmits this information along with range when a Range and Depth command is sent to the modem. An Analog Input board, the same as that described above is also included with this option. To order the Depth Sensor option, add a "-S4" at the end of the modem part number.

Compact Modems

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

Remote Transducers

The remote transducers consist of two types:

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

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

Remote Omnidirectional Transducer

The remote omnidirectional transducer is available in three frequency bands: 9–14 kHz (LF), 16–21 kHz (MF) and 22–27 kHz (Band C). The omnidirectional transducer provides toroidal transmit and receive beam patterns. It is best used in both deep and shallow water applications where the direction of the receiving transducer is not known or is not fixed. However, because of its toroidal beam pattern, the directivity index is relatively small, and the multipath is more severe than a directional transducer with the same input power level, as the energy is more widely distributed. The remote omnidirectional transducer's typical vertical beam pattern for both the LF and MF versions are shown in Figure 1-18, and for Band C, in Figure 1-19.

Remote Directional Transducer

The remote directional transducer is available in two frequency bands: 9–14 kHz (LF) and 16–21 kHz (MF). Whenever possible, the remote directional transducer should be used, as it provides conical transmit and receive beam patterns. And because the energy is focused into a narrow beam, it provides a higher directivity index than the remote omnidirectional transducer with the same input power level. The remote directional transducer is most effective when used in the vertical channel, or when the transducer can be pointed toward the receiving transducer in the horizontal channel. In the latter case, multipath due to sea surface and sea floor reflections is minimized as most of the energy is directed horizontally. The remote directional transducer's typical vertical beam pattern for both the LF and MF versions are shown in Figure 1-20 on page 1-25.

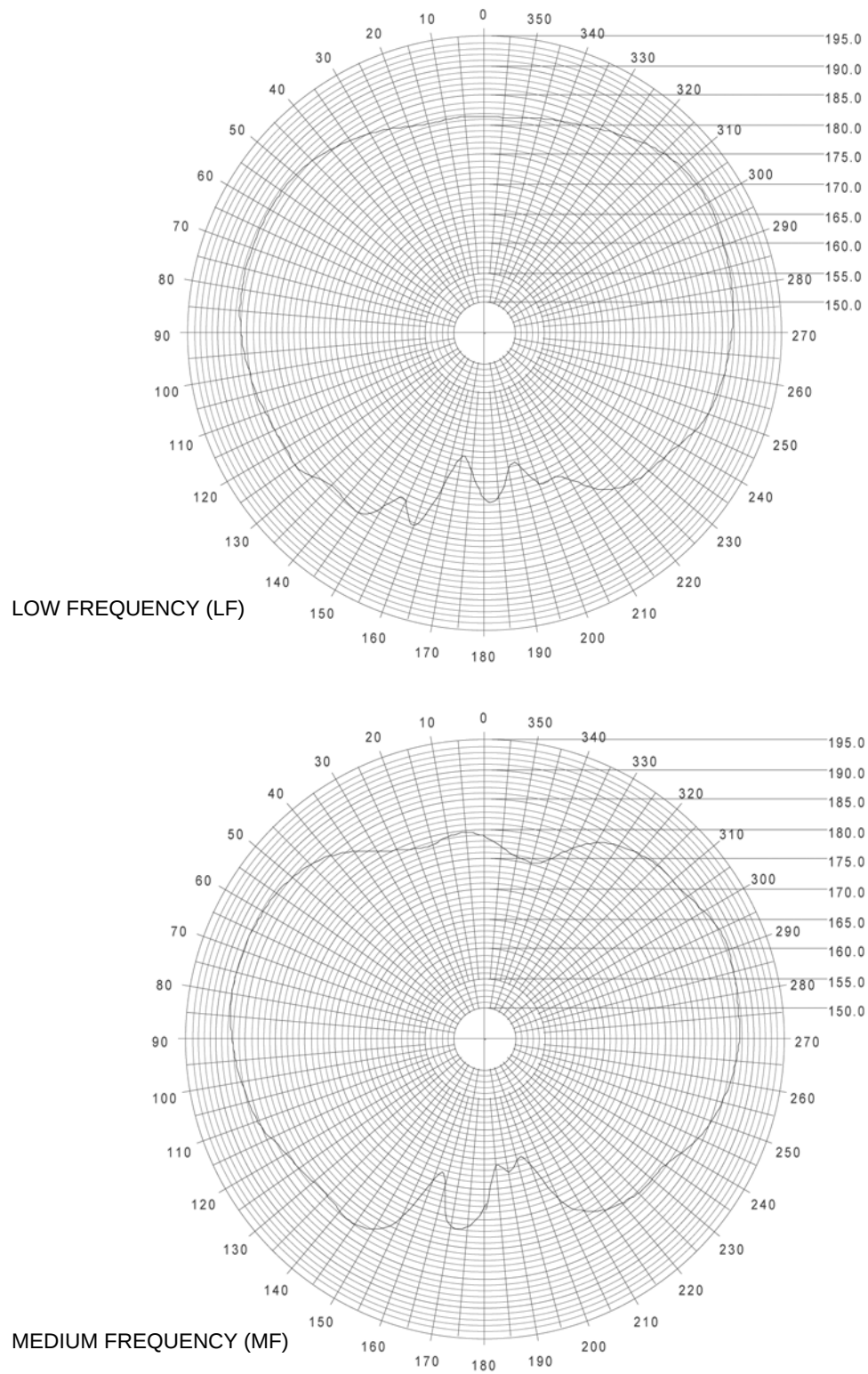


Figure 1-18 Remote Omnidirectional Transducer, LF and MF Vertical Beam Patterns

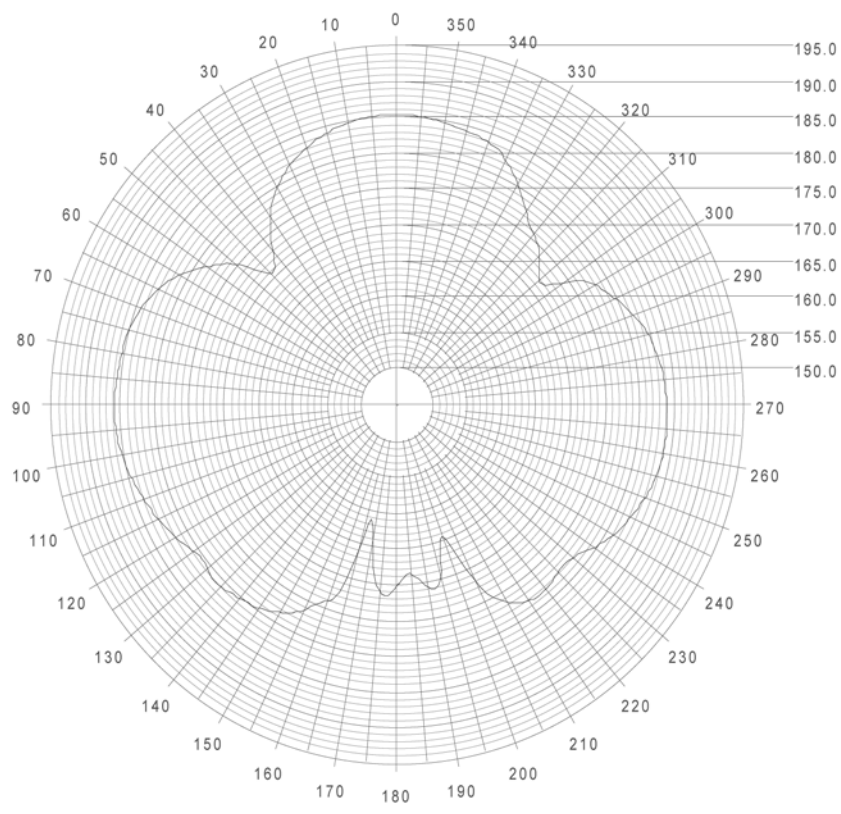


Figure 1-19 Remote Omnidirectional Transducer, Band C Vertical Beam Pattern

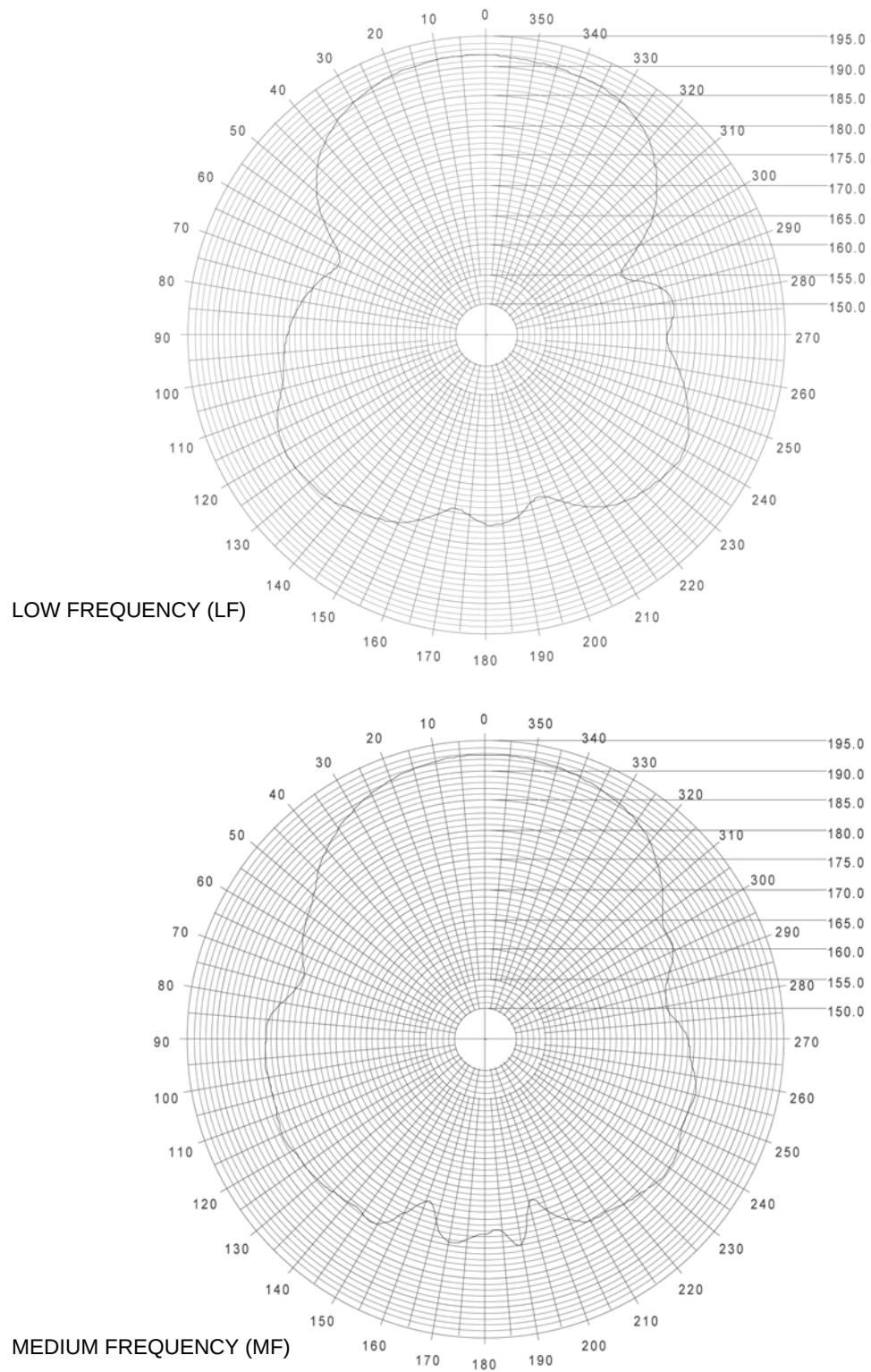


Figure 1-20 Remote Directional Transducer, LF and MF Vertical Beam Patterns

Acoustic Baffles

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

2 Specifications

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



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



NOTE For detailed dimensional outline information for each of the modems, refer to Section 10, "Drawings."

General

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

Frequency band:	8.96–14.08 kHz (LF), 16.00–21.12 kHz (MF) or 22.56–27.68 kHz (Band C)
Data modulation:	PSK, MFSK and FH
Bit rate:	2560–15,360 bits/sec (PSK transmit); 140–2400 bits/sec (MFSK transmit/receive); 80 bits/sec (FH transmit/receive)
Addressable modems:	250
Processing features:	Data redundancy 1/2 rate convolutional coding Multipath guard period
Temperature, operating:	-5°C to 50°C (23°F to 122°F)
Temperature, nonoperating:	-45°C to 85°C (-49°F to 185°F)
Serial interface:	RS-232/422/485 at 115,200; 57,600; 38,400; 19,200; 9600; 4800; 2400; or 1200 baud

Flow control:	RS-232—hardware CTS handshaking or software XON/XOFF RS-422—software XON/XOFF handshaking
External DC input power:	12–36 VDC
Average transmit power @ 21 VDC:	20 watts at power level 8 14 watts at power level 7 10 watts at power level 6 7 watts at power level 5 5 watts at power level 4 3.5 watts at power level 3 2.5 watts at power level 2 >2 watts at power level 1 (depending on transducer)
Peak transmit current:	3 A, 50 ms @ 21 VDC
Receive active power:	720 mW max @ 24VDC 650 mW typ @ 24 VDC
Lowpower state power:	12.0 mW max @ 24 VDC 10.2 mW typ @ 24 VDC
Low frequency (LF) omnidirectional transducer:	Frequency band: 9–14 kHz Source level: 185 dB re 1 μ Pa @ 1 m typ Beam pattern: toroidal $\pm 30^\circ$ @ 12 khz typ
Medium frequency (MF) omnidirectional transducer:	Frequency band: 16–21 kHz Source level: 183 dB re 1 μ Pa @ 1 m typ Beam pattern: toroidal $\pm 30^\circ$ @ 18 khz typ
Band C omnidirectional transducer:	Frequency band: 22–27 kHz Source level: 178 dB re 1 μ Pa @ 1 m typ Beam pattern: toroidal $\pm 30^\circ$ @ 25 khz typ

**Low frequency (LF)
directional transducer:**

Frequency band: 9–14 kHz
Source level: 190 dB re 1 μ Pa @ 1 m typ
Beam pattern: conical $\pm 35^\circ$ @ 12 kHz typ

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

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

Operator controls:

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

Device enable:

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

Real-Time Clock

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

Clock accuracy:

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

Coin cell life:

1.4 years min, 2 years typ

ATM-914 Subsea Modem

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



NOTE The default power level setting for the ATM-914 Acoustic Telemetry Modems is 6. These modems can be operated at that level indefinitely. However, due to excessive heat that can quickly build up in the PVC housing during continuous transmissions, operation at higher power levels should be limited. Refer to "TxPower" on page 8-56 for more information.

Housing construction:	PVC
Dimensions:	Reference Drawing B-270-437 on page 10-3.
Mounting:	316 stainless steel sidebar
Weight in air:	9.1 kg (20 lb)
Weight in water:	2.7 kg (6 lb)
Operating depth:	500 m (1640 ft)
POWER/SERIAL connector:	MCBH16M
TRANSDUCER connector:	MCBH3F

ATM-915 Subsea Modem

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



NOTE The default power level setting for the ATM-915 Acoustic Telemetry Modems is 6. These modems can be operated at that level indefinitely. However, due to excessive heat that can quickly build up in the PVC housing during continuous transmissions, operation at higher power levels should be limited. Refer to "TxPower" on page 8-56 for more information.

Housing construction:	PVC
Dimensions:	Reference Drawing B-270-432 on page 10-4.
Mounting:	316 stainless steel sidebar

Weight in air:	10.0 kg (22 lb), LF omni
	11.8 kg (26 lb), LF dir
	9.5 kg (21 lb), omni
	12.2 kg (27 lb), MF dir
	9.5 kg (21 lb), Band C
Weight in water:	2.7 kg (6 lb), LF omni
	3.2 kg (7 lb), LF dir
	2.3 kg (5 lb), MF omni
	3.6 kg (8 lb), MF dir
	2.3 kg (5 lb), Band C
Operating depth:	500 m (1640 ft)
POWER/SERIAL connector:	MCBH16M

ATM-916 Subsea Modem

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



NOTE The default power level setting for the ATM-916 Acoustic Telemetry Modems is 6. These modems can be operated at that level indefinitely. However, due to excessive heat that can quickly build up in the PVC housing during continuous transmissions, operation at higher power levels should be limited. Refer to "TxPower" on page 8-56 for more information.

Housing construction:	PVC
Dimensions:	Reference Drawing B-270-433 on page 10-5.
Mounting:	316 stainless steel sidebar
Weight in air:	5.4 kg (12 lb), LF omni
	6.8 kg (15 lb), LF dir
	5.0 kg (11 lb), MF omni
	7.3 kg (16 lb), MF dir
	4.5 kg (10 lb), Band C

Weight in water:	1.8 kg (4 lb), LF omni
	2.7 kg (6 lb), LF dir
	1.8 kg (4 lb), MF omni
	3.2 kg (7 lb), MF dir
	1.8 kg (4 lb), Band C
Operating depth:	500 m (1640 ft)
POWER/SERIAL connector:	MCBH16M

ATM-924 Subsea Modem

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

Housing construction:	Hard coat anodized aluminum
Dimensions:	Reference Drawing D-270-088 on page 10-6.
Mounting:	316 stainless steel sidebar
Weight in air:	9.5 kg (21 lb)
Weight in water:	4.1 kg (9 lb)
Operating depth:	2000 m (6560 ft)
POWER/SERIAL connector:	MCBH16M
TRANSDUCER connector:	MCBH3F

ATM-925 Subsea Modem

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

Housing construction:	Hard coat anodized aluminum
Dimensions:	Reference Drawing D-270-053 on page 10-7.
Mounting:	316 stainless steel sidebar

Weight in air:	10.9 kg (24 lb), LF omni 12.7 kg (28 lb), LF dir 10.4 kg (23 lb), MF omni 13.2 kg (29 lb), MF dir 10.4 kg (23 lb), Band C
Weight in water:	5.0 kg (11 lb), LF omni 5.4 kg (12 lb), LF dir 4.5 kg (10 lb), MF omni 5.9 kg (13 lb), MF dir 4.5 kg (10 lb), Band C
Operating depth:	2000 m (6560 ft)
POWER/SERIAL connector:	MCBH16M

ATM-926 Subsea Modem

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

Housing construction:	Hard coat anodized aluminum
Dimensions:	Reference Drawing D-270-060 on page 10-8.
Weight in air:	4.1 kg (9 lb), LF omni 5.9 kg (13 lb), LF dir 3.6 kg (8 lb), MF omni 6.4 kg (14 lb), MF dir 3.6 kg (8 lb), Band C
Weight in water:	1.8 kg (4 lb), LF omni 2.7 kg (6 lb), LF dir 1.4 kg (3 lb), MF omni 3.2 kg (7 lb), MF dir 1.4 kg (3 lb), Band C
Operating depth:	2000 m (6560 ft)
POWER/SERIAL Connector:	MCBH16M

ATM-964 Subsea Modem

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

Housing construction:	Hard coat anodized aluminum
Dimensions:	Reference Drawing D-270-089 on page 10-9.
Mounting:	316 stainless steel sidebar
Weight in air:	16.8 kg (37 lb)
Weight in water:	8.6 kg (19 lb)
Operating depth:	6000 m (19,680 ft)
POWER/SERIAL connector:	MCBH16M
TRANSDUCER connector:	MCBH3F

ATM-965 Subsea Modem

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

Housing construction:	Hard coat anodized aluminum
Dimensions:	Reference Drawing D-270-056 on page 10-10.
Mounting:	316 stainless steel sidebar
Weight in air:	17.2 kg (38 lb), LF omni 19.1 kg (42 lb), LF dir 16.8 kg (37 lb), MF omni 19.5 kg (43 lb), MF dir 16.8 kg (37 lb), Band C

Weight in water:	9.1 kg (20 lb), LF omni
	9.5 kg (21 lb), LF dir
	8.6 kg (19 lb), MF omni
	10.0 kg (22 lb), MF dir
	8.6 kg (19 lb), Band C
Operating depth:	6000 m (19,680 ft)
POWER/SERIAL Connector:	MCBH16M

ATM-966 Subsea Modem

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

Housing construction:	Hard coat anodized aluminum
Dimensions:	Reference Drawing C-270-259 on page 10-11.
Weight in air:	7.3 kg (16 lb), LF omni
	8.6 kg (19 lb), LF dir
	6.8 kg (15 lb), MF omni
	9.1 kg (20 lb), MF dir
	6.4 kg (14 lb), Band C
Weight in water:	3.2 kg (7 lb), LF omni
	4.1 kg (9 lb), LF dir
	2.7 kg (6 lb), MF omni
	4.5 kg (10 lb), MF dir
	2.7 kg (6 lb), Band C
Operating depth:	6000 m (19,680 ft)
POWER/SERIAL Connector:	MCBH16M

ATM-900 Modem Board Set

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

Chassis Dimensions:	Reference Drawing B-270-156 on page 10-12. When ordered with the SD Datalogger option ("-D"), the chassis is longer as shown in drawing B-270-504 on page 10-13.
Mounting:	Chassis mounting holes
Weight:	0.27 kg (0.6 lb) 0.32 kg (0.7 lb), SD Datalogger ("-D") option

ATM-903 Modem Board Set

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

Chassis Dimensions:	Reference Drawing B-270-156 on page 10-12. When ordered with the SD Datalogger option ("-D"), the chassis is longer as shown in drawing B-270-504 on page 10-13.
Mounting:	Chassis mounting holes
Weight:	0.27 kg (0.6 lb) 0.32 kg (0.7 lb), SD Datalogger ("-D") option

Remote Omnidirectional Transducer

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

Low frequency (LF):	Frequency band: 9–14 kHz Source level: 185 dB re 1 μ Pa @ 1 m typ Beam pattern: toroidal $\pm 30^\circ$ @ 12 khz typ
Medium frequency (MF):	Frequency band: 16–21 kHz Source level: 183 dB re 1 μ Pa @ 1 m typ Beam pattern: toroidal $\pm 30^\circ$ @ 18 khz typ
Band C:	Frequency band: 22.6–27.7 kHz Source level: 178 dB re 1 μ Pa @ 1 m typ Beam pattern: toroidal $\pm 30^\circ$ @ 25 khz typ
Housing construction:	PVC and 316 stainless steel
Dimensions:	Reference Drawing B-270-267 on page 10-15 for LF Reference Drawing B-270-509 on page page 10-16 for MF and Band C
Weight in air:	2.2 kg (4.8 lb), LF 2.9 kg (6.4 lb), MF 2.8 kg (6.1 lb), Band C
Weight in water:	1.4 kg (3.0 lb), LF 2.4 kg (5.2 lb), MF 5.1 kg (2.3 lb), Band C
Operating depth:	6000 m (19,680 ft)

Remote Directional Transducer

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

Low frequency (LF):	Frequency band: 9–14 kHz Source level: 190 dB re 1 μ Pa @ 1 m typ Beam pattern: conical $\pm 35^\circ$ @ 12 khz typ
Medium frequency (MF):	Frequency band: 16–21 kHz Source level: 190 dB re 1 μ Pa @ 1 m typ Beam pattern: conical $\pm 30^\circ$ @ 18 khz typ

Housing construction:	PVC and 316 stainless steel
Dimensions:	Reference Drawing B-270-591 on page 10-17 for LF w/LR2 connector; Drawing B-270-592 on page 10-18 for LF w/LA2 connector Reference Drawing B-270-371 on page 10-19 for MF
Weight in air:	3.6 kg (7.8 lb), LF, LR2 connector 2.8 kg (6.1 lb), LF, LA2 connector 3.6 kg (7.8 lb), MF
Weight in water:	1.9 kg (4.2 lb), LF, LR2 connector 1.4 kg (2.5 lb), LF, LA2 connector 1.9 kg (4.2 lb), MF
Operating depth:	6000 m (19,680 ft)

Modem Battery Pack Capacities

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

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

Capacity (at power level 08):	250 watt-hours (when transmit power is consistently at the max power level 08)
Capacity (at power level 07):	300 watt-hours (when transmit power is limited to power level 07)



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

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

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

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

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



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

3 Deployment Considerations

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

Remote Transducer Selection

When an ATM-914, ATM-924, ATM-964, or ATM-903 Acoustic Telemetry Modem, each of which use a remote transducer, is to be installed, the type of remote transducer to use should be carefully selected to best suit the application. Refer to "Remote Transducers" on page 1-22 for general information on the available remote transducers, and to Section 2, "Specifications," for detailed specifications. Also refer to Section 10, "Drawings," for dimensioned outline drawings.

The remote omnidirectional transducer LF and MF beam patterns are shown in Figure 1-18 on page 1-23. Its beam patterns show that it transmits and receives signals in a toroidal pattern. This transducer should be selected when the horizontal direction or the depth of the receiving modem is not known or is not always the same. However, more power is required compared to a directional transducer to produce an equivalent source level, and the effects of multipath are usually greater.

The remote directional transducer LF and MF beam patterns are shown in Figure 1-19 on page 1-24. Whenever possible, this transducer should be selected. Its transmit and receive beam patterns are that of a narrow cone; hence it is a good choice when the depth and direction of the receiving modem is known and is stable, and the transducer can be pointed at the receiving modem. This transducer requires the least amount of power to produce the equivalent source level of an omnidirectional transducer, and it provides the best protection against the effects of multipath.

Modem Battery Pack

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



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

Battery Pack Power Usage

In the lowpower state, where the modem is switched on but is inactive, a very small amount of power, a maximum of 12 mW, is drawn from the modem battery pack. Therefore, the battery pack can provide power in the lowpower state for over 2 years. However, when the DSP and the receiver are active, hence not in the lowpower state, a relatively large amount of power, a maximum of 720 mW, is drawn from the battery pack while the modem receives data or commands. The most power, a maximum of 20 watts which occurs at a power level of 8, is drawn when the modem is transmitting. Therefore, unless a modem is to be deployed for well over a year with few transmissions, it is the amount of data to be transmitted that determines its useful deployment life.

Processing Overhead

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

Modem Battery Pack Capacity Calculations

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



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

Verifying the Modem Battery Pack Capacity for a Short Deployment

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

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

Where

D = the amount of data to be transmitted in bytes

P = the transmitter power in watts

R = the bit rate in bits/second

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

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

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

Referring to "Modem Battery Pack Capacities" on page 2-12, it can be seen that a modem battery pack for an ATM-914, ATM-915, ATM-924, ATM-925, ATM-964, and ATM-965 Acoustic Telemetry Modem is more than adequate.

An Example Deployment Calculation

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

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

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

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

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

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

Calculate the number of packets transmitted per day.

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

Then calculate the number of hours transmitting per day.

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

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

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

Calculate the time spent in the lowpower state per day.

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

Calculate the power per day consumed in the lowpower state.

$$\begin{aligned}\text{Lowpower state power/day} &= 23.89 \text{ hours} * 12.0 \text{ mW} * 1 \text{ watt}/1000 \text{ mW} \\ &= 0.29 \text{ watt-hours/day}\end{aligned}$$

Calculate the total power consumed per day.

$$\begin{aligned}\text{Total power/day} &= 0.29 + 2.12 \\ &= 2.41 \text{ watt-hours/day}\end{aligned}$$

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

$$\begin{aligned}\text{Deployment days} &= (187.5 \text{ watt-hours}) / (2.41 \text{ watt-hours/day}) \\ &= 77 \text{ days}\end{aligned}$$

Although at the end of the 77 days the battery will not have the capacity to continue to transmit at full power, it will have remaining capacity to transmit at a reduced power level. When a modem reaches the point that the battery can no longer support full power transmission, it will reduce its power level. A modem that is transmitting at power level 7 will only require 14 watts. At this power level the battery capacity is 300 watt-hours. Repeating the above calculation for a modem transmitting at 14 watts will show that the modem will consume 1.77 watt-hours per day. For the average transmit power for each of the power level settings, refer to Section 2, "Specifications." Therefore, with the capacity of the battery being 300 - 250, or 50 watt-hours, and derating the 50 watt-hours for temperature, provides $50 * 0.75$ or 37.5 watt-hours remaining capacity. Therefore, the total number days the modem will continue operating at power level 7 is

$$\begin{aligned}\text{Additional days at level 7} &= (37.5 \text{ watt-hours}) / (1.77 \text{ watt-hours/day}) \\ &= 21 \text{ days}\end{aligned}$$

Alternatively, if the modem is at power level 7 for the entire deployment, then the battery capacity available would be 300 watt-hours. Derating for temperature provides $300 * 0.75$, or 225 watt-hours. Transmitting at power level 7 consumes 1.77 watt-hours/ day.

$$\begin{aligned}\text{Deployment days at level 7} &= (225.0 \text{ watt-hours}) / (1.77 \text{ watt-hours/day}) \\ &= 127 \text{ days}\end{aligned}$$

Modem Operating Depth

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



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

Modem Communications Range

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

Multipath and Noise

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

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

Transducer Orientation

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

Use of an Acoustic Baffle

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

Height Above the Bottom and Distance Below the Surface

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

Other Acoustic Devices

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

Typical Deployment Configurations

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

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

UDB-9400 Universal Deck Box Transducer Deployment

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

Subsea Modem Deployment

A subsea modem is typically moored on the sea floor, attached to a subsea structure, or installed on an AUV. In all cases the modem's built-in transducer or its remote transducer should be mounted such that it is oriented correctly. Refer to "Transducer Orientation" on page 3-7 for more specific requirements, and to Section 10, "Drawings," for detailed dimensional information on the subsea modems and remote transducers. When a subsea modem is moored, it should be securely anchored using a clump weight. And if it is moored or attached to a subsea structure, it should be pulled up vertically using flotation. The sidebar that is attached to the modem housing is used both to attach the flotation and to anchor the modem to a clump weight or to a structure.

Corrosion Protection

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

O-Ring Inspection

When deploying a subsea modem that has *not* been opened since being sealed at the factory, no O-ring maintenance is required. However, if a subsea modem has been opened, the O-ring should be carefully inspected and, if necessary, replaced. Refer to "Cleaning or Replacing an O-ring" on page 9-14 for instructions on how to clean or replace an O-ring.

4 Setup and Test

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



NOTE For instructions on how to set up the SR-50 and SR-9100 SMART Releases and the SM-975 SMART Modem, refer to their respective user's manual.

Unpacking and Inspection

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

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

UDB-9400 Universal Deck Box Components

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

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

ATM-914 Components

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

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

ATM-915 Components

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

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

ATM-916 Components

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

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

ATM-924 Components

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

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

ATM-925 Components

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

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

ATM-926 Components

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

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

ATM-964 Components

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

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

ATM-965 Components

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

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

ATM-966 Components

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

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

ATM-900 Components

The ATM-900 Board Set includes the following components:

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

ATM-903 Components

The ATM-903 Board Set includes the following components:

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

Modem Connections

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

UDB-9400 Universal Deck Box Connections

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

PWR:	5-pin bulkhead connector—connects to the AC power source.
XDCR:	12-pin bulkhead connector—connects to the transducer.
AUX:	15-pin bulkhead connector—available for connection to headphones and to external 10–30 VDC power (optional). Also provides spare outputs and inputs and a transmit sync output.
COM1:	DB-9S connector—female serial port connector that connects to the host processor and is used for sending and receiving acoustic telemetry modem commands and data. COM1 is connected to serial port 1 of the DSP board.
COM2:	DB-9S connector—female serial port connector that connects to a PC and is used for inputting commands and outputting round trip travel times and status information in a manner that emulates the DS-7000 Acoustic Deck Set.

Subsea Modem Connections

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

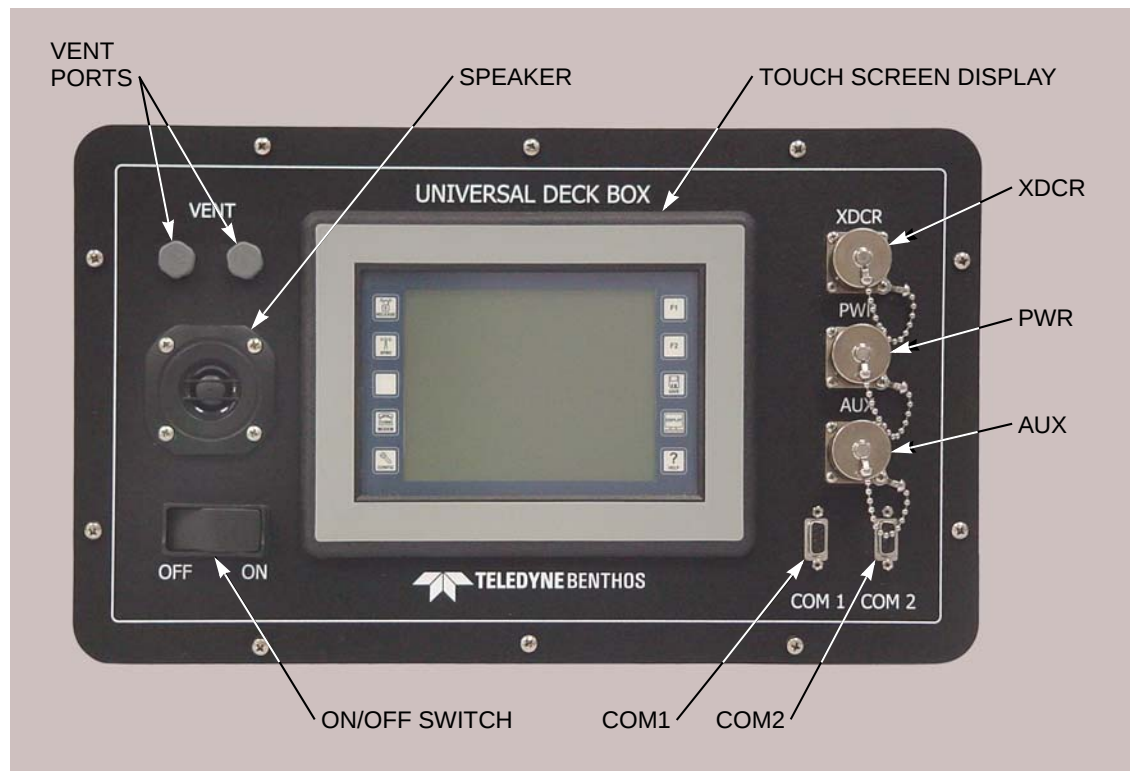


Figure 4-1 UDB-9400 Front Panel Operator Functions and Connectors

Modem Operator Functions

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

UDB-9400 Universal Deck Box Operator Functions

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

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

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

Speaker:

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

Vent ports:

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

Subsea Modem Operator Functions

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

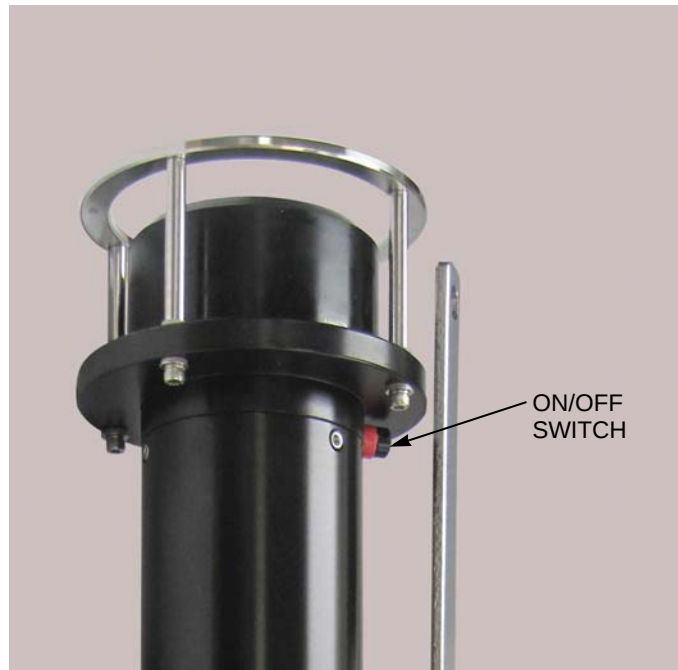


Figure 4-2 Subsea Modem On/Off Switch



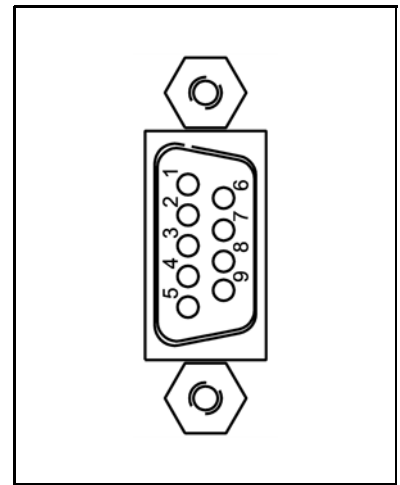
NOTE The on/off switch on a subsea modem is protected with a red rubber cap. This cap must be removed before the switch can be operated and must be left off when deploying the modem.

Setting Up the Modems

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

Setting up the UDB-9400 Universal Deck Box

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



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

Table 4-1 UDB-9400 COM1 Connector Pinouts

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

Perform the steps listed below to connect a transducer to a UDB-9400 Universal Deck Box and to connect the deck box to a serial RS-232 port of a PC. Refer to "UDB-9400 Universal Deck Box Connections" on page 4-6 for information on the deck box connectors and their locations. To connect the deck box to an instrument or PC using the RS-485 serial interface, refer to Figure 4-4. Table 4-2 is for connecting to the serial RS-232 port of a PC.

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

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

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

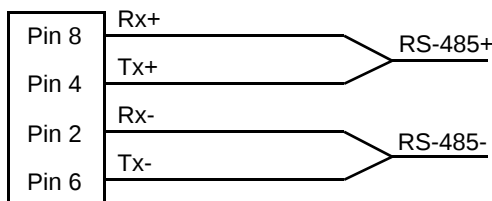


Figure 4-4 UDB-9400 COM1 Connector RS-485 Connections

Setting up the Subsea Modems

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

Power and Serial Interface Connections.

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

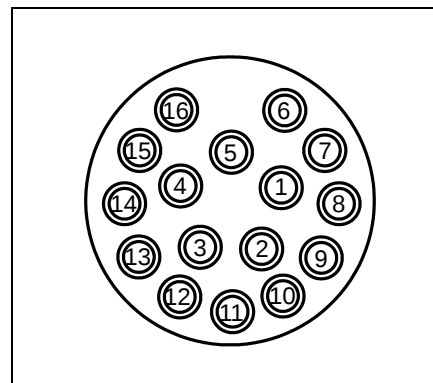


Figure 4-5 Subsea Modem POWER/SERIAL Connector, Face View

Table 4-3 Subsea Modem POWER/SERIAL Connector Pinouts

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

Figure 4-5 for the POWER/SERIAL connector pin orientation, and to Table 4-3 for the pinout information. The POWER/SERIAL connector is a 16-pin Impulse MCBH16M bulkhead connector that requires an Impulse MCIL16F mating connector pigtail.



NOTE The Device Enable output is on when the modem is sending data to the host or if the modem receives the Dial command (ATD). Refer to "Device Enable" on page 5-98 for more information. Refer also to Section 2, "Specifications," for the electrical specifications.



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

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

To connect a subsea modem to an instrument using the RS-485 serial interface, refer to Figure 4-6.

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

1. Connect the connector pigtail to the POWER/SERIAL connector.
2. Refer to Table 4-4 and connect the pins listed to an available serial RS-232 port on the PC. The table shows the connections for a DB-9 serial port connector typically used on laptop computers.



NOTE Only serial port 1 will accept all the commands.

3. Refer to Table 4-3 on page 4-11 and connect the DC power and ground pins to the DC power supply if one is used

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

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

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

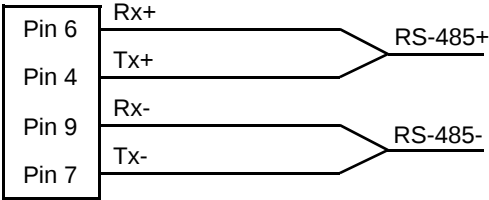


Figure 4-6 Subsea Modem POWER/SERIAL Connector Serial Port 1 RS-485 Connections

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

The ATM-900 and ATM-903 Board Sets are set up with all of the connections made directly to the boards. The locations of the connectors are shown in Drawing B-270-156. The drawing is included in Section 10, "Drawings."

Power and Serial Interface Connections.

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

The second serial interface connection is made to J8. Refer to Figure 4-8 for the DSP Board serial connector J8 pin orientation, and to Table 4-6 for the pinout information. J8 requires a Hirose DF11-6DS-2C mating connector with Hirose DF11-2428SCA pins. J8 is serial port 2.

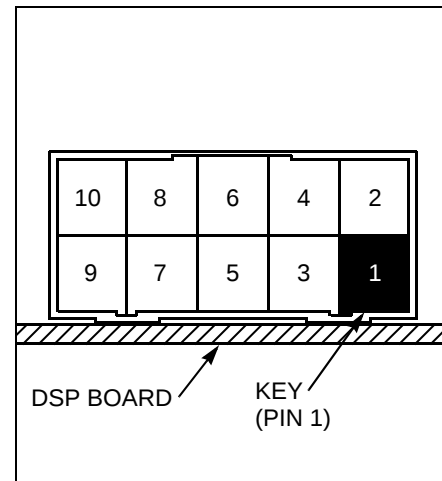


Figure 4-7 ATM-900 and ATM-903 DSP Board Serial Connector J7, Face View

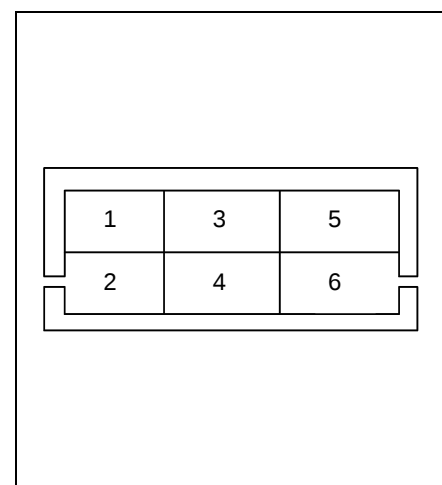


Figure 4-8 ATM-900 and ATM-903 DSP Board Serial Connector J8, Face View

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

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

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

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



NOTE The Device Enable output is on when the modem is sending data to the host or if the modem receives the Dial command (ATD). Refer to "Device Enable" on page 5-98 for more information. Refer also to Section 2, "Specifications," for the electrical specifications.

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

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

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



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

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



NOTE Only serial port 1 will accept all the commands.

If connecting the ATM-900 or ATM-903 to a PC, refer to Table 4-8 for serial port 1 or to Table 4-9 for serial port 2 and connect the pins listed to an available serial RS-232 port on the PC. The tables show the connections for a DB-9 serial port connector typically used on laptop computers.

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



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

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

To connect an ATM-900 or ATM-903 to an instrument using the RS-485 serial interface, refer to Figure 4-9.

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

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

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

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

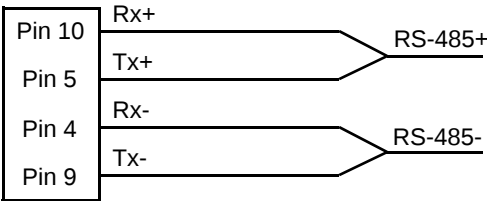


Figure 4-9 ATM-900 and ATM-903 DSP Board Serial Port 1 Connector J7 RS-485 Connections

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

Table 4-10 ATM-903 Transducer Cable Wiring

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

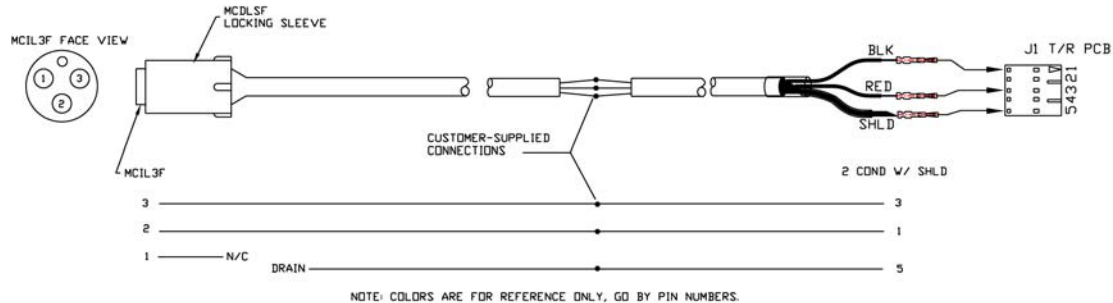


Figure 4-10 ATM-903 Transducer Cable Wiring Diagram

DSP Board I/O Connector. The ATM-900 and ATM-903 Board Sets include an I/O connector J3 on the DSP board. This connector provides a CMOS interface that becomes serial port 2 when the P2Protocol configuration parameter is set to 1 (CMOS). When set to 0 (RS-232), serial port 2 is an RS-232 interface and is available on J8. For information on how to set configuration parameters, refer to "Configuration System" on page 5-53. For information on the P2Protocol configuration parameter and its available settings, refer to "P2Protocol" on page 8-19. The I/O connector is also used to input a one pulse per second (1PPS) signal for driving the modem's real time clock. Refer to "Real-Time Clock" on page 5-92 for information on the real-time clock. Table 4-11 lists the connector pinout information and Figure 4-11 shows the connector pin orientation. J3 requires a Hirose DF11-12DS-2C mating connector with Hirose DF11-22SCA pins.

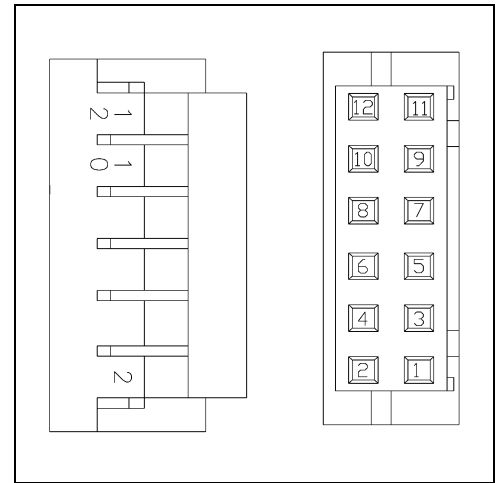


Figure 4-11 ATM-900 and ATM-903 I/O Connector J3, Face View

Table 4-11 DSP Board I/O Connector J3 Pinouts

DSP BOARD I/O CONNECTOR J3	LABEL	FUNCTION	SIGNAL DIRECTION
1	RXD	Port 2 CMOS Receive	Host to Modem
2	GND	Ground	
3	TXD	Port 2 CMOS Transmit	Modem to Host
4	GND	Ground	
5	RE	Release Enable	Modem to Host
6	BIN_OUT0	Reserved Output	Modem to Host
7	GND	Ground	
8	BIN_OUT1	Reserved Output	Modem to Host
9	BIN_IN0	1PPS In	Host to Modem
10	GND	Ground	
11	BIN_IN1	Reserved Input	Host to Modem
12	RELEASE SENSE	Release Sense	Host to Modem

Connecting External Sensors to the Optional Analog Input Board

The Analog Input board is provided with the Analog Input option which is available only with the ATM-903 and ATM-900 Board Sets. This board provides six analog inputs, Channels 1 to 6, for connecting to external sensors. Included with the board is an interface cable. Connect this cable to J6 on the board and wire the opposite end to a customer supplied bulkhead connector. Connect the external sensors to this bulkhead connector. Refer to Figure 4-12 for the Analog Input board J6 pin orientation, and to Table 4-12 for the pinout information. J6 requires a Hirose DF11-20DS-2C mating connector with Hirose DF11-2428SCA pins. This connector is factory installed on the interface cable. For more information on the Analog Input option, refer to "Analog Input Option" on page 5-71.

Table 4-12 Analog Input Board J6 Pinouts

ANALOG INPUT BOARD CONNECTOR J6	FUNCTION	CHANNEL NO.
1	Power Output (22 VDC maximum)	1
2	Ground (for 0–10 VDC input only)	
3	4–20 mA Return (for 4–20 mA input only)	
4	0–10 VDC Input	
5	Voltage Signal Reference (can connect to Pin 2)	
6	Power Output (22 VDC maximum)	2
7	Ground (for 0–5 VDC input only)	
8	4–20 mA Return (for 4–20 mA input only)	
9	0–5 VDC Input	
10	Voltage Signal Reference (can connect to Pin 7)	
11	Power Output (22 VDC maximum)	3
12	4–20 mA Return	
13	Power Output (22 VDC maximum)	4
14	4–20 mA Return	
15	5 VDC Output, Resistive Sensor	5
16	Return, Resistive Sensor	
17	5 VDC Output, Bridge Excitation	6
18	Bridge Excitation Return	
19	Bridge Signal Input (+)	
20	Bridge Signal Input (-)	

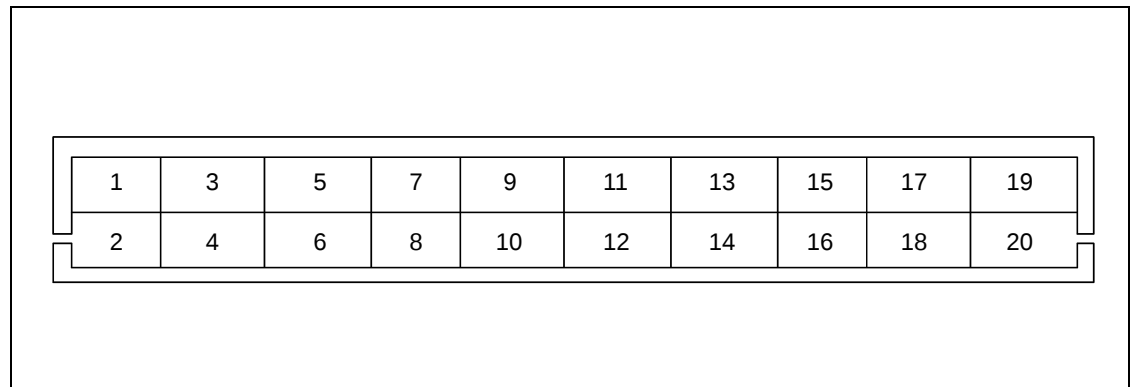


Figure 4-12 Analog Input Board Connector J6, Face View

Setting up the Host Processor

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

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

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

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

Baud Rate:	9600 baud
Parity:	None
Data Bits:	8
Stop Bits:	1

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

Checking the Modems and Host Processors

Once the modems and host processors are set up, several simple preliminary checks can be made to verify that the modems are operating properly and that all of the connections are correct. In addition, the modems can be prepared for online or datalogger operation before deployment.

Turning on a Modem and Entering Command Mode

Perform the steps listed below to turn on a modem, enter Command mode and execute a few simple commands. When entering a command, always follow it by pressing Enter. In addition, be sure the PC is connected to serial port 1 of the modem. Serial port 1 should always be used when in Command mode.

1. Turn on the PC and run the terminal program.
2. If an ATM-900 Series Acoustic Telemetry Modem is being used as the modem, switch on the modem by pushing in the switch on the side of the end cap. If a UDB-9400 Universal Deck Box is being used as the modem, switch the OFF/ON switch on the front panel to ON.

The banner message should be displayed, and if the modem is set to power up in Command mode, the command prompt (>) will also be displayed as in the following example:

```
Teledyne Benthos ATM-900 Series
LF Frequency Band
Standard Modem Version 8.6.0
Jan 6 2012 18:16:52
>
```

If the command prompt is not displayed, enter +++ rapidly. The modem should go into Command mode and display the command prompt.

3. At the command prompt enter the command `cfg all`, for example, to view all of the modem settings.
4. To change any setting, at the command prompt enter `@[parameter]=[value]`. For example, entering `@TxRate=1200` will change the transmitting acoustic bit rate to 1200 bits per second.

Verifying the Acoustic Operation of a Modem's Receiver

It is best to check the acoustic receive capability of the modem before deploying it in the water. While in Command mode, a simple procedure can determine if the modem's receiver is functioning properly. However, this method should not be used to determine the receive sensitivity of modem. For more information, refer to "Acoustic Test" on page 5-100.

Perform the steps listed below to verify the acoustic operation of the modem's receiver.

1. At the command prompt enter ATTN1.

Values for the automatic gain control (AGC) should be displayed, updating once per second.

2. Lightly rub and tap the transducer.

The AGC values should change, decreasing the more vigorously the transducer is rubbed and tapped.

3. To stop the display of the AGC values, enter ATTN0.

Checking the Acoustic Link between a Pair of Modems in Air

The acoustic link between a pair of modems in air can be checked with no risk of damaging them when used at power levels at or below -6dB. However, it is preferable to operate the modems at the lowest possible power setting of -21 dB which usually results in a better acoustic connection. The modem transducers should also be placed about 6 inches (15 cm) apart in open air with no obstacles between them. Should the connection be poor, it may be necessary to add acoustic baffling material, such as bubble wrap, around the transducers to reduce ambient noise and multipath interference.

Perform the steps listed below to check the acoustic link between a pair of modems in air.

1. Place the modems approximately 6 inches (15 cm) apart in open air with the transducers facing each other and with no obstacles between them.
2. Turn on the PC and run the terminal program.

3. Turn on the modem.

The banner message should be displayed, followed by the command prompt. If the command prompt is not displayed, enter +++ rapidly. The modem should go into Command mode and display the command prompt.

4. Enter ATXn, where n is the address of the remote modem. 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.
5. Verify that the displayed output is similar to the following example:

```
00800 bits/sec  
MOD:05 ERR:000 SNR:27.1 AGC:07 SPD:+00.0 CCERR:014
```

Preparing a Pair of Modems for Real-Time Data Transfer

One of the operating modes of a modem is Online mode. In Online mode any input received over the serial interface from its host processor is automatically transferred in real time to another modem with which it is online by transmitting the data over the acoustic link. And any data received from that modem over the acoustic link is automatically output on the serial interface to the host processor. To be in Online mode two modems are required. In addition, all modems are shipped with a default address of 0 and are set to go into Online mode automatically when they are switched on. However, it is best to prepare the modems for real-time data transfer by using a unique address for each.

Perform the steps listed below to prepare a modem pair for real-time data transfer using 3 for the subsea modem address and 2 for the surface modem address.

1. Connect the modem to be used as the subsea modem to the serial port of the PC as described in "Setting Up the Modems" on page 4-9.
2. Turn on the PC and run the terminal program.
3. Turn on the modem.

The banner message should be displayed, followed by the command prompt. If the command prompt is not displayed, enter +++ rapidly. The modem should go into Command mode and display the command prompt.

4. At the command prompt enter `@LocalAddr=3`.
5. At the command prompt enter `@RemoteAddr=2`.
6. At the command prompt enter `@OpMode=Online`. This setting causes the modem to go into Online mode when it is powered up.
7. Enter `+++` rapidly to place the modem back into Command mode.
8. At the command prompt enter `cfg store`. This command will store the new configuration.
9. Connect the modem to be used as the surface modem to the serial port of the PC
10. Turn on the PC and run the terminal program.
11. Turn on the modem.

The banner message should be displayed, followed by the command prompt. If the command prompt is not displayed, enter `+++` rapidly. The modem should go into Command mode and display the command prompt.

12. At the command prompt enter `@LocalAddr=2`.
13. At the command prompt enter `@RemoteAddr=3`.
14. At the command prompt enter `@OpMode=Online`.
15. Enter `+++` rapidly to place the modem back into Command mode.
16. At the command prompt enter `cfg store`.

When the modems are deployed, any data input to either serial port of the surface or subsea modem will be transmitted acoustically to the other modem.

Preparing a Modem for Data Logging

Another operating mode of a modem is Datalogger mode where any input received over the serial interface from its host processor is stored in the modem's flash memory.

Perform the following steps to prepare a modem for data logging.

1. Connect the modem to be used as the data logging modem to the serial port of the PC as described in "Setting Up the Modems" on page 4-9.

2. Turn on the PC and run the terminal program.
3. Turn on the modem.

The banner message should be displayed, followed by the command prompt. If the command prompt is not displayed, enter +++ rapidly. The modem should go into Command mode and display the command prompt.

4. At the command prompt enter `@OpMode=Datalog`. This setting causes the modem to go into Datalogger mode when it is powered up.
5. Enter +++ rapidly to place the modem back into Command mode.
6. If desired, enable the ring buffer by entering `@RingBuf=Ena` at the command prompt. For information on the ring buffer, refer to "RingBuf" on page 8-39.
7. At the command prompt enter `cfg store`. This command will store the new configuration.
8. Turn the modem off and then on again. It will go into Datalogger mode automatically when powered up.

Reloading Software Applications

A modem runs the following software applications: bootloader, diagnostic and modem. The bootloader is used for loading the diagnostic and modem software. The diagnostic software contains the Power On Self Test (POST) and is in the S-270-67 Diag Utility vx.x.rom file. The modem software is in the S-270-68 Standard Modem vx.x.x.rom file. Both files are included with this manual. Typically, when an application upgrade occurs, only the modem software needs to be updated. This process can be done using the ATEU command as described on page 7-14. When using this command, follow the on screen prompts. If power is lost during the update procedure, or the procedure fails altogether, the modem will boot into the following prompt:

```
Boot Loader version 3.6
(FFS-enabled)
[Boot] user:1>
```

Entering `format FSS` and rebooting will display the prompt shown above. Refer to "File System Commands" on page 5-42 for information on the `format` command. Should this prompt appear for any of these reasons, the diagnostic software or modem software, or both, may need to be reloaded.



NOTE Should the prompt not appear, verify that the baud rate is 115,200 as instructed during the update. Also verify that the parity is none, the number of data bits is eight, and the number of stop bits is one. Be sure to use any standard terminal program that features the Xmodem or 1K-Xmodem transfer protocol, such as ProComm Plus or Tera Term. Turn on the modem and within a second or two press Escape several times until the Boot Loader banner and prompt appear. Repeat the process if they don't. If repeating the process does not work, contact Teledyne Benthos. For information on how to contact Teledyne Benthos, refer to "Customer Service" on page vi.

Follow the steps listed below to reload the diagnostic and modem software.

1. Save the S-270-67 Diag Utility vx.x.rom and S-270-68 Standard Modem vx.x.x.rom files on the PC that is connected to the modem.
2. At the Boot Loader prompt, enter:

`update diag`
3. Follow the on screen instructions to transfer the file S-270-67 Diag Utility vx.x.rom from the PC to the modem using the Xmodem or 1K-Xmodem protocol.
4. At the Boot Loader prompt, enter:

`update`
5. Follow the on screen instructions to transfer the file S-270-68 Standard Modem vx.x.x.rom from the PC to the modem using the Xmodem or 1K-Xmodem protocol.
6. Return the baud rate to 9600 baud.
7. Turn the modem off and then on again.

The banner message should be displayed, and if the modem is set to power up in Command mode, the command prompt (>) will also be displayed as in the following example:

```
Teledyne Benthos ATM-900 Series
LF Frequency Band
Standard Modem Version 8.6.0
Jan 6 2012 18:16:52
>
```


5 Modem Operation

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



NOTE To enter commands serial port 1 of the modem must be connected to a computer that is set up to run a terminal program, such as ProComm Plus or Tera Term. Refer to "Setting Up the Modems" on page 4-9 for instructions on how to connect the modem to a PC and to "Setting up the Host Processor" on page 4-21 for instructions on how to set up the PC as the local host processor.

Modem commands are entered using the Command Line for Acoustic Modem (CLAM) shell user interface. The CLAM shell provides both user input and output and is similar to that provided on Unix platforms. The CLAM shell also supports the AT command set which is similar to the Hayes standard AT commands that is used for dial-up modems. All the AT commands begin with "AT," and all the CLAM shell and AT commands are accepted on serial port 1 only. For a detailed description of the available AT commands, refer to Section 7, "Modem AT Command Set." Many of these commands are called out in this section.

Although the modem commands control the operation of the modems, configuration parameters directly affect how some of the commands are applied and how a modem functions in each of its operating modes. For a detailed description of the configuration parameters and how to set them, refer to Section 8, "Modem Configuration Parameters." A number of the configuration parameters are called out in this section.



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

Online Mode

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

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

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

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

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

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

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

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

Transmit Data Buffers

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



WARNING If the Online Interrupt command (+++) is entered to place the modem into Command mode while data remains in a partially filled 4-kbyte transmit data buffer, the data will not be transmitted and the buffer will be cleared. Refer to "Online Interrupt +++" on page 7-7 for information on the Online Interrupt command.

While data are being transmitted from a 4-kbyte transmit data buffer, data can continue to be input to the modem over the serial interface, filling the additional 4-kbyte transmit data buffers. Since the serial interface baud rate is typically faster than the acoustic bit rate, having the eight 4-kbyte transmit data buffers allows a faster serial interface baud rate for up to 32 kbytes of data. If an instrument is expected to output a continuous stream of data to the modem that exceeds 32 kbytes, flow control must be used to prevent loss of data. For information how to set the flow control, refer to "P1FlowCtl" on page 8-11 for serial port 1 and to "P2FlowCtl" on page 8-18 for serial port 2.



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

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

should an error occur. If disabled, the full 32 kbytes are available. For information on the DataRetry configuration parameter, refer to "DataRetry" on page 8-44. Flow control will ensure there is no loss of data, as when the eight 4-kbyte transmit data buffers are full, flow control will not allow the host processor to output data to the modem.

Data Format

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

Online Break

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

Error Checking

With each 4-kbyte data packet transmitted, a checksum is calculated and also transmitted. The modem that receives the packet also calculates a checksum and compares it to the transmitted checksum. If enabled with the setting of the Verbose configuration parameter, the received data statistics comprising the checksum pass or fail results (CRC), the multipath delay (MPD), the signal-to-noise ratio (SNR), the relative speed between the local and remote modems (SPD), the automatic gain control (AGC), and the corrected channel errors (CCERR) are displayed. Refer to "Acoustic Link Test ATXn" on page 7-24 for a detailed description of the received data statistics. The Verbose configuration parameter must be set to 2 or higher for the received data statistics to be displayed. In addition, the ShowBadData configuration parameter must be set to Ena to display data packets with failed CRCs.

Command Mode

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



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

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

```
Teledyne Benthos ATM-900 Series
LF Frequency Band
Standard Modem Version 8.6.0
Jan 6 2012 18:16:52
CONNECT 00800 bits/sec
```

The banner message is suppressed when @Verbose=0.



NOTE When there are a lot of data stored in the data logger of the modem, the boot up time is longer, delaying the banner message on power up by 10 seconds or more.

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

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

Using the Online Interrupt command (+++). Entering the Online Interrupt command will place the modem into Command mode. Refer to "Online Interrupt +++" on page 7-7 for information on the Online Interrupt command.

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

Acoustic Command Execution

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

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

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

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

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

Entering Commands

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



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

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

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

Command Line Shortcuts

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

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

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

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

Ctrl-U. Deletes the entire command line.

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

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

Tab Completion

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



NOTE Tab completion cannot be used when entering AT commands.

Command Prompts

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

```
user:5>
```

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

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

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

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

```
user:36>
```

for a privilege level of user. To select no prompt, enter `@prompt=0`. To display the codes for the prompts, enter `@prompt`. For more information on the Prompt configuration parameter, command, refer to "Prompt" on page 8-29.

Strict AT

Although both CLAM shell and AT commands can be used interchangeably, a modem can be commanded to accept *only* AT commands by entering `strictat` or by setting `@StrictAT=Ena`. To return to normal operation, enter `nostrictat`. For descriptions of the AT commands and how to enter them, refer to Section 7, "Modem AT Command Set." For information on the `strictat` command, refer to "strictat" on page 5-14, and for the `nostrictat` command, "nostrictat" on page 5-14.

Command Numbers and History

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

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

Privilege Levels

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

- safe
- user
- update

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

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

Command Aliases

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

```
alias sf setpriv safe
```

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

```
unalias sf
```

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

Command Syntax

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

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

Parser Commands

The following parser commands are available:

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

alias

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

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

Privilege: user

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

```
alias sf setpriv safe
```

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

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

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

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

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

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

```
alias
```

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

```
alias sf
```

unalias

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

Syntax: `unalias <alias>`

Privilege: `user`

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

```
unalias sf
```

help

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

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

Privilege: `safe`

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

```
help
```

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

```
help setpriv
```

hist

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

Syntax: `hist`

Privilege: `safe`

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

```
hist
```

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

Example 2: To execute command number 25, enter:

```
!25
```

setpriv

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

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

Privilege: `safe`

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

```
setpriv user
```

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

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

```
setpriv
```

strictat

The `strictat` command places the modem into a state that enables processing of AT commands only. With the exception of the `nostrictat` command, CLAM shell commands are not processed.

Syntax: `strictat`

Privilege: `user`

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

`strictat`

nostrictat

The `nostrictat` command places the modem into a state that enables processing of both AT and CLAM shell commands.

Syntax: `nostrictat`

Privilege: `user`

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

`nostrictat`

Datalogger Mode

When a modem is in Datalogger mode, input from its host processor over the serial interface is treated as data which are stored in the internal flash memory or optionally in an external SDHC card. Up to 6 MB of data can be stored in internal memory. However, with the SD Datalogger option ("-D"), which adds an SDHC card and its carrier board, the total memory size is increased to 4 GB. With this option, setting `@LogStore=SDHC` enables the 4 GB of memory, which is the maximum limit of the datalogger memory even though a 32-GB SDHC card is actually used. With `@LogStore=internal`, only the internal 6 MB of memory can be used, and when using this memory, the actual available memory for data storage, however, depends primarily on the record sizes and the metadata, which is information about the data. For example, if the average record size is 1 KB, the metadata will consume only about 3% of memory; if 32 bytes, then 50% of memory. The available memory also depends on the file system formatting. The file system formatting memory requirements do not apply to the 6 MB of internal memory available for data storage, however.



NOTE When the SDHC card is enabled by setting `@LogStore=SDHC`, all the datalogger commands will apply only to the datalogger on the SDHC card. In addition, the `RingBuf` configuration parameter cannot be set to `Ena` to enable the ring buffer. For information on the `RingBuf` configuration parameter, refer to "RingBuf" on page 8-39.

The stored data are partitioned into discrete, searchable records with metadata tags that allow them to be searched and filtered. Local and remote data and metadata retrieval functions are supported on both memory configurations. A modem will go into Datalogger mode when it is powered up *only* if `@OpMode=Datalog`. Data stored in the data logger 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.



WARNING With firmware version 8.6.0 installed, some Datalogger mode functions will not be compatible with earlier versions. Therefore, before upgrading to 8.6.0, the contents of the data logger memory should be output and then cleared. For instructions on how to output the contents of the data logger memory, refer to "Output Local Data Logger ATBT" on page 7-64, and to clear it, "Clear Local Data Logger ATBC" on page 7-62.

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

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

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

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

6-MB Internal Memory

For the 6-MB internal memory only, the data logger can hold up to 6 MB of data in either one of two storage modes: flat mode where data accumulates up to the 6-MB limit at which recording stops, or ring buffer mode where the data are accumulated until the 6-MB limit is reached, at which point the oldest 384–388 kbyte files are erased and new incoming data continues to be recorded. These modes are selected with the RingBuf configuration parameter. Files stored in the flash file system will also reduce the amount of memory available. For information on the flash file system, refer to "Flash File System" on page 5-39.

SDHC Card Memory and Formatting

The SDHC card can be removed and read directly on a PC. For instructions on how to change the SDHC card, refer to "Changing the SDHC Card" on page 9-11. The file formats for the data files are in the form `nnnnnnnn.log` where `nnnnnnnn` is a 0-padded number that increases from 0 to 99999999 until the data logger is cleared. In addition, a set of index files in the form `nnnnnnnn.idx` is also included, following the same conventions as the .log files. The index files contain the indexing and time stamping data that correspond to the discrete data records in the log files. Each .idx file will have one 32-byte metadata record for every data parcel that begins in the corresponding .log file, regardless of whether it is fully contained within that .log file or spills over into the next one. If it is desired to clear the SDHC card while installed on a PC, then the card must be formatted either on the PC before being reinstalled into the modem or with the `format` command after it is reinstalled. The format must be FAT32 with 4096-byte cluster sizes. The modem should always be deployed with a newly formatted SDHC card.

Record Parceling

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

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

Search and Retrieval

Data can be searched for and retrieved from the local and remote modems either as single contiguous blocks or as discrete records. For contiguous block retrieval, where there are both 4-kbyte blocks and 256-byte sub-blocks, AT commands are used. For descriptions of the AT commands and how to enter them, refer to Section 7, "Modem AT Command Set." When retrieving data as contiguous blocks, no time stamps are provided. For discrete record retrieval, records of a particular type and with time stamps can be selected. Single records and multiple records over any specified range can be retrieved from the local and remote modems with a 64-kbyte limit per command execution on the remote modem only.



NOTE When there are a lot of data stored in the data logger of the modem, the boot up time is longer, delaying the banner message on power up by 10 seconds or more.

Data Logger Commands

The following data logger commands are available:

- `dlfind`
- `dllist`
- `dlrecs`
- `rdlfind`
- `rdllist`
- `rdlrecs`
- `dlldump`
- `rdldump`
- `rdlblk`
- `dlclear`
- `rdlclear`
- `ATBC`
- `AT$BCn`
- `AT$BEn`
- `AT$BDn`

dlfind

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

- Starting point
- Ending point
- Step interval
- Flags

The starting and ending point parameters can be in the form of a time stamp in years, months, days, hours, minutes, and seconds; a record number referenced to the start or the end of the data logger's data set; or the number of records from the starting point. The step interval specifies how many records should be skipped when displaying data. For example, an interval of 15 would display the first and then every 15th record from the starting point

to the ending point. If no step interval is specified, then every record from the starting point to the ending point would be displayed. The flags parameter specifies the source of the data. Valid flags are the following:

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

Multiple flag types may be joined with "&." Not specifying a flag will include all flags. In addition, an optional "-i" modifier will cause metadata to be displayed for each record along with the record itself. The metadata is composed of the record number, the time stamp, the file size in bytes, and the flags for each record. An optional "-x" modifier specifies that the data are to be displayed as ASCII hexadecimal values, otherwise as ASCII text.

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

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

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

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

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

Privilege: user

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

```
dlfind @2011
```

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

```
dlfind -i @2011
```

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

```
dlfind @20110103 @20110207
```

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

```
dlfind +2 -2
```

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

```
dlfind +30
```

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

```
dlfind -30
```

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

```
dlfind +30 7
```

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

```
dlfind -30 7
```

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

```
dlfind -30 -1
```

dllist

The `dllist` command displays the number of bytes and the number of records in the data logger of the local modem, along with the time stamps for the first and last record. Each time stamp comprises the year, month, day, hour, minute, and second the record was created. The total number of bytes and records from all the data sources together are displayed as well as those from the individual data sources. In addition, which memory, internal or the SDHC containing the stored data is indicated. The Local Bytes Stored command (ATBN) can also be used to display only the total number of bytes stored.

Syntax: dlist

Privilege: user

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

dlist

or

ATBN

dlrecs

The `dlrecs` command displays, in accordance with specified search parameters, the number of bytes and the number of records in the data logger of the local modem, along with the approximate time in seconds that it will take to transmit them to a remote modem at the current acoustic bit rate of the local modem. The acoustic bit rate is determined by the setting of the `TxRate` configuration parameter in the local modem, and the search parameters are the same as that for the `dlfind` command as described in "dlfind" on page 5-18.

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

Privilege: user

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

dlrecs @2011

As in the example above, all of the examples provided for the `dlfind` command as described in "dlfind" on page 5-18 apply in exactly the same way for the `dlrecs` command.

rdlfind

The `rdlfind` command causes a remote modem to extract and to transmit over the acoustic link its data logger records, up to 16 kbytes at a time, in accordance with specified search parameters. This command can only be entered on serial port 1. Except for the additional command parameter "addr," which is the remote modem address, these search parameters are the same as that for the `dlfind` command as described in "dlfind" on page 5-18.

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

Privilege: user

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

```
rdlfind 5 @2011
```

As in the example above, with the exception of the additional command parameter "addr," all of the examples provided for the `dlfind` command as described in "dlfind" on page 5-18 apply in exactly the same way for the `rdlfind` command.

rdllist

The `rdllist` command causes a remote modem to transmit over the acoustic link the number of bytes and the number of records in its data logger, along with the time stamps for the first and last record. This command can only be entered on serial port 1. Each time stamp comprises the year, month, day, hour, minute, and second the record was created. The only command parameter is "addr," which is the remote modem address.

Syntax: `rdllist <addr>`

Privilege: user

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

```
rdllist 5
```

rdlrecs

The `rdlrecs` command causes a remote modem to transmit over the acoustic link, in accordance with specified search parameters, the number of bytes and the number of records in its data logger, along with the approximate time in seconds that it will take to transmit them to the local modem at the current acoustic bit rate of the remote modem. This command can only be entered on serial port 1. The acoustic bit rate is determined by the setting of the TxRate configuration parameter in the remote modem, and except for the additional command parameter "addr," which is the remote modem address, the search parameters are the same as that for the `dlfind` command as described in "dlfind" on page 5-18.

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

Privilege: user

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

```
dlrecs @2011
```

As in the example above, with the exception of the additional command parameter "addr," all of the examples provided for the `dlfind` command as described in "dlfind" on page 5-18 apply in exactly the same way for the `rdlrecs` command.

dldump

The `dldump` command causes the local modem to extract and to display a selectable number of contiguous bytes from its data logger records that were input from a specific data source or all the sources beginning with a specific byte. The byte index is zero based, meaning that the first byte is byte 0, the second is byte 1, the third is byte 2, and so on. An optional "-x" modifier specifies that the data are to be displayed as ASCII hexadecimal values, otherwise the data are displayed as ASCII text. The data source is selected with the flags parameter which is described in "dlfind" on page 5-18. However, only one flag can be selected. If no flag is specified, data from all the data sources are included.

Syntax: `dldump [-x] <byte_index> <byte_count> [<flags>]`

Privilege: user

Example 1: To extract and display 1000 bytes beginning with the 500th byte from the data logger of the local modem, enter:

```
dldump 499 1000
```

Example 2: To extract and display 1000 bytes beginning with the 500th byte from the data logger of the local modem and display their ASCII hexadecimal values, enter:

```
dldump -x 499 1000
```

Example 3: To extract and display 1000 bytes beginning with the 500th byte from the data logger of the local modem that were received on serial port 1 and display their ASCII hexadecimal values, enter:

```
dldump -x 499 1000 p1
```

rdldump

The `rdldump` command causes a remote modem to extract and to transmit over the acoustic link a selectable number of contiguous bytes from its data logger records that were input from a specific data source or all the sources beginning with a specific byte. This command can only be entered on serial port 1. The byte index is zero based, meaning that the first byte is byte 0, the second is byte 1, the third is byte 2, and so on. Except for the additional command parameter "addr," which is the remote modem address, the search parameters are the same as that for the `dlldump` command as described in "dlldump" on page 5-24.

Syntax: `rdldump <addr> [-x] <byte_index> <byte_count> [<flags>]`

Privilege: user

Example 1: To extract and display 1000 bytes beginning with the 500th byte from the data logger records of the remote modem at address 5, enter:

```
rdldump 5 499 1000
```

Example 2: To extract and display 1000 bytes beginning with the 500th byte from the data logger records of the remote modem at address 5 and display their ASCII hexadecimal values, enter:

```
rdldump 5 -x 499 1000
```

Example 3: To extract and display 1000 bytes beginning with the 500th byte from the data logger records of the remote modem at address 5 that were received on serial port 1 and display their ASCII hexadecimal values, enter:

```
rdldump 5 -x 499 1000 p1
```

rdlblk

The `rdlblk` command provides the same results and is used in the same way as the `rdldump` command, but the data are transmitted more efficiently as less data overhead is required, and the amount of data is limited to 4096 bytes. This command can only be entered on serial port 1. The optional "-x" modifier, however, is not available, and therefore the data are displayed only as ASCII text. In addition, the byte index is zero based, meaning that the first byte is byte 0, the second is byte 1, the third is byte 2, and so on.

Syntax: `rdlblk <addr> <byte_index> <byte_count> [<flags>]`

Privilege: user

Example: To extract and display 1000 bytes beginning with the 500th byte from the data logger records of the remote modem at address 5, enter:

```
rdlblk 5 499 1000
```

dlclear

The `dlclear` command clears the contents of the data logger memory of the local modem.

Syntax: `dlclear`

Privilege: `user`

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

```
dlclear
```

The modem responds with:

```
Are you sure? [y/n]:
```

If you are sure, enter:

```
y
```

rdlclear

The `rdlclear` command clears the contents of the data logger memory of a remote modem and can only be entered on serial port 1. The only command parameter is "addr," which is the remote modem address.

Syntax: `rdlclear <addr>`

Privilege: `user`

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

```
rdlclear 5
```

The modem responds with:

```
Are you sure? [y/n]:
```

If you are sure, enter:

```
y
```

ATBC

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

Syntax: `ATBC`

Privilege: `user`

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

ATBC

AT\$BCn

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

Syntax: AT\$BCn

Privilege: user

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

AT\$BC5

AT\$BEn

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

Syntax: AT\$BEn

Privilege: user

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

AT\$BE5

AT\$BDn

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

Syntax: AT\$BDn

Privilege: user

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

AT\$BD5

Dual Serial Port Option

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

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

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

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

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

InputMode Configuration Parameter

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

Dual Serial Port Data Logging

When a modem is in Datalogger mode with @InputMode=Dual, data can be input to either serial port 1 or serial port 2, or both. The data will be stored in the data logger of the modem, and data records will be generated in accordance with the setting of the LogMode configuration parameter which is described below. Each record will be tagged with metadata which includes, among other information, a flag that indicates which serial port the data were input to. This flag can be used when retrieving the data to separate the data from the two serial ports. For more information about the metadata flags, refer to "Data Logger Commands" on page 5-18. Data stored in the data logger are partitioned into discrete records in accordance with the setting of the LogMode configuration parameter for which three settings are available:

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

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

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

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

Dual Online Mode

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



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

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

TPortMode Configuration Parameter

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



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

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

TportMode=InpMode

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

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

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

TportMode=AlwaysOn

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

SrcP1 and SrcP2 Configuration Parameters

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

Dst1, Dst2, Dst3, and Dst4 Configuration Parameters

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

Flow Control

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

Default Transport Addressing

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

Default Transport Addressing—Topside and Subsea Modems

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

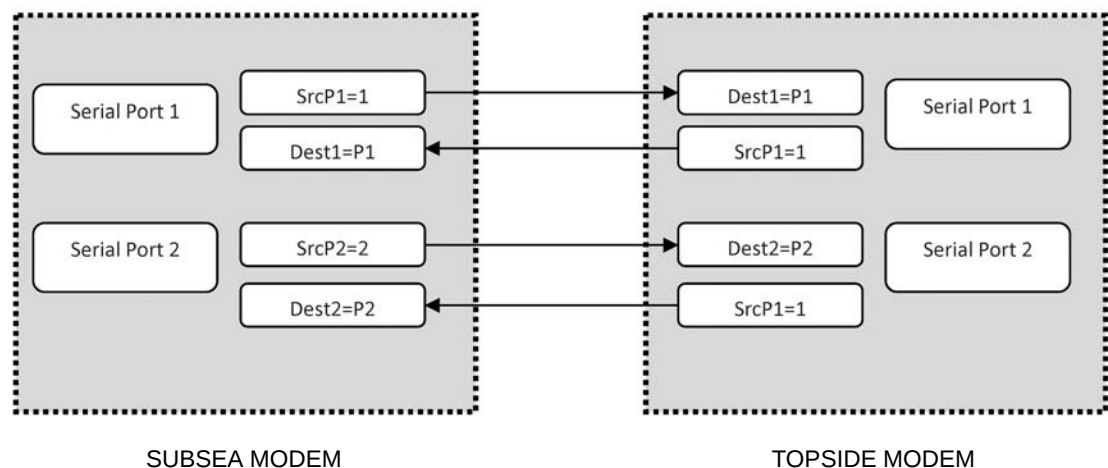


Figure 5-1 Default Transport Addressing—Topside and Subsea ATM-900 Series Acoustic Telemetry Modems

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

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

Default Transport Addressing—UDB-9400 and Subsea Modems

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

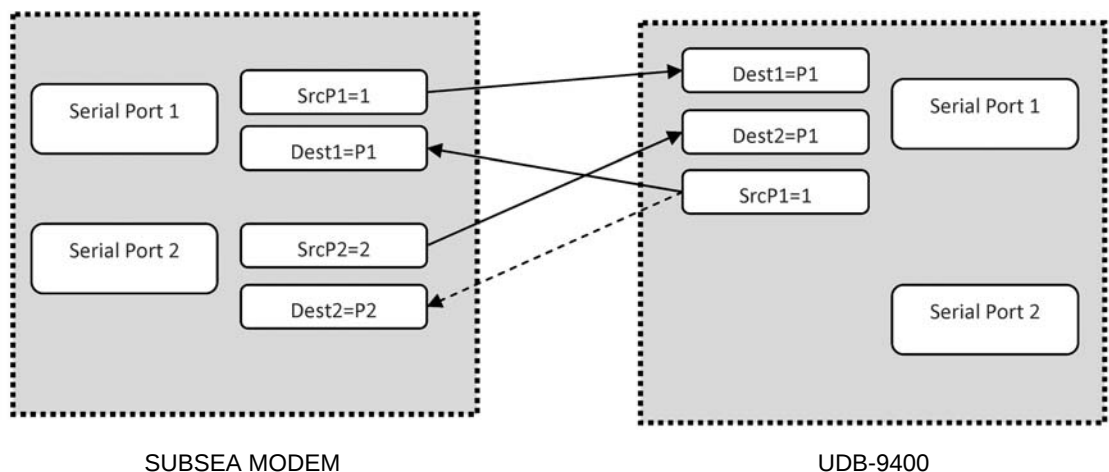


Figure 5-2 Default Transport Addressing—Topside ATM-900 Series and Subsea ATM-900 Series Acoustic Telemetry Modems

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

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

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

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

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

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

Backward Compatibility

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

Lowpower State

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

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



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



NOTE When the modem transitions into the lowpower state, it will take approximately 30 seconds for the power consumption to fall to that specified in the lowpower state power specification stated in Section 2, "Specifications."

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

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

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

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

Waking up a Modem

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

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

Lowpower State Commands

The following lowpower state commands are available:

- ATL
- ATH

ATL

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

Syntax: ATL

Privilege: user

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

ATL

ATH

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

Syntax: ATH

Privilege: user

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

ATH

File System

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

Flash File System

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

External SDHC Card

The external SD card (SD) mount point maps to a FAT32 file system on an external secure digital (SD) or secure digital high capacity (SDHC) card. This mount is present only when the SD Datalogger option ("-D") is installed which includes a formatted SDHC card and its carrier board. The use of the FAT32 file system allows the card to be removed from the modem and read directly on a PC. An SD or SDHC card must be formatted either on the PC before being reinstalled into the modem or with the `format` command after it is reinstalled. The format must be FAT32 with 4096-byte cluster sizes. The modem should always be deployed with a newly formatted SDHC card. If formatting on a PC, then the format must be FAT32. The card will be mounted automatically when the modem is powered up, and the following line will be added to the banner message:

```
SD V1.4 on slot 0
```

In addition, the `umount` command must be executed on a powered up modem before removing the card, and if a new card is inserted in a modem that is powered up, the `mount` command must be run for the card to be recognized.

System Devices

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

File Attributes

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

The flags are the following:

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

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

drwx user

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

Directories

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

8-Bit Versus 16-bit Wide Files

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

Redirection

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

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

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

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

- < Redirects the input from the named device.

Examples are the following:

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

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

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

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

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

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

To write the text "My modem data." and save it to the file named "mydatafile1," enter:

```
echo "My modem data." > /mydatafile1
```

Tab Completion for File System Names

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

File System Commands

The following file system commands are available:

- format
- mount
- umount
- cat
- cp
- df
- ls
- mkdir
- mv
- rm
- rmdir
- chown
- chmod
- echo
- rb
- rx
- rz
- sb
- sx
- sz

format

The `format` command clears all data and reinitializes the directory structure of the specified path. If the path is SD, then the external SD or SDHC card is cleared. If the path is FFS, then the entire modem file system is cleared, including the `factcfg.ini`, `diag.rom`, `standard.ini`, and `modem.rom` files. The feature keys will *not* be lost. To reload these files, refer to "Reloading Software Applications" on page 4-26.

Syntax: `format <path>`

Privilege: `update`

Example 1: To format the SDHC card, enter:

```
format sd
```

If the card is mounted, then the modem will respond with:

```
Are you sure? ['y' to proceed]
```

```
If you are sure, enter:
```

```
y
```



WARNING Formatting the flash file system will will erase the entire modem file system.

Example 2: To format the flash file system:

```
format FFS
```

The modem will respond with:

```
Are you sure? ['y' to proceed]
```

```
If you are sure, enter:
```

```
y
```

mount

The `mount` command tells the modem to make the files and directories on an SD or SDHC card available to the modem's file system by way of the `/sd/` path.

Syntax: `mount <path> [0|1]`

Privilege: `user`

Example 1: To install the first available card, enter:

```
mount sd
```

If a card is inserted in slot 0, the modem will respond with:

```
SD card mount complete
```

```
SD v1.4 on slot 0
```

```
OK
```

If a card is inserted in slot 1, the modem will respond with:

```
SD card mount complete
```

```
SD v1.4 on slot 1
```

```
OK
```

Example 2: To specifically install a card in slot 1, enter:

```
mount sd 1
```

If a card is inserted in slot 1, the modem will respond with:

```
SD card mount complete
SD v1.4 on slot 1
OK
```

If there is no card inserted in slot 1, the modem will respond with:

```
SD v1.4 no card
Error
```

umount

The `umount` command tells the modem to make the SDHC card ready to remove from the modem. The SD mount point is the only mount point that can be removed.

Syntax: `umount <path>`

Privilege: `user`

Example 1: Before removing an SDHC card from its carrier board, first enter:

```
umount sd
```

The `/sd/` path will no longer be available.

cat

The `cat` (concatenate) command displays the contents of a specified file. An optional `"-n"` modifier adds a line number to each line, and an optional `"-c"` or `"-l"` modifier enables a range of characters or lines, respectively, to be specified. This command can also be used as an easy way to create a text file or to add to an existing one. To do this, enter the command name followed by a space, the `">"` or the `">>"` character, the path, and the file name. Using `">"` will replace the contents of the named file with all subsequent text entered after the prompt. If the file does not exist, it will be created automatically. Using `">>"` will add all subsequent text entered after the prompt to the existing named file. To end either process, enter `Ctrl+D`.

Syntax: `cat [-n|(-c|l)(<num>|([<from>]:<to>]))] {{<path>/}<file>} [> <file>]`

Privilege: `user`

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

```
cat /mydatafile1
```

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

```
cat /ffs/mylogfile1
```

Example 3: To display the contents of the file named "mylogfile1" in the flash file system and include line numbers, enter:

```
cat -n /ffs/mylogfile1
```

Example 4: To display only the 2nd through the 10th line of the contents of the file named "mylogfile1" in the flash file system, enter:

```
cat -2:10 /ffs/mylogfile1
```

Example 5: To display only the 20th line of the contents of the file named "mylogfile1" in the flash file system, enter:

```
cat -l20 /ffs/mylogfile1
```

Example 6: To display the 20th line through the last line of the contents of the file named "mylogfile1" in the flash file system, enter:

```
cat -l20: /ffs/mylogfile1
```

Example 7: To display only the 50th through the 100th character of the contents of the file named "mylogfile1" in the flash file system, enter:

```
cat -c50:100 /ffs/mylogfile1
```

Example 8: To write the text "My modem data." and save it to the file named "mydatafile2" in the root directory, enter:

```
cat > /mydatafile2
```

Next, enter:

```
My modem data.
```

Then enter:

```
Ctrl+D
```

cp

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

Syntax: `cp <src path> <dst path>`

Privilege: user

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

```
cp /mydatafile1 /mydatafile2
```

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

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

df

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

Syntax: `df [<mount>]`

Privilege: `user`

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

```
df
```

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

```
df /ffs
```

ls

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

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

Privilege: `user`

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

```
ls
```

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

```
ls -l /ffs
```

mkdir

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

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

Privilege: `user`

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

```
mkdir /datafiles
```

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

```
mkdir /ffs/logfiles
```

mv

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

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

Privilege: `user`

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

```
mv /mydatafile2 /mydatafile3
```

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

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

rm

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

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

Privilege: `user`

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

```
rm /mydatafile1
```

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

```
rm /ffs/mylogfile2
```

rmmdir

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

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

Privilege: user

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

```
rmmdir /datafiles
```

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

```
rmmdir /ffs/logfiles
```

chown

The `chown` command changes the privilege level of a file.

Syntax: `chown [safe|user|update|factory|diag|sys] <path>`

Privilege: user

Example : To change the privilege level of the file named "mydatafile1" in the root directory to safe, enter:

```
chown safe /mydatafile1
```

chmod

The `chmod` command changes the permission properties of a file. The file must be at or below the command privilege level. For a list of permission properties and their definitions, refer to "File Attributes" on page 5-40.

Syntax: `chmod {+|-}[rwx]} <path>`

Privilege: user

Example : To change the permission properties of the file named "mydatafile1" in the root directory such that it can be read from but not written to or deleted, enter:

```
chmod +r -w /mydatafile1
```

echo

The `echo` command echos back entered text following the command. To preserve case, enclose entered text in quotes (" "). An optional "-n" modifier will cause the carriage return and line feed to be suppressed. The text can also be redirected to a file and saved to the file by using ">" followed by a space and a file name. The contents of the file will be replaced with the new text. If the file does not exist, it will be created automatically. Using ">>" will append the text to the contents of an existing file.

Syntax: `echo [-n] <text> [> <file> ]`

Privilege: user

Example : To write the text "My modem data." and save it to the file named "mydatafile1," enter:

```
echo "My modem data." > /mydatafile1
```

The use of the quotes (" ") preserves the case.

rb

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

Syntax: `rb [-f]`

Privilege: user

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

```
rb
```

The modem responds with:

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

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

rx

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

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

Privilege: user

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

```
rx /datafile1
```

The modem responds with:

```
rx: ready to receive /datafile1
```

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

rz

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

Syntax: **rz** [-f]

Privilege: user

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

```
rz
```

The modem responds with:

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

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

sb

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

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

Privilege: user

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

```
sb /datafile1 /datafile2
```

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

sx

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

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

Privilege: user

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

```
sx /datafile1
```

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

SZ

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

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

Privilege: `user`

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

```
sz /datafile1
```

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

Configuration System

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

Configuration Files

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

Standard.ini File

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

Factcfg.ini File

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

Configuration Parameter Sections

There are up to 14 configuration parameter sections in the standard.ini and factcfg.ini files, each containing a group of related configuration parameters:

- Version
- Serial
- System
- Coproc
- Recorder
- Datalog
- Modem
- Release
- Transport
- Test
- Xpnd
- Nav
- Ain
- Pressure

The Ain and Pressure sections are available only if either one or both the Analog Input and Depth Sensor options are installed. Entering @ will display a list of these sections. To display a list of the configuration parameters in a specific section, enter @ followed by the section name. For example, to display a list of the configuration parameters in the Modem section, enter @modem. The parameters are displayed as shown in Figure 5-3.

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

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

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

The columns in the list are defined as follows:

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

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

Tab Completion for Configuration System

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

Configuration System Commands

The following configuration system commands are available:

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

@

The @ command lists all of the configuration parameter sections.

Syntax: @

Privilege: user

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

@

cfg all

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

Syntax: `cfg all`

Privilege: `user`

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

```
cfg all
```

@<section name>

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

Syntax: `@<section name>`

Privilege: `user`

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

```
@modem
```

@<parameter name>

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

Syntax: `@<parameter name>`

Privilege: `user`

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

```
@txpower
```

@<parameter name>=<value>

The @<parameter name>=<value> command sets the named parameter to the desired setting. Many configuration parameters have enumerations which allow entry of a number for the setting. For example, the TxPower configuration parameter can be set to "3" for -15 db or to "-15db" for -15 db. Shown in Figure 5-3 on page 5-55 are the available settings for the TxPower configuration parameter.

Syntax: @<parameter name>=<value>

Privilege: user

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

```
@txpower=3
```

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

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

cfg load

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

Syntax: `cfg load [<file>]`

Privilege: user

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

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

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

```
cfg load
```

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

```
cfg store
```

cfg store

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

Syntax: `cfg store [<file>]`

Privilege: `user`

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

```
cfg store /ffs/newstandard1
```

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

```
cfg store
```

factory_reset

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

Syntax: `factory_reset`

Privilege: `user`

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

```
factory_reset
```

or

```
AT&F
```

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

```
cfg store
```

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

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

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

Privilege: user

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

```
#5 @TxPower=-9db
```

#<address> cfg store

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

Syntax: #<address> cfg store

Privilege: user

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

```
#5 cfg store
```

Transponder Operation

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

Required Configuration Parameter Settings

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

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

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

RxFreq. The RxFreq configuration parameter sets the receive frequency of the modem. It is set in 250-Hz increments within the frequency band of the modem. The RxFreq setting should be the same as the transponder transmit frequency unless the LBL/Multi-Receive feature key is installed in which case it does not apply. The default setting is 11000 for 11,000 Hz.

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

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

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



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

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

Transponder Operation Commands

The following transponder operation command is available:

- ATNm

ATNm

The Transpond (ATNm) command causes the local modem to display the two-way travel time in milliseconds from the modem to a transponder. The interrogation frequency m of the modem should be set to an integer value in hertz in 250-Hz increments that is within the frequency band of the modem. This frequency must be the same as the receive frequency of the transponder. If m is set for a frequency outside of this band, the modem will still transmit at the set frequency but at a reduced source level. If the LBL/Multi-Receive feature key is *not* installed, the @RxFreq configuration parameter must be set to the reply frequency of the transponder. This frequency should also be within the frequency band of the modem.

Syntax: ATNm

Privilege: user

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

If the LBL/Multi-Receive feature key is *not* installed, set the RxFreq configuration parameter to 14000 by entering:

```
@rxfreq=14000
```

Set the TAT configuration parameter to 150 ms by entering:

```
@TAT=150
```

Set the RxToneDur configuration parameter to 12 by entering:

```
@rxtonedur=12
```

Set the TxToneDur configuration parameter to 12 by entering:

```
@txttonedur=12
```

Set the RxThresh configuration parameter to 15 by entering:

```
@rxthresh=15
```

Set the RxLockout configuration parameter to 50 by entering:

```
@rxlockout=50
```

Set the AcRspTmOut configuration parameter to 10 by entering:

```
@acrsptmout=10
```

Then enter:

```
ATN9000
```

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

Set the RxFreq configuration parameter to 12500 by entering:

```
@rxfreq=12500
```

Set the TAT configuration parameter to 30 by entering:

```
@TAT=30
```

Set the RxToneDur configuration parameter to 10 by entering:

```
@rxtonedur=10
```

Set the TxToneDur configuration parameter to 10 by entering:

```
@txttonedur=10
```

Set the RxThresh configuration parameter to 10 by entering:

```
@rxthresh=10
```

Set the RxLockout configuration parameter to 100 by entering:

```
@rxlockout=100
```

Set the AcRspTmOut configuration parameter to 13 by entering:

```
@acrsptmout=13
```

Then enter:

```
ATN10000
```

LBL/Multi-Receive Option

The LBL/Multi-Receive option is enabled with the purchase and installation of a feature key. This feature is already included in the UDB-9400-M Series Acoustic Telemetry Modems. It is not included and is not optionally available for the UDB-9400-E Universal Deck Box. The LBL/Multi-Receive option enables a modem to be operated with other modems in an all-modem long baseline (LBL) acoustic positioning system that uses broadband triggered chirp transmissions and tonal responses, or as a single modem with multiple transponders in an all-tonal based configuration. The all-modem based configuration provides more reliable operation than the all-tonal, as the reception of broadband chirp transmissions are more reliable than that of tones.

Long Baseline Acoustic Positioning Concept

A typical long baseline acoustic positioning system uses an acoustic transducer that transmits an interrogation pulse to an array of three or more transponders which upon receiving the interrogation pulse transmit a reply. The replies are received by the interrogation transducer and the two-way travel times between the transmitted interrogation pulse and the received replies are measured. The times are used to calculate the ranges to each of the transponders based on the known speed of sound in water. If the transponder baselines, which are the distances between them, and their depths, along with the interrogating transducer's depth, are known, the location of the interrogating transducer with respect to the transponder array can be calculated. Although only three transponders are required to determine the location of the interrogating transducer, a fourth is often used to improve accuracy and to provide some redundancy in case one of the replies is not received or does not occur.

Broadband Triggered LBL Configuration

In an all-modem based LBL configuration, a local modem is used to interrogate an array of remote modems with a broadband chirp interrogation and receive their replies. The local modem can be either an ATM-900 Series Acoustic Telemetry Modem with the LBL/Multi-Receive option installed or a UDB-9400-M Acoustic Telemetry Modem. The remote modems must be configured as transponders, each with a different reply frequency, which should be set within the frequency band of the modem in 250-Hz increments. Therefore up to 21 remote modem transponders can be used if an ATM-900

Series Acoustic Telemetry Modem operating in the LF, MF, or Band C frequency band is used as the interrogator. The same is true for a UDB-9400-M Acoustic Telemetry Modem operating in the MF or Band C frequency band. Up to 37 remote modem transponders can be used in an LF system with a WLF (wide low frequency) UDB-9000-M Acoustic Telemetry Modem as the interrogator, as this modem operates in the wider 7–16 kHz band versus the LF band's 9–14 kHz. However, any remote modem transponder reply frequencies set to between 7 kHz and 9 kHz, and between 14 kHz and 16 kHz, will be transmitted at a lower source level.

For an all-modem based LBL configuration, the following configuration parameters must be correctly set for the local modem:

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

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

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

Configuring a Modem as a Remote Modem Transponder

Any ATM-900 Series Acoustic Telemetry Modem with the LBL/Multi-Receive option installed can be configured as a remote modem transponder. However, the TAT configuration parameter is not used for broadband triggered LBL responses and is set to a fixed delay of 600 ms from the start of the broadcast chirp to the start of the reply. Configuring the modem as a remote modem transponder requires the following configuration parameters to be correctly set:

RespFreq. The RespFreq configuration parameter sets the reply frequency of the modem. The frequency should be set to an integer value in hertz in 250-Hz increments that is within the frequency band of the modem. The default setting is modem model specific.

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

LBLmode. The LBLmode configuration parameter setting enables or disables the modem as a remote modem transponder. A setting of Tone causes the modem to reply to a broadband chirp transmission after a fixed 600-ms turn-around-time. A setting of Listen causes the modem to passively listen for the broadband chirp transmissions from an interrogating modem and the replies from the remote modem transponders. A setting of Off disables the modem as a remote transponder.

The Listen setting for the LBLmode configuration parameter enables an ATM-900 Series Acoustic Telemetry Modem with the LBL/Multi-Receive option installed or an UDB-900-M Acoustic Telemetry Modem to passively listen for both the broadband chirp transmission of an interrogating modem *and* the replies from the remote modem transponders. When a broadcast chirp transmission is received, the modem displays the time of day at which the transmission was received followed by the elapsed time to when each reply was received less the 600-ms turn-around-time. For example, a broadcast chirp transmission below was received at 11:37:03.5333.

```
Broadcast RX time:11:37:03.5333
Start Transponder Mode
09.00 kHz  430.3 ms Detect=034 SNR=15.31
11.00 kHz  438.3 ms Detect=031 SNR=14.91
10.00 kHz  788.3 ms Detect=021 SNR=13.22
End Transponder Mode
```

In addition to the elapsed time, the signal detect and the signal-to-noise ratio is displayed. Detect is the actual number of standard deviations that the detected signal has risen above the background noise. The minimum number of standard deviations that the signal must rise above the noise for it to be marked as a received reply is set by the RxThresh configuration parameter. The signal-to-noise level is defined to be $10\log(\text{detect})$.

Broadband Triggered LBL Configuration Commands

The following all-modem based LBL configuration commands are available:

- ATNL
- rxadj

ATNL

The Broadband Chirp Interrogate (ATNL) command causes the local modem to display the two-way travel times from the modem to all remote modem transponders from which it receives replies. The local modem transmits a broadband chirp interrogation pulse and then begins listening for tonal replies. It will listen for the replies for the period set by the AcRspTmOut configuration parameter and display the two-way travel times, with the 600-ms turn-around-time removed, to each transponder from which it receives a reply, along with the detect values and signal-to-noise ratios of the received signals. After this period, the modem will go back into Command mode.

Syntax: ATNL

Privilege: user

Example 1: To transmit a broadband chirp interrogation pulse and display the two-way travel times to each transponder along with the detect value and signal-to-noise levels of the received signals, enter:

ATNL

As an example where two reply frequencies are received, one at 11.00 kHz and one at 12.00 kHz, the modem will respond with:

```
Start Transponder Mode
11.00 kHz  100.7 ms Detect=020 SNR=13.01
12.00 kHz  131.4 ms Detect=023 SNR=13.61
End Transponder Mode
```

rxadj

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

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

Privilege: user

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

```
rxadj
```

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

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

```
rxadj 10.5 .2
```

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

```
rxadj reset
```

Example 4: To save all the receive thresholds:

```
rxadj save
```

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

```

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

```

Figure 5-4 Example List of Receive Threshold Adjustments

All-Tonal Based LBL Configuration

In an all-tonal based LBL configuration, a local modem is used to interrogate an array of transponders with a tonal interrogation pulse. The local modem can be either an ATM-900 Series Acoustic Telemetry Modem with the LBL/Multi-Receive option installed or a UDB-9400-M Acoustic Telemetry Modem. In this configuration the modem functions similar to that described in "Transponder Operation" on page 5-61. However, the modem can receive more than one reply. The modem also requires that the same configuration parameters be correctly set. Any Teledyne Benthos manufactured acoustic transponders or releases can be used in the transponder array. So can transponders made by manufacturers other than Teledyne Benthos.

All-Tonal Based LBL Configuration Commands

The following all-tonal based LBL configuration commands are available:

- ATNm
- rxadj

The Transpond (ATNm) command is the same command available for the transponder commands as described in "Transponder Operation Commands" on page 5-63. The rxadj command is the same command available for the all-modem based configuration and is described in "Broadband Triggered LBL Configuration Commands" on page 5-68.

Analog Input Option

The Analog Input option is available for the ATM-903 and ATM-900 Board Sets only. This option, which adds an Analog Input board to the board set, provides six analog inputs, Channels 1 to 6, for connecting to external sensors. The channel inputs are as follows:

Channel 1:	4-20 mA or 0–10 VDC
Channel 2:	4-20 mA or 0–5 VDC
Channel 3:	4-20 mA
Channel 4:	4-20 mA
Channel 5:	Internal bridge completion for a single external resistor type sensor powered by 22 VDC maximum
Channel 6:	Four-wire external bridge type sensor powered by 5 VDC

All of the 4–20 mA inputs conform to the SIIS (Subsea Instrumentation Interface Standardization) 4–20 mA two-wire loop input standard. All the inputs are calibrated to 0.5% of full scale and are protected against electrostatic discharge (ESD), reverse voltage, overvoltage, and include 40-ma current limiting.



NOTE For instructions on how to connect sensors to the Analog Input board, refer to "Connecting External Sensors to the Optional Analog Input Board" on page 4-20.

Polling

Any one or more of the analog Channels 1 to 6 can be polled, read and recorded to the data logger memory on a scheduled basis. When polling, which occurs at a rate determined by the setting of the `AinPollRate` configuration parameter, each channel, one at a time, is turned on, and after a delay as determined by the setting of the `Ain<Channel No.>StrtDly` configuration parameter, is read and recorded the number of times specified by the setting of the `Ain<Channel No.>Nmeas` configuration parameter and then shut off. In each case `<Channel No.>` is the analog Channel number 1 to 6. If `AinPollRate=0`, then polling is disabled; if `Ain<Channel No.>Nmeas=0`, then the channel is not read. The time between successive readings for each channel is determined by the setting of the `Ain<Channel No.>RptDly` configuration parameter.

Analog Input Commands

The following analog input command is available:

- `analogin`

analogin

The `analogin` command selects one of the six analog input channels, turns it on, reads and records it to the data logger memory, and then turns it off. An optional "nmeas" modifier specifies how many readings are to be made, an optional "iterate_time" modifier specifies the time in seconds between successive readings, and an optional "start_delay" modifier specifies when the first reading is to be made after turning on the channel. If no modifiers are entered, all the channels are turned on, immediately read and recorded to the data logger memory once, and then turned off. Refer to Table 5-1 for the default and allowable settings for the optional modifiers.

Table 5-1 Analogin Command Ranges for Optional Modifiers

MODIFIER	DEFAULT	RANGE
nmeas	1	1–10
iterate_time	1	0.05–10 sec (0.05-sec increments)
start_delay	1	0–10 sec (0.05-sec increments)

Syntax: `analogin [<chan> [nmeas> [<iterate_time> [<start_delay>]]]]`

Privilege: user

Example 1: To read Channel 2 four times in 2-second intervals after a start delay of 5 seconds, enter:

```
analogin 2 4 2 5
```

The modem responds, for example, with:

```
[2] 2001 2001 2002 2001
```

Example 2: To read all the channels once, enter:

```
analogin
```

The modem responds, for example, with:

```
[1] 2001
[2] 2010
[3] 1998
[4] 1996
[5] 2001
[6] 2004
```

Depth Sensor Option

The Depth Sensor option is available for the and SM-976 SMART Modem only. This option includes a factory calibrated and installed pressure transducer which measures the depth of the modem and transmits this information along with range when a Range and Depth command is sent to the modem or periodically records the depth to the data logger memory. This option also includes an Analog Input board, the same board as provided with the Analog Input option as described in "Analog Input Option" on page 5-71. The standard depth sensor measures depths to 1000 meters. Other depth ranges are optionally available.

Depth Sensor Commands

The following depth sensor command is available:

- ATRDn



NOTE Both polling and the **analogin** command can be used with the Depth Sensor option as described in "Analog Input Option" on page 5-71. All the command modifiers and configuration parameters associated with these functions also apply. However, the pressure transducer is factory connected to analog Channel 6, therefore Channel 6 must be used as the analog input channel.

ATRDn

The Range and Depth command causes the local modem to display the range from the local modem to the remote modem and the depth of the remote modem at address n. The displayed range and depth are in meters, each with a resolution of 0.1 meters.

Syntax: ATRDn

Privilege: user

Example 1: To display the range from the local modem to the remote modem and the depth of the remote modem at address 5, enter:

ATRDn

The modem responds, for example, with:

Depth 22.5 m
Range 0 to 5 : 109.4 m

Acoustic Recorder Option

The Acoustic Recorder option is enabled with the installation of a feature key. This feature, which includes the SD Datalogger option and is available for ATM-900 Series Acoustic Telemetry Modems only, enables the recording of received signals that are within the modem's operating frequency band as basebanded complex data. The data are recorded on up to two 32-GB SDHC cards at a 10240-Hz sampling rate as stereo WAV files in 16-bit format with the left channel as the real part and the right channel as the imaginary part. Up to two weeks of data can be continuously recorded.

Automatic gain control (AGC) is also recorded in the least significant bits of the left channel as a serial bit stream with the most significant bits sent first with two start bits. Each value is an 8-bit number representing a gain between 0 and 90 that applies to the block of 16 samples containing it. Similar coding is used on the right channel to identify the data as transmitted or received.

Generating Basebanded Signals

The Acoustic Recorder option employs a heterodyning scheme to shift the passband signals received by the modem to basebanded signals, where the passband center frequency is converted to 0 Hz, or DC, and the bandwidth is 5120 Hz. The basebanded signals enable the use of a relatively low 10240 Hz complex sampling frequency to fully reconstruct the original signal components and amplitude, without aliasing, and make the most efficient use of the available memory when recording. The heterodyning process mixes the received signals with the modem's passband center frequency and applies a lowpass filter to extract only the basebanded signals.

Mathematically describing the heterodyning scheme first requires that a time varying waveform $s(t)$ received by the modem be expressed as

$$s(t) = a(t)\cos(2\pi f_c t) \quad (1)$$

The variables for this equation are defined as follows:

- f_c The passband center frequency of the modem, or 11,520 Hz for a modem operating in the LF frequency band, 18,560 Hz for the MF frequency band, and 25,120 Hz for Band C.
- $a(t)$ Narrow band waveform with bandwidth w , where w must be much less than f_c . In this case w is 5120 Hz.
- t Time in seconds.

Using Euler's identity the equation can be rewritten with complex exponentials as

$$s(t) = \frac{1}{2} \times a(t) \times \left[e^{i2\pi f_c t} + e^{-i2\pi f_c t} \right] \quad (2)$$

The Fourier transform of $s(t)$ is $S(F)$ which can be visualized as shown in Figure 5-5.

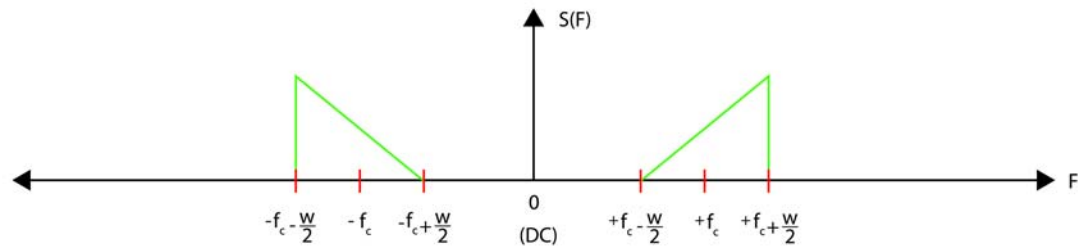


Figure 5-5 Spectral Plot $S(F)$ of Waveform $s(t)$

To shift $s(t)$ to its baseband equivalent, it is mixed with an in-phase (I) and quadrature (Q) mixer. The I/Q mixer multiplies both an in-phase sinusoid at a frequency of f_c and a quadrature sinusoid which also has a frequency of f_c , but it is phased shifted by 90° with $s(t)$. Since a sine shifted by 90° is a cosine, the mixing signal can be expressed as

$$\cos(2\pi f_c t) - i \sin(2\pi f_c t)$$

Again, using Euler's identity these terms can be rewritten as

$$e^{-i2\pi f_c t}$$

Therefore, to perform the mixing or heterodyning process, $s(t)$ is multiplied by this expression to obtain

$$x(t) = s(t) \times e^{-i2\pi f_c t} \quad (3)$$

where $x(t)$ is the desired output. Substituting for $s(t)$ from Equation (2) leaves

$$x(t) = \frac{1}{2} \times a(t) \times \left[e^{i2\pi f_c t} + e^{-i2\pi f_c t} \right] \times e^{-i2\pi f_c t} \quad (4)$$

which simplifies to

$$x(t) = a(t) + a(t) \times e^{-i2\pi 2f_c t} \quad (5)$$

The Fourier transform of $x(t)$ is $X(F)$ which can be visualized as shown in Figure 5-6. This plot shows that $s(t)$ has been shifted such that f_c is now at 0 Hz. However, an extra frequency component is now included with center frequency $2f_c$.

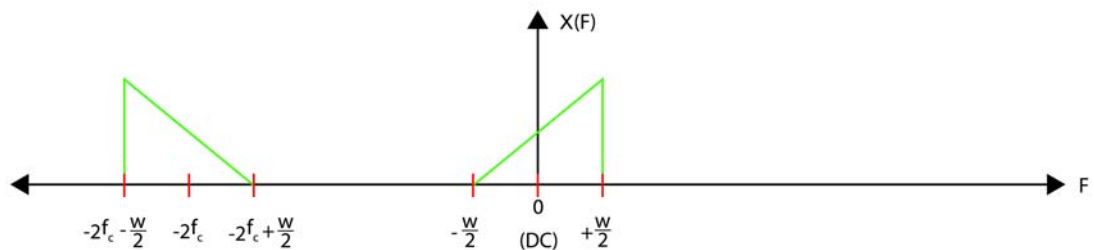


Figure 5-6 Spectral Plot $X(F)$ of Baseband Waveform $x(t)$

Next, $x(t)$ is passed through a low-pass filter to remove the frequency component at $2f_c$. This leaves the desired baseband waveform $a(t)$, centered at DC as

$$x(t) = a(t) \quad (6)$$

The Fourier Transform of $x(t)$ is $X(F)$, which can be visualized as shown in Figure 5-7.

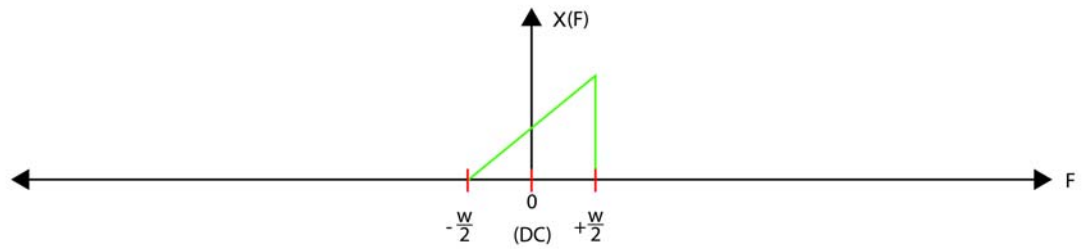


Figure 5-7 Low Pass Filtered Spectral Plot $X(F)$ of Baseband Waveform $x(t)$

Acoustic Recorder Commands

The following acoustic recorder commands are available:

- record
- record on
- record off

Record

The `Record` command displays the on or off status of the acoustic recorder. If on, the time and date at which it was started is also displayed.

Syntax: `record`

Privilege: `user`

Example: To display the status of the acoustic recorder, enter:

```
record
```

Record on

The `Record on` command starts the acoustic recorder and indicates the time and date at which it was started. Data are recorded in contiguous .WAV files to the SDHC card as stereo WAV files in 16-bit format with the left channel as the real part and the right channel as the imaginary part. Each file contains 60 seconds of data and named in accordance with the setting of the NameFormat configuration parameter. During recording, a log file with the same name as the first file, but with a .LOG extension is recorded to the flash file system. This file contains high resolution timing information about the start and stop times of each .WAV file. When recording ends, this file is copied to the SDHC card. If power is lost before the recording session stops, the .LOG file will be left in the flash file system.

The acoustic recorder can also be started when an SDHC card is mounted as determined by the setting of the RecMode configuration parameter. If the Acoustic Recorder is on, the LogStore configuration parameter cannot be set to 1 (SDHC). If an attempt is made to set it to 1 (SDHC), the message "SD card is in use for logger" will be displayed.

Syntax: `record on`

Privilege: `user`

Example: To start the acoustic recorder, enter:

```
record on
```

Record off

The `Record off` command stops the acoustic recorder and indicates the time and date at which it was stopped. The acoustic recorder can also be stopped when the idle time expires as determined by the `RecMode` configuration parameter.

Syntax: `record on`

Privilege: `user`

Example: To stop the acoustic recorder, enter:

`record off`

Setting up for Data Recording

Setting up for data recording requires that the SDHC card or cards be formatted.

To set up for data recording:

1. Connect the PC to the POWER/SERIAL connector of the modem if the modem is a subsea modem, or to J7 of the DSP board if the modem is a modem board set.
2. Set the terminal program baud rate to 9600.
3. Turn on the modem and wait for the command prompt.
4. Insert the SDHC card or cards into the slots on the SDHC board.
5. At the command prompt enter `setpriv update`.
6. Enter `mount sd 0` and wait for the message "SD card mount complete" to be displayed.
7. Enter `format sd` and then confirm by entering "y."
8. If a second SDHC card is to be formatted, enter `umount sd` and continue with Step 9, otherwise go to Step 11.
9. Enter `mount sd 1` and wait for the message "SD card mount complete" to be displayed.
10. Enter `format sd` and then confirm by entering "y."
11. Enter `reboot` to restart the modem and wait for the command prompt to be displayed.
12. Enter `df sd` to confirm the capacity of the card or cards and that there is 0% capacity used.

Removing an SDHC Card with Recorded Acoustic Recorder Data

If an SDHC card is to be removed, and it contains acoustic recorder data, the acoustic recorder should first be stopped.

To remove an SDHC card with recorded acoustic recorder data:

1. Enter `record off`.
2. Enter `umount sd`.
3. Remove the SDHC card.

Reading Recorded Files Using Matlab Utilities

Two Matlab utilities are included with all ATM-900 Series Acoustic Telemetry Modems and the UDB-9400 Universal Deck Box:

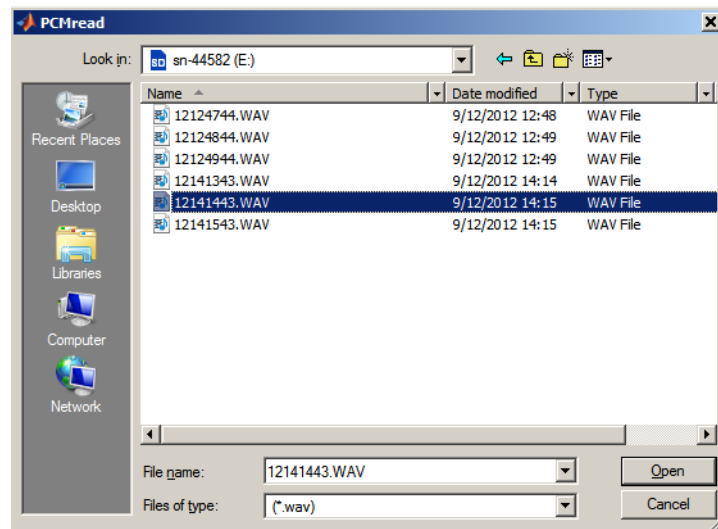
- `logread.m`
- `pcmread.m`

A third utility, `lin_resample.m`, is also provided to support the other two. It cannot be run directly.

The `pcmread.m` utility enables the reading of .WAV files individually. The `logread.m` utility creates a series of one minute files using the .LOG file created during a recording session to read all of the .WAV files as a batch.

Reading Individual .WAV Files

The Matlab `pcmread.m` utility reads individual .WAV files and provides an array of complex values representing the signals at the modem's transducer. The utility may be run with a file hydrophone sensitivity value or with a list of .WAV files to process, or both. In the absence of a file, a dialog box will open enabling the selection of the file:

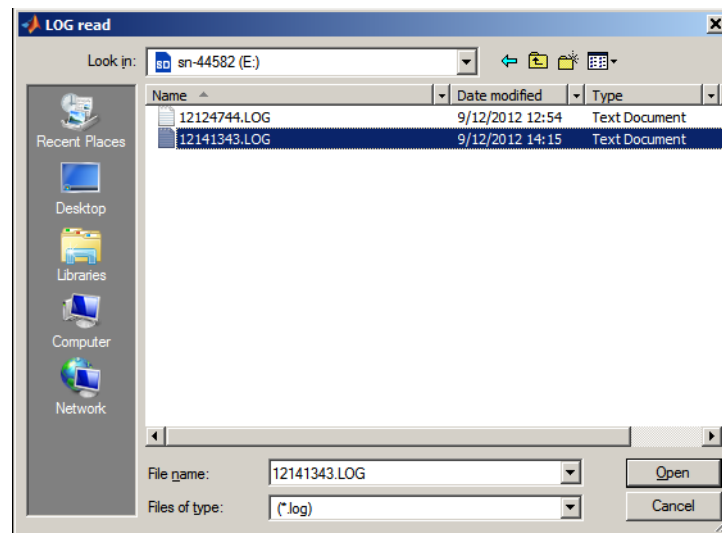


Optional functions which can be switched on or off in the pcmread.txt file are the following:

- RETURN_PASCALS:** Controls whether the sensitivity value is used to convert the voltage to pascals.
- UNWIND_AGC:** Controls whether the AGC data is reapplied.
- SAVE_WAV_FILES:** Controls the generation of separate wave files for transmit and receive as TX.WAV and RX.WAV.
- PLOT_OUTPUT:** Generates plots of the AGC history and the final output.

Reading .WAV Files as a Batch

The Matlab logread.m utility reads a series of one minute files from the time period covered by the .LOG file. They are realigned to the start of the minutes based on the real-time clock and placed in a directory named for the log file. The utility may be run with a file hydrophone sensitivity value or with a list of .LOG files to process, or both. In the absence of a file, a dialog box will open enabling the selection of the file:



Optional functions which can be switched on or off in the pcmread.txt file are the following:

- | | |
|-------------------------|---|
| TIME_CORRECTION: | Enables time correction. |
| PASSBAND_OUTPUT: | Adjusts the output to the original frequency. |
| OUTPUT_AS_WAV: | Controls the generation of separate wave files for transmit and receive as TX.WAV and RX.WAV. |
| Fc: | Allows setting of the center frequency. |
| FSout: | Allows setting of the sample rate. |

In addition, the hydrophone sensitivity in dBV/ μ Pa may also be specified so that the final output is in terms of dB re 1 μ Pa @ 1 m in water rather than dBV at the modem's transducer.

Waveform Play Option

The Waveform Play option is enabled with the purchase and installation of a feature key. This feature enables transmission of signals that are within the modem's operating frequency using the modem's transmitter and transducer. The signals must be in the form of basebanded complex data with a bandwidth of 5120 Hz sampled at 10240 samples per second and with 0 Hz, or DC, as the basebanded passband center frequency, or -2560 Hz to +2560 Hz in this case. The data are mixed, or Heterodyned, to the center frequency using a process that is the inverse of that used for the acoustic recorder as described in "Generating Basebanded Signals" on page 5-74. The data can be generated using a Matlab utility and then uploaded to the modem's flash file system.

Creating a Basebanded Waveform

A basebanded waveform can be created using a Matlab utility. For example, the routine below generates a baseband tonal signal that can be uploaded to the modem's flash file system and played back as passband signals.

```
fsdat=10240;    %This is usually the baseband sample rate to use
T=0.05; %pulse duration, seconds
N=fix(T*fsdat);
F0=100;        %tone to be transmitted - 100hz above center frequency

%generate the baseband tonal. This is what goes into the modem.
A=exp(i*2*pi*F0*(0:(N-1))/fsdat);
wavwrite([real(A), imag(A)], fsdat, 16, 'myfile')

%The following simulates what the modem does to transmit the waveform.
Fc=11520;    %center frequency for the LF band
decim=4;     %the interpolation ratio
fs=fsdat*decim; %This is the passband sample rate
B=interp(A,decim);
lB=length(B);
e=exp(i*2*pi*Fc*(0:(lB-1))/fs);
C=real(B.*e);
dt1=1/fsdat;
dt2=1/fs;
t1=0:dt1:(N-1)*dt1;
t2=0:dt2:(lB-1)*dt2;
t1=t1*1000; %convert to milliseconds
t2=t2*1000;
```

```
subplot(2,1,1),plot(t1,real(A));  
title('Real part of baseband tonal')  
subplot(2,1,2),plot(t2,C);  
title('Passband Tonal')  
xlabel('Time (ms)')
```

Uploading a Basebanded Waveform

To upload a basebanded waveform file, first connect the PC containing the file to the modem as described in "Setting Up the Modems" on page 4-9. Next, use the `rz` command with the `-f` option to upload the file to the modem's flash file system. For information on the `rz` command refer to "rz" on page 5-50. To confirm that the file has been received, use the `ls` command.

Waveform Play Commands

The following waveform play commands are available:

- `play`

play

The `play` command plays the contents of the specified file of the local modem by transmitting the passband signals on its transducer.

Syntax: `play {<path>}/<file>`

Privilege: `user`

Example 1: To play the contents of the file "mydatafile1" in the modem's flash file system, enter:

```
play /ffs/mydatafile1
```

Example 2: To play the contents of the file "mydatafile1" in the flash file system of the remote modem at address 5, enter:

```
#5 play /ffs/mydatafile1
```

SMART Releases and Modems

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

SR-50 and SR-9100 SMART Releases

The Teledyne Benthos SR-50 and SR-9100 SMART Releases are combination acoustic releases and acoustic modems that provide reliable wireless digital communications with other deployed underwater instrument packages and surface or subsea platforms. They use a motorized type release mechanism to release themselves from their moorings. The acoustic telemetry is disabled when the battery voltage falls below a safe threshold at which only the release and transponder functions and the ability to send status messages can be activated.

SM-975 SMART Modem

The Teledyne Benthos SM-975 Smart Modem is a combination full ocean depth acoustic release and an acoustic modem that provides reliable wireless digital communications with other deployed underwater instrument packages and surface or subsea platforms. It uses an electrolytic dissolving wire ("burn wire") type release mechanism to release itself from its mooring. The acoustic telemetry is disabled when the battery voltage falls below a safe threshold at which only the release and transponder functions and the ability to send status messages can be activated.

SMART Release and Modem Commands

The following SMART Release and Modem commands are available:

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

getcurrent

When an SM-975 SMART Modem is in the process of being released, the burn wire current is sampled and stored once per minute. The `getcurrent` command displays the sampled currents in amperes of a local SM-975 SMART modem.

Syntax: `getcurrent`

Privilege: `user`

Example: To display the burn wire current samples of a local SM-975 SMART modem in the process of being released, enter:

`getcurrent`

AT\$Tn

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

Syntax: `AT$Tn`

Privilege: `user`

Example: To display the status of the SR-9100 SMART Release at address 5, enter:

`AT$T5`

AT\$Rn,m

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

Syntax: `AT$Rn,m`

Privilege: `user`

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

`AT$R5,188`

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

AT\$Nn,m

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

Syntax: AT\$Nn,m

Privilege: user

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

```
AT$N5,198
```

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

#n getcurrent

When an SM-975 SMART Modem is in the process of being released, the burn wire current is sampled and stored once per minute. The #n getcurrent command displays the sampled currents in amperes of a remote SM-975 SMART modem at address n.

Syntax: #n getcurrent

Privilege: user

Example: To display the burn wire current samples of a remote SM-975 SMART modem at address 5 in the process of being released, enter:

```
#5 getcurrent
```

Navigation

A modem can store navigation and position information such as latitude, longitude and depth as configuration parameters in the Nav section of the configuration system. This information can be entered manually or input from an attached instrument. For example, if the location of a modem can be determined from a bottom survey, the modem's latitude and longitude could be acoustically transmitted to it. Or a modem installed in a buoy could be connected to a GPS which could be configured to continuously output the latitude and longitude to the modem for access over the acoustic link. A typical system might have a radio transmitter connected to serial port 1 of the modem and a GPS connected to serial port 2. In this configuration the modem can be set up to continuously read NMEA data from the GPS and update the Nav configuration parameters by installing a startup script as in the following example:

```
user:1>echo gpsd > /ffs/.clamshrc2
user:1>reboot
```

Updated information can now be remotely read from the configuration parameters as in the following example:

```
user:12>#0 cfg latitude; cfg longitude
41.725556
-49.946944
```

Speed of Sound

The NAV configuration section also holds a value for the speed of sound in water which is used in all range calculations where a time difference measurement is converted to distance. The default value used for the sound speed is 1500 meters/second which is the approximate speed of sound in seawater. If the actual sound speed has been determined, for example, from a conductivity, temperature, depth (CTD) instrument, then this value can be used instead.

Navigation Commands

The following Navigation commands are available:

- gpsd
- tcm5d
- compass

gpsd

The `gpsd` command starts a parser process that will translate messages from navigation instruments and store the extracted information in the NAV configuration section. An optional "-s" modifier switches serial port 2 to an RS-232 serial interface that can receive GPS messages from an externally connected GPS upon the reception of an acoustic command or data. The RS-232 interface is available on J8 of the DSP board for the ATM-900 and ATM-903 Board Sets and on the POWER/SERIAL connector of all other modems. After receiving the data, serial port 2 switches back to a CMOS serial interface that is available on J3 of the DSP board to receive internal compass data. The received GPS and compass data are available through the configuration parameters in the Nav section of the configuration system. Enter Ctrl-D or rapidly enter +++ to terminate the command.



NOTE The optional "-s" modifier applies only when the GPS is connected to serial port 2 and the P2Protocol configuration parameter is set to 1 (CMOS).

Syntax: `gpsd [-s] [<NMEA>]`

Privilege: `user`

Example 1: To start the parser process, enter:

```
gpsd
```

(To terminate the command, enter Ctrl-D or rapidly enter +++)

For an input string of:

```
$GPGLL,4138.8119,N,07038.2037,W,A,*31
```

@Latitude will be set to 41.646865 and @Longitude will be set to -70.636728 having been converted to decimal degrees from the NMEA format of degrees and decimal minutes.

For an input string of:

```
$GPGGA,171235.00,4138.8119,N,07038.2037,W,1,05,1.2,5.0,M,-22.3,M,,*55
```

@Latitude will be set to 41.646865 and @Longitude will be set to -70.636728 having been converted to decimal degrees from the NMEA format of degrees and decimal minutes. @GpsAlt will be set to 5.0 meters above mean sea level and the modem's system time will be set to 17:12:35.

For an input string of:

```
$GPZDA,171235.00,05,12,2011,-5,0*49
```

The NMEA time and date string will set the system time and date to 17:12:35 on December 5th 2011.

For an input string of:

```
$C90.4P0.1R-1.3*7C
```

Compass, pitch and roll data as output from the OceanServer compass will be read to set the @Compass, @Pitch and @Roll parameters to 90.4, 0.1 and -1.3 degrees respectively.

For an input string of:

```
$PHTRO,0.1,P,-1.3,T*7B
```

Pitch and roll data as from this NMEA string will be read to set the @Pitch and @Roll parameters as 0.1 and -1.3 degrees respectively.

For an input string of:

```
$HCHDG,101.1,,,7.1,W*3C
```

Heading data as from this NMEA string will be read to set the @Compass parameter as 101.1 degrees.

For an input string of:

```
R23.4
```

The output from a PSA-916 altimeter will set the @Altitude parameter to 23.4 meters.

Example 2: To cause the #51 time string from a TM-4 unit by Spectrum Instruments, Inc. to set the system time and date, enter:

```
"#51,12052011,171236"
```

Example 3: To cause the #52 position string from a TM-4 unit by Spectrum Instruments, Inc. to set the @Latitude and @Longitude parameters, enter:

```
"#52,4138.41,N,07036.59,W,1,9"
```

Example 4: To cause the #53 altitude string from a TM-4 unit by Spectrum Instruments, Inc. to set the @GpaAlt parameter, enter:

```
"#53,+0016,M"
```

tcm5d

The `tcm5d` command starts a parser process that polls a TCM5 compass in its native binary format for latitude and longitude data.

Syntax: `tcm5d`

Privilege: `user`

Example: To start the parser process, enter:

`tcm5d`

(To terminate the command, enter Ctrl-D or rapidly enter +++.)

Compass

The `compass` command enables characters entered on serial port 1 to be sent directly to a compass or other navigation device that is attached to serial port 2. In addition, characters input on serial port 2 from the device are displayed.

Syntax: `compass`

Privilege: `user`

Example: To enable all characters entered on serial port 1 to be output on serial port 2, and characters input on serial port 2 to be displayed, enter:

`Compass`

(To terminate the command, enter Ctrl-D or rapidly enter +++.)

Real-Time Clock

A modem includes a battery backed real time clock and is shipped with the UTC time setting. Refer to "Real-Time Clock" on page 2-3 for the real-time clock specifications. The time and date are read from the real-time clock when the modem is powered up. The clock uses an internal one pulse per second (1PPS) signal to keep time, but it is possible to switch to an external 1PPS signal source, such as a GPS, for a more accurate time. If this configuration is desired, refer to "Synchronizing a Modem to an External 1PPS Signal" on page 5-93. In addition, setting @Verbose=3 enables time stamping of all received and transmitted acoustic messages with a resolution of 0.1 ms as in the following example.

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

For additional specifications on the real-time clock, refer to Section 2, "Specifications."

SyncPPS Configuration Parameter

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

RTC. With @SyncPPS=RTC, the time and date are driven from the internal real-time clock, and the RX and TX time stamps, shown at verbose level 3, will be at a 0.1 ms time accuracy.

ExtRise. With @SyncPPS=ExtRise, the modem synchronizes to the rising edge of an external 1PPS signal. The 1PPS signal is input to the modem on pin 9 of the DSP board I/O connector J3, and the RX and TX time stamps, shown at verbose level 3, are at 0.1 ms accuracy with respect to the rising edge of the 1PPS signal as shown in Figure 5-8.

ExtFall. With @SyncPPS=ExtFall, the modem synchronizes to the falling edge of an external 1PPS signal. The 1PPS signal is input to the modem on pin 9 of the DSP board I/O connector J3, and the RX and TX time stamps, shown at verbose level 3, are at 0.1 ms accuracy with respect to the falling edge of the 1PPS signal as shown in Figure 5-8.

Refer to Table 4-11 on page 4-19 for the connector pinout information for the DSP board I/O connector J3 and to Figure 4-11 on page 4-19 for the connector pin orientation.

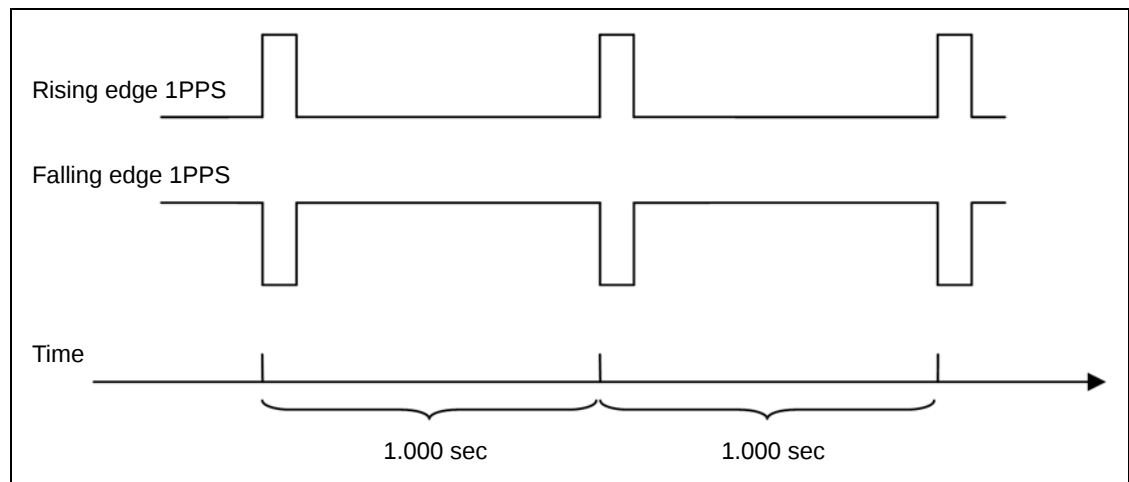


Figure 5-8 1PPS Input Signals

Synchronizing a Modem to an External 1PPS Signal

An ATM-903 or ATM-900 Modem Board Set can be synchronized to an external 1PPS signal, such as from a GPS, as a modem can input NMEA messages from most GPS units. If it is desired to access the 1PPS input for this purpose in one of the other ATM-900 Series Acoustic Telemetry Modems or the UDB-9400 Universal Deck Box, contact Teledyne Benthos. For information on how to contact Teledyne Benthos, refer to "Customer Service" on page vi. Once synchronized, a modem is able to output time stamps of received and transmitted acoustic packets with the accuracy of the external time reference.

The following are required of the time reference for a modem to synchronize with it:

- A logic level (0–3.3 or 0–5 volts) rising or falling 1PPS signal output.
- An RS-232 serial port.
- Output of a \$GPGGA, \$GPGLL or \$GPZDA NMEA version 1.30 format message.
- An RS-232 null modem.

Perform the steps listed below to synchronize a modem to an external 1PPS signal.

1. Determine whether the 1PPS signal is a rising or falling edge.
2. Connect the 1PPS signal to pin 9 of the DSP board I/O connector J3

and ground to pin 10 of the same connector. Refer to Table 4-11 on page 4-19 for the DSP board I/O connector J3 pinouts.

3. Enter +++ rapidly to place the modem into Command mode.
4. Set @SyncPPS=1 (ExtRise) or 4 (ExtFall) based on whether the 1PPS signal is a rising or falling edge signal, respectively.
5. Wait for 20–25 seconds, and then enter `sync`.
6. Check that the fourth line displays "Synchronized" as in the following example:

```
ppsx10 = 1638385, st = 1, vld = 20, q = 0, ts = 1
fD[3]: -15    fA: -15.392448
eD[3]: 0.392449    eA: -0.015065
Synchronized
Ok
```

If "Not in Sync" is displayed, then wait another 20 seconds and enter `sync` again. If the modem is not synchronizing, then it is likely that the 1PPS signal is not stable or the connection is bad.

Once the modem is synchronized, it will remain synchronized as long as the 1PPS signals are accurate. A loss of synchronization can indicate a loss of the 1PPS signal. If the modem loses synchronization, the modem will attempt to regain synchronization on its own. A modem that enters the lowpower state will lose synchronization with an external 1PPS signal. In the lowpower state the 1PPS input will be ignored and the modem will use the internal RTC. When the modem re-enters active receive mode, it will require approximately 20 seconds to re-synchronize with the external 1PPS signal. If entering the lowpower state is not desired, then set `@ldletimer=0`.

Inputting Time and Date from an External Time Source

1. Select a modem serial port, either serial port 1 or serial port 2, that will be connected to the external time source, such as a GPS, and set the baud rate to that of the time source. For a GPS it is typically 9600. The baud rate of serial port 1 is set with the P1Baud configuration parameter, and serial port 2 with the P2Baud configuration parameter.
2. Enter `gpsd` on the selected serial port.
3. Disconnect the host processor from the modem.

4. Connect the serial port of the external time source to the null modem and the null modem to the selected serial port of the acoustic modem, and then wait about five seconds.
5. Disconnect the modem from the external time source and reconnect the host processor to the modem.
6. Enter Ctrl-D or rapidly enter +++ to terminate the `gpsd` command.
7. Enter `date`, and then verify that a new time is displayed with the message "`* Not Stored`" as in the following example:

```
Sun Nov 30, 2011 18:52:02 *Not Stored
```

Most GPS units output GMT/UTC time.

8. If the date is correct, enter `date -store`.

The time and date are stored to the real-time clock of the modem, meaning that rebooting the modem using the `reboot` command, powering down the modem and then powering up the modem, or waking it up from the lowpower state will use the time and date from the real-time clock.

Real-Time Clock Commands

The following Real-Time Clock commands are available:

- `date`
- `uptime`
- `rtc battery`
- `sync`

date

The `date` command sets or displays the current time and date. It also provides "+sec" and "-sec" modifiers which can be used to add or to subtract one second from the current time to aid in synchronizing the real-time clock. Optional "-12" and "-24" modifiers are available for 12-hour and 24-hour time displays, and a "-store" modifier will store the time and date from a connected GPS to the real-time clock chip. If a GPS is connected to the modem and the `date` command is used without the modifier "-store," the message "`*Not Stored`" will be displayed. The `gpsd` command must also be running for the modem to input the time and date.

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

Privilege: user

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

```
date
```

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

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

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

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

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

```
date -sec
```

Example 5: To store the time and date provided from a connected GPS to the real-time clock, enter:

```
date -store
```

uptime

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

Syntax: uptime

Privilege: user

Example: To display the time and date at which the modem last rebooted, enter:

```
uptime
```

rtc_battery

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

Syntax: rtc_battery

Privilege: user

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

```
rtc_battery
```



NOTE The real-time clock battery is an Energizer CR1632 or equivalent and should be replaced after two years of modem off time or when the battery voltage is less than 2.7 VDC. For instructions on how to replace the real-time clock battery, refer to "Changing the Real-Time Clock Battery" on page 9-7.

sync

The `sync` command displays the status of the modem's synchronization state and includes a number of factory use statistics with the last line being the synchronization status as follows:

Synchronized. Properly synchronized to either the internal RTC or external 1PPS source.

Not in Sync. Not synchronized. If set for external synchronization, then there may not be a 1PPS signal present. If set for the internal real-time clock synchronization, then there could be an internal fault. However, during power up and when coming out of the lowpower state there is a short time when the modem will not be synchronized.

Qualifying. The modem is in the process of synchronizing which takes about 10 seconds and occurs when an external 1PPS signal is first connected, the modem has just been powered up, or the modem is coming out of its lowpower state.

Syntax: `sync`

Privilege: `user`

Example: To display the synchronization statistics, enter:

```
sync
```

The modem responds with:

```
ppsx10 = 1638359, st = 1, vld = 10, q = 0, ts = 1
fD[10]: -41    fA: -39.900002
eD[10]: -1.099998    eA: -1.499127
Synchronized
Ok
```

or

```
ppsx10 = 1638362, st = 0, vld = 0, q = 0, ts = 0
fD[0]: -39    fA: -39.264385
eD[0]: 0.264385    eA: -0.188572
Not in Sync
Ok
```

or

```
ppsx10 = 1638363, st = 0, vld = 1, q = 1, ts = 1
fD[1]: -37    fA: -37.000000
eD[1]: 0.000000    eA: 0.000000
Qualifying
Ok
```

Device Enable

Device Enable is an open collector output provided with each serial port of a modem. Refer to "Setting Up the Modems" on page 4-9 for connection information. Device Enable can be used to switch on a modem's host processor or connected instrument when the modem is ready to send data to it that were received over the acoustic link, and to switch off the host processor when the modem is in the lowpower state, such as when it receives the Hang Up command (ATH), the Lowpower State command (ATL) or the idle time expires. When the Device Enable output is set, it will switch up to 20 mA to ground. Whenever it is cleared, it is a high impedance. Refer to Section 2, "Specifications," for additional electrical specifications.

Automatic Device Enable Output Setting

The Device Enable output can be set automatically or with a command by setting the DevEnable configuration parameter to Auto. When DevEnable is set to 1 (Auto), the Device Enable output will set automatically when the modem receives data over the acoustic link, 80 ms prior to sending the data to the host processor, or if it receives the Dial command (ATD).

Manual Device Enable Output Settings

The Device Enable output can be set *only* with a command by setting the DevEnable configuration parameter to 2 (Manual-LP) or 3 (Manual). When set to 2 (Manual-LP), the setting will be preserved upon entering and exiting from the lowpower state. When set to 3 (Manual), the device enable output will be cleared when entering the lowpower state and remain cleared upon exiting from the lowpower state.

Device Enable Commands

The following device enable commands are available:

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

ATTDm,p

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

Syntax: ATTDm,p

Privilege: user

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

ATTD1 , 2

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

ATTD0 , 1

or

ATTD0

AT\$Xn,m,p

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

Syntax: AT\$Xn,m,p

Privilege: user

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

AT\$X5 , 1 , 2

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

AT\$X5 , 0 , 1

or

AT\$X5 , 0

Acoustic Test

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

Background Noise Interpretations

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

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

Acoustic Test Commands

The following acoustic test commands are available:

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

spectrum

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

Syntax: `spectrum`

Privilege: `user`

Example: To start the graphical spectral analyzer, enter:

`spectrum`

An example Spectral Frequency Graph is shown in Figure 5-9.

To stop the graphical spectral analyzer display, enter:

`x`

autobaud

The `autobaud` command initiates a communication sequence with a remote modem that cycles through test packets at different acoustic bit rates to determine the fastest bit rate the acoustic channel will support. This command can only be entered on serial port 1. An optional "-a" modifier automatically sets the TxRate configuration parameter upon completion of the sequence on the local modem, the remote modem, or both.

xmittime

The `xmittime` command calculates the time it will take to transmit a fixed number of bytes at a given acoustic bit rate. An optional "-m" modifier specifies an acoustic bit rate. Without this modifier the acoustic bit rate is determined by the setting of the TxRate configuration parameter. An optional "-i" modifier specifies in milliseconds an interpacket delay. Without this modifier the delay is 25 ms and is only relevant if the amount of data to be transmitted need to be broken into multiple 4-kbyte acoustic packets. Optional "+w" and "-w" modifiers include or exclude, respectively, the lowpower wakeup signal. Without these modifiers, transmission of a lowpower wakeup signal is determined by the setting of the WakeTones configuration parameter. The time is displayed in hours, minutes, seconds, and thousandths of seconds.

Syntax: `xmittime [-m<modspec>] [+|-w] [-i<interpacket_delay_ms>] <bytes>`

Privilege: user

Example 1: To calculate the time it will take to transmit 16 kbytes of data at an acoustic bit rate of 7 (1200 bigts/sec) with an interpacket delay of 50 ms, including the lowpower wakeup signal, enter:

```
xmittime -m7 +w -i50 16000
```

ATTNn

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

Syntax: `ATTNn`

Privilege: user

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

```
ATTN1
```

ATT2

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

Syntax: ATT2

Privilege: user

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

ATT2

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

To stop the display, enter:

ATT1

ATT1

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

Syntax: ATT1

Privilege: user

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

ATT1

AT\$G

The Output Remote AGC command (AT\$G) outputs ten seconds of AGC history from the remote modem at address n. The history begins ten seconds prior to receipt of the command and ends at the receipt of the command. For every sample two numbers are output, one is the highest AGC measurement during a one second interval and the other, the lowest. The displayed values indicate the relative amount of background signal or noise present. Low

values indicate a strong received signal, and high values, a weak received signal. The AGC ranges are 0–91 dB for the ATM-900 Series Acoustic Telemetry Modems and 0–77 dB for the UDB-9400 Universal Deck Box.

Syntax: AT\$Gn

Privilege: user

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

AT\$G5

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

6 Modem CLAM Shell Command Set

This section provides a summarized description of each of the available Teledyne Benthos ATM-900 Series Acoustic Telemetry Modem and UDB-9400 Universal Deck Box Command Line for Acoustic Modem (CLAM) shell commands. Each description includes the command syntax, the privilege level and, for most of the commands, a reference to where in this manual a more detailed description of the command and one or more examples of its use can be found. The commands are listed in alphabetical order. For information on the command syntax, refer to "Command Syntax" on page 5-10.



NOTE To enter commands serial port 1 of the modem must be connected to a computer that is set up to run a terminal program, such as ProComm Plus or Tera Term. Refer to "Setting Up the Modems" on page 4-9 for instructions on how to connect the modem to a PC and to "Setting up the Host Processor" on page 4-21 for instructions on how to set up the PC as the local host processor.



NOTE Most CLAM shell commands can be entered on either serial port 1 or serial port 2 of ATM-900 Series Acoustic Telemetry Modems. CLAM shell commands that can *only* be entered on serial port 1 are **Autobaud** and any remote modem command—those commands whose name begin with the letters "rd."

@

The @ command lists all of the configuration parameter sections, lists all of the configuration parameters in a configuration parameter section, displays the setting for a configuration parameter, or sets a configuration parameter to a particular value.

Syntax: @ [<section name>] [<parameter name>] [<parameter name>=<value>]

Privilege: user

Reference: none

#

The # command executes most commands on a remote modem. The command is acoustically transmitted to the remote modem from the local modem and is run on the remote modem. Depending on the command the response from the remote modem will be acoustically transmitted to the local modem.

Syntax: #<address> <command>

Privilege: user

Reference: "Troubleshooting" on page 9-15.

addkey

The addkey command adds a feature key to the modem. This command can only be used when running the diagnostic software application. The rundiag command is used to start the diagnostic software application.

Syntax: addkey <feature key>

Privilege: update

Reference: "Troubleshooting" on page 9-15.

alarm

The alarm command is used to set an alarm event which will execute the instructions in /ffs/.alarmrc. The alarm can be set to trigger once at a set time of the current day or once at a set time and date, to trigger once every 24 hours at a set time, or to trigger at regular intervals counting from midnight of the current day. An optional modifier "-r" identifies the entered time as an interval rather than a specific time. The interval starts at midnight of the

current day and repeats continuously, triggering the alarm at the end of each interval. The alarm command can also be used to display a list of the times and dates at which an alarm will occur.

Syntax: alarm [[mm/dd] <hh:mm> [-r]][off]

Privilege: user

Reference: none

alias

The `alias` command creates an alias for a single command or for multiple commands in a command string. One or more aliases can be created for any command.

Syntax: alias [<alias> [<cmd>]]

or

alias [<alias> "[<cmd>]"]

Privilege: user

Reference: "Command Mode" on page 5-5.

autobaud

The `autobaud` command initiates a communication sequence with a remote modem that cycles through test packets at different acoustic bit rates to determine the fastest bit rate the acoustic channel will support. This command can only be entered on serial port 1. An optional "-a" modifier automatically sets the TxRate configuration parameter upon completion of the sequence on the local modem, the remote modem, or both. An optional "-e" modifier sets the maximum allowable number of bit errors for a given rate to be considered acceptable. And an optional "-m" modifier specifies the maximum acoustic bit rate at which to begin testing and optionally, the minimum bit rate at which to end testing. Without this modifier the fastest bit rate is 8 (2400 bits/sec) and the minimum, 2 (140 bits/sec).

Syntax: autobaud [-a<local|remote|both>] [-m<max_modspec>[,<min_modspec>]]
[-e<max_bit_errs (0-999)>] <addr>

Privilege: user

Reference: "Acoustic Test" on page 5-100.

bats

The `bats` command enables access to status information on the two rechargeable lithium ion battery packs in an SM-976 SMART Modem. Pressing the Space bar after the command has been entered opens the Battery Status screen where the voltage, current, temperature, percent charge, and capacity of each of the two battery packs are displayed. This screen also displays the time remaining on the charge and the combined battery status, both under the current load. This command also enables the FullBATS and MiniBATS diagnostic programs available from OceanServer, the battery pack manufacturer, to be used to display battery status and performance.

Syntax: `bats`

Privilege: `user`

Reference: `none`

calc

The `calc` command evaluates an expression.

Syntax: `calc [-x] <value> {(+|-|/|*) <value>}`

Privilege: `user`

Reference: `none`

cat

The `cat` (concatenate) command displays the contents of a specified file. An optional `-n` modifier adds a line number to each line, and an optional `-c` or `-l` modifier enables a range of characters or lines, respectively, to be specified. This command can also be used as an easy way to create a text file or to add to an existing one. To do this, enter the command name followed by a space, the `>` or the `>>` character, the path, and the file name. Using `>` will replace the contents of the named file with all subsequent text entered after the prompt. If the file does not exist, it will be created automatically. Using `>>` will add all subsequent text entered after the prompt to the existing named file. To end either process, enter Ctrl+D.

Syntax: `cat [-n|(-c|l)(<num>|([<from>]:<to>]))] {{<path>/}<file>} [> <file>]`

Privilege: `user`

Reference: "File System" on page 5-39.

cfg all

The `cfg all` command lists all of the configuration parameter sections along with the configuration parameters in each.

Syntax: `cfg all`

Privilege: `user`

Reference: "Configuration System" on page 5-53.

cfg load

The `cfg load` command imports a specified configuration file, or if no file is specified, it loads the configuration parameters from the `standard.ini` file.

Syntax: `cfg load [<file>]`

Privilege: `user`

Reference: "Configuration System" on page 5-53.

cfg store

The `cfg store` command exports the current modem configuration to a specified configuration file, or if no file is specified, it saves the current modem configuration to the `standard.ini` file.

Syntax: `cfg store [<file>]`

Privilege: `user`

Reference: "Configuration System" on page 5-53.

char

The `char` command converts decimal ASCII code to ASCII text.

Syntax: `char <ASCII>`

Privilege: `user`

Reference: `none`

chmod

The `chmod` command changes the permission properties of a file. The file must be at or below the command privilege level.

Syntax: `chmod {+|-}[rwx]} <path>`

Privilege: user

Reference: "File System" on page 5-39.

chown

The `chown` command changes the privilege level of a file.

Syntax: `chown safe|user|update|factory|diag|sys <path>`

Privilege: user

Reference: "File System" on page 5-39.

clearkeys

The `clearkeys` command clears all of the feature keys installed on the modem. This command can only be used when running the diagnostic software application. The `rundiag` command is used to start the diagnostic software application.

Syntax: `clearkeys`

Privilege: update

Reference: none

compass

The `compass` command enables characters entered on serial port 1 to be sent directly to a compass or other navigation device that is attached to serial port 2. In addition, characters input on serial port 2 from the device are displayed. To end either process, enter Ctrl+D or rapidly enter +++.

Syntax: `compass`

Privilege: user

Reference: "Navigation" on page 5-88.

cp

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

Syntax: `cp <src path> <dst path>`

Privilege: user

Reference: "File System" on page 5-39.

date

The `date` command sets or displays the current time and date. It also provides "+sec" and "-sec" modifiers which can be used to add or to subtract one second from the current time to aid in synchronizing the real-time clock. Optional "-12" and "-24" modifiers are available for 12-hour and 24-hour time displays, and a "-store" modifier will store the time and date from a connected GPS to the real-time clock chip.

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

Privilege: user

Reference: "Real-Time Clock" on page 5-92.

delkey

The `delkey` command clears a feature key from the modem. This command can only be used when running the diagnostic software application. The `rundiag` command is used to start the diagnostic software application.

Syntax: `delkey <feature key>`

Privilege: update

Reference: none

df

The `df` (disk free) command displays the file system usage in bytes for the specified mount point, or if no mount point is specified, the file system usage for all the files in the root directory. The displayed usage comprises the file system size, the amount of storage used, the amount of storage available, and the percentage of available storage used. In addition, the number of

bytes shown will include some unusable overhead bytes. Therefore a completely full file system will still show some space free even though no more data can be stored.

Syntax: df [<mount>]

Privilege: user

Reference: "File System" on page 5-39.

dlclear

The `dlclear` command clears the contents of the data logger memory of the local modem.

Syntax: dlclear

Privilege: user

Reference: "Datalogger Mode" on page 5-15.

dldump

The `dldump` command causes the local modem to extract and to display a selectable number of contiguous bytes from its data logger records that were input from a specific data source or all the sources beginning with a specific byte. An optional "-x" modifier specifies that the data are to be displayed as ASCII hexadecimal values, otherwise the data are displayed as ASCII text.

Syntax: dldump [-x] <byte_index> <byte_count> [<flags>]

Privilege: user

Reference: "Datalogger Mode" on page 5-15.

dlfind

The `dlfind` command extracts and displays data logger records from the local modem in accordance with specified search parameters. These search parameters contain one or more of the following: starting point, ending point, step interval, and flags. The starting and ending point parameters can be in the form of a time stamp in years, months, days, hours, minutes, and seconds; a record number referenced to the start or the end of the data logger's data set; or the number of records from the starting point. The step interval specifies how many records should be skipped when displaying data. The flags parameter specifies the source of the data.

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

Privilege: user

Reference: "Datalogger Mode" on page 5-15.

dllist

The `dllist` command displays the number of bytes and the number of records in the data logger of the local modem, along with the time stamps for the first and last record. Each time stamp comprises the year, month, day, hour, minute, and second the record was created. The total number of bytes and records from all the data sources together are displayed as well as those from the individual data sources. In addition, which memory, internal or the SDHC containing the stored data is indicated. The Local Bytes Stored command (ATBN) can also be used to display only the total number of bytes stored.

Syntax: `dllist`

Privilege: user

Reference: "Datalogger Mode" on page 5-15.

dlrecs

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

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

Privilege: user

Reference: "Datalogger Mode" on page 5-15.

echo

The `echo` command echoes back entered text following the command. To preserve case, enclose entered text in quotes (" "). An optional "-n" modifier will cause the carriage return and line feed to be suppressed. The text can

also be redirected to a file and saved to the file by using ">" followed by a space and a file name. The contents of the file will be replaced with the new text. If the file does not exist, it will be created automatically. Using ">>" will append the text to the contents of an existing file.

Syntax: echo [-n] <text> [> <file>]

Privilege: user

Reference: "File System" on page 5-39.

factory_reset

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

Syntax: factory_reset

Privilege: user

Reference: "Configuration System" on page 5-53.

format

The `format` command clears all data and reinitializes the directory structure of the specified path. If the path is SD, then the external SD or SDHC card is cleared. If the path is FFS, then the entire modem file system is cleared, including the `factcfg.ini`, `diag.rom`, `standard.ini`, and `modem.rom` files. The feature keys will *not* be lost.

Syntax: format <path>

Privilege: update

Reference: "File System" on page 5-39.

getcurrent

When an SM-975 SMART Modem is in the process of being released, the burn wire current is sampled and stored once per minute. The `getcurrent` command displays the sampled currents in amperes of a local SM-975 SMART modem.

Syntax: getcurrent

Privilege: user

Reference: "SMART Releases and Modems" on page 5-85.

gpsd

The `gpsd` command starts a parser process that translates messages from navigation instruments and stores the extracted information in the NAV configuration section. An optional "-s" modifier, which applies only when the command is run from serial port 2, allows switching between an internal and external source for data. For switching to occur, the P2Protocol configuration parameter must be set to 1 (CMOS) at the time the command is entered. In addition, both the internal and external devices must be set at the same baud rate, where the default baud rate is 19200 baud. On the reception of an acoustic command or data, the P2Protocol configuration parameter is momentarily set to 0 (RS-232), allowing data from an external sensor to be read, and then is switched back to 1 (CMOS) to read the internal sensor.

For example, the `gpsd` command could be used when an external GPS is connected to the modem. The modem will normally read the pitch, roll and heading from the internal compass, and then update the Pitch, Roll and Compass configuration parameters. When a command or data are received, the port will switch over to the external GPS receiver, read its output, and then update the Latitude and Longitude configuration parameters which can be read using the `ATRXn` command.

A source quality requirement can also be set independently for location, heading and attitude data, as `l<0-2>`, `h<0-2>` and `a<0-2>`, respectively, as follows:

- | | |
|---------------|--|
| 0 (None): | Leave out entirely. No requirement; the current settings of the configuration parameters for the sensor will be used. |
| 1 (Internal): | If a value <i>cannot</i> be read from the internal sensor, the settings of the configuration parameters for the sensor will remain unchanged and <i>cannot</i> be read using the <code>ATRXn</code> command. |
| 2 (External): | If a value <i>cannot</i> be read from the external sensor, the settings of the configuration parameters for the sensor will remain unchanged and <i>cannot</i> be read using the <code>ATRXn</code> command. |

Enter Ctrl-D or rapidly enter +++ to terminate the command.

Syntax: `gpsd [<NMEA>|-s[l<0-2>][h<0-2>][a<0-2>]]`

Privilege: user

Reference: "Navigation" on page 5-88.

grep

The `grep` command searches for and displays lines containing a specified pattern of characters in a file, and optionally, a specified number of lines following these lines. An optional "-c" modifier displays just a count of the lines, including the specified number of optional ones. An optional "-n" modifier adds a line number to each displayed line. And an optional "v" modifier inverts the match so that only those lines that *do not* contain the specified pattern are displayed.

Syntax: `grep [-(c|n|v)] [+<lines>] <pattern> [< <file>]`

Privilege: user

Reference: none

help

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

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

Privilege: safe

Reference: "Command Mode" on page 5-5.

hist

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

Syntax: `hist`

Privilege: safe

Reference: "Command Mode" on page 5-5.

ls

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

Syntax: `ls [-(l|w)] [<path>]`

Privilege: user

Reference: "File System" on page 5-39.

mdm_battery

The `mdm_battery` command displays the voltage of the modem battery.

Syntax: `mdm_battery`

Privilege: `user`

Reference: `none`

mkdir

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

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

Privilege: `user`

Reference: "File System" on page 5-39

mmpd

The `mmpd` command starts the Modem Management Protocol (MMP) interface for the modem serial port it is connected to. The MMP can be used to communicate with and control the modem from another computer. For more information on this command, contact Teledyne Benthos. For information on how to contact Teledyne Benthos, refer to "Customer Service" on page vi. Enter Ctrl-D or rapidly enter +++ to terminate the command.

Syntax: `mmpd`

Privilege: `user`

Reference: `none`

more

The `more` command displays the contents of a file as ASCII text, eight lines at a time with a pause between groups of eight lines. To continue after a pause, press Enter. An optional "-l" modifier specifies a different number of lines to display before pausing. An optional "-d" modifier specifies that the data are to be displayed as ASCII decimal values. And an optional "-x" modifier specifies that the data are to be displayed as ASCII hexadecimal values.

Syntax: `more [-d|x] [-l <lines>] {{<path>/}<file>}`

Privilege: `user`

Reference: `none`

mount

The `mount` command tells the modem to make the files and directories on an SD or SDHC card available to the modem's file system by way of the `/sd/` path.

Syntax: `mount <path> [0|1]`

Privilege: `user`

Reference: "File System" on page 5-39.

mv

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

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

Privilege: `user`

Reference: "File System" on page 5-39.

nostrictat

The `nostrictat` command places the modem into a state that enables processing of both AT and CLAM shell commands.

Syntax: `nostrictat`

Privilege: `user`

Reference: "Command Mode" on page 5-5.

pinger

The `pinger` command transmits a sine wave burst at a specified frequency, pulse duration and repetition rate. The frequency is in hertz and must be within the operating frequency band of the modem. The pulse width range is 1–25 ms, and the repetition range is 250–30000 ms. Entering "off" turns off the pinger if it is on.

Syntax: `pinger [<freq> [<width 1–25 ms> [<rate 250–30000 ms>]]] | off`

Privilege: `user`

Reference: `none`

play

The `play` command plays the contents of the specified file or files of the local modem by transmitting the passband signals on its transducer. This command is only available if the Waveform Play option is installed.

Syntax: `play {<path>/}<file>`

Privilege: `user`

Reference: "Waveform Play Option" on page 5-83.

post

The `post` command executes the Power On Self Test (POST) and displays the test pass or fail results. This command can only be used when running the diagnostic software application. The `rundiag` command is used to start the diagnostic software application.

Syntax: `post`

Privilege: `user`

Reference: `none`

rb

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

Syntax: `rb [-f]`

Privilege: `user`

Reference: "File System" on page 5-39.

rdlblk

The `rdlblk` command provides the same results and is used in the same way as the `rdldump` command, but the data are transmitted more efficiently as less data overhead is required, and the amount of data is limited to 4096 bytes. This command can only be entered on serial port 1. The optional `"-x"` modifier, however, is not available, and therefore the data are displayed only as ASCII text.

Syntax: `rdlblk <addr> <byte_index> <byte_count> [<flags>]`

Privilege: `user`

Reference: "Datalogger Mode" on page 5-15.

rdlclear

The `rdlclear` command clears the contents of the data logger memory of a remote modem and can only be entered on serial port 1. The only command parameter is "addr," which is the remote modem address.

Syntax: `rdlclear <addr>`

Privilege: `user`

Reference: "Datalogger Mode" on page 5-15.

rdldump

The `rdldump` command causes a remote modem to extract and to transmit over the acoustic link a selectable number of contiguous bytes from its data logger records that were input from a specific data source or all the sources beginning with a specific byte. This command can only be entered on serial port 1. Except for the additional command parameter "addr," which is the remote modem address, the search parameters are the same as that for the `dlldump` command.

Syntax: `rdldump <addr> [-x] <byte_index> <byte_count> [<flags>]`

Privilege: `user`

Reference: "Datalogger Mode" on page 5-15.

rdlfind

The `rdlfind` command causes a remote modem to extract and to transmit over the acoustic link its data logger records, up to 16 kbytes at a time, in accordance with specified search parameters. This command can only be entered on serial port 1. Except for the additional command parameter "addr," which is the remote modem address, these search parameters are the same as that for the `dlfind` command.

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

Privilege: `user`

Reference: "Datalogger Mode" on page 5-15.

rdllist

The `rdllist` command causes a remote modem to transmit over the acoustic link the number of bytes and the number of records in its data logger, along with the time stamps for the first and last record. This command can only be entered on serial port 1. Each time stamp comprises the year, month, day, hour, minute, and second the record was created. The only command parameter is "addr," which is the remote modem address.

Syntax: `rdllist <addr>`

Privilege: `user`

Reference: "Datalogger Mode" on page 5-15.

rdlrecs

The `rdlrecs` command causes a remote modem to transmit over the acoustic link, in accordance with specified search parameters, the number of bytes and the number of records in its data logger, along with the approximate time in seconds that it will take to transmit them to the local modem at the current acoustic bit rate of the remote modem. This command can only be entered on serial port 1. The acoustic bit rate is determined by the setting of the TxRate configuration parameter in the remote modem, and except for the additional command parameter "addr," which is the remote modem address, the search parameters are the same as that for the `dlfind` command.

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

Privilege: `user`

Reference: "Datalogger Mode" on page 5-15.

reboot

The `reboot` command reboots the firmware of the local modem causing the modem to reset in the same manner as it would when the power is cycled off and then on. An optional "-safe" modifier will reboot the modem into the safe command privilege level. This process takes about five seconds.

Syntax: `reboot [-safe]`

Privilege: `user`

Reference: "Reboot ATES" on page 7-12.

record

The `Record` command displays the on or off status and starts or stops the acoustic recorder. When displaying the status and the recorder is on, or when starting the recorder, the time and date at which it was started is also displayed. Similarly, when displaying the status and the recorder is off, or when stopping the recorder, the time and date at which it was stopped is also displayed. The acoustic recorder can also be stopped when the idle time expires as determined by the `RecMode` configuration parameter. When on, data will be recorded in contiguous files containing 60-seconds of data each and named in accordance with the setting of the `NameFormat` configuration parameter. The recorder can also be started when an SDHC card is mounted as determined by the setting of the `RecMode` configuration parameter. This command is only available if the Acoustic Recorder option is installed.

Syntax: `record [on|off]`

Privilege: `user`

Reference: "Acoustic Recorder Option" on page 5-74.

rm

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

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

Privilege: `user`

Reference: "File System" on page 5-39.

rmdir

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

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

Privilege: `user`

Reference: "File System" on page 5-39.

rtc_battery

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

Syntax: `rtc_battery`

Privilege: `user`

Reference: "Real-Time Clock" on page 5-92.

rundiag

The `rundiag` command starts the diagnostic software application.

Syntax: `rundiag`

Privilege: `user`

Reference: `none`

rx

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

Syntax: `rx [-f] {<path>/}<file>`

Privilege: `user`

Reference: "File System" on page 5-39.

rxadj

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

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

Privilege: `user`

Reference: "File System" on page 5-39.

rz

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

Syntax: `rz [-f]`

Privilege: `user`

Reference: "File System" on page 5-39.

sb

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

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

Privilege: `user`

Reference: "File System" on page 5-39.

set

The `set` command sets an environment variable to the specified value. This command is used for scripts.

Syntax: `set <name> <value>`

Privilege: `user`

Reference: `none`

setpriv

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

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

Privilege: `safe`

Reference: "Command Mode" on page 5-5.

showkeys

The `showkeys` command displays all of the feature keys installed on the modem. This command can only be used when running the diagnostic software application. The `rundiag` command is used to start the diagnostic software application.

Syntax: `showkeys`

Privilege: `update`

Reference: `none`

sleep

The `sleep` command creates a delay for a specified time. However, the during the delay the modem functions normally and can still respond to messages received over the acoustic link. This command is used for scripts.

Syntax: `sleep <seconds>`

Privilege: `user`

Reference: `none`

spectrum

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

Syntax: `spectrum`

Privilege: `user`

Reference: "Acoustic Test" on page 5-100.

strictat

The `strictat` command places the modem into a state that enables processing of AT commands only. With the exception of the `nostrictat` command, CLAM shell commands are not processed.

Syntax: `strictat`

Privilege: `user`

Reference: "Command Mode" on page 5-5.

sync

The `sync` command displays the status of the modem's synchronization state and includes a number of factory use statistics with the last line being the synchronization status: Synchronized, Not in Sync or Qualifying.

Syntax: `sync`

Privilege: `user`

Reference: "Real-Time Clock" on page 5-92.

sx

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

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

Privilege: `user`

Reference: "File System" on page 5-39.

sz

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

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

Privilege: `user`

Reference: "File System" on page 5-39.

tcm5d

The `tcm5d` command starts a parser process that polls a TCM5 compass in its native binary format for latitude and longitude data.

Syntax: `tcm5d`

Privilege: `user`

Reference: "Navigation" on page 5-88.

umount

The `umount` command tells the modem to make the SDHC ready to remove from the modem. The SD mount point is the only mount point that can be removed.

Syntax: `umount <path>`

Privilege: `user`

Reference: "File System" on page 5-39.

unalias

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

Syntax: `unalias <alias>`

Privilege: `user`

Reference: "Command Mode" on page 5-5.

update

The `update` command updates the software stored in the modem.

Syntax: `unalias <alias>`

Privilege: `user`

Reference: "Reloading Software Applications" on page 4-26.

uptime

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

Syntax: `uptime`

Privilege: `user`

Reference: "Real-Time Clock" on page 5-92.

verify

The `verify` command performs a checksum on an image in the file system. This command can only be used when running the boot loader software application.

Syntax: `verify [-d] [<file>]`

Privilege: `user`

Reference: "Reloading Software Applications" on page 4-26.

version

The `version` command displays the modem type, the firmware version number, the firmware version build date, the PLD (Programmable Logic Device) version numbers, and the serial number of the local modem.

Syntax: `version`

Privilege: `user`

Reference: "Version AT!" on page 7-11.

wc

The `wc` command counts characters, words or lines in a file. An optional `"-c"` modifier counts characters only, an optional `"-w"` modifier counts words only, and an optional `"-l"` modifier counts lines only.

Syntax: `wc [-c|w|l]`

Privilege: `user`

Reference: `none`

xmittle

The `xmittle` command calculates the time it will take to transmit a fixed number of bytes at a given acoustic bit rate. An optional `"-m"` modifier specifies an acoustic bit rate. Without this modifier the acoustic bit rate is determined by the setting of the TxRate configuration parameter. An optional `"-i"` modifier specifies in milliseconds an interpacket delay. Without this modifier the delay is 25 ms and is only relevant if the amount of data to be transmitted need to be broken into multiple 4-kbyte acoustic packets. Optional `"-w"` and `"-W"` modifiers include or exclude, respectively, the lowpower wakeup signal. Without these modifiers, transmission of a

lowpower wakeup signal is determined by the setting of the WakeTones configuration parameter. The time is displayed in hours, minutes, seconds, and thousandths of seconds.

Syntax: xmittime [-m<modspec>] [+|-w] [-i<interpacket_delay_ms>] <bytes>

Privilege: user

Reference: "Acoustic Test" on page 5-100.

7 Modem AT Command Set

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

The modem AT commands are listed in Table 7-1 on page 7-2. Also listed in the table are the page references to where detailed descriptions of the commands are provided. Some of the descriptions of the modem AT commands call out configuration parameters. For a detailed description of the configuration parameters and how to set them, refer to Section 8, "Modem Configuration Parameters."



NOTE To enter commands the modem must be connected to a computer that is set up to run a terminal program, such as ProComm Plus or Tera Term. Refer to "Setting Up the Modems" on page 4-9 for instructions on how to connect the modem to a PC and to "Setting up the Host Processor" on page 4-21 for instructions on how to set up the PC as the local host processor.



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

Table 7-1 ATM-900 Series Acoustic Telemetry Modem and UDB-9400 Universal Deck Box AT Command Set

Command Syntax	Command Name	Result	Page
+++	Online Interrupt	Causes the local modem to go into Command mode.	7-7
AT [Enter]	Attention	Resets the local modem idle time timer and verifies communications between the host processor and the modem.	7-9
ATC [Enter]	Check Mode	Checks the operating mode of the local modem.	7-10
ATI [Enter]	Version	Displays the modem type, the firmware version number, the firmware version build date, the PLD (Programmable Logic Device) version numbers, and the serial number of the local modem.	7-11
ATES [Enter]	Reboot	Reboots the firmware of the local modem.	7-12
AT\$ESn [Enter]	Remote Acoustic Reset	Resets the remote modem at address n.	7-13
ATEU [Enter]	Update Firmware	Initiates the local modem firmware update procedure.	7-14
ATDn [Enter]	Dial	Causes the local modem to go into Online mode and to go online with the remote modem at address n.	7-16
AT&F [Enter]	Factory Reset	Resets the local modem's configuration parameter settings to their factory default settings.	7-18
ATHn [Enter]	Hang Up	Causes the remote modem at address n to go into the lowpower state.	7-19
ATO [Enter]	Online	Causes the local modem to go into Online mode from Command mode.	7-20
AT\$Kn,p [Enter]	Remote Break	Causes the remote modem at address n to send a break on its serial port p and to go online with the local modem.	7-22
ATXn [Enter]	Acoustic Link Test	Tests the acoustic link with the modem at address n.	7-24

Table 7-1 ATM-900 Series Acoustic Telemetry Modem and UDB-9400 Universal Deck Box AT Command Set (Continued)

Command Syntax	Command Name	Result	Page
ATYn [Enter]	Multiple Bit Rate Test	Tests the acoustic link with the modem at address n at multiple bit rates.	7-28
AT\$Pn,m [Enter]	Remote Power	Sets the transmit power level of the remote modem at address n to level m.	7-31
AT\$An,m [Enter]	Remote Bit Rate	Sets the transmitting acoustic bit rate of the remote modem at address n to m.	7-33
ATSn? [Enter]	Read Register	Displays the setting of the local modem's configuration parameter n.	7-35
AT\$Sn [Enter]	Read Remote Registers	Displays the configuration parameter settings of the remote modem at address n.	7-37
ATSn=n [Enter]	Set Register	Sets the local modem's configuration parameter number n to the value entered following "=".	7-39
AT&W [Enter]	Write	Saves the local modem's configuration parameter settings as the new startup configuration.	7-41
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.	7-42
ATTDm,p [Enter]	Local Device Enable	Sets or clears the Device Enable output of serial port p of the local modem.	7-44
AT\$Xn,m,p [Enter]	Remote Device Enable	Sets or clears the Device Enable output of serial port p of the remote modem at address n.	7-45
ATRn [Enter]	Range	Displays the range from the local modem to the remote modem at address n.	7-47
ATRDn [Enter]	Range and Depth	Displays the range from the local modem to the remote modem and the depth of the remote modem at address n.	7-51
ATRFn [Enter]	Fast Range	Displays the range from the local modem to the remote modem at address n using a shorter turn-around time.	7-49
ATRXn [Enter]	Range and Location	Displays the range from the local modem to the remote modem and the location of the remote modem at address n.	7-53

Table 7-1 ATM-900 Series Acoustic Telemetry Modem and UDB-9400 Universal Deck Box AT Command Set (Continued)

Command Syntax	Command Name	Result	Page
ATV [Enter]	Local Battery Voltage	Displays the input power supply voltage and internal temperature of the local modem.	7-55
AT\$Vn [Enter]	Remote Battery Voltage	Displays the input power supply and real-time clock battery voltages of the remote modem at address n.	7-56
AT\$BEn [Enter]	Remote Data Logger Enable	Causes the remote modem at address n to go into Datalogger mode.	7-58
AT\$BDn [Enter]	Remote Data Logger Disable	Causes the remote modem at address n to go into Online mode if it is in Datalogger mode.	7-59
AT\$BTn [Enter]	Read Remote Data Logger	This command has been deleted in firmware version 8.6.0.	—
AT\$BBn,m [Enter]	Output Data Logger Block	This command has been deleted in firmware version 8.6.0.	—
AT\$BSn,m [Enter]	Output Data Logger Sub-Block	This command has been deleted in firmware version 8.6.0.	—
AT\$BCn [Enter]	Clear Remote Data Logger	Clears the contents of the data logger memory of the remote modem at address n.	7-60
AT\$BNn [Enter]	Remote Bytes Stored	Displays the number of bytes of data stored in the data logger of the remote modem at address n.	7-61
ATBC [Enter]	Clear Local Data Logger	Clears the contents of the data logger memory of the local modem.	7-62
ATBN [Enter]	Local Bytes Stored	Displays the number of bytes of data stored in the data logger of the local modem.	7-63
ATBT [Enter]	Output Local Data Logger	Outputs the contents of the data logger memory of the local modem over the serial interface.	7-64
ATBPn [Enter]	Output Local Page	Outputs the contents of page n of the data logger of the local modem over the serial interface.	7-66
ATTNn [Enter]	AGC Diagnostic	Enables or disables the display of the AGC output of the local modem.	7-68

Table 7-1 ATM-900 Series Acoustic Telemetry Modem and UDB-9400 Universal Deck Box AT Command Set (Continued)

Command Syntax	Command Name	Result	Page
AT\$Gn [Enter]	Output Remote AGC	Outputs ten seconds of AGC history from the remote modem at address n.	7-70
ATT2 [Enter]	AGC Diagnostic Enable	Enables the display of the minimum and maximum AGC outputs of the local modem.	7-73
ATT1 [Enter]	AGC Diagnostic Disable	Disables the display of the minimum and maximum AGC outputs of the local modem.	7-75
AT\$Tn [Enter]	Release Status	Displays the status of the SMART Release or the SMART Modem at address n.	7-76
AT\$Rn,m [Enter]	Release	Activates the release mechanism of the SMART Release at address n with release code m.	7-78
AT\$Nn,m [Enter]	Burn Wire Release	Activates the burn wire release of the SMART Modem at address n with release code m.	7-79
ATWn,m [Enter]	Compact Modem Wakeup	Wakes up a Compact Modem at address n and sets the idle time to m.	7-80
ATNm [Enter]	Transpond	Causes the local modem to display the two-way travel time from the modem to a transponder of receive frequency m.	7-81
ATNL [Enter]	Broadband Chirp Interrogate	Causes the local modem to display the two-way travel times from the modem to all remote modem transponders from which it receives replies.	7-82
ATRCn	Compass and Tilt	Displays the range and the compass heading and tilt of the remote modem at address n.	7-83
ATRTn	Pitch and Roll	Displays the range and the pitch and roll of the remote modem at address n.	7-85
ATRCHn	Compass	Displays the range and the high resolution compass heading of the remote modem at address n.	7-87
ATRCpn	Pitch	Displays the range and the high resolution pitch of the remote modem at address n.	7-89

**Table 7-1 ATM-900 Series Acoustic Telemetry Modem and UDB-9400
Universal Deck Box AT Command Set (Continued)**

Command Syntax	Command Name	Result	Page
ATRCRn	Roll	Displays the range and the high resolution roll of the remote modem at address n.	7-91
ATCP	Local Charge Percentage	Displays the charge percentage remaining of the rechargeable lithium ion battery packs of the local modem. The local modem must be an SM-976 SMART modem.	7-93
AT\$CPn	Remote Charge Percentage	Displays the charge percentage remaining of the rechargeable lithium ion battery packs of the remote modem at address n. The remote modem must be an SM-976 SMART Modem.	7-94

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. And if the characters +++ are typed in rapid succession when the modem is not transmitting or receiving data, either over the serial interface or over the acoustic link, the local modem will switch to Command mode.



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

How to Use

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

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

Special Considerations

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

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

The three conditions are shown graphically in Figure 7-1.

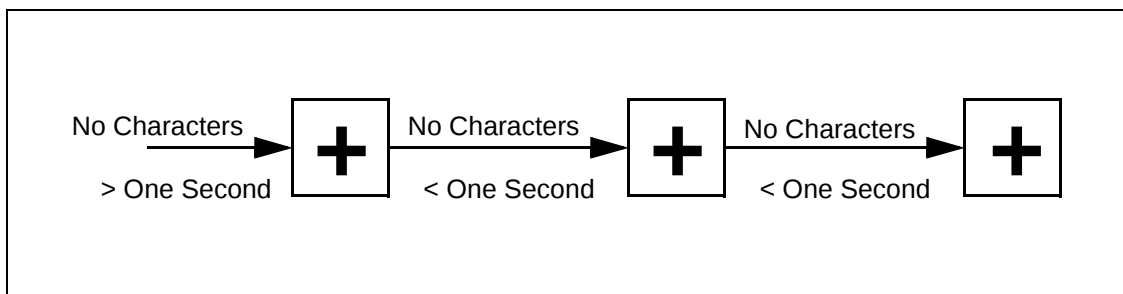


Figure 7-1 Conditions for Recognizing an Online Interrupt Command

Attention

AT

Syntax

AT [Enter]

Definition

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



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

How to Use

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

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

Check Mode

ATC

Syntax

ATC [Enter]

Definition

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

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



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

How to Use

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

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

Version

ATI

Syntax

ATI [Enter] or Version [Enter]

Definition

The Version command displays the modem type, the firmware version number, the firmware version build date, the PLD (Programmable Logic Device) version numbers, and the serial number of the local modem for the following modem types:

Standard Modem:	The modem is an ATM-900 Series Acoustic Telemetry Modem, a SMART Release (SR-50 or SR-9100), or a SMART Modem (SM-975).
Universal Deck Box:	The modem is a UDB-9400 Universal Deck Box.
Compact Modem:	The modem is a Compact Modem.

Instead of ATI, the `version` command can be used. This information, along with the firmware version numbers of the programmable logic devices in the modem, is displayed by the local modem.



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

How to Use

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

The local modem will display the modem type, the firmware version number, the firmware version build date, the PLD version numbers, and the modem serial number.

Reboot

ATES

Syntax

ATES [Enter] or Reboot [Enter]

Definition

The Reboot command reboots the firmware of the local modem causing the modem to reset in the same manner as it would when the power is cycled off and then on. Instead of ATES, the `reboot` command can also be used. This process takes about five seconds.



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

How to Use

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

The local modem will reboot its firmware and automatically enter the mode determined by the setting of the OpMode configuration parameter.

Remote Acoustic Reset

AT\$ESn

Syntax

AT\$ESn [Enter]

Definition

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



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

How to Use

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

The remote modem will reset.

Special Considerations

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

Update Firmware

ATEU

Syntax

ATEU [Enter]

Definition

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



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

How to Use

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

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

Special Considerations

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

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

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

Dial

ATDn

Syntax

ATDn [Enter]

Definition

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



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

How to Use

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

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

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

Special Considerations

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

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

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

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



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

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

Factory Reset

AT&F

Syntax

AT&F [Enter] or factory_reset [Enter]

Definition

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



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



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

How to Use

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

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

Special Considerations

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

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

Hang Up

ATHn

Syntax

ATHn [Enter]

Definition

The Hang Up command causes the remote modem at address n to go into the lowpower state. Using no address or the global address 255 causes all the remote modems to go into the lowpower state.



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

How to Use

To use the Hang Up command, type ATH followed by the address of the remote modem, and then press Enter.

The local modem will send the Hang Up command to the remote modem at address n. If no address is specified, or the address is the global address of 255, then all the remote modems that receive the command will go into the lowpower state. When the local modem has completed the transmission, it will respond with the message "Off Line."

Special Considerations

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

- When a remote modem receives the Hang Up command, it will not send an acknowledgment to the local modem. Instead, it will cease transmissions and go into the lowpower state.
- Because a remote modem goes into the lowpower state when it receives the Hang Up command, its Device Enable output will turn off. Refer to "Device Enable" on page 5-98 for information on the Device Enable output.
- The global address 255 is allowed with the ATHn command.

Online

ATO

Syntax

ATO [Enter]

Definition

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



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

How to Use

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

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

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

Special Considerations

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

- To display the message "CONNECT" followed by the acoustic bit rate and many other messages, the Verbose configuration parameter must be set to 1 or higher, where 1 is the factory default setting.

- If it is desired to enter commands after going online with the remote modem, type +++ in rapid succession to cause the local modem to go into Command mode. Then enter the desired commands. To go back online with the same remote modem, use the Online command.

.

Remote Break

AT\$Kn,p

Syntax

AT\$Kn [Enter]

Definition

Causes the remote modem at address n to send a break on its serial port p and to go online with the local modem. If p is left out, serial port 1 is assumed.

The settings for p are 1 and 2 as follows:

- 1: Serial port 1.
- 2: Serial port 2.



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

How to Use

To use the Remote Break command, type AT\$K followed by the address of the remote modem, the comma character ",", and the serial port number, and then press Enter.

The remote modem will send a break on the specified serial port and then the local modem will go online with the remote modem and display the message "CONNECT" followed by the transmitting acoustic bit rate of the local modem.

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

Special Considerations

When using the Remote Break command, take note of the following:

- To display the message "CONNECT" followed by the transmitting acoustic bit rate and many other messages, the Verbose configuration parameter must be set to 1 or higher, where 1 is the factory default setting.
- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of the AcRspTmOut configuration parameter. If an acknowledgment is not received, "Response Not Received" will be displayed.
- The Remote Break command sets the RemotAddr configuration parameter of the remote modem to the address of the local modem.
- The Remote Break command sets RemotAddr configuration parameter of the local modem to the address of the remote modem.
- If it is desired to enter commands after going online with the remote modem, type +++ in rapid succession to cause the local modem to go into Command mode. Then enter the desired commands. To go back online with the same remote modem, use the Dial command.
- If the remote modem goes into the lowpower state and @OpMode=Command, then the modem will go into Command mode. To go back online with the same remote modem, use the Dial command.

Acoustic Link Test

ATXn

Syntax

ATXn [Enter]

Definition

The Acoustic Link Test command tests the acoustic link between the local modem and the remote modem at address n by causing the remote modem to transmit one of 8 different length preset test messages at the acoustic bit rate determined by the setting of the TxRate configuration parameter of the remote modem. The preset test message length and whether the message is displayed when received by the local modem is determined by the settings of the PktSize and PktEcho configuration parameters, respectively.

In addition, the local modem measures and displays the following, which are the received data statistics:

- | | |
|-------------|--|
| ERR: | Errors—the number of bits received that did not match the test message. |
| CRC: | Checksum—pass or fail, where a pass condition signifies no errors were detected, and a fail condition signifies one or more bit errors were detected. |
| MPD: | Multipath Delay—in milliseconds, where the higher the number the greater the multipath. The range is from 0 to 50. |
| SNR: | Signal to Noise Ratio—a measurement that provides information on the quality of the processed signal. The value takes into account all the processing and the effects of multipath. Use Table 7-2 as a guide for adjusting the power level and acoustic bit rates to obtain the optimum SNR. |
| 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 value that indicates how much gain is being applied to the received signals. The higher the AGC value the higher the gain. Use Table 7-3 as a guide for adjusting the power level and acoustic bit rates based on the AGC value.

CCERR: Corrected Channel Error—Metric 0–14.

Table 7-2 Guide for Obtaining the Optimum SNR

SNR VALUE	SIGNAL QUALITY	RECOMMENDED ACTION
20 and higher	High	Can lower the power level or increase the acoustic bit rate.
19–15	Good	No action is recommended.
14–12	Acceptable	For an extra margin use a higher power level.
Less than 12	Poor	Use a higher power level. If multipath is suspected as the cause, try a lower power level. Try a lower acoustic bit rate at all power levels.

Table 7-3 Guide for Obtaining the Optimum AGC

AGC VALUE	RECEIVED SIGNAL	RECOMMENDED ACTION
00–15	Extremely strong	Can lower the power level or increase the acoustic bit rate.
16–25	Strong	May be able to use a lower power level or a higher acoustic bit rate.
26–31	Average	Some noise exists in the channel. No action is recommended.
32–40	Low	Use a higher power level or lower acoustic bit rate.
41–49	Weak	Use a higher power level or lower acoustic bit rate.
Greater than 50	Extremely weak	Use a higher power level or lower acoustic bit rate.



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

How to Use

To use the Acoustic Link Test command, type ATX followed by the address of the remote modem, and then press Enter.

The remote modem will transmit the preset test message selected by the setting of the local modem's PktSize configuration parameter at the acoustic bit rate determined by the setting of the remote modem's TxRate configuration parameter, and the local modem will display the received data statistics described above. In addition, if @PktEcho=Ena, the local modem will display the preset test message which consists of the alphanumeric ASCII character set.



WARNING The ATXn command sets the RemoteAddr configuration parameter of the remote modem to the address of the local modem. If the remote modem will later be used in Online mode, then its RemoteAddr configuration parameter may need to be set back to the setting it was before the ATXn command was sent to it. To display the setting of the RemoteAddr configuration parameter of the remote modem *before* using the ATXn command, enter #n @RemoteAddr where n is the address of the remote modem. To return the setting to its original value *after* using the ATXn command, enter #n @RemoteAddr=<value>, where "value" is the original setting. If the original setting is not known, use the Remote Reset command (AT\$ESn) to reboot the modem and set all of its configuration parameters back to their previously saved values.

Special Considerations

When using the Acoustic Link Test command, take note of the following:

- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of AcRspTmOut configuration parameter. If an acknowledgment is not received, "Response Not Received" will be displayed.

-
- To optimize the performance and efficiency of the modems, consider reducing the transmit power level of the remote modem with the Remote Power command (AT\$Pn,m) and use the Acoustic Link Test command to verify a low error rate—8 or less. Also consider increasing the remote modem's transmitting acoustic bit rate by changing the setting of the TxRate configuration parameter with the Remote Bit Rate command (AT\$An,m). Again, use the Acoustic Link Test command to verify a low error rate. Similarly, if a high error rate is observed, consider increasing the transmit power level or decreasing the transmitting acoustic bit rate, or both.
 - The RemoteAddr configuration parameter on the remote modem will be set to address of the local modem.

Multiple Bit Rate Test

ATYn

Syntax

ATYn [Enter]

Definition

The Multiple Bit Rate Test command tests the acoustic link between the local modem and the remote modem at address n by causing the remote modem to transmit a 256-byte preset test message multiple times, one time for each of the acoustic bit rates listed below. If @PktEcho=Ena, the preset test message is displayed when received by the local modem. If the local modem is an ATM-900 Series Acoustic Telemetry Modem, six different acoustic bit rates are used to transmit the preset test message: 300, 600, 800, 1000, 1200, and 2400 bits/sec. If the local modem is a UDB-9400 Universal Deck Box, these bit rates plus five additional bit rates are used: 2560; 5120; 7680; 10,240; and 15,360 bits/sec.

In addition, the local modem measures and displays the following, which are the received data statistics:

ERR:	Errors—the number of bits received that did not match the test message.
CRC:	Checksum—pass or fail, where a pass condition signifies no errors were detected, and a fail condition signifies one or more bit errors were detected.
MPD:	Multipath Delay—in milliseconds, where the higher the number the greater the multipath. The range is from 0 to 50.
SNR:	Signal to Noise Ratio—a measurement that provides information on the quality of the processed signal. The value takes into account all the processing and the effects of multipath. Use Table 7-2 on page 7-25 as a guide for adjusting the power level and acoustic bit rates to obtain the optimum SNR.
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 value that indicates how much gain is being applied to the received signals. The higher the AGC value the higher the gain. Use Table 7-3 on page 7-25 as a guide for adjusting the power level and acoustic bit rates based on the AGC value.
- CCERR:** Corrected Channel Error—Metric 0–14.



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

How to Use

To use the Multiple Bit Rate Test command, type ATY followed by the address of the remote modem, and then press Enter.

The remote modem will transmit the 256-byte preset test message at each of the different acoustic bit rates, and the local modem will display the received data statistics described above. In addition, depending on the setting of the PktSize and PktEcho configuration parameters, the local modem will display the preset test message which consists of the alphanumeric ASCII character set.



WARNING The ATYn command sets the RemoteAddr configuration parameter of the remote modem to the address of the local modem. If the remote modem will later be used in Online mode, then its RemoteAddr configuration parameter may need to be set back to the setting it was before the ATYn command was sent to it. To display the setting of the RemoteAddr configuration parameter of the remote modem *before* using the ATYn command, enter #n @RemoteAddr where n is the address of the remote modem. To return the setting to its original value *after* using the ATYn command, enter #n @RemoteAddr=<value>, where "value" is the original setting. If the original setting is not known, use the Remote Reset command (AT\$ESn) to reboot the modem and set all of its configuration parameters back to their previously saved values.

Special Considerations

When using the Multiple Bit Rate Test command, take note of the following:

- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of the AcRspTmOut configuration parameter. If an acknowledgment is not received, "Response Not Received" will be displayed.
- To optimize the performance and efficiency of the modems, consider reducing the transmit power level of the remote modem with the Remote Power command (AT\$Pn,m) and use the Multiple Bit Rate Test command to verify a low error rate—8 or less. Also consider increasing the remote modem's transmitting acoustic bit rate by changing the setting of the TxRate configuration parameter with the Remote Bit Rate command (AT\$An,m). Again, use the Multiple Bit Rate Test command to verify a low error rate. Similarly, if a high error rate is observed, consider increasing the transmit power level or decreasing the transmitting acoustic bit rate, or both.

Remote Power

AT\$Pn,m

Syntax

AT\$Pn,m [Enter]

Definition

The Remote Power command sets the transmit power level of the remote modem at address n to level m. The range of settings for m is from 1 to 8 for a range of 0 dB to -21 dB of attenuation in -3 dB steps, where 0 dB is the maximum transmit power level and -21 dB is the minimum transmit power level as follows:

- 1: -21 dB (minimum power level)
- 2: -18 dB
- 3: -15 dB
- 4: -12 dB
- 5: -09 dB
- 6: -06 dB
- 7: -03 dB
- 8: 00 dB (maximum power level)



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



WARNING Exceeding the recommended power level and continuous transmission time limits for an ATM-914, ATM-915 or ATM-916 Acoustic Telemetry Modems may cause the transmitter to overheat and to automatically shut down. Should this condition occur, a message will be output on the serial interface indicating such. Once the modem cools down it will be able to transmit again. To display the internal temperature of the local modem, use the ATV command.

How to Use

To use the Remote Power command, type AT\$P followed by the address of the remote modem, the comma character "," and the value of m as determined by the required transmit power level, and then press Enter.

The remote modem will set its transmit power level, and then the local modem will respond with the message "OK."

Special Considerations

When using the Remote Power command, take note of the following:

- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of the AcRspTmOut configuration parameter. If an acknowledgment is not received, "Response Not Received" will be displayed.

Remote Bit Rate

AT\$An,m

Syntax

AT\$An,m [Enter]

Definition

The Remote Bit Rate command sets the transmitting acoustic bit rate of the remote modem at address n to m. The range of settings for m is from 2 to 13 as follows:

- 1: 80 bits/sec FH with rate 1/2 convoutional coding
- 2: 140 bits/sec MFSK repeated four times with rate 1/2 convolutional coding and 25-ms multipath guard period
- 3: 300 bits/sec MFSK repeated twice with rate 1/2 convolutional coding and 25-ms multipath guard period
- 4: 600 bits/sec MFSK with rate 1/2 convolutional coding and 25-ms multipath guard period
- 5: 800 bits/sec MFSK with rate 1/2 convolutional coding and 12.5-ms multipath guard period
- 6: 1066 bits/sec MFSK with rate 1/2 convolutional coding and 3.125-ms multipath guard period
- 7: 1200 bits/sec MFSK with rate 1/2 convolutional coding
- 8: 2400 bits/sec MFSK
- 9: 2560 bits/sec PSK, with rate 1/2 convolutional coding
- 10: 5120 bits/sec PSK, with rate 1/2 convolutional coding
- 11: 7680 bits/sec PSK, with rate 1/2 convolutional coding
- 12: 10,240 bits/sec PSK
- 13: 15,360 bits/sec PSK



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

How to Use

To use the Remote Bit Rate command, type AT\$A followed by the address of the remote modem, the comma character "," and the value of m as determined by the required acoustic bit rate, and then press Enter.

The remote modem will set its transmitting acoustic bit rate, and then the local modem will respond with the message "OK."

Special Considerations

When using the Remote Bit Rate command, take note of the following:

- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of the AcRspTmOut configuration parameter. If an acknowledgment is not received, "Response Not Received" will be displayed.
- The Remote Bit Rate command sets the TxRate configuration parameter of the remote modem to the selected value.
- When using settings 9–13, a coprocessor is required to receive the data. The coprocessor is standard for a UDB 9400 Universal Deck Box and is also available when the PSK Coprocessor option is ordered.

Read Register

ATSn?

Syntax

ATSn? [Enter] or ATS? [Enter]

Definition

The Read Register command causes the local modem to display the setting of its S Register n, or if the S Register number is not specified, the settings of all its S Registers.



NOTE S Registers are available for backward compatibility, as they perform many of the same functions as those of the configuration parameters. Changing the setting of a configuration parameter will automatically change the setting of its equivalent S Register if there is one. The reverse is also true. However, only a limited set of configuration parameters can be accessed with S Registers. Therefore using the configuration parameters instead of the S Registers is highly recommended.



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

How to Use

To use the Read Register command, type ATS and the number of the S Register that is to be read, followed by a question mark (?). Or type ATS? to read the first 21 S Registers, and then press Enter.

The local modem will display its S Register setting or settings. An example that uses the Read Register command is shown in Figure 7-2, where all the S Register settings were displayed by entering ATS?

Special Considerations

The S Register settings can be interpreted from Table 8-1 on page 8-2, which includes page references to where detailed descriptions are provided.

```
user:1>ats?  
Local Sregisters  
S00=080 S01=000 S02=000 S03=130 S04=005 S05=000 S06=008  
S07=015 S08=060 S09=000 S10=036 S11=000 S12=000 S13=001  
S14=000 S15=001 S16=001 S17=001 S18=000 S19=000 S20=000
```

Figure 7-2 Read Register Command and Resulting Display

Read Remote Registers

AT\$Sn

Syntax

AT\$Sn [Enter]

Definition

The Read Remote Registers command causes the local modem to display the S Register settings of the remote modem at address n.



NOTE S Registers are available for backward compatibility, as they perform many of the same functions as those of the configuration parameters. Changing the setting of a configuration parameter will automatically change the setting of its equivalent S Register if there is one. The reverse is also true. However, only a limited set of configuration parameters can be accessed with S Registers. Therefore using the configuration parameters instead of the S Registers is highly recommended.



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

How to Use

To use the Read Remote Registers command, type AT\$S followed by the address of the remote modem, and then press Enter.

The local modem will display the S Register settings of the remote modem. An example that uses the Read Remote Registers command is shown in Figure 7-3, where the S Register settings of the remote modem with address 1 were displayed by entering AT\$S1.

Special Considerations

When using the Read Remote Registers command, take note of the following:

- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by

the setting of the AcRspTmOut configuration parameter. If an acknowledgment is not received, "Response Not Received" will be displayed.

- The S Register settings can be interpreted from Table 8-1 on page 8-2, which includes page references to where detailed descriptions are provided.

```
user:1>at$s1
Remote Sregisters
S00=080  S01=000  S02=000  S03=130  S04=003  S05=000  S06=001
S07=015  S08=060  S09=000  S10=036  S11=000  S12=000  S13=001
S14=000  S15=001  S16=001  S17=001  S18=001  S19=000  S20=000
```

Figure 7-3 Read Remote Registers Command and Resulting Display

Set Register

ATS_n=n

Syntax

ATS_n=n [Enter]

Definition

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



NOTE S Registers are available for backward compatibility, as they perform many of the same functions as those of the configuration parameters. Changing the setting of a configuration parameter will automatically change the setting of its equivalent S Register if there is one. The reverse is also true. However, only a limited set of configuration parameters can be accessed with S Registers. Therefore using the configuration parameters instead of the S Registers is highly recommended.



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

How to Use

To use the Set Register command, type ATS and the S Register number to be set, followed by the equal character "=" and the setting desired, and then press Enter.

The local modem will set the S Register setting and respond with the message "OK."

Special Considerations

When using the Set Register command, take note of the following:

- Entering `cfg store` after using the Set Register command will save the S Register setting as part of the startup configuration, which is the S Register settings when the modem is powered up.

- If at any time it is desired to return the S Register settings to the values they were when the modem was first powered up—and `cfg_store` was not used to save the S Register settings as part of the startup configuration—power down the modem, and then power up the modem again.

Write

AT&W

Syntax

AT&W [Enter] or cfg store [Enter]

Definition

The Write command saves the configuration parameter settings of the local modem as the new startup configuration.



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

How to Use

To use the Write command, type AT&W, and then press Enter.

The local modem will save its current configuration parameter settings as the startup configuration, and then respond with the message "Registers Stored."



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

Special Considerations

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

- When the modem is powered up, the configuration parameters will be set to their new startup configuration. The configuration parameter settings can again be changed with the Set Register command (ATSn=n) or @<parameter name>=<value>, and then saved as the new startup configuration with the Write command or by entering `cfg store`.

Lowpower State

ATL

Syntax

ATL [Enter]

Definition

The Lowpower State command forces the idle time of the local modem to expire, which in turn causes the modem to go into the lowpower state.



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

How to Use

To use the Lowpower State command, type ATL, and then press Enter.

The local modem will immediately go into the lowpower state and respond with the message "Lowpower."



WARNING Depending on the setting of the LPFlowCtl configuration parameter, the RS-232 drivers may be set to turn off whenever the modem is in the lowpower state. Refer to "LPFlowCtl" on page 8-22 for information on the LPFlowCtl configuration parameter. Therefore, hardware CTS handshaking *must* be disabled at the host processor when sending the first byte of data to the modem over the serial interface. After the first byte is sent, handshaking can be turned on again or left disabled.

Special Considerations

When using the Lowpower State command, take note of the following:

- To display the message "Lowpower" and many other messages, the Verbose configuration parameter must be set to 1 or higher, where 1 is the factory default setting.

- The local modem can be awakened by input either from its host processor over the serial interface or from a remote modem over the acoustic link. When awakened, the modem will go into the operating mode determined by the setting of the OpMode configuration parameter.
- When the modem is in the lowpower state, the Device Enable output is turned off. Refer to "Device Enable" on page 5-98 for information on the Device Enable output.

Local Device Enable

ATTDm,p

ATTDm,p [Enter]

Definition

Sets or clears the Device Enable output of serial port p of the local modem. If p is left out, serial port 1 is assumed. The Device Enable output can also be set or cleared *both* as described in "Analog Input Option" on page 5-71 *and* with the Local Device Enable command by setting @DevEnable=Auto which is its default setting. To set or clear the Device Enable output *only* with the Local Device Enable command, the DevEnable configuration parameter must be set to 3 (Manual).

The settings for m are 0 and 1 as follows:

- 0: Clear Device Enable output (high impedance).
- 1: Set Device Enable output (low impedance).

The settings for p are 1 and 2 as follows:

- 1: Serial port 1.
- 2: Serial port 2.



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

How to Use

To use the Local Device Enable command, type ATTD followed by the value of m as determined by the required setting, and the serial port number, and then press Enter.

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

Remote Device Enable

AT\$Xn,m,p

AT\$Xn,m,p [Enter]

Definition

The Remote Device Enable command sets or clears the Device Enable output of serial port p of the remote modem at address n. If p is left out, serial port 1 is assumed. The Device Enable output can also be set or cleared both as described in "Device Enable" on page 5-98 *and* with the Remote Device Enable command by setting @DevEnable=Auto which is its default setting. To set or clear the Device Enable output *only* with the Remote Device Enable command, the DevEnable configuration parameter must be set to 3 (Manual).

The settings for m are 0 and 1 as follows:

- 0: Clear Device Enable output (high impedance).
- 1: Set Device Enable output (low impedance).

The settings for p are 1 and 2 as follows:

- 1: Serial port 1.
- 2: Serial port 2.



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

How to Use

To use the Remote Device Enable command, type AT\$X followed by the address of the remote modem, the comma character ",", the value of m as determined by the required setting, another comma character, and the serial port number, and then press Enter.

The remote modem will clear or set the Device Enable output of the specified serial port.

Special Considerations

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

- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of the AcRspTmOut configuration parameter. If an acknowledgment is not received, "Response Not Received" will be displayed.

Range

ATRn

Syntax

ATRn [Enter]

Definition

The Range command causes the local modem to display the range from the local modem to the remote modem at address n. The displayed range is in meters with a resolution of 0.1 meters. The information displayed and the format are dependent on the setting of the Verbose configuration parameter as listed below.

Output format @Verbose=0 and 1:

Range <local address> to <remote address> : <range> m

Output format @Verbose=2:

Range <local address> to <remote address> : <range> m speed <relative speed> m/s

Output format @Verbose=3:

TX time: hh:mm:ss.nnnn

RX time: hh:mm:ss.nnnn

Range <local address> to <remote address> : <range> m (Round-trip <range> ms) speed <relative speed> m/s

For @Verbose=3, hh is hours, mm is minutes, ss is seconds, and nnnn is tenths of milliseconds.



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

How to Use

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

The local modem will respond by displaying the range in meters to the remote modem. The displayed information will be in accordance with the Verbose configuration parameter.

Special Considerations

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

- The displayed range is the one-way range to the remote modem and is determined acoustically based on the setting of the SpeedOfSound configuration parameter.
- To acquire the range to a remote modem, the local modem transmits an interrogation signal to the remote modem, and when the remote modem receives the signal, it responds with a reply. The local modem must receive the reply from the remote modem within the acoustic response timeout, which is determined by the setting of the AcRspTmOut configuration parameter. If a reply is not received, "Response Not Received" will be displayed.
- The output format is for ATM-900 Series Acoustic Telemetry Modem and a UDB-9400 Universal Deck Box only.

Fast Range

ATRFn

Syntax

ATRFn [Enter]

Definition

The Fast Range command causes the local modem to display the range from the local modem to the remote modem at address n using a shorter turn-around time, as the wakeup tones are omitted. The displayed range is in meters with a resolution of 0.1 meters. The information displayed and the format are dependent on the setting of the Verbose configuration parameter as listed below.



NOTE If the modem is in the lowpower state, the Fast Range command will not awaken it, and therefore the range will not be displayed.

Output format @Verbose=0 and 1:

Range <local address> to <remote address> : <range> m

Output format @Verbose=2:

Range <local address> to <remote address> : <range> m speed <relative speed> m/s

Output format @Verbose=3:

TX time: hh:mm:ss.nnnn

RX time: hh:mm:ss.nnnn

Range <local address> to <remote address> : <range> m (Round-trip <range> ms) speed <relative speed> m/s

For @Verbose=3, hh is hours, mm is minutes, ss is seconds, and nnnn is tenths of milliseconds.



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

How to Use

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

The local modem will respond by displaying the range in meters to the remote modem. The displayed information will be in accordance with the Verbose configuration parameter.

Special Considerations

When using the Fast 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 the setting of the SpeedOfSound configuration parameter.
- To acquire the range to a remote modem, the local modem transmits an interrogation signal to the remote modem, and when the remote modem receives the signal, it responds with a reply. The local modem must receive the reply from the remote modem within the acoustic response timeout, which is determined by the setting of the AcRspTmOut configuration parameter. If a reply is not received, "Response Not Received" will be displayed.
- The output format is for ATM-900 Series Acoustic Telemetry Modem and a UDB-9400 Universal Deck Box only.

Range and Depth

ATRDn

Syntax

ATRDn [Enter]

Definition

The Range and Depth command causes the local modem to display the range from the local modem to the remote modem and the depth of the remote modem at address n. The displayed range and depth are in meters with a resolution of 0.1 meters. All data are displayed in accordance with the Verbose configuration parameter as listed below.

Output format @Verbose=0 and 1:

Depth: <depth>

Range <local address> to <remote address> : <range> m

Output format @Verbose=2:

Depth: <depth>

Range <local address> to <remote address> : <range> m speed <relative speed> m/s

Output format @Verbose=3:

TX time: hh:mm:ss.nnnn

RX time: hh:mm:ss.nnnn

Depth: <depth>

Range <local address> to <remote address> : <range> m (Round-trip <range> ms) speed <relative speed> m/s

For @Verbose=3, hh is hours, mm is minutes, ss is seconds, and nnnn is tenths of milliseconds.

How to Use

To use the Range and Depth command, type ATRD followed by the address of the remote modem, and then press Enter.

The modem will respond by displaying the depth in meters of the remote modem and the range in meters to the remote modem. The information is transmitted to the local modem from the remote modem over the acoustic

link. The displayed information will be in accordance with the Verbose configuration parameter.

Special Considerations

When using the Range and Depth command, take note of the following:

- The displayed range is the one-way range to the remote modem and is determined acoustically based on the setting of the SpeedOfSound configuration parameter.
- If the modem does not have a pressure transducer installed, only range will be displayed.
- To acquire the range to a remote modem, the local modem transmits an interrogation signal to the remote modem, and when the remote modem receives the signal, it responds with a reply. The local modem must receive the reply from the remote modem within the acoustic response timeout, which is determined by the setting of the AcRspTmOut configuration parameter. If a reply is not received, "Response Not Received" will be displayed.
- The output format is for ATM-900 Series Acoustic Telemetry Modem and a UDB-9400 Universal Deck Box only.

Range and Location

ATRXn

Syntax

ATRXn [Enter]

Definition

The Range and Location command causes the local modem to display the range from the local modem to the remote modem and the location of the remote modem at address n. The displayed range is in meters with a resolution of 0.1 meters. The information displayed and the format are dependent on the setting of the Verbose configuration parameter as listed below.

Output format @Verbose=0 and 1:

Range <local address> to <remote address> : <range> m

Output format @Verbose=2:

Range <local address> to <remote address> : <range> m speed <relative speed> m/s

Output format @Verbose=3:

TX time: hh:mm:ss.nnnn

RX time: hh:mm:ss.nnnn

Range <local address> to <remote address> : <range> m (Round-trip <range> ms) speed <relative speed> m/s

For @Verbose=3, hh is hours, mm is minutes, ss is seconds, and nnnn is tenths of milliseconds.

In addition to the range, the location of the remote modem is displayed in latitude and longitude, along with its depth or altitude in accordance with the setting of the ReplyData configuration parameter.



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

How to Use

To use the Range and Location command, type ATRX followed by the address of the remote modem, and then press Enter.

The local modem will respond by displaying the range in meters to the remote modem. The displayed information will be in accordance with the Verbose configuration parameter. In addition to the range, the location of the remote modem will be displayed in latitude and longitude, along with its depth or altitude in accordance with the setting of the ReplyData configuration parameter.

Special Considerations

When using the Range and Location command, take note of the following:

- The displayed range is the one-way range to the remote modem and is determined acoustically based on the setting of the SpeedOfSound configuration parameter.
- To acquire the range to a remote modem, the local modem transmits an interrogation signal to the remote modem, and when the remote modem receives the signal, it responds with a reply. The local modem must receive the reply from the remote modem within the acoustic response timeout, which is determined by the setting of the AcRspTmOut configuration parameter. If a reply is not received, "Response Not Received" will be displayed.
- The output format is for ATM-900 Series Acoustic Telemetry Modem and a UDB-9400 Universal Deck Box only.

Local Battery Voltage

ATV

Syntax

ATV [Enter]

Definition

The Local Battery Voltage command causes the local modem to display the input power supply voltage—whether it is from the transmitter battery or an external power source—and the internal temperature. Refer to Table 9-1 on page 9-3 for the estimated modem battery pack capacity remaining versus the voltage of the transmitter power supply.



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



WARNING Exceeding the recommended power level and continuous transmission time limits for an ATM-914, ATM-915 or ATM-916 Acoustic Telemetry Modems may cause the transmitter to overheat and to automatically shut down. Should this condition occur, a message will be output on the serial interface indicating such. Once the modem cools down it will be able to transmit again.

How to Use

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

The local modem will display its input power supply voltage in volts and its internal temperature in degrees Celsius.

Special Considerations

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

- The accuracy of the input power supply voltage measurement is ± 1.0 volts.
- Should the internal temperature of the modem exceed 80°C, the modem transmitter will shut down. Once cooled to 60°C, the transmitter will again be operational.

Remote Battery Voltage

AT\$Vn

Syntax

AT\$Vn [Enter]

The Remote Battery Voltage command causes the local modem to display the input power supply voltage—whether it is from the transmitter battery or an external power source—and the real-time clock battery voltage of the remote modem at address n. Refer to Table 9-1 on page 9-3 for the estimated modem battery pack capacity remaining versus the voltage of the transmitter power supply.



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

How to Use

To use the Remote Battery Voltage command, type AT\$V followed by the address of the remote modem, and then press Enter.

The local modem will display the input power supply and real-time clock battery voltages in volts of the remote modem.

Special Considerations

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

- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of the AcRspTmOut configuration parameter. If an acknowledgment is not received, "Response Not Received" will be displayed.
- The accuracy of the input power supply voltage measurement is ± 1.0 volts.
- The real-time clock battery voltage is displayed following "DSP Bat =."
- If the real-time clock battery is installed and has sufficient capacity, its voltage will be 2.7 VDC or higher.

- If the real-time clock battery voltage is less than 2.7 VDC, the battery is either not installed or has little remaining capacity and should be replaced.

Remote Data Logger Enable

AT\$BEn

Syntax

AT\$BEn [Enter]

Definition

The Remote Data Logger Enable command causes the remote modem at address n to go into Datalogger mode.



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

How to Use

To use the Remote Data Logger Enable command, type AT\$BE followed by the address of the remote modem, and then press Enter.

The remote modem will go into Datalogger mode, and then the local modem will respond with the message "OK."

Special Considerations

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

- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of the AcRspTmOut configuration parameter. If an acknowledgment is not received, "Response Not Received" will be displayed.
- The Remote Data Logger Enable command sets @OpMode=Datalog of the remote modem.

Remote Data Logger Disable

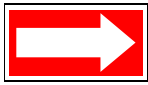
AT\$BDn

Syntax

AT\$BDn [Enter]

Definition

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



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

How to Use

To use the Remote Data Logger Disable command, type AT\$BD followed by the address of the remote modem, and then press Enter.

The local modem will go online with the remote modem if the remote modem is in Datalogger mode, and then respond with the message "OK."

Special Considerations

When using the Remote Data Logger Disable command, take note of the following:

- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of the AcRspTmOut configuration parameter. If an acknowledgment is not received, "Response Not Received" will be displayed.
- The Remote Data Logger Disable command sets @OpMode=Online of the remote modem.
- The Remote Data Logger Disable command has no effect on the remote modem if the remote modem is not in Datalogger mode.

Clear Remote Data Logger

AT\$BCn

Syntax

AT\$BCn [Enter]

Definition

The Clear Remote Data Logger command causes the remote modem at address n to clear the contents of its data logger memory.



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

How to Use

To use the Clear Remote Data Logger command, type AT\$BC followed by the address of the remote modem, and then press Enter.

The remote modem will clear the contents of its data logger memory, and then the local modem will respond with the message "OK."

Special Considerations

When using the Clear Remote Data Logger command, take note of the following:

- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of the AcRspTmOut configuration parameter. If an acknowledgment is not received, "Response Not Received" will be displayed.
- The time required to clear a remote modem's data logger is up to 20 seconds depending on how much data are stored plus the one-way sound travel time for the acoustic command to reach the remote modem. Since sound travels at about 1500 meters/second in seawater, it will take approximately 22 seconds to clear the data logger of a remote modem that is 3000 meters away from the local modem.

Remote Bytes Stored

AT\$BNn

Syntax

AT\$BNn [Enter]

Definition

The Remote Bytes Stored command causes the local modem to display the number of bytes of data stored in the data logger of the remote modem at address n. If the number of bytes stored is greater than 1 MB, the number is shown in MB; if less, then in bytes.



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

Use of the `rdllist` command instead of the Remote Bytes Stored command is recommended unless it is expected that 4 MB or less of data are stored, in which case the Remote Bytes Stored command can be used.

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.

Special Considerations

When using the Remote Bytes Stored command, take note of the following:

- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of the `AcRspTmOut` configuration parameter. If an acknowledgment is not received, "Response Not Received" will be displayed.

Clear Local Data Logger

ATBC

Syntax

ATBC [Enter]

Definition

The Clear Local Data Logger command causes the local modem to clear the contents of its data logger memory.



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

How to Use

To use the Clear Local Data Logger command, type ATBC, and then press Enter.

The local modem will clear the contents of its data logger memory. While clearing the memory, the message "Deleting 1 file (up to n seconds to clear)" is displayed, where "n" is the amount of time in seconds to clear and is based on the amount of data in the data logger. Once cleared, "file 1 of 1" followed by "Buffer Cleared" are displayed.

Special Considerations

When using the Clear Local Data Logger command, take note of the following:

- The time required to clear the local modem's data logger depends on the amount of data stored and can take from a few seconds to several minutes.
- While the contents of the local modem's data logger are being cleared, the local modem will not accept any input over the serial interface or over the acoustic link.
- If the ATBC command is used to clear a large amount of data stored to the optional SDHC card, the card should be removed and reformatted on a PC after clearing. For instructions on how to change the SDHC card, refer to "Changing the SDHC Card" on page 9-11.

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.



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

Use of the `dllist` command instead of the Local Bytes Stored command is recommended, as the number of records and a time stamp of the first and last record is included.

How to Use

To use the Local Bytes Stored command, type ATBN, and then press Enter.

The local modem will display the number of bytes of data stored in its data logger.

Output Local Data Logger

ATBT

Syntax

ATBT [Enter]

Definition

The Output Local Data Logger command causes the local modem to output the contents of its data logger memory over the serial interface.



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

Use of the `dlfind` command instead of the Output Local Data Logger command is recommended unless it is desired to display the contents of the entire data logger memory, in which case the Output Local Data Logger command can be used.



WARNING If data are stored in the data logger from multiple sources, using the Output Local Data Logger or `dlfind` command will *not* display the contents of the data logger memory as separate records.

How to Use

To use the Output Local Data Logger command, type ATBT, and then press Enter.

The local modem will output the contents of its data logger memory over the serial interface.

Special Considerations

When using the Output Local Data Logger command, take note of the following:

- The contents of the local modem's data logger memory do not change when it is output over the serial interface.

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

Output Local Page

ATBPn

Syntax

ATBPn [Enter]

Definition

The Output Local Page command causes the local modem to output the contents of page n of its data logger over the serial interface, where 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 5-6 for instructions on how to place the modem into Command mode.

Use of the `dlfind` command instead of the Output Local Page command is recommended unless it is desired to display the contents of the entire page, in which case the Output Local Page command can be used.



WARNING If data are stored in the data logger from multiple sources, using the Output Local Page or `dlfind` command will *not* display the contents of the data logger memory as separate records.

How to Use

To use the Output Local Page command, type ATBP followed by the selected data logger page number of the local modem's data logger, and then press Enter.

The local modem will output the contents of the selected data logger page over the serial interface.

Special Considerations

When using the Output Local Page command, take note of the following:

- The contents of the local modem's data logger page do not change when it is output over the serial interface.

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

AGC Diagnostic

ATTNn

Syntax

ATTNn [Enter]

Definition

The AGC Diagnostic command enables or disables the display of the automatic gain control (AGC) output of the local modem. When enabled, the display is updated once a second. The displayed values are averages and range from 0 dB to 91 dB for the ATM-900 Series Acoustic Telemetry Modems and 0 to 77 dB for the UDB-9400 Universal Deck Box. Low values indicate a strong signal is being received, and high values indicate a weak signal is being received. The displayed values are also an indication of the relative amount of background noise present when there are no modems transmitting.

The settings for n are 0 and 1 as follows:

- 0: Disable display of AGC output
- 1: Enable display of AGC output.

For ATM-900 Series Acoustic Telemetry Modems only, the following is a rough guide for interpreting the relative amount of background noise when there are *no* modems transmitting:

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



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

How to Use

To use the AGC Diagnostic command, type ATTN followed by the value of n as determined by the required setting, and then press Enter.

The local modem will enable or disable the display of its AGC output. If enabled, the local modem will respond with the message "AGC test ON." If disabled, the local modem will respond with the message "AGC test OFF."

Output Remote AGC

AT\$Gn

Syntax

AT\$Gn [Enter]

Definition

The Output Remote AGC command causes the remote modem at address *n* to output ten seconds of automatic gain control (AGC) history over the acoustic link in chronological order beginning ten seconds prior to receipt of the command and ending at the receipt of the command. For every sample two numbers are output, one is the highest AGC measurement during a one second interval, and the other, the lowest. Low values indicate a strong received signal, and high values, a weak received signal. The AGC ranges are 0–91 dB for the ATM-900 Series Acoustic Telemetry Modems and 0–77 dB for the UDB-9400 Universal Deck Boxes.

For ATM-900 Series Acoustic Telemetry Modems only, the following is a rough guide for interpreting the relative amount of background noise when there are *no* modems transmitting:

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



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

How to Use

To use the Output Remote AGC command, type AT\$G followed by the address of the remote modem, and then press Enter.

The remote modem will output ten seconds of AGC history over the acoustic link. An example of an actual measurement is shown in Figure 7-4, where the leftmost pair of numbers are the *earliest*. The rightmost, *most recent* pair occur during receipt of the command where the AGC is lowest, indicating a relatively strong input signal.

Special Considerations

When using the Output Remote AGC command, take note of the following:

- The local modem must receive an acknowledgment from the remote modem within the acoustic response timeout, which is determined by the setting of the AcRspTmOut configuration parameter. If an acknowledgment is not received, "Response Not Received" will be displayed.

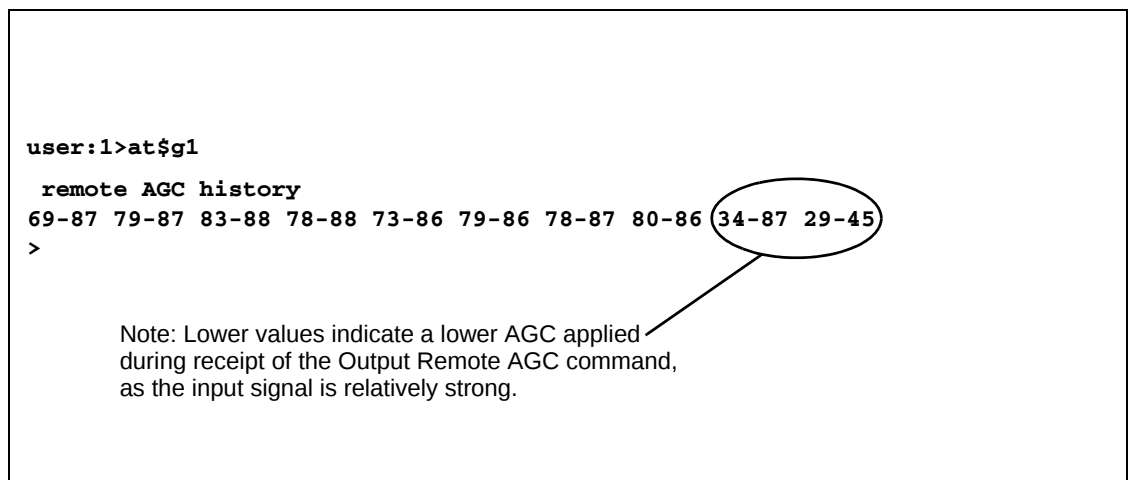


Figure 7-4 Output Remote AGC Command and Resulting Display

- The AGC history is the last 10 samples at one sample per second that occur *at and prior to* the receipt of the Output Remote AGC command.

- The last one or two AGC samples occur while receiving the Output Remote AGC command, and therefore are lower indicating a relatively strong input signal.
- The AGC history is transmitted at the bit rate set by the TxRate configuration parameter of the remote modem.
- While the AGC history is being transmitted, communications with or between other remote modems is not possible.
- While the AGC history of the remote modem is being transmitted, any input received over the serial link will not be transmitted until after the history is transmitted.

AGC Diagnostic Enable

ATT2

Syntax

ATT2 [Enter]

Definition

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



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

For ATM-900 Series Acoustic Telemetry Modems only, the following is a rough guide for interpreting the relative amount of background noise when there are *no* modems transmitting:

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

How to Use

To use the AGC Diagnostic command, type ATT2, and then press Enter.

The local modem will output minimum and maximum AGC once per second. An example of actual measurements is shown in Figure 7-5.

```
user:1>att2
AGC Test
user:2>77-81 78-81 78-81 78-82 78-81 77-82 77-81 78-81 77-82 77-81 78-81 78-
81 77-81 78-81 78-81 78-82 77-81 77-81 77-81 78-81 78-81 78-81 78-81 77-81 78-
81 78-81 78-81 78-81 77-82 77-81 77-81 77-81 77-81 77-81 77-81 78-81 78-
81 77-81 77-81 78-81 77-81 77-82 77-81 77-81 77-81 78-81 77-81 77-81 78-81 77-
81 77-81 76-81 77-81 77-81 78-81 77-81 77-81 77-81 76-81 78-81 77-81 77-81 77-
81 77-81 77-81 77-81 78-81 78-81 77-82 77-81 77-81 77-81 77-81 77-81 77-81 77-
81 78-81 78-81 77-82 77-81 77-81 77-81 77-81 77-81 77-81 77-81 78-81 78-81 77-
81 77-81 78-81 77-81 77-82 77-81 77-81 77-81 78-81 77-81 77-81 78-81 77-81 77-
81 76-81 77-81 77-81 78-81 77-81 77-82 77-81 77-81 77-81 77-81 77-81 77-81 77-
81 78-81 78-81 77-81 77-81 78-81 77-81 77-82 77-81 77-81 77-81 78-81 77-81 77-
```

***Figure 7-5 Output AGC Diagnostic Command and Resulting Display
for an ATM-900 Series Acoustic Telemetry Modem***

AGC Diagnostic Disable

ATT1

Syntax

ATT1 [Enter]

Definition

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



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

How to Use

To use the AGC Diagnostic disable command, type ATT1, and then press Enter.

The local modem will disable the display of its AGC output.

Release Status

AT\$Tn

Syntax

AT\$Tn [Enter]

Definition

The Release Status command causes a SMART Release (SR-50 or SR-100); a SMART Modem (SM-975); or an ATM-900 Series Acoustic Telemetry Modem or UDB-9400 Universal Deck Box at address n to transmit its status, the type of status information being different for each modem configuration. The status information is displayed by the local modem.

For a SMART Release, the local modem displays the following status information:

ARMED:	Displayed when no Release command has been received.
RELEASED and CONFIRMED:	Displayed when the release mechanism has been activated and the release has released from its mooring.
RELEASED and NOT CONFIRMED:	Displayed when the release mechanism has been activated but the release has not released from its mooring.
Tilt Sensor: Tilted:	Displayed when the release is tilted at a angle of greater than 25° from vertical.
Tilt Sensor: OK:	Displayed when the release is not tilted or is tilted at an angle is less than 25° from vertical.
Battery: OK:	Displayed when the battery is good and does not need to be replaced.
Battery: Reduced:	Displayed when the battery capacity is reduced. The transmit power level is capped at 7 (-03 dB).
Battery: Low:	Displayed when the battery capacity is low. The transmit power level is capped at 6 (-06 dB). The battery should be replaced.

For a SMART Modem, the local modem displays the following status information:

ARMED:	Displayed when no Release command has been received and the dissolving wire module is currently not activated.
Burn Wire Activated:	Displayed when the dissolving wire module is currently activated.
Burn Wire Released, Unit Tilted:	Displayed when the SM-975 has been released.
Battery: OK:	Displayed when the battery is good and does not need to be replaced.
Battery: Reduced:	Displayed when the battery capacity is reduced. The transmit power level is capped at 7 (-03 dB).
Battery: Low:	Displayed when the battery capacity is low. Data transmissions are not allowed. The battery should be replaced.

For an ATM-900 Series Acoustic Telemetry Modem or a UDB-9400 Universal Deck Box, the local modem displays the following:

Standard Modem



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

How to Use

To use the Release Status command, type AT\$T followed by the address of the release, and then press Enter.

The release will transmit its release status and the local modem will display the information described above.

Release

AT\$Rn,m

Syntax

AT\$Rn,m [Enter]

Definition

The Release command causes the SMART Release at address n with release code m to activate its release mechanism.



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

How to Use

To use the Release Status command, type AT\$R followed by the address of the release, the comma character "," and the release code, and then press Enter.

The message "Valid release code-waiting for confirmation..." should be displayed. If the release code is incorrect, the message "Invalid release code" will be displayed, instead. If the correct release code was received, the next message displayed should be "RELEASED and CONFIRMED," which acknowledges that the release mechanism has been activated and that the release has released itself from its mooring. If, instead, the message "RELEASED and NOT CONFIRMED" is displayed, the release mechanism has been activated but the release has not released itself from its mooring.

Burn Wire Release

AT\$Nn,m

Syntax

AT\$Nn,m [Enter]

Definition

The Burn Wire Release command causes the SMART Modem at address n with release code m to activate its burn wire release.



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

How to Use

To use the Burn Wire Release command, type AT\$N followed by the address of the release, a comma character "," and the release code, and then press Enter.

The message "Valid Release Code-Waiting for Burn..." should be displayed. If the release code is incorrect, the message "Invalid Release Code" will be displayed, instead. If the correct release code was received, the dissolving wire module will be activated, during which the SMART Modem will continue to respond to acoustic commands if they are sent. For example, sending the Release Status command (AT\$Tn) during this time should display the message "Burn Wire Activated," which acknowledges that the dissolving wire module is currently activated. Once the burn wire has fully burned, the SMART Modem will tilt which will cause it to transmit an acknowledgement. If the acknowledgement is received, the message "Burn wire RELEASED" will be displayed. Typically it takes 10 minutes for the burn wire to dissolve, but it could take up to 30 minutes. After 30 minutes, the burn wire will be shut down. If not released, the command can be resent.

Compact Modem Wakeup

ATWn,m

Syntax

ATWn,m [Enter]

Definition

The Compact Modem Wakeup command causes the local modem to transmit a wakeup signal of duration m followed immediately by the compact modem address n. A compact modem is normally in a hibernate state where everything is essentially shut down, even the receiver. However, while in this hibernate state, the modem will activate its receiver and listen for a wakeup signal from a transmitting modem for 150 ms every wakeup period. This period is the setting of the CMWakeHib configuration parameter in the Compact Modem. The transmitted wakeup signal must be equal in duration to the wakeup period of the Compact Modem to guarantee that it will be received by the modem during the 150-ms listening period, immediately after which the modem will determine if it is the one being addressed.



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

How to Use

To use the Compact Modem Wakeup command, type ATW followed by the address of the Compact Modem, the comma character "," and the idle time, and then press Enter.

The local modem will transmit a wakeup command to the Compact Modem and set the idle time.

Special Considerations

When using the Compact Modem Wakeup command, take note of the following:

- When not specifying a value of m, or when specifying 0, the idle time is set to 3 minutes which is the built-in default value.

Transpond

ATNm

Syntax

ATNm [Enter]

Definition

The Transpond command causes the local modem to display the two-way travel time in milliseconds from the modem to a transponder. The interrogation frequency *m* of the modem should be set to an integer value in hertz in 250-Hz increments that is within the frequency band of the modem. This frequency must be the same as the receive frequency of the transponder. If *m* is set for a frequency outside of this band, the modem will still transmit at the set frequency but at a reduced source level. If the LBL/Multi-Receive feature key is *not* installed, the @RxFreq configuration parameter must be set to the reply frequency of the transponder. This frequency should also be within the frequency band of the modem.



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



NOTE Refer to "Transponder Operation" on page 5-61 for information on acquiring and displaying the two-way sound travel time to any Teledyne Benthos manufactured acoustic transponder or release.

How to Use

To use the Transpond command, type ATN followed by the receive frequency of the transponder in hertz, and then press Enter.

The two-way travel time in milliseconds from the modem to the transponder is displayed.

Broadband Chirp Interrogate

ATNL

Syntax

ATNL [Enter]

Definition

The Broadband Chirp Interrogate command causes the local modem to display the two-way travel times from the modem to all remote modem transponders from which it receives replies. The local modem transmits a broadband chirp interrogation pulse and then begins listening for tonal replies. It will listen for the replies for the period set by the AcRspTmOut configuration parameter and display the two-way travel times, with the 600-ms turn-around-time removed, to each transponder from which it receives a reply, along with the detect values and signal-to-noise ratios of the received signals. After this period, the modem will go back into Command mode.



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

How to Use

To use the Broadband Chirp Interrogate command, type ATNL, and then press Enter.

The two-way travel times in milliseconds from the modem to the remote modem transponders are displayed, along with the detect values and signal-to-noise ratios of the received signals.

Compass and Tilt

ATRCn

Syntax

ATRCn [Enter]

Definition

The Compass and Tilt command displays the range and the compass heading and tilt of the remote modem at address n. The displayed range is in meters with a resolution of 0.1 meters. The displayed compass heading and tilt are in degrees with a resolution of 1.0 degree. All data are displayed in accordance with the Verbose configuration parameter as listed below.

Output format @Verbose=0 and 1:

Compass: <heading>, <tilt>

Range <local address> to <remote address> : <range> m

Output format @Verbose=2:

Compass: <heading>, <tilt>

Range <local address> to <remote address> : <range> m speed <relative speed> m/s

Output format @Verbose=3:

TX time: hh:mm:ss.nnnn

RX time: hh:mm:ss.nnnn

Compass: <heading>, <tilt>

Range <local address> to <remote address> : <range> m (Round-trip <range> ms) speed <relative speed> m/s

For @Verbose=3, hh is hours, mm is minutes, ss is seconds, and nnnn is tenths of milliseconds.

How to Use

To use the Compass and Tilt command, type ATRC followed by the address of the remote modem, and then press Enter.

The modem will respond by displaying the compass heading and tilt in degrees of the remote modem and the range in meters to the remote modem. The information is transmitted to the local modem from the

remote modem over the acoustic link. The displayed information will be in accordance with the Verbose configuration parameter.

Special Considerations

When using the Compass and Tilt command, take note of the following:

- The displayed range is the one-way range to the remote transponder or modem and is determined acoustically based on the setting of the SpeedOfSound configuration parameter.
- To acquire the range, the local transponder (or modem) transmits an interrogation signal to the remote modem (or transponder). When this signal is received, a reply is transmitted. The local transponder (or modem) must receive the reply within the acoustic response timeout, which is determined by the setting of the AcRspTmOut configuration parameter. If a reply is not received, "Response Not Received" will be displayed.

Pitch and Roll

ATRTn

Syntax

ATRTn [Enter]

Definition

The Pitch and Roll command displays the range and the pitch and roll of the remote modem at address n. The displayed range is in meters with a resolution of 0.1 meters. The displayed pitch and roll are in degrees with a resolution of 1.0 degree. All data are displayed in accordance with the Verbose configuration parameter as listed below.

Output format @Verbose=0 and 1:

Tilt: <pitch>, <roll>

Range <local address> to <remote address> : <range> m

Output format @Verbose=2:

Tilt: <pitch>, <roll>

Range <local address> to <remote address> : <range> m speed <relative speed> m/s

Output format @Verbose=3:

TX time: hh:mm:ss.nnnn

RX time: hh:mm:ss.nnnn

Tilt: <pitch>, <roll>

Range <local address> to <remote address> : <range> m (Round-trip <range> ms) speed <relative speed> m/s

For @Verbose=3, hh is hours, mm is minutes, ss is seconds, and nnnn is tenths of milliseconds.

How to Use

To use the Pitch and Roll command, type ATRT followed by the address of the remote modem, and then press Enter.

The modem will respond by displaying the pitch and roll in degrees of the remote modem and the range in meters to the remote modem. The information is transmitted to the local modem from the remote modem

over the acoustic link. The displayed information will be in accordance with the Verbose configuration parameter.

Special Considerations

When using the Pitch and Roll command, take note of the following:

- The displayed range is the one-way range to the remote transponder or modem and is determined acoustically based on the setting of the SpeedOfSound configuration parameter.
- To acquire the range, the local transponder (or modem) transmits an interrogation signal to the remote modem (or transponder). When this signal is received, a reply is transmitted. The local transponder (or modem) must receive the reply within the acoustic response timeout, which is determined by the setting of the AcRspTmOut configuration parameter. If a reply is not received, "Response Not Received" will be displayed.

Compass

ATRCHn

Syntax

ATRCHn [Enter]

Definition

The Compass command displays the range and the high resolution compass heading of the remote modem at address n. The displayed range is in meters with a resolution of 0.1 meters. The compass heading is in degrees with a resolution of 0.1 degree. All data are displayed in accordance with the Verbose configuration parameter as listed below.

Output format @Verbose=0 and 1:

Compass: <heading>

Range <local address> to <remote address> : <range> m

Output format @Verbose=2:

Compass: <heading>

Range <local address> to <remote address> : <range> m speed <relative speed> m/s

Output format @Verbose=3:

TX time: hh:mm:ss.nnnn

RX time: hh:mm:ss.nnnn

Compass: <heading>

Range <local address> to <remote address> : <range> m (Round-trip <range> ms) speed <relative speed> m/s

For @Verbose=3, hh is hours, mm is minutes, ss is seconds, and nnnn is tenths of milliseconds.

How to Use

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

The modem will respond by displaying the high resolution compass heading and tilt in degrees of the remote modem and the range in meters to the remote modem. The information is transmitted to the local modem

from the remote modem over the acoustic link. The displayed information will be in accordance with the Verbose configuration parameter.

Special Considerations

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

- The displayed range is the one-way range to the remote transponder or modem and is determined acoustically based on the setting of the SpeedOfSound configuration parameter.
- To acquire the range, the local transponder (or modem) transmits an interrogation signal to the remote modem (or transponder). When this signal is received, a reply is transmitted. The local transponder (or modem) must receive the reply within the acoustic response timeout, which is determined by the setting of the AcRspTmOut configuration parameter. If a reply is not received, "Response Not Received" will be displayed.

Pitch

ATRCPn

Syntax

ATRCPn [Enter]

Definition

The Pitch command displays the range and the high resolution pitch of the remote modem at address n. The displayed range is in meters with a resolution of 0.1 meters. The pitch is in degrees with a resolution of 0.1 degree. All data are displayed in accordance with the Verbose configuration parameter as listed below.

Output format @Verbose=0 and 1:

Pitch: <pitch>

Range <local address> to <remote address> : <range> m

Output format @Verbose=2:

Pitch: <pitch>

Range <local address> to <remote address> : <range> m speed <relative speed> m/s

Output format @Verbose=3:

TX time: hh:mm:ss.nnnn

RX time: hh:mm:ss.nnnn

Pitch: <pitch>

Range <local address> to <remote address> : <range> m (Round-trip <range> ms) speed <relative speed> m/s

For @Verbose=3, hh is hours, mm is minutes, ss is seconds, and nnnn is tenths of milliseconds.

How to Use

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

The modem will respond by displaying the high resolution pitch in degrees of the remote modem and the range in meters to the remote modem. The information is transmitted to the local modem from the remote modem

over the acoustic link. The displayed information will be in accordance with the Verbose configuration parameter.

Special Considerations

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

- The displayed range is the one-way range to the remote transponder or modem and is determined acoustically based on the setting of the SpeedOfSound configuration parameter.
- To acquire the range, the local transponder (or modem) transmits an interrogation signal to the remote modem (or transponder). When this signal is received, a reply is transmitted. The local transponder (or modem) must receive the reply within the acoustic response timeout, which is determined by the setting of the AcRspTmOut configuration parameter. If a reply is not received, "Response Not Received" will be displayed.

Roll

ATRCRn

Syntax

ATRCRn [Enter]

Definition

The Roll command displays the range and the high resolution roll of the remote modem at address n. The displayed range is in meters with a resolution of 0.1 meters. The displayed range is in meters with a resolution of 0.1 meters. The roll is in degrees with a resolution of 0.1 degree. All data are displayed in accordance with the Verbose configuration parameter as listed below.

Output format @Verbose=0 and 1:

Roll: <roll>

Range <local address> to <remote address> : <range> m

Output format @Verbose=2:

Roll: <roll>

Range <local address> to <remote address> : <range> m speed <relative speed> m/s

Output format @Verbose=3:

TX time: hh:mm:ss.nnnn

RX time: hh:mm:ss.nnnn

Roll: <roll>

Range <local address> to <remote address> : <range> m (Round-trip <range> ms) speed <relative speed> m/s

For @Verbose=3, hh is hours, mm is minutes, ss is seconds, and nnnn is tenths of milliseconds.

How to Use

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

The modem will respond by displaying the high resolution roll in degrees of the remote modem and the range in meters to the remote modem. The information is transmitted to the local modem from the remote modem

over the acoustic link. The displayed information will be in accordance with the Verbose configuration parameter.

Special Considerations

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

- The displayed range is the one-way range to the remote transponder or modem and is determined acoustically based on the setting of the SpeedOfSound configuration parameter.
- To acquire the range, the local transponder (or modem) transmits an interrogation signal to the remote modem (or transponder). When this signal is received, a reply is transmitted. The local transponder (or modem) must receive the reply within the acoustic response timeout, which is determined by the setting of the AcRspTmOut configuration parameter. If a reply is not received, "Response Not Received" will be displayed.

Local Charge Percentage

ATCP

Syntax

ATCP [Enter]

Definition

The Local Charge Percentage command causes the local modem to display the charge percentage remaining of the rechargeable lithium ion battery packs. The local modem must be an SM-976 SMART modem.

How to Use

To use the Local Charge Percentage command, type ATCP, and then press Enter.

The local modem will display the charge percentage remaining on the local modem. If no lithium ion battery packs are present, the message "Battery capacity unavailable" is displayed.

Remote Charge Percentage

AT\$CPn

Syntax

AT\$CPn [Enter]

Definition

The Remote Charge Percentage command causes the local modem to display the charge percentage remaining of the rechargeable lithium ion battery packs of the remote modem at address n. The remote modem must be an SM-976 SMART Modem.

How to Use

To use the Remote Charge Percentage command, type AT\$CP followed by the address of the remote modem, and then press Enter.

The local modem will display the charge percentage remaining on the remote modem. If no lithium ion battery packs are present, the message "Battery capacity unavailable" is displayed.

8 Modem Configuration Parameters

This section provides descriptions of each of the available Teledyne Benthos ATM-900 Series Acoustic Telemetry Modem and UDB-9400 Universal Deck Box configuration parameters and how to set them. The configuration parameters, which are provided by the configuration system for the modem, determine how the modem operates in all of its operating modes and how some of the commands are executed. They include the serial interface baud rate, the acoustic bit rate, the modem address, the idle time, the transmit power level, the forwarding delay, and many others. The configuration parameters are the same as the S Registers used in modems prior to the ATM-900 Series, and these S Register settings can still be changed using commands in the AT command set. For a detailed description of the available AT commands and how to use them, refer to Section 7, "Modem AT Command Set."



NOTE S Registers are available for backward compatibility, as they perform many of the functions of the configuration parameters. They can be set interchangeably with the configuration parameters, and changing the setting of a configuration parameter will automatically change the setting of its equivalent S Register if there is one. The reverse is also true. However, using *only* the S Registers to control the functions of the modems limits the functions that can be performed. Therefore, setting the configuration parameters instead of setting the S Registers is highly recommended.

The configuration parameters are displayed, imported, exported, and stored using the configuration commands provided by the configuration system as described in "Configuration System" on page 5-53. The available configuration parameters are listed in Table 8-1 on page 8-2. Also listed in the table are short descriptions, the equivalent S Registers, if any, and the page references to where detailed descriptions of the configuration parameters are provided. In addition, Table 8-2 on page 8-8 lists all of the factory set configuration parameters. These parameters can be viewed but not changed at the User privilege level.

The configuration parameters are organized into 10 separate sections as described in "Configuration Parameter Sections" on page 5-54. Each section is composed of related configuration parameters. To display the sections and the configuration parameters in them, enter `cfg all`.

Table 8-1 ATM-900 Series Acoustic Telemetry Modem and UDB-9400 Universal Deck Box Configuration Parameters

Name	Description	Factory Default	S Register	Page
SERIAL				
P1Baud	Serial port 1 baud rate.	9600	S3	8-9
P1EchoChar	Serial port 1 echo enable/disable.	Dis	S3	8-10
P1FlowCtl	Serial port 1 flow control.	0 (None)	S11	8-11
P1Protocol	Serial port 1 protocol.	0 (RS-232)	S3	8-12
P1StripB7	Serial port 1 strip bit 7.	Dis	—	8-14
P2Baud	Serial port 2 baud rate.	9600 ^a	—	8-15
P2EchoChar	Serial port 2 echo enable/disable.	Dis	—	8-17
P2FlowCtl	Serial port 2 flow control.	0 (None)	—	8-18
P2Protocol	Serial port 2 protocol.	0 (RS-232)	—	8-19
P2StripB7	Serial port 2 strip bit 7.	Dis	—	8-21
LPFlowCtl	Low power serial port control.	0 (Lowpower)	—	8-22
SYSTEM				
SyncPPS	1 PPS clock source.	2 (RTC)	—	8-24
IdleTimer	Low power idle timer.	00:03:00 ^b	S10 ^c	8-25
Verbose	Display verbosity.	1	S13	8-27
Prompt	Prompt setting.	7	—	8-29
CMWakeHib	Compact modem wakeup period.	9 (48sec)	—	8-30
CMFastWake	Fast compact modem wakeup scheme enable/disable.	Ena	—	8-31
MinOpVolt	The voltage below which the modem brown out function will activate.	9.6	—	8-32
COPROC				
CPBoard	Coprocessor board presence.	0 (Off)	S9	8-33

Table 8-1 ATM-900 Series Acoustic Telemetry Modem and UDB-9400 Universal Deck Box Configuration Parameters (Continued)

Name	Description	Factory Default	S Register	Page
RECORDER				
RecMode	Acoustic Recorder start and stop.	Manual	—	8-35
NameFormat	File name format for the files containing the data recorded by the Acoustic Recorder.	1 (DDHHMMSS)	—	8-36
DATALOG				
AcData	Output or store received data.	0 (UART)	S22	8-37
AcStats	Store received data and time stamps.	0 (Off)	—	8-38
RingBuf	Data storage mode.	Dis	S37	8-39
LogMode	Data storage method.	0 (FwdDelay)	—	8-40
Sentinel	Character for data partitioning.	0	—	8-41
ChrCount	Character count for data partitioning.	1024	—	8-42
LogStore	Data logger memory.	0 (Internal)	—	8-43
MODEM				
DataRetry	Number of times a data packet is retransmitted.	0	—	8-44
AcRspTmOut	Modem acoustic response timeout.	7.5	S7	8-45
OpMode	Modem operating mode.	1 (Online)	S15	8-47
DevEnable	Device enable performance.	0 (Auto)	S28	8-48
FwdDelay	Modem forwarding delay.	3.0	S8	8-49
LocalAddr	Local modem address.	0	S18	8-50
RemoteAddr	Online remote modem address.	0	S14	8-51
ShowBadData	Display packet errors enable/disable.	Ena	S16	8-52
StartTones	Play start tones enable/disable.	Ena	—	8-53

Table 8-1 ATM-900 Series Acoustic Telemetry Modem and UDB-9400 Universal Deck Box Configuration Parameters (Continued)

Name	Description	Factory Default	S Register	Page
TxRate	Transmitting acoustic bit rate.	5 (800)	S4	8-54
TxPower	Transmit power level.	8 (Max)	S6	8-56
WakeTones	Wakeup signal enable/disable.	Ena	S17	8-58
PrintHex	Display data in hex enable/disable.	Dis	—	8-59
StrictAT	AT commands enable/disable	Dis	—	8-60
InputMode^d	Single/Dual serial port selection.	1 (Single)	—	8-61
SmartRetry	Retransmit at successively slower acoustic bit rates.	Dis	—	8-62
RELEASE				
TimedRelease	Elapsed time to release activation.	0	S50	8-64
TRANSPORT				
TPortMode	Routing of data input on serial port 1 and serial port 2.	0 (InpMode)	—	8-65
SrcP1	Transport address that will be attached to transmitted data that are input to serial port 1.	1	—	8-67
SrcP2	Transport address that will be attached to transmitted data that are input to serial port 2.	2	—	8-68
Dst1	Serial port on which data received over the acoustic link with transport address 1 will be output.	1 (P1)	—	8-69
Dst2	Serial port on which data received over the acoustic link with transport address 2 will be output.	2 (P2) ^e	—	8-70
Dst3	Reserved	—	—	8-71
Dst4	Reserved	—	—	8-72

Table 8-1 ATM-900 Series Acoustic Telemetry Modem and UDB-9400 Universal Deck Box Configuration Parameters (Continued)

Name	Description	Factory Default	S Register	Page
TEST				
SimAcDly	Simulated acoustic delay.	0	—	8-73
PktEcho	Test message display enable/disable.	0	S12	8-74
PktSize	Test message size.	0 (8B)	S12	8-75
RcvAll	Receive all data enable/disable.	Dis	—	8-76
XPND				
RxFreq	Modem receive frequency.	11000	S53	8-77
RxThresh	Detected signal standard deviation.	10	S21	8-78
RxToneDur	Modem receive pulse width.	10	S33	8-79
RxLockout	Modem lockout time.	75	S55	8-80
TxToneDur	Modem transmit pulse width.	10	—	8-81
TAT	Transponder turn-around-time.	0	S40	8-82
LBLmode	Modem transponder enable.	Off		8-83
RspFreq	Modem reply frequency.	Model specific		8-84
NAV				
Latitude	Latitude of modem location.	41.638246	—	8-85
Longitude	Longitude of modem location.	-70.6090376	—	8-86
GPSAlt	Altitude of modem with respect to sea level.	0	—	8-87
Altitude	Altitude of modem above the sea floor.	0	—	8-88
Depth	Depth of modem.	0	—	8-89
Compass	Modem heading.	0	—	8-90
HeadOffset	Modem heading offset.	0	—	8-91
Pitch	Pitch of modem mounting platform.	0	—	8-92

Table 8-1 ATM-900 Series Acoustic Telemetry Modem and UDB-9400 Universal Deck Box Configuration Parameters (Continued)

Name	Description	Factory Default	S Register	Page
Roll	Roll of modem mounting platform.	0	—	8-93
SpeedOfSound	Speed of sound in water.	1500	—	8-94
ReplyData	Enables display of location and depth or altitude of remote modem.	1 (LatLong)	—	8-95
AIN				
Ain1Type	The Channel 1 input type.	2 (10V)	—	8-96
Ain2Type	The Channel 2 input type.	1 (5V)	—	8-97
AinPollRate	The rate at which polling of analog channels is performed.	(0) Off	—	8-98
Ain1Nmeas	The number of readings to be made for Channel 1.	0	—	8-99
Ain2Nmeas	The number of readings to be made for Channel 2.	0	—	
Ain3Nmeas	The number of readings to be made for Channel 3.	0	—	
Ain4Nmeas	The number of readings to be made for Channel 4.	0	—	
Ain5Nmeas	The number of readings to be made for Channel 5.	0	—	
Ain6Nmeas	The number of readings to be made for Channel 6.	0	—	
Ain1RptDly	The time in seconds between Channel 1 readings.	1	—	8-100
Ain2RptDly	The time in seconds between Channel 2 readings.	1	—	
Ain3RptDly	The time in seconds between Channel 3 readings.	1	—	
Ain4RptDly	The time in seconds between Channel 4 readings.	1	—	
Ain5RptDly	The time in seconds between Channel 5 readings.	1	—	
Ain6RptDly	The time in seconds between Channel 6 readings.	1	—	

Table 8-1 ATM-900 Series Acoustic Telemetry Modem and UDB-9400 Universal Deck Box Configuration Parameters (Continued)

Name	Description	Factory Default	S Register	Page
Ain1StrtDly	The delay in seconds after turning on Channel 1 to making the first reading.	1	—	8-101
Ain2StrtDly	The delay in seconds after turning on Channel 2 to making the first reading.	1	—	
Ain3StrtDly	The delay in seconds after turning on Channel 3 to making the first reading.	1	—	
Ain4StrtDly	The delay in seconds after turning on Channel 4 to making the first reading.	1	—	
Ain5StrtDly	The delay in seconds after turning on Channel 5 to making the first reading.	1	—	
Ain6StrtDly	The delay in seconds after turning on Channel 6 to making the first reading.	1	—	
PRESSURE				
PressureChnl	The analog channel to which the pressure transducer connects.	6	—	8-102
MetersPerPSI	The pressure to depth conversion factor.	0.680	—	8-103
ATMOffset	The atmospheric pressure.	14.7	—	8-104
PSI	The most recent pressure reading.	As measured	—	8-105

- a. Factory default setting applies to an ATM-900 Series Acoustic Telemetry Modem only. For a UDB-9400 Universal Deck Box, @P2Baud=115,200.
- b. Factory default setting applies to an ATM-900 Series Acoustic Telemetry Modem only. For a UDB-9400 Universal Deck Box, @IdleTimer=0.
- c. S Register 10 does not correspond with the full range of the IdleTimer configuration parameter.
- d. Available only if the Dual Serial Port feature key is installed. If not installed, the configuration parameter name is not visible when listing parameters using configuration system commands such as `cfg all`.
- e. Factory default setting applies to an ATM-900 Series Acoustic Telemetry Modem only. For a UDB-9400 Universal Deck Box, @Dst2=P1.

Table 8-2 ATM-900 Series Acoustic Telemetry Modem and UDB-9400 Universal Deck Box Factory Default Configuration Parameters

Name	Factory Default	S Register
SERIAL		
P1Mode	0 (Cooked)	
P2Mode	0 (Cooked)	
P1NoSleep	Dis	
P2NoSleep	Dis	
SYSTEM		
CarrFreq	Model specific	S24
HalfBW	1	S23
FHThresh	100	
RlsType	Model specific	S44
WakeThresh	524	
AuxInp	Dis	
AuxOut	0	
SyncOut	0 (Off)	
Pullup0	Dis	
Pullup1	Dis	
BatteryType	0 (Std) ^a	
COPROC		
FdFwdTaps	20	S30
FdBckTaps	4	S31
MODEM		
RxPktType	0 (MFSK)	S5
RELEASE		
FSKRlsDur	8	S51
LstCommsCnt	0	S39
RlsCode	Unit specific	S41
TRANSPORT		
L4Enable	Ena	
TEST		
RspDelayl	Dis	
DbgLvl	0	
XPND		
AGCRef	60	S58

a. For an SM-976 the factory default setting of the BatteryType configuration parameter is 1 (IBPS).

P1Baud

Default Setting

9600 Serial port 1 is configured for 9600 baud.

Definition

The setting of the P1Baud configuration parameter is the baud rate of serial port 1.

Available Settings

The available settings for the P1Baud configuration parameter are listed below.

1200:	1200 baud
2400:	2400 baud
4800:	4800 baud
9600:	9600 baud
19200:	19200 baud
38400:	38400 baud
57600:	57600 baud
115200:	115200 baud



WARNING Changes to the P1Baud configuration parameter take place immediately. Therefore be sure to set the baud rate of the host processor to the same baud rate, otherwise it will not be possible for the host processor to establish communications with the modem.

Special Considerations

When setting the P1Baud configuration parameter, take note of the following:

- When connecting an instrument to the modem, and with the P1Baud configuration parameter set to the default 9600 for 9600 baud, the instrument's serial port should be configured as follows:

Baud rate:	9600 baud
Parity:	none
Data bits:	8
Stop bits:	1

P1EchoChar

Default Setting

Dis	Echoing of characters entered from the keyboard is disabled for serial port 1.
-----	--

Definition

The setting of the P1EchoChar configuration parameter determines whether characters entered from the keyboard for serial port 1 are echoed back to the host computer.

Available Settings

There are two available settings for the P1EchoChar configuration parameter as listed below.

- Ena: Enables echoing of characters entered from the keyboard for serial port 1.
- Dis: Disables echoing of characters entered from the keyboard for serial port 1.

If a PC is being used as the host processor, and it is desired to display all of the characters entered from the keyboard, select Ena.

Special Considerations

When setting the P1EchoCar configuration parameter, take note of the following:

- In Command mode using the keyboard arrow keys for command history and line editing are best viewed when @P1EchoChar=Ena.
- In Online mode having @P1EchoChar=Ena may affect the connected instrument.
- If @P1EchoChar=Dis, then use the terminal program's echo capability.
- If double characters are displayed, then either turn off the terminal program's echo or set @P1EchoChar=Dis.

P1FlowCtl

Default Setting

0 (None) There is no handshaking for serial port 1.

Definition

The setting of the P1FlowCtl configuration parameter determines whether hardware CTS handshaking or software XON/XOFF handshaking is used for flow control, or if no handshaking is used.

Available Settings

The available settings for the P1FlowCtl configuration parameter are listed below.

- 0 (None): Selects no handshaking.
- 1 (SW): Selects software XON/XOFF handshaking.
- 2 (HW): Selects hardware CTS handshaking.



WARNING Setting @P1FlowCtl=2 (HW) and @LPFlowCtl=0 (Lowpower) turns off the RS-232 driver whenever the modem is in the lowpower state. Thus CTS is held off which prevents a device connected to a serial port to wake up the modem by sending data. Therefore to bring the modem out of the lowpower state, hardware CTS handshaking must be disabled at the host processor when sending the first byte of data to the modem over the serial interface.

Special Considerations

When setting the P1FlowCtl configuration parameter, take note of the following:

- If 2 (HW) is selected, handshaking when in the lowpower state will be in accordance with the setting of the LPFlowCtl configuration parameter.

P1Protocol

Default Setting

0 (RS-232) Serial port 1 is configured as an RS-232 serial interface.

Definition

The setting of the P1Protocol configuration parameter determines whether serial port 1 is configured as an RS-232, RS-422 or RS-485 serial interface.



NOTE A setting of 1 (RS-422) or 2 (RS-485) will disable the use of the RS-232 protocol on serial port 2.

Available Settings

There are three available settings for the P1Protocol configuration parameter as listed below.

- 0 (RS-232): Configures serial port 1 as an RS-232 serial interface.
- 1 (RS-422): Configures serial port 1 as an RS-422 serial interface.
- 2 (RS-485): Configures serial port 1 as an RS-485 serial interface.

Special Considerations

When setting the P1Protocol configuration parameter, take note of the following:

- After changing from RS-232 to RS-422, an RS-422 connection is required to switch back to RS-232. The opposite is true after changing from RS-422 to RS-232.
- The setting for RS-485 does not internally make the bus connections between the RX and TX lines. This must be done externally by connecting RS422_RX+ to RS422_TX+ and RS422_RX- to RS422_TX-. Refer to the serial port connection information provided in "Setting Up the Modems" on page 4-9. Also refer to Figure 4-4 on page 4-10 for a UDB-9400 Universal Deck Box, to Figure 4-6 on page 4-13 for a subsea modem, and to Figure 4-9 on page 4-18 for an ATM-900 or ATM-903 Board Set for the connector wiring information for these external connections.

- RS-485 is a half-duplex protocol and as such does not support the X-modem protocol required for firmware updates.

P1StripB7

Default Setting

Dis Serial port 1 is configured to use all 8 bits for data and 1 stop bit.

Definition

The setting of the P1StripB7 configuration parameter determines whether serial port 1 will use 8 bits or strip the last bit and allow only 7 bits.

Available Settings

There are two available settings for the P1StripB7 configuration parameter as listed below.

Ena: Configures serial port 1 to strip and ignore the parity bit and allow 7 data bits and 1 stop bit. This allows 7,E,1 or 7,O,1 formats.

Dis: Configures serial port 1 to use all 8 bits for data and 1 stop bit.



NOTE In most cases @P1StripB7=Dis unless receiving serial data with a format of 7,E,1 or 7,O,1.

P2Baud

Default Setting

9600 Serial port 2 is configured for 9600 baud.

Definition

The setting of the P2Baud configuration parameter is the baud rate of serial port 2.

Available Settings

The available settings for the P2Baud configuration parameter are listed below.

1200:	1200 baud
2400:	2400 baud
4800:	4800 baud
9600:	9600 baud
19200:	19200 baud
38400:	38400 baud
57600:	57600 baud
115200:	115200 baud



WARNING Changes to the P2Baud configuration parameter take place immediately. Therefore be sure to set the baud rate of the host processor to the same baud rate, otherwise it will not be possible for the host processor to establish communications with the modem.

Special Considerations

When setting the P2Baud configuration parameter, take note of the following:

- When connecting an instrument to the modem, and with the P2Baud configuration parameter set to the default 9600 for 9600 baud, the instrument's serial port should be configured as follows:

Baud rate:	9600 baud
Parity:	none
Data bits:	8
Stop bits:	1

- @P2Baud=115200 is the default setting for an ATM-9400 Series Acoustic Telemetry Modem.

P2EchoChar

Default Setting

Dis	Echoing of characters entered from the keyboard is disabled for serial port 2.
-----	--

Definition

The setting of the P2EchoChar configuration parameter determines whether characters entered from the keyboard for serial port 2 are echoed back to the host computer.

Available Settings

There are two available settings for the P2EchoChar configuration parameter as listed below.

- Ena: Enables echoing of characters entered from the keyboard for serial port 2.
- Dis: Disables echoing of characters entered from the keyboard for serial port 2.

If a PC is being used as the host processor, and it is desired to display all of the characters entered from the keyboard, select Ena.

Special Considerations

When setting the P2EchoCar configuration parameter, take note of the following:

- In Command mode using the keyboard arrow keys for command history and line editing are best viewed when @P2EchoChar=Ena.
- In Online mode having @P2EchoChar=Ena may affect the connected instrument.
- If @P2EchoChar=Dis, then use the terminal program's echo capability.
- If double characters are displayed, then either turn off the terminal program's echo or set @P2EchoChar=Dis.

P2FlowCtl

Default Setting

0 (None) There is no handshaking for serial port 2.

Definition

The setting of the P2FlowCtl configuration parameter determines whether hardware CTS handshaking or software XON/XOFF handshaking is used for flow control, or if no handshaking is used.

Available Settings

The available settings for the P2FlowCtl configuration parameter are listed below.

- 0 (None): Selects no handshaking.
- 1 (SW): Selects software XON/XOFF handshaking.
- 2 (HW): Selects hardware CTS handshaking.



WARNING Setting @P2FlowCtl=2 (HW) and @LPFlowCtl=0 (Lowpower) turns off the RS-232 driver whenever the modem is in the lowpower state. Thus CTS is held off which prevents a device connected to a serial port to wake up the modem by sending data. Therefore to bring the modem out of the lowpower state, hardware CTS handshaking must be disabled at the host processor when sending the first byte of data to the modem over the serial interface.

Special Considerations

When setting the P2FlowCtl configuration parameter, take note of the following:

- If 2 (HW) is selected, handshaking when in the lowpower state will be in accordance with the setting of the LPFlowCtl configuration parameter.

P2Protocol

Default Setting

0 (RS-232) Serial port 2 is configured as an RS-232 serial interface.

Definition

The setting of the P2Protocol configuration parameter determines whether serial port 2 is configured as an RS-232 or CMOS serial interface.



NOTE A setting of 1 (RS-422) or 2 (RS-485) on serial port 1 will disable the use of the RS-232 protocol on serial port 2.

Available Settings

There are two available settings for the P2Protocol configuration parameter as listed below.

- 0 (RS-232): Configures serial port 2 as an RS-232 serial interface.
- 1 (CMOS): Configures serial port 2 as a CMOS serial interface.

Special Considerations

When setting the P2Protocol configuration parameter, take note of the following:

- If the P1Protocol configuration parameter is set to 1 (RS-422) or 2 (RS-485), the RS-232 protocol will be disabled on serial port 2 but the CMOS serial interface will still function.
- If the P2Protocol configuration parameter is set to 0 (RS-232), serial port 2 is available on J8 of the DSP board for the ATM-900 and ATM-903 Board Sets and on the POWER/SERIAL connector of all other modems. Refer to Table 4-6 on page 4-15 for the connector pinout information for J8 and to Figure 4-8 on page 4-14 for the connector pin orientation.

- If the P2Protocol configuration parameter is set to 1 (CMOS), serial port 2 is available on the DSP board I/O connector J3 for the ATM-900 and ATM-903 Board Sets and is *not* available on the POWER/SERIAL connector of all other modems. Refer to Table 4-11 on page 4-19 for the connector pinout information for J3 and to Figure 4-11 on page 4-19 for the connector pin orientation.

P2StripB7

Default Setting

Dis Serial port 2 is configured to use all 8 bits for data and 1 stop bit.

Definition

The setting of the P2StripB7 configuration parameter determines whether serial port 2 will use 8 bits or strip the last bit and allow only 7 bits.

Available Settings

There are two available settings for the P2StripB7 configuration parameter as listed below.

Ena: Configures serial port 2 to strip and ignore the parity bit and allow 7 data bits and 1 stop bit. This allows 7,E,1 or 7,O,1 formats.

Dis: Configures serial port 2 to use all 8 bits for data and 1 stop bit.



NOTE In most cases @P2StripB7=Dis unless receiving serial data with a format of 7,E,1 or 7,O,1.

LPFlowCtl

Default Setting

0 (Lowpower) The RS-232 driver for both serial ports 1 and 2 is turned off when the modem is in the lowpower state.

Definition

The setting of the LPFlowCtl configuration parameter determines whether the RS-232 driver for both serial ports 1 and 2 is turned off or left on when the modem is in the lowpower state.

Available Settings

The available settings for the LPFlowCtl configuration parameter are listed below.

- 0 (Lowpower): Turns off the RS-232 driver for both serial ports 1 and 2 when the modem is in the lowpower state.
- 2 (Always on): Leaves the RS-232 driver for both serial ports 1 and 2 turned on when the modem is in the lowpower state. CTS is held on which enables a device connected to a serial port to wake up the modem by sending data. However, the modem draws additional power.



WARNING A setting of @LPFlowCtl=2 (Always on) will cause the modem to use an additional 42 mW of power which shortens the battery pack life.

Special Considerations

When setting the LPFlowCtl configuration parameter, take note of the following:

- The LPFlowCtl configuration parameter affects both serial ports 1 and 2.
- If @P1FlowCtl or @P2FlowCtl=0 (None) or 1 (SW), then the LPFlowCtl configuration parameter should be set to 0 (Lowpower).

- If CTS handshaking is desired for serial ports 1 or 2 while the modem is in the lowpower state, then the LPFlowCtl configuration parameter should be set to 2 (Always on).

SyncPPS

Default Setting

- | | |
|---------|---|
| 1 (RTC) | The time and date are driven from the internal real-time clock. |
|---------|---|

Definition

The setting of the SyncPPS configuration parameter determines whether the internal real-time clock provides the one pulse per second (1PPS) signal to keep time or an external 1PPS, such as a GPS, is used.

Available Settings

The available settings for the SyncPPS configuration parameter are listed below.

- | | |
|--------------|---|
| 2 (RTC): | The time and date are driven from the internal real-time clock, and the RX and TX time stamps, shown at verbose level 3, will be at a 0.1 ms time accuracy. |
| 1 (ExtRise): | The modem synchronizes to the rising edge of an external 1PPS signal. The 1PPS signal is input to the modem on pin 9 of the DSP board I/O connector J3, and the RX and TX time stamps, shown at verbose level 3, are at 0.1 ms accuracy with respect to the rising edge of the 1PPS signal. |
| 4 (ExtFall): | The modem synchronizes to the falling edge of an external 1PPS signal. The 1PPS signal is input to the modem on pin 9 of the DSP board I/O connector J3, and the RX and TX time stamps, shown at verbose level 3, are at 0.1 ms accuracy with respect to the falling edge of the 1PPS signal. |

IdleTimer

Default Setting

00:03:00

If the local modem does not receive input from its host processor over the serial interface or from a remote modem over the acoustic link in 3 minutes, it will go into the lowpower state.

Definition

The setting of the IdleTimer configuration parameter determines the time after which a modem will go into the lowpower state if there is no input either from the serial interface or from a remote modem over the acoustic link. For a Compact Modem the modem goes into its hibernate state.



NOTE When the modem transitions into the lowpower state, it will take approximately 30 seconds for the power consumption to fall to that specified in the lowpower state power specification stated in Section 2, "Specifications."

Available Settings

The range of available settings for the IdleTimer configuration parameter is from 1 second to 23 hours, 59 minutes and 59 seconds in the following format:

hh:mm:ss

where "hh" is hours, "mm" is minutes and "ss" is seconds. A setting of 0 disables the IdleTimer.

Special Considerations

When setting the IdleTimer configuration parameter, take note of the following:

- The default IdleTimer configuration parameter setting for a UDB-9400 Universal Deck Box is 0.
- If a remote modem will be accessed periodically to retrieve a small amount of data, the idle time should be set relatively short. If there will

be more frequent and more interactive sessions, the idle time should be set relatively long to avoid the need to frequently reawaken the modem from its lowpower state.

- Setting the IdleTimer configuration parameter will automatically set S Register 10 to the setting that corresponds to the same time or the time that is within the 5-second increment allowed by S Register 10 up to a maximum of 1270 seconds (21 minutes and 10 seconds).
- Setting S Register 10 will automatically set the IdleTimer configuration parameter to the same time.

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

Verbose

Default Setting

- 1 Data and some diagnostic messages are displayed when received by the local modem.

Definition

The setting of the Verbose configuration parameter determines whether only data, or data and other information, when received by the local modem, are displayed.



NOTE Should a fatal error occur, it is displayed regardless of the setting of the Verbose configuration parameter.

Available Settings

The range of available settings for the Verbose configuration parameter is from 0 to 4 as listed below.

- 0: Only data are displayed.
- 1: Data and some diagnostic messages are displayed.
- 2: Data, most diagnostic messages, and received data statistics are displayed.
- 3: Data, additional diagnostic messages, and received data statistics are displayed.
- 4: For factory use only.

With a setting of 2 or higher, data, along with received data statistics, are displayed in the following general format:

DATA(# of bytes of data): the actual data

Source:xx Destination:xx

CRC:Pass/Fail MPD:x.x SNR:xx.x SPD:+/-xx.x AGC:x.x CCERR:xx

The received data statistics shown above are composed of the following:

- Source:** The address of the modem that transmitted the data.
- Destination:** The address of the modem that received the data.
- CRC:** Checksum—pass or fail, where a pass condition signifies no errors were detected, and a fail condition signifies one or more bit errors were detected.
- MPD:** Multipath Delay—in milliseconds, where the higher the number the greater the multipath. The range is from 0 to 50.
- SNR:** Signal to Noise Ratio—A metric that provides information on the quality of the processed signal. The value is not related to the input SNR, but instead takes into account all the processing and the effects of multipath.
- SPD:** Speed—the relative speed in knots between the local and remote modems, where a negative number indicates the modems are moving farther apart and a positive number indicates the modems are moving closer together.
- AGC:** Automatic Gain Control—a decimal number where the lower the number the less gain, which means a strong input signal was received. Similarly, the higher the number the more gain, which means a weak input signal was received. The lowest gain indication is 00, and the highest is 95.
- CCERR:** Corrected Channel Error—Metric 0–14.

Special Considerations

When setting the Verbose configuration parameter, take note of the following:

- When a PC is used as the host processor, the Verbose configuration parameter should be set to 1 or higher.
- When an instrument is used as the host processor, the Verbose configuration parameter should be set to 0. This setting will avoid errors that might occur should the instrument be unable to recognize the diagnostic messages or received data statistics.

Prompt

Default Setting

7

The command prompt combines the ">" character with the privilege level and the command history number.

Definition

The Prompt configuration parameter determines the characters displayed for the command prompt which can include any combination of the ">" character, the privilege level and the history number as in the following example:

user:5>

Available Settings

The available settings for the Prompt configuration parameter are listed below.

0: No command prompt is selected.

1: The ">" character is displayed.

2: The privilege level is displayed.

Example: user

3: Combines the ">" character with the privilege level.

Example: user>

4: The command history number is displayed.

Example: :5

5: Combines the ">" character with the command history number.

Example: :5>

6: Combines the privilege level with the command history level.

Example: user:5

7: Combines the ">" character with the privilege level and the command history number.

Example: user:6>

CMWakeHib

Default Setting

9 (48sec) The wakeup period of the compact modem is 48 seconds.

Definition

The setting of the CMWakeHib configuration parameter, which applies only to compact modems, determines the wakeup period of the modem. A compact modem is normally in a hibernate state where everything is essentially shut down, even the receiver. However, while in this hibernate state, the modem will activate its receiver and listen for a wakeup signal from a transmitting modem for 150 ms every wakeup period. The length of the wakeup period determines how often the Compact Modem will listen for a wakeup signal. A shorter wakeup period means that the modem will listen more frequently and therefore can be awakened quicker. A longer wakeup period means that the modem will listen less frequency and therefore will be awakened slower. A shorter wakeup period uses more power than a longer wakeup period.

Available Settings

The available settings for the CMWakeHib configuration parameter, are listed below.

-1 (Off):	The compact modem wakeup is off.
0 (2sec):	2 seconds (compact modem firmware versions prior to 1.2.7)
1 (3sec):	3 seconds
2 (4sec):	4 seconds
3 (6sec):	6 seconds
4 (8sec):	8 seconds
5 (12sec):	12 seconds
6 (16sec):	16 seconds
7 (24sec):	24 seconds
8 (32sec):	32 seconds
9 (48sec):	48 seconds
11 (96sec):	96 seconds (compact modem firmware versions 1.2.7 and higher)

CMFastWake

Default Setting

Ena The fast wakeup scheme for waking up a compact modem is enabled.

Definition

The setting of the CMFastWake configuration parameter determines whether the slow wakeup scheme is used to wake up a compact modem or the fast wakeup scheme. The slow wakeup scheme is implemented in all UDB-9400 Universal Deck Boxes, in standard modems of all firmware versions, and in Compact Modems with firmware versions prior to 1.2.7 only. The fast wakeup scheme is implemented in UDB-9400 Universal Deck Boxes with firmware versions 1.9.9 and higher, in standard modems with firmware versions 6.9.4 and higher, and in Compact Modems with firmware versions 1.2.7 and higher. This provides backwards compatibility with those compact modems that use the slow wakeup scheme. Table 8-3 summarizes which firmware versions provide which wakeup scheme for the deck box and modems.

Table 8-3 UDB-9400 Universal Deck Box, Standard Modem and Compact Modem Firmware Versions Versus Slow and Fast Wakeup Schemes

PRODUCT AND FIRMWARE VERSION	SLOW	FAST
UDB-9400 Universal Deck Box (prior to 1.9.9)	•	
UDB-9400 Universal Deck Box (1.9.9 and higher)	•	•
Standard modem (prior to 6.9.4)	•	
Standard modem (6.9.4 and higher)	•	•
Compact Modem (prior to 1.2.7)	•	
Compact Modem (1.2.7 and higher)		•

Available Settings

The available settings for CMFastWake configuration parameter are listed below.

Ena: Enables the fast wakeup scheme for waking up a compact modem.

Dis: Disables the fast wakeup scheme for waking up a compact modem and instead uses the slow wakeup scheme.

MinOpVolt

Default Setting

9.6	The voltage below which the modem brown out function will activate is 9.6.
-----	--

Definition

The setting of the MinOpVolt configuration parameter is the voltage below which the modem brown out function will activate. When the modem brown out function is activated, the transmit power is dropped to reduce the current demand on the modem battery.

Available Settings

The range of available settings for the MinOpVolt configuration parameter is from 0.0 to 24.0.

CPBoard

Default Setting

0 (Off) The Coprocessor board is disabled.

Definition

The setting of the CPBoard configuration parameter determines whether the Coprocessor board is enabled, and if enabled, whether it is enabled only when receiving data or at all times, or if it is enabled for firmware updating only.

Available Settings

The available settings for the CPBoard configuration parameter are listed below.

- | | |
|---------------|--|
| 0 (Off): | Disables the Coprocessor board. |
| 1 (Pwrsave): | Enables the Coprocessor board, but places it in a low power state in between receiving data packets. The board will be powered up in full when a new data packet is received and put back into its low power state after receiving the packet. |
| 2 (AlwaysOn): | Enables the Coprocessor board, keeping it fully powered at all times. |
| 3 (Program): | Enables the Coprocessor board but does not establish communications with it. This setting is used only for updating the firmware on the board. |

Special Considerations

When setting the CPBoard configuration parameter, take note of the following:

- The ATM-903 and ATM-900 Modem Board Sets can optionally include a coprocessor by adding "-P" at the end of the modem part number when ordering.
- The Coprocessor board must be enabled for the modem to receive at the high bit rates of 2560–15,360 bits/sec.

- Enabling the Coprocessor board when the board is not present forces the CPBoard configuration parameter setting to 0.
- When setting the CPBoard configuration parameter to 1 or 2, the modem will respond with the message "coprocessor ver x.x" if the Coprocessor board is installed and fully operational.
- When setting the CPBoard configuration parameter to 1 or 2, the modem will respond with the message "coprocessor not responding" if the Coprocessor board is not installed or is installed and not fully operational.

RecMode

Default Setting

- | | |
|------------|--|
| (0) Manual | The Acoustic Recorder starts and stops when manually commanded to do so. |
|------------|--|

Definition

The RecMode configuration parameter determines how the Acoustic Recorder is started and stopped.

Available Settings

The available settings for the RecMode configuration parameter are listed below.

- (0) Manual: The Acoustic Recorder starts and stops when manually commanded to do so.
- (1) Auto: The Acoustic Recorder starts when an SDHC is mounted.
- (2) Auto-LP: The Acoustic Recorder starts when an SDHC is mounted, but stops when the idle time expires. The modem also enters the lowpower state.

NameFormat

Default Setting

- 1 (DDHHMMSS) The file name format for the files containing the data recorded by the Acoustic Recorder is DDHHMMSS for day, hour, minute, and second.

Definition

The NameFormat configuration parameter establishes the file name format for the files containing the data recorded by the Acoustic Recorder.

Available Settings

The available settings for the RecMode configuration parameter are listed below.

- 0 (MMDDHHMM): The file name format is month, day, hour, and minute.
- 1 (DDHHMMSS): The file name format is day of current month, hour, minute, and second.
- 3 (HH-MM-SS): The file name format is hour, minute and second separated by hyphens.

AcData

Default Setting

0 (UART)

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

Definition

The setting of the AcData configuration parameter determines whether data received over the acoustic link are output over the serial interface, stored in the data logger memory or both.

Available Settings

The available settings for the AcData configuration parameter are listed below.

0 (UART):

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

1 (Datalog):

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

2 (UART+Datalog):

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

AcStats

Default Setting

0 (Off) Statistics and time stamps for data received over the acoustic link are not stored in the data logger memory.

Definition

The setting of the AcStats configuration parameter determines whether statistics and time stamps for data received over the acoustic link are stored in the data logger memory.

Available Settings

The available settings for the AcStats configuration parameter are listed below.

0 (Off):	Statistics and time stamps for data received over the acoustic link are not stored in the data logger memory.
1 (Stats):	Statistics for data received over the acoustic link are stored in the data logger memory.
4 (TimeStamp):	Time stamps for data received over the acoustic link are stored in the data logger memory.
5 (Stats+Time):	Statistics and time stamps for data received over the acoustic link are stored in the data logger memory.

RingBuf

Default Setting

Dis	The data logger will record up to 6 MB of data and then stop recording.
-----	---

Definition

The setting of the RingBuf configuration parameter determines whether the data logger will record data in flat mode where up to 6 MB of data are recorded and then recording stops, or in ring buffer mode where data are recorded in a 6-MB "ring" buffer. When recording data in the ring buffer and the buffer fills, the oldest 384 kbytes of data are erased making room for new data which can continue to be recorded until the 6-MB ring buffer is again filled. This cycle repeats continuously as long as new data are received, ensuring that the latest 6 MB of data are always available. The data can be received acoustic data if the AcData configuration parameter is set to 1 (Datalog) or 2 (UART+Datalog), or the data can be data received on the serial interface if the OpMode configuration parameter is set to 2 (Datalog).

Available Settings

There are two available settings for the Ringbuf configuration parameter as listed below.

- Ena: The data logger will continuously record data in the 6-MB ring buffer.
- Dis: The data logger will record up to 6 MB of data and then recording will stop.

Special Considerations

When setting the Ringbuf configuration parameter, take note of the following:

- To store data received over the acoustic link in the data logger memory, the AcData configuration parameter must be set to 1 (Datalog) or 2 (UART+Datalog).
- To store data received over the serial interface in the data logger memory, the OpMode configuration parameter must be set to 2 (Datalog).
- If the LogStore configuration parameter is set to 1 (SDHC), the RingBuf configuration parameter cannot be set to Ena.

LogMode

Default Setting

0 (FwdDelay) Once characters are received on the serial interface, if no more characters are received for the amount of time configured by the FwdDelay configuration parameter, a discrete record is created and the characters are stored in the data logger memory.

Definition

The setting of the LogMode configuration parameter determines how records are indexed in the data logger memory. The setting applies to both serial port 1 and serial port 2 when @InputMode=Dual.

Available Settings

The available settings for the LogMode configuration parameter are listed below.

- | | |
|---------------|---|
| 0 (FwdDelay): | Once characters are received on the serial interface, if no more characters are received for the amount of time configured by the FwdDelay configuration parameter, a discrete record is created and the characters are stored in the data logger memory. |
| 1 (Sentinel): | When the ASCII code of a character received on the serial interface matches the setting of the Sentinel configuration parameter, a discrete record is created and subsequently received characters are stored in the data logger memory. |
| 2 (ChrCount): | When the number of characters received on the serial interface matches the number configured by the setting of the ChrCount configuration parameter, a discrete record is created and the characters are stored in the data logger memory. |

Sentinel

Default Setting

0 The ASCII code for the character 0 will be used as a sentinel.

Definition

The setting of the Sentinel configuration parameter, which applies only when @LogMode=Sentinel, is the character for the ASCII code that is to be used as a sentinel for partitioning data received on a the serial interface into discrete records. Monitoring for the ASCII code is performed separately for serial port 1 and serial port 2 when @InputMode=Dual.

Available Settings

The range of available settings for the Sentinel configuration parameter is 0 to 255.

Special Considerations

When setting the Sentinel configuration parameter, take note of the following:

- The sentinel character should be the last character in a data string and therefore is typically 13 for a carriage return or 10 for a line feed.
- The sentinel character is included in the record and is the last character in the record.



WARNING If data are input without the sentinel character, the modem will not go into the lowpower state until the sentinel character is received.

ChrCount

Default Setting

1024

The number of characters to receive on the serial interface before a discrete record is stored in the data logger memory is 1024.

Definition

The setting of the ChrCount configuration parameter, which applies only when the LogMode configuration parameter is set to ChrCount, is the number of characters to receive on the serial interface before a discrete record is stored in the data logger memory. Monitoring for the character count is performed separately for serial port 1 and serial port 2 when @InputMode=Dual.

Available Settings

The range of available settings for the ChrCount configuration parameter is 0 to 4096.



WARNING The modem will not go into the lowpower state until the full character count is received.

LogStore

Default Setting

0 (Internal) Data are stored in the 6-MB internal flash memory of the modem.

Definition

The setting of the LogStore configuration parameter determines which memory, the internal 6-MB internal flash memory or the secure digital high capacity (SDHC) card memory, on the local modem the data logger information will be stored.

Available Settings

There are two available settings for the LogStore configuration parameter as listed below.

- 0 (Internal): Data are stored in the 6-MB internal flash memory of the modem.
- 1 (SDHC): Data are stored to an SDHC.

Special Considerations

When setting the LogStore configuration parameter, take note of the following:

- If the RingBuf configuration parameter is set to Ena, the LogStore configuration parameter cannot be set to 1 (SDHC).
- All the datalogger commands apply only to the memory selected with the LogStore command.
- The LogStore configuration parameter is only available with the SD Datalogger option.
- If the Acoustic Recorder is on, the LogStore configuration parameter cannot be set to 1 (SDHC). If an attempt is made to set it to 1 (SDHC), the message "SDHC is in use for logger" will be displayed.

DataRetry

Default Setting

0 A data packet will not be retransmitted if the data were received with errors or if no acknowledgement was received.

Definition

The setting of the DataRetry configuration parameter determines whether an acoustic data packet that is received with errors is retransmitted and how many times. A setting greater than 0 requires that the transmitting modem receive an acknowledgement from the receiving modem after transmitting each data packet. If errors are detected, or if no acknowledgement is received, the data are retransmitted up to the number of times determined by the DataRetry setting. For a setting of 0, data are not retransmitted.



NOTE As each packet of data contains sixteen 256-byte cells for a total of 4 kbytes, only the 256-byte cells containing errors are retransmitted.

Available Settings

The range of available settings for the DataRetry configuration parameter is from 0 to 6 where 0 is disabled.

Special Considerations

When setting the DataRetry configuration parameter, take note of the following,

- For data retry to function properly, the setting of the DataRetry configuration parameter must be the same for both the local and remote modems.
- If the DataRetry configuration parameter is enabled, and if more than 28 kbytes of data are to be transmitted, then hardware CTS handshaking should be used.
- If the DataRetry configuration parameter is disabled, and if more than 32 kbytes of data are to be transmitted, then hardware CTS handshaking should be used.

AcRspTmOut

Default Setting

7.5	The local modem will wait 7.5 seconds after sending an acoustic command to a remote modem for the remote modem to acknowledge receipt of the command.
-----	---

Definition

The setting of the AcRspTmOut configuration parameter determines the acoustic response timeout, which is the time during which a local modem will wait for an acknowledgment to an acoustic command sent to a remote modem. If no acknowledgment is received, the local modem will output the results message "Response Not Received." When setting the AcRspTmOut configuration parameter, the total two-way sound travel time to the remote modem must be taken into account, along with approximately 3.5 seconds for the remote modem to transmit an acknowledgement to the command.

Available Settings

The range of available settings for the AcRspTmOut configuration parameter is from 2.0 to 99.5 seconds in 0.5-second increments.

Special Considerations

When setting the AcRspTmOut configuration parameter, take note of the following.

- The acoustic response timeout should be increased as the range between a local and remote modem increases. As sound travels at about 1500 meters/sec in seawater, the total time for the sound to travel a distance of 6000 meters, for example, is about 4 seconds. Considering also the 3.5 seconds it takes for the remote modem to transmit an acknowledgement, the AcRspTmOut configuration parameter setting of 7.5 seconds is sufficient for modem ranges equal to or less than 3000 meters, which is equivalent to a two-way distance of 6000 meters.

- As another example, for an AcRspTmOut configuration parameter setting of 17.5 seconds, subtracting 3.5 seconds for the time it takes for the remote modem to transmit an acknowledgement leaves 14 seconds for the two-way travel time, which is equivalent to 7 seconds of one-way travel time. With sound traveling at 1500 meters/sec in seawater, the range to the modem can be as long as 10,500 meters.
- If the range to the modem exceeds that accounted for by the setting of the AcRspTmOut configuration parameter, the local modem will output the results message "Response Not Received." This message may also be followed by the message "ACK" *if @Verbose=2 and* the acknowledgement is received after the acoustic response timeout.
- For a UDB-9400 Universal Deck Box, changing the Timeout setting in the Transpond Parameters pop-up will change the setting of the AcRspTmOut configuration parameter. As this setting could be as low as 2 seconds, it may have to be changed for an acknowledgement to be received.

OpMode

Default Setting

- | | |
|------------|---|
| 1 (Online) | When the modem is powered up or awakened from the lowpower state, the modem will go into Online mode. |
|------------|---|

Definition

The setting of the OpMode configuration parameter determines the operating mode that a modem will go into when it is powered up or when the modem is awakened from the lowpower state.

Available Settings

The available settings for the OpMode configuration parameter are listed below.

- | | |
|--------------|---|
| 0 (Command): | Command mode
(Refer to "Command Mode" on page 5-5 for information on Command mode.) |
| 1 (Online): | Online mode
(Refer to "Online Mode" on page 5-2 for information on Online mode.) |
| 2 (Datalog): | Datalog mode
(Refer to "Datalogger Mode" on page 5-15 for information on Datalogger mode.) |

DevEnable

Default Setting

0 (Auto) The Device Enable output is set automatically and can also be set with the Local Device Enable (ATTDm) and Remote Device Enable (AT\$Xn,m) commands.

Definition

The setting of the DevEnable configuration parameter determines whether the Device Enable output is set automatically or with a command, or set only with a command. The Device Enable output operates as described in "Device Enable" on page 5-98.

Available Settings

The available settings for the DevEnable configuration parameter are listed below.

- | | |
|----------------|---|
| 0 (Auto): | The Device Enable output is set automatically and can also be set with the Local Device Enable (ATTDm) and Remote Device Enable (AT\$Xn,m) commands. Should the modem enter the lowpower state, the device enable output will be cleared. Upon exiting from the lowpower state when the modem receives data over the acoustic link, the device enable output will be set. |
| 1 (MBARI): | Reserved and should not be used. |
| 2 (Manual-LP): | The Device Enable output is set <i>only</i> with the Local Device Enable (ATTDm) and Remote Device Enable (AT\$Xn,m) commands. The setting will be preserved upon entering and exiting from the lowpower state. |
| 3 (Manual): | The Device Enable output is set <i>only</i> with the Local Device Enable (ATTDm) and Remote Device Enable (AT\$Xn,m) commands. Should the modem enter the lowpower state, the device enable output will be cleared and remain cleared upon exiting from the lowpower state. |

FwdDelay

Default Setting

3.0

The modem will transmit any buffered data if it is in Online mode or store the data in the data logger memory if it is in Datalogger mode when the corresponding buffer is full or 3.0 seconds after the last data are input, whichever occurs first.

Definition

The setting of the FwdDelay configuration parameter determines the forwarding delay of a modem. When a local modem is online with a remote modem, the local modem accumulates data in its 4-kbyte transmit data buffers. These data are input from its host processor over the serial interface. Immediately after the first transmit data buffer has filled, the 4-kbyte data packet is transmitted. However, if the transmit data buffer does not fill, the data are transmitted anyway a preset time after the last data are input. This time is the forwarding delay. Similarly, when a modem is in Datalogger mode, the data in the transmit data buffer are transferred to the data logger memory immediately after the buffer has filled, or after the forwarding delay.



NOTE While data are being transmitted from a 4-kbyte transmit data buffer, data can continue to be input to the modem over the serial interface, filling the additional 4-kbyte transmit data buffers.

Available Settings

The range of available settings for the FwdDelay configuration parameter is from 0.05 to 5 seconds in 50-millisecond increments.

Special Considerations

When setting FwdDelay configuration parameter, take note of the following:

- The transmission efficiency is improved if the 4-kbyte transmit data buffer is allowed to fill before transmitting the data.

LocalAddr

Default Setting

0 The address of the modem is 0.

Definition

The setting of the LocalAddr configuration parameter determines the address of the modem.

Available Settings

The range of available settings for the LocalAddr configuration parameter is from 0 to 249. This provides a total of 250 unique addresses.

Special Considerations

When setting the LocalAddr configuration parameter, take note of the following:

- The LocalAddr configuration parameter cannot be changed remotely over the acoustic link, therefore it is important that the correct address be set prior to deploying the modem.
- The same address can be used for more than one modem; however, this may not be desirable in some situations.

RemoteAddr

Default Setting

0 The address of the remote modem that the local modem is online with is 0.

Definition

The setting of the RemoteAddr configuration parameter is the address of the remote modem that the local modem is online with when the local modem is powered up or awakened from the lowpower state. This occurs only if @OpMode=1.

Available Settings

The range of available settings for the RemoteAddr configuration parameter is from 0 to 249 and 255. This provides a total of 250 addresses plus the global address 255.

Special Considerations

When setting the RemoteAddr configuration parameter, take note of the following:

- The Dial command (ATDn) sets the RemoteAddr configuration parameter of the remote modem to the address of the local modem.
- The Dial command (ATDn) sets the RemoteAddr configuration parameter of the local modem to the address of the remote modem.
- If @RemoteAddr=255, data sent from the address will be received by all modems.

ShowBadData

Default Setting

Ena Data packets containing errors are displayed.

Definition

The setting of the ShowBadData configuration parameter determines whether data packets that contain errors are displayed.

Available Settings

There are two available settings for the ShowBadData configuration parameter as listed below.

Ena: Data packets containing errors are displayed.

Dis: Data packets containing errors are not displayed.

StartTones

Default Setting

Ena On power up or when rebooted, the modem transducer will beep four times in rapid secession.

Definition

The setting of the StartTones configuration parameter determines whether the modem transducer will beep when the modem is powered up or rebooted.

Available Settings

There are two available settings for the StartTones configuration parameter as listed below.

Ena: On power up or when rebooted, the modem transducer will beep four times in rapid secession.

Dis: The modem transducer will not beep when the modem is powered up or rebooted.

TxRate

Default Setting

5 (800) The transmitting acoustic bit rate of the modem is 800 bits/second, with rate 1/2 convolutional coding and 12.5-ms multipath guard period.

Definition

The setting of the TxRate configuration parameter determines the transmitting acoustic bit rate, the modulation technique—MFSK, PSK or FH—and whether any one or more of the three methods for increased reliability are used, which are data redundancy, convolutional coding and multipath guard period.



NOTE The setting of the TxRate configuration parameter determines the transmitting acoustic bit rate only. The receiving modem will receive data and commands from the transmitting modem regardless of the bit rate of the transmitting modem. Therefore the bit rates can be different in each direction for an asymmetrical acoustic link. Only a UDB-9400 Universal Deck Box, however, can receive the bit rates of settings 9–13 below.

Available Settings

The range of available settings for the TxRate configuration parameter is from 2 to 14 as follows:

- 1 (80): 80 bits/sec FH with rate 1/2 convoutional coding
- 2 (140): 140 bits/sec MFSK repeated four times with rate 1/2 convolutional coding and 25-ms multipath guard period
- 3 (300): 300 bits/sec MFSK repeated twice with rate 1/2 convolutional coding and 25-ms multipath guard period
- 4 (600): 600 bits/sec MFSK with rate 1/2 convolutional coding and 25-ms multipath guard period
- 5 (800): 800 bits/sec MFSK with rate 1/2 convolutional coding and 12.5-ms multipath guard period
- 6 (1066): 1066 bits/sec MFSK with rate 1/2 convolutional coding and 3.125-ms multipath guard period

7 (1200):	1200 bits/sec MFSK with rate 1/2 convolutional coding
8 (2400):	2400 bits/sec MFSK
9 (2560):	2560 bits/sec PSK, with rate 1/2 convolutional coding
10 (5120):	5120 bits/sec PSK, with rate 1/2 convolutional coding
11 (7680):	7680 bits/sec PSK, with rate 1/2 convolutional coding
12 (10240):	10,240 bits/sec PSK
13 (15360):	15,360 bits/sec PSK

Special Considerations

When setting the TxRate configuration parameter, take note of the following:

- To maximize the modem battery pack life for the amount of data transmitted, use the highest acoustic bit rate that yields good results.
- When selecting a bit rate that includes a multipath guard period, the selection should include the multipath guard period that is longer than the multipath delay. The multipath delay is measured and displayed as a part of the received data statistics when using the Acoustic Link Test command (ATXn).
- When using settings 9–13, a coprocessor is required to receive the data. The coprocessor is standard for a UDB 9400 Universal Deck Box and is also available when the PSK Coprocessor option is ordered.

TxPower

Default Setting

8 (Max) The transmit power level of the modem is set to 0 dB, which is the highest power level.

Definition

The setting of the TxPower configuration parameter determines the transmit power level of a modem.

Available Settings

The range of available settings for the TxPower configuration parameter is from 1 to 8 for a range of 0 dB to -21 dB of attenuation in -3 dB steps, where 0 dB is the maximum transmit power level and -21 dB is the minimum transmit power level as follows:

- 1 (-21 dB): -21 dB (minimum transmit power)
- 2 (-18 dB): -18 dB
- 3 (-15 dB): -15 dB
- 4 (-12 dB): -12 dB
- 5 (-09 dB): -09 dB
- 6 (-06 dB): -06 dB
- 7 (-03 dB): -03 dB
- 8 (Max): 00 dB (maximum transmit power)

Special Considerations

When setting the TxPower configuration parameter, take note of the following:

- The transmit power of the modem can be changed remotely with the Remote Power command (AT\$Pn,m).
- To maximize the modem battery pack life, use the lowest power setting that yields good communications.
- The minimum power may be less than -21 dB, depending on the input voltage and the transducer.

- When transmitting at power level 7 for an ATM-914, ATM-915 or ATM-916 Acoustic Telemetry Modem in a 23°C environment at 21 VDC, limit continuous transmissions to 45 minutes, and then allow the modem to cool for 10 minutes before retransmitting. When using power level 8, limit any continuous transmissions to 15 minutes, and then allow the modem to cool for 10 minutes before retransmitting.



WARNING Exceeding the recommended power level and continuous transmission time limits for an ATM-914, ATM-915 or ATM-916 Acoustic Telemetry Modems may cause the transmitter to overheat and to automatically shut down. Should this condition occur, a message will be output on the serial interface indicating such. Once the modem cools down it will be able to transmit again. To display the internal temperature of the local modem, use the ATV command.

WakeTones

Default Setting

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

Definition

The setting of the WakeTones configuration parameter enables or disables transmission of the lowpower wakeup signal at the beginning of every data packet. The lowpower wakeup signal is a 375-ms long signal that wakes up all the remote modems that are in the lowpower state.

Available Settings

There are two available settings for the WakeTones configuration parameter as listed below.

Ena: Enables the lowpower wakeup signal.

Dis: Disables the lowpower wakeup signal.

Special Considerations

When setting the WakeTones configuration parameter, take note of the following:

- The lowpower wakeup signal should be disabled only for the transmitting modem, and only if it is known that the receiving modem will never go into the lowpower state. To prevent the receiving modem from going into the lowpower state, set its IdleTimer configuration parameter to 0.
- Disabling the lowpower wakeup signal lengthens the modem battery pack life for the transmitting modem.

PrintHex

Default Setting

Dis When displaying data bytes received acoustically from a remote modem, the data are displayed in ASCII format.

Definition

The setting of the PrintHex configuration parameter determines whether data bytes received from a remote modem are displayed in ASCII or hexadecimal format.

Available Settings

There are two available settings for the PrintHex configuration parameter as listed below.

- Ena: Displays hexadecimal values of the data bytes received acoustically from a remote modem.
- Dis: Displays the ASCII values of the data bytes received acoustically from a remote modem.

Special Considerations

When setting the PrintHex configuration parameter, take note of the following:

- The PrintHex configuration parameter, when enabled, allows comparison of a binary file sent from a remote modem to the output of the local modem.

StrictAT

Default Setting

Dis The modem will process both CLAM shell and AT commands.

Definition

The setting of the StrictAT configuration parameter determines whether the modem will process both CLAM shell and AT commands or just AT commands.

Available Settings

There are two available settings for the StrictAT configuration parameter as listed below.

Ena: The modem will process only AT commands.

Dis: The modem will process both CLAM shell and AT commands.

InputMode

Default Setting

- 1 (Single) The modem will allow only one instrument to be connected to the modem for the input of data.

Definition

The setting of the InputMode configuration parameter determines whether one or two instruments can be connected to the modem for the input of data and whether transport information will be sent with the data.



NOTE For the InputMode configuration parameter to be available, a Dual Serial Port feature key must be purchased and installed in the modem.

Available Settings

There are two available settings for the InputMode configuration parameter as listed below.

- 1 (Single): The modem will allow only one instrument to be connected to the modem for the input of data when the modem is in Online or Datalogger mode. The instrument must be connected to serial port 1. Transport information will be transmitted with the data packets only if @TPortMode=Always.
- 2 (Dual): Two instruments can be connected to the modem, one to serial port 1 and the other to serial port 2. Both serial ports will input data when the modem is in Online or Datalogger mode. Transport information will be transmitted with the data packets.

Special Considerations

When setting the InputMode configuration parameter, take note of the following:

- Serial port 1 should always be used when in Command mode.
- Although serial port 2 can be used for some CLAM shell commands, it will not accept any AT commands.
- Command mode is not affected by the setting of the InputMode configuration parameter.

SmartRetry

Default Setting

Dis Smart retry is disabled.

Definition

The setting of the SmartRetry configuration parameter determines whether an acoustic data packet that is received with errors is retransmitted at successively slower acoustic bit rates. When enabled, the transmitting modem requires an acknowledgement from the receiving modem after transmitting each data packet. If errors are detected, or if no acknowledgement is received, the data are retransmitted.



NOTE As each packet of data contains sixteen 256-byte cells for a total of 4 kbytes, only the 256-byte cells containing errors are retransmitted.

The smart retry feature functions by first determining the percentage of cells in a data packet that are received with errors to that of the total number of cells received and then adjusting the setting of the TxRate configuration parameter as follows:

Greater than 50%: The setting is dropped by 2.

25–49%: The setting is dropped by 1.

Less than 25%: The setting is left as is.

Available Settings

There are two available settings for the SmartRetry configuration parameter as listed below.

Ena: Enables smart retry.

Dis: Disables smart retry.

Special Considerations

When setting the SmartRetry configuration parameter, take note of the following:

- For smart retry to function properly, the setting of the SmartRetry configuration parameter must be the same for both the local and remote modems.
- The setting of the TxRate configuration parameter will not be dropped below 2 which is 140 bits/sec.
- Only one retransmission will be made at 140 bits/sec. If no response is received, no further attempts will be made to transmit the data and the entire data packet will be discarded.
- If no response is received from the remote modem, the TxRate configuration parameter setting will not be changed for the retransmission attempt. If no response is received after one retransmission, no further attempts will be made to transmit the data and the entire data packet will be discarded.
- The DataRetry configuration parameter setting must be greater than 0.

TimedRelease

Default Setting

0 The timed release is disabled.

Definition

The setting of the TimedRelease configuration parameter is the elapsed time in hours after power up before activation of the release of a SMART Release or SMART Modem.

Available Settings

The range of available settings for the TimedRelease configuration parameter is from 0 to 999, where 0 disables the timed release function, and each increment represents one hour for a range of 1 to 999 hours of delay before the release is activated.

Special Considerations

When setting the TimedRelease configuration parameter, take note of the following:

- The setting of the TimedRelease configuration parameter must be saved by entering `cfg store`.
- The timer starts when the modem is powered up, when a Remote Acoustic Reset command (AT\$ESn) is sent or with any other type of reset.

TPortMode

Default Setting

0 (InpMode) Transport addressing is in accordance with the setting of the InputMode configuration parameter.

Definition

The setting of the TPortMode configuration parameter determines whether transport addresses are attached to transmitted data packets.

Available Settings

There are two available settings for the TPortMode configuration parameter as listed below.

0 (InpMode): Transport addressing is in accordance with the setting of the InputMode configuration parameter.

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

When @InputMode=Dual, transport addressing is enabled, and data that are input to serial port 1 of the local modem and transmitted to a remote modem will include a transport address attached to the data packets in accordance with the setting of the SrcP1 configuration parameter, indicating to the remote modem which port on the local modem the data were input. The same is true for serial port 2 and the setting of the SrcP2 configuration parameter. Data packets that are received over the acoustic link from a remote modem with a transport address attached will be routed in accordance with the setting of the Dst1 and Dst2 configuration parameters to serial port 1 or to serial port 2.

- 1 (AlwaysOn): Transport addressing is always enabled regardless of the setting of the InputMode configuration parameter. Data that are input to serial port 1 of the local modem and transmitted to a remote modem will include a transport address attached to the data packets in accordance with the setting of the SrcP1 configuration parameter, indicating to the remote modem which port on the local modem the data were input. The same is true for serial port 2 and the setting of the SrcP2 configuration parameter. Data packets that are received over the acoustic link from a remote modem with a transport address attached will be routed in accordance with the setting of the Dst1 and Dst2 configuration parameters to serial port 1 or to serial port 2.

SrcP1

Default Setting

- | | |
|---|---|
| 1 | The transport address for data input on serial port 1 is 1. |
|---|---|

Definition

The setting of the SrcP1 configuration parameter is the transport address that will be attached to transmitted data packets that are generated from data that are input to serial port 1 when @TPortMode=AlwaysOn, or when @TPortMode=InpMode and @InputMode=Dual.

Available Settings

The available settings for the SrcP1 configuration parameter are listed below.

- 1: The transport address for data input on serial port 1 is 1.
- 2: The transport address for data input on serial port 1 is 2.
- 3: Reserved.
- 4: Reserved.

Special Considerations

When setting the SrcP1 configuration parameter, take note of the following:

- If @TPortMode=InpMode and @InputMode=Single, no transport addresses will be attached to transmitted data packets.

SrcP2

Default Setting

2 The transport address for data input on serial port 2 is 2.

Definition

The setting of the SrcP2 configuration parameter is the transport address that will be attached to transmitted data packets that are generated from data that are input to serial port 2 when @TPortMode=AlwaysOn, or when @TPortMode=InpMode and @InputMode=Dual.

Available Settings

The available settings for the SrcP2 configuration parameter are listed below.

- 1: The transport address for data input on serial port 2 is 1.
- 2: The transport address for data input on serial port 2 is 2.
- 3: Reserved.
- 4: Reserved.

Special Considerations

When setting the SrcP2 configuration parameter, take note of the following:

- If @TPortMode=InpMode and @InputMode=Single, no transport addresses will be attached to transmitted data packets.

Dst1

Default Setting

- 1 (P1) Data received over the acoustic link with transport address 1 will be output on serial port 1.

Definition

The setting of the Dst1 configuration parameter determines to which serial port, serial port 1 or serial port 2, that data packets received over the acoustic link with transport address 1 will be output when @TPortMode=AlwaysOn, or when @TPortMode=InpMode and @InputMode=Dual.

Available Settings

There are two available settings for the Dst1 configuration parameter as listed below.

- 1 (P1): Data received over the acoustic link with transport address 1 will be output on serial port 1.
- 2 (P2): Data received over the acoustic link with transport address 1 will be output on serial port 2.

Special Considerations

When setting the Dst1 configuration parameter, take note of the following:

- The Dst1 configuration parameter does not apply when @TportMode=InpMode and @InputMode=Single. In this case data packets with transport addresses attached will be output on serial port 1.

Dst2

Default Setting

2 (P2) Data received over the acoustic link with transport address 2 will be output on serial port 2.

Definition

The setting of the Dst2 configuration parameter determines to which serial port, serial port 1 or serial port 2, that data packets received over the acoustic link with transport address 2 will be output when @TPortMode=AlwaysOn, or when @TPortMode=InpMode and @InputMode=Dual.

Available Settings

There are two available settings for the Dst2 configuration parameter as listed below.

- 1 (P1): Data received over the acoustic link with transport address 2 will be output on serial port 1.
- 2 (P2): Data received over the acoustic link with transport address 2 will be output on serial port 2.

Special Considerations

When setting the Dst2 configuration parameter, take note of the following:

- The Dst2 configuration parameter does not apply when @TportMode=InpMode and @InputMode=Single. In this case data packets with transport addresses attached will be output on serial port 1.
- For a UDB-9400 Universal Deck Box, @Dst2=P1 is the default setting.

Dst3

(Reserved)

Dst4

(Reserved)

SimAcDly

Default Setting

0 The simulated acoustic delay is 0 ms.

Definition

The setting of the SimAcDly configuration parameter simulates the acoustic delay that would occur when sending and receiving data or commands over the acoustic link in water. It applies only to the transmitting modem and is useful when testing the modems in air.

Available Settings

The range of available settings for the SimAcDly configuration parameter is from 0 to 30000 ms in 1-ms increments.

PktEcho

Default Setting

- 0 When the local modem transmits the Acoustic Link Test command (ATXn) to a remote modem, the preset test message transmitted by the remote modem will not be displayed when the message is received by the local modem.

Definition

The setting of the PktEcho configuration parameter determines whether the local modem will display the preset test message received from a remote modem. The remote modem will transmit the preset test message when it receives the Acoustic Link Test command (ATXn) from the local modem.

Available Settings

There are two available settings for the PktEcho configuration parameter as listed below.

- Ena: Enables the display of the preset test message when received from a remote modem.
- Dis: Disables the display of the preset test message when received from a remote modem.

PktSize

Default Setting

0 (8B) When the local modem transmits the Acoustic Link Test command (ATXn) to a remote modem, the remote modem will transmit an 8-byte preset test message.

Definition

The setting of the PktSize configuration parameter determines the test message size in bytes that a remote modem will be commanded to transmit when it receives the Acoustic Link Test command (ATXn) from the local modem.

Available Settings

The available settings for the PktSize configuration parameter are listed below.

- 0 (8B): 8-byte message
- 1 (32B): 32-byte message
- 2 (128B): 128-byte message
- 3 (256B): 256-byte message
- 4 (512B): 512-byte message
- 5 (1024B): 1024-byte message
- 6 (2048B): 2048-byte message
- 7 (4096B): 4096-byte message

RcvAll

Default Setting

Dis	The local modem will not receive data from all transmitting modems, only the data addressed to itself.
-----	--

Definition

The setting of the RcvAll configuration parameter determines whether the local modem will receive all data transmitted from other modems or only the data addressed to itself.

Available Settings

There are two available settings for the RcvAll configuration parameter as listed below.

- Ena: Enables the local modem to receive data from all transmitting modems.
- Dis: Disables the local modem from receiving data from all transmitting modems. Only the data addressed to itself is received.

RxFreq

Default Setting

11000

The local modem's receive frequency is 11000 Hz.

Definition

The setting of the RxFreq configuration parameter is the receive frequency of the modem in hertz and must be correctly set when using the Transpond (ATNm) command to acquire the two-way sound travel time to a transponder. The RxFreq setting should be the same as the transponder transmit frequency unless the Multi-Receive feature key is installed in which case it does not apply.

Available Settings

The range of available settings for the RxFreq configuration parameter is from 0 to 35000 in integer increments for a receive frequency of 7000 Hz to 16,000 Hz in 250-Hz increments.

RxThresh

Default Setting

10	The number of standard deviations that a detected signal must rise above the background noise level before it is marked as a received transponder reply by the local modem is 10.
----	---

Definition

The setting of the RxThresh configuration parameter is the number of standard deviations that a detected signal must rise above the background noise level at that frequency before it is marked as a received transponder reply. It must be correctly set when using the Transpond (ATNm) command to acquire the two-way sound travel time to a transponder. The lower this setting the more sensitive is the receiver and the more likely a detected signal will be marked as a received reply. However, with a low setting there is also a greater likelihood of "false positives," where a detected signal is incorrectly marked as a received reply. The higher the setting the less sensitive is the receiver and the less likely a detected signal will be marked as a received reply. Therefore a high setting increases the likelihood of missing valid detections. The receive threshold should be adjusted in accordance with the background noise such as to minimize false positives and negatives.

Available Settings

The range of available settings for the RxThresh configuration parameter is from 10 to 256 in integer increments. The default setting is 10.

RxToneDur

Default Setting

10 The local modem's receive pulse width is 10 ms.

Definition

The setting of the RxToneDur configuration parameter determines the receive pulse width of the modem and must be correctly set when using the Transpond (ATNm) command to acquire the two-way sound travel time to a transponder. The RxToneDur setting should be the same as the transponder's transmit pulse width as determined by the TxToneDur setting.

Available Settings

The available settings for the RxToneDur configuration parameter are listed below.

0 (12.5ms):	12.5 ms
1 (6.25ms):	6.25 ms
5 (5ms):	5 ms
6 (6ms):	6 ms
7 (7ms):	7 ms
8 (8ms):	8 ms
9 (9ms):	9 ms
10 (10ms):	10 ms
11 (11ms):	11 ms
12 (12ms):	12 ms
13 (13ms):	13 ms
14 (14ms):	14 ms
15 (15ms):	15 ms

RxLockout

Default Setting

75 The local modem's lockout time is 75 ms.

Definition

The setting of the RxLockout configuration parameter is the lockout time in milliseconds of the local modem and must be correctly set when using the Transpond (ATNm) command to acquire the two-way sound travel time to a transponder. The lockout time is a period that begins at the start of the interrogation pulse during which the modem will ignore any received replies from the transponder. The RxLockout setting prevents interrogation pulse transmission echoes from nearby objects from being detected as replies

Available Settings

The range of available settings for the RxLockout configuration parameter is from 0 to 1000 in integer increments for a lockout time of 0 ms to 1000 ms in 1-ms increments.

TxToneDur

Default Setting

10 The local modem's transmit pulse width is 10 ms.

Definition

The setting of the RxToneDur configuration parameter determines the transmit pulse width of the modem and must be correctly set when using the Transpond (ATNm) command to acquire the two-way sound travel time to a transponder. The TxToneDur setting should be the same as the transponder's receive pulse width as determined by the RxToneDur setting.

Available Settings

The available settings for the RxToneDur configuration parameter are listed below.

0 (12.5ms):	12.5 ms
1 (6.25ms):	6.25 ms
5 (5ms):	5 ms
6 (6ms):	6 ms
7 (7ms):	7 ms
8 (8ms):	8 ms
9 (9ms):	9 ms
10 (10ms):	10 ms
11 (11ms):	11 ms
12 (12ms):	12 ms
13 (13ms):	13 ms
14 (14ms):	14 ms
15 (15ms):	15 ms

TAT

Default Setting

0 The local modem's turn-around-time is 0 ms.

Definition

The setting of the TAT configuration parameter is the turn-around-time of the transponder and must be correctly set when using the Transpond (ATNm) command to acquire the two-way sound travel time to a transponder. The turn-around-time is the time in milliseconds from when the transponder receives an interrogation pulse to when it transmits the reply. It is subtracted from the measured two-way travel time.

Available Settings

The range of available settings for the TAT configuration parameter is from 0 to 1000 in integer increments for a turn-around-time of 0 ms to 100.0 ms in 0.1-ms increments.

LBLmode

Default Setting

Off The modem is disabled as a remote modem transponder.

Definition

The setting of the LBLmode configuration parameter enables or disables the modem as a remote modem transponder, and if enabled, whether it will listen for and reply to the broadband chirp transmissions from an interrogating modem, or passively listen both for the broadband chirp transmissions and the replies from other remote modem transponders.

Available Settings

There are three available settings for the LBLmode configuration parameter as listed below.

- Off: Disables the modem as a remote modem transponder.
- Tone: Enables the modem as a remote modem transponder. The modem will reply to the broadband chirp transmissions from an interrogating modem after a fixed 600-ms turn-around-time at the frequency set by the RespFreq configuration parameter and the transmit pulse width set by the TxToneDur configuration parameter.
- Listen: Causes the modem to passively listen for the broadband chirp transmissions from an interrogating modem and the replies from the remote modem transponders. The modem displays the time at which each reply is received after the broadcast chirp.

RespFreq

Default Setting

Model specific	The modem's reply frequency is dependent on the modem model.
----------------	--

Definition

The setting of the RespFreq configuration parameter is the reply frequency of the modem in hertz when the modem is configured as a remote modem transponder. To configure the modem as a remote modem transponder, set the LBLmode configuration parameter to Tone.

Available Settings

The range of available settings for the RespFreq configuration parameter is an integer value within the frequency band of the modem in 250-Hz increments.

Latitude

Default Setting

41.638246

The latitude is 41.638246 degrees north, the location of the Teledyne Benthos factory.

Definition

The Latitude configuration parameter stores the latitude in decimal degrees of the location of the modem. A positive value represents north, and a negative value represents south. This value can be updated automatically when a GPS is connected or set manually.

Available Settings

The range of available settings for the Latitude configuration parameter is from -90.000000 to 90.000000 in 0.000001-degree increments.

Longitude

Default Setting

-70.609376

The longitude is 70.609376 degrees west, the location of the Teledyne Benthos factory.

Definition

The Longitude configuration parameter stores the longitude in decimal degrees of the location of the modem. A positive value represents east, and a negative value represents west. This value can be updated automatically when a GPS is connected or set manually.

Available Settings

The range of available settings for the Longitude configuration parameter is from -180.000000 to 180.000000 in 0.000001-degree increments.

GPSAlt

Default Setting

0 The altitude of the modem is 0 meters (at sea level).

Definition

The GpsAlt configuration parameter stores the altitude of the modem in meters with respect to sea level. This value is typically provided as part of a 3-dimensional GPS fix and is updated automatically when a GPS unit is connected, or it can be set manually.

Available Settings

The range of available settings for the GPSAlt configuration parameter is from -20000.0 to 20000.0 in 0.01-meter increments.

Altitude

Default Setting

0 The modem is at an altitude of 0 meters (on the sea floor).

Definition

The Altitude configuration parameter stores the height of the modem above the sea floor in meters. This value is typically provided by a sonar altimeter, such as a Teledyne Benthos PSA-916, and is updated automatically when the altimeter is connected, or it can be set manually.

Available Settings

The range of available settings for the Altitude configuration parameter is from 0 to 12000.00 in 0.01-meter increments.

Depth

Default Setting

0	The modem is at a depth of 0 meters (at the surface).
---	---

Definition

The Depth configuration parameter stores the depth of the modem in meters. This value is typically provided from a pressure transducer and is updated automatically when the transducer is connected, or it can be set manually.

Available Settings

The range of available settings for the Depth configuration parameter is from 0 to 12000.0 in 0.1-meter increments.

Compass

Default Setting

0 The heading is 0 degrees (north).

Definition

The Compass configuration parameter stores the modem heading in degrees. This value is provided from a compass and is updated automatically when the compass is connected, or it can be manually entered if no compass is selected. However, the value is offset by the setting of the HeadOffset configuration parameter.

Available Settings

The range of available settings for the Compass configuration parameter is from 0 to 359.9 in 0.1-degree increments.

HeadOffset

Default Setting

0 The heading offset is 0 degrees (north).

Definition

The HeadOffset configuration parameter stores the heading offset in degrees of the modem. This value, which must be entered manually, is added to the setting of the Compass configuration parameter.

Available Settings

The range of available settings for the HeadOffset configuration parameter is from 0 to 359.9 in 0.1-degree increments.

Pitch

Default Setting

0 The pitch is 0 degrees (horizontal).

Definition

The Pitch configuration parameter stores the pitch angle in degrees of the platform to which the modem is mounted. This value is provided from a compass or attitude sensor and is updated automatically when the compass or sensor is connected, or it can be set manually. A positive values is bow down; a negative value, bow up.

Available Settings

The range of available settings for the Pitch configuration parameter is from -90.0 to 90.0 in 0.1-degree increments.

Roll

Default Setting

0 The roll is 0 degrees (horizontal).

Definition

The Roll configuration parameter stores the roll angle in degrees of the platform to which the modem is mounted. This value is provided from a compass or attitude sensor and is updated automatically when the compass or sensor is connected, or it can be set manually. A positive values is port up; a negative value, port down.

Available Settings

The range of available settings for the Roll configuration parameter is from -180.0 to 180.0 in 0.1-degree increments.

SpeedOfSound

Default Setting

1500 The speed of sound in water is 1500 meters/sec.

Definition

The SpeedOfSound configuration parameter stores the speed in meters of sound in water. This value is used in all range calculations where a time difference measurement is converted to distance.

Available Settings

The range of available settings for the SpeedOfSound configuration parameter is from 0 to 10000.0 in 0.1-meter/sec increments.

ReplyData

Default Setting

- | | |
|-------------|---|
| 1 (LatLong) | Only location will be displayed along with range when using the ATRX command. |
|-------------|---|

Definition

The ReplyData configuration parameter enables the local modem to display the location in latitude and longitude and the depth or altitude of a remote modem along with the range to the remote modem from the local modem when using the ATRX command. Latitude is in decimal degrees where a positive value represents north and a negative value represents south. Similarly, longitude is in decimal degrees where a positive value represents east and a negative value represents west. Depth and altitude units are in meters.

Available Settings

The available settings for the ReplyData configuration parameter are listed below.

- | | |
|---------------|---|
| 0 (Off): | Only range will be displayed when using the ATRX command. The ATRX command performs the same as an ATR command. |
| 1 (LatLong): | Only location will be displayed along with range when using the ATRX command. |
| 2 (Depth): | Location and depth will be displayed along with range when using the ATRX command. |
| 3 (SeaFloor): | Location and altitude, as provided by an altimeter, will be displayed along with range when using the ATRX command. |
| 4 (GpsAlt): | Location and height above mean sea level, as provided by a GPS, will be displayed along with range when using the ATRX command. |

Ain1Type

Default Setting

2 (10V) The Channel 1 input voltage range is 0–10 VDC.

Definition

Available only if the Analog Input option is installed, the setting of the Ain1Type configuration parameter is the Channel 1 input range in VDC or mA.

Available Settings

There are three available settings for the Ain1Type configuration parameter as listed below.

- | | |
|--------------|--|
| 0 (4-20 mA): | The Channel 1 input range is 4–20 mA. |
| 1 (5V): | The Channel 1 input range is 0–5 VDC. |
| 2 (10V): | The Channel 1 input range is 0–10 VDC. |



NOTE The Ain1Type configuration parameter setting of 1 is available only when factory enabled. Otherwise setting the Ain1Type configuration parameter to 1 will return an error message.

Ain2Type

Default Setting

1 (5V) The Channel 2 input voltage range is 0–5 VDC.

Definition

Available only if the Analog Input option is installed, the setting of the Ain2Type configuration parameter is the Channel 2 input range in VDC or mA.

Available Settings

There are three available settings for the Ain2Type configuration parameter as listed below.

- | | |
|--------------|--|
| 0 (4-20 mA): | The Channel 2 input range is 4–20 mA. |
| 1 (5V): | The Channel 2 input range is 0–5 VDC. |
| 2 (10V): | The Channel 2 input range is 0–10 VDC. |



NOTE The Ain2Type configuration parameter setting of 2 is available only when factory enabled. Otherwise setting the Ain2Type configuration parameter to 2 will return an error message.

AinPollRate

Default Setting

0 (Off) Scheduled polling of analog Channels 1 to 6 is not performed.

Definition

Available only if the Analog Input option is installed, the setting of the AinPollRate configuration parameter enables or disables scheduled polling of analog Channels 1 to 6, and if enabled, sets the polling rate.

Available Settings

The range of available settings for the AinPollRate configuration parameter is from 1 minute to 31 days in 1-minute intervals in the following format:

dd-hh:mm

where "dd" is the number of days between polling (0–31), "hh" is the hour of the day (1–24) and "mm" is the minute of the hour (1–59). A setting of 0 for "dd" ignores any "hh" or "mm" settings and instead synchronizes the polls with certain convenient times to ensure the polling schedule will include midnight and other "on-the-hour" times, but only if the polling interval is a convenient divider of a 24-hour period. A setting of 0 (Off) disables scheduled polling.

Ain<Channel No.>Nmeas

Default Setting

0 Analog Channel <Channel No.> does not participate in scheduled polling.

Definition

Available only if the Analog Input option is installed, the setting of the Ain<Channel No.>Meas configuration parameter enables or disables participation of analog Channel <Channel No.> in scheduled polling, and if enabled, sets the number of readings and recordings to the data logger memory to be made. For example,

@Ain3Nmeas=5

specifies that Channel 3 is to be read and recorded to the data logger memory 5 times.

Available Settings

The range of available settings for the Ain<Channel No.>Nmeas configuration parameter is from 0 to 60, where 0 disables participation. The range for <Channel No.> is from 1 to 6.

Ain<Channel No.>RptDly

Default Setting

- | | |
|---|---|
| 1 | The time between successive readings and recordings to the data logger memory of Channel <Channel No.> is 1 second. |
|---|---|

Definition

Available only if the Analog Input option is installed, the setting of the Ain<Channel No.>RptDly configuration parameter is the time in seconds between successive readings and recordings to the data logger memory of the Channel <Channel No.> input. For example,

@Ain3RptDly=5

specifies that the time between successive readings and recordings of Channel 3 is 5 seconds.

Available Settings

The range of available settings for the Ain<Channel No.>RptDly configuration parameter is from 0 to 10.0 in 0.1-second increments. The range for <Channel No.> is from 1 to 6.

Ain<Channel No.>StrtDly

Default Setting

- | | |
|---|--|
| 1 | The delay after turning on analog Channel <Channel No.> before making the first reading and recording to the data logger memory is 1 second. |
|---|--|

Definition

Available only if the Analog Input option is installed, the setting of the Ain<Channel No.>StrtDly configuration parameter is the delay in seconds after turning on analog Channel <Channel No.> before making the first reading and recording to the data logger memory. For example,

@Ain3StrtDly=5

specifies that the delay after turning on Channel 3 before making the first reading and recording is 5 seconds.

Available Settings

The range of available settings for the Ain<Channel No.>StrtDly configuration parameter is from 0 to 10.0 in 0.1-second increments. The range for <Channel No.> is from 1 to 6.

PressureChnl

Default Setting

6 The pressure transducer connects to analog Channel 6.

Definition

Available only if the Depth Sensor option is installed, the setting of the PressureChnl configuration parameter is the analog channel to which the pressure transducer connects.

Available Settings

The range of available settings for the PressureChnl configuration parameter is from 0 to 6, where a setting of 0 indicates no pressure transducer is connected.

MetersPerPSI

Default Setting

0.680 The pressure to depth conversion factor is 0.680 meters/psi.

Definition

Available only if the Depth Sensor option is installed, the setting of the MetersPerPSI configuration parameter is the pressure to depth conversion factor in meters/psi that is applied to every pressure measurement to determine depth after subtracting the setting of the ATMOffset configuration parameter.

Available Settings

The range of available settings for the MetersPerPSI configuration parameter is from 0 to 1.000 in 0.001-meters/psi increments.

Special Considerations

When setting the MetersPerPSI configuration parameter, take note of the following:

- To avoid having the Depth configuration parameter setting updated, set the MetersPerPSI configuration parameter to 0.
- To have ranges that normally display in meters display in psi instead, set the MetersPerPSI configuration parameter to 1. With this setting the Depth configuration parameter setting is still updated for each pressure measurement after first subtracting the setting of the ATMOffset configuration parameter.
- To record depth to the data logger memory, @MetersPerPSI must be greater than 0 and less than 1. To record pressure, @MetersPerPSI must be either 0 or 1. The output format of the data logger will substitute a "D" for the channel number if the recording is depth and a "P" if the recording is pressure.

ATMOffset

Default Setting

14.7 The atmospheric pressure is 14.7 psi.

Definition

Available only if the Depth Sensor option is installed, the setting of the ATMOffset configuration parameter is the atmospheric pressure in psi. If converting pressure to depth using the setting of MetersPerPSI as a conversion factor, then this pressure is subtracted from the pressure measured by the pressure transducer before the pressure to depth conversion is made.

Available Settings

The range of available settings for the ATMOffset configuration parameter is from 14.0 to 15.5 in 0.1-psi increments.

PSI

Default Setting

As measured

The most recent pressure reading is as measured by the pressure transducer.

Definition

Available only if the Depth Sensor option is installed, the setting of the PSI configuration parameter is the most recent pressure reading as measured by the pressure transducer. This setting can also be manually entered; however, the value will be overwritten by the next pressure measurement.

Available Settings

The range of available settings for the PSI configuration parameter is from 0 to 18000 in 1-psi increments.

Special Considerations

When setting the PSI configuration parameter, take note of the following:

If @MetersPerPSI is greater than 0, the Depth configuration parameter setting is updated for each pressure measurement after first subtracting the setting of the ATMOffset configuration parameter.

9 Maintenance and Troubleshooting

This section encompasses the recommended care and maintenance procedures for the subsea modem components of the Teledyne Benthos ATM-900 Series Acoustic Telemetry Modems. Adherence to these procedures will help to ensure many years of continuous, reliable performance from the modems. In addition, a troubleshooting guide is provided which will assist in isolating and correcting a few of the basic operational problems that could occur during setup or deployment.



NOTE For maintenance and troubleshooting of the UDB-9400 Universal Deck Box, the SR-50 and SR-9100 SMART Releases and the SM-975 SMART Modem, refer to their respective user's manual.

The care and maintenance of the modems involve three areas: general cleaning and inspection, changing the modem battery packs, and cleaning or replacing the O-rings. The tools required for these tasks include the following:

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

General Cleaning and Inspection

After retrieving a subsea modem, clean and inspect the modem as follows:

1. Turn the modem off by pulling the on/off switch all the way out. Refer to Figure 4-2 on page 4-8 for the location of the modem on/off switch.
2. Using a cloth or paper towel dry the modem thoroughly.
3. Unplug the cable from the POWER/SERIAL connector on the modem, inspect and clean the cable, and then clean the connector with an alcohol wipe.

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



NOTE Be especially careful not to get any lubricant on the face of the transducer as this will severely degrade its performance.

For the ATM-914, ATM-924 and ATM-964 Acoustic Telemetry Modems, perform all the steps listed below. For the ATM-915, ATM-916, ATM-925, ATM-926, ATM-965, and ATM-966 modems, go to Step 7.

5. Unplug the remote transducer cable from both the remote transducer connector on the modem and the connector on the remote transducer, inspect and clean the cable, and then clean the connectors with an alcohol wipe.
6. Lubricate the connector pins on both the remote transducer connector on the modem and the connector on the remote transducer with a light coat of silicone lubricant and install the dummy connectors supplied.
7. Wash down the modem with clean, *fresh* water and remove any debris that may have become attached to the housing.
8. Clean the transducer with a mild, non-abrasive detergent, being careful to remove any buildup. After cleaning, spray the transducer again with fresh water.



NOTE Do not use an ammonia-based cleaner such as a glass cleaner to clean the transducer.

9. Carefully inspect the transducer for any signs of damage.

Changing the Modem Battery Packs

The subsea modems, except for the ATM-916, ATM-926 and ATM-966 Acoustic Telemetry Modems, have an internal modem battery pack which will occasionally require changing. To change the battery pack, the modem requires disassembly, and the procedures for disassembling the ATM-914, ATM-915, ATM-925, and ATM-926 Acoustic Telemetry Modems are different than those for the ATM-964 and ATM-965 modems.



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

Checking the Modem Battery Pack

The best way to determine the remaining capacity of a modem battery pack is to keep track of the watt-hours consumed. If unable to do this, then the capacity of the battery pack can be estimated by measuring the battery pack voltage. To check the battery pack voltage after removing it from a modem, connect a 150-ohm, 3-watt resistor across the battery pack terminals, measure the voltage across the load resistor with a digital multimeter, and then refer to Table 9-1 to determine the battery pack capacity.

Table 9-1 Modem Battery Pack Capacity vs. Voltage

Voltage Under 150-Ohm Load (volts)	Capacity Remaining (%)
20	90–100%
19	70–90%
18	50–70%
17	40–60%
16	10–30%
15	<10%

Changing the ATM-914, ATM-915, ATM-924, or ATM-925 Modem Battery Pack

For the ATM-914, ATM-915, ATM-924, and ATM-925 Acoustic Telemetry Modems, both end caps require removal when changing the modem battery pack. First, the POWER/SERIAL connector end cap must be removed, and then the transducer end cap for the ATM-915 and ATM-925 or the remote transducer connector end cap for an ATM-914 and ATM-924.

To change the modem battery pack for an ATM-914, ATM-915, ATM-924, or ATM-925:

1. Turn the modem off by pulling the on/off switch all the way out. Refer to Figure 4-2 on page 4-8 for the location of the modem on/off switch.
2. With the modem on its side and resting on a flat surface, use a 9/64 Allen wrench to remove the three socket head screws that attach the POWER/SERIAL connector end cap to the housing.
3. Carefully pull the end cap straight out from the housing. If required, rotate the end cap slightly while pulling.
4. Disconnect the in-line connector that connects the battery pack to the connector on the POWER/SERIAL connector end cap.
5. Using a 9/64 Allen wrench remove the three socket head screws that attach the remote transducer connector end cap for an ATM-914 or ATM-924 Acoustic Telemetry Modem, or the transducer end cap for an ATM-915 or ATM-925 Acoustic Telemetry Modem.
6. Carefully pull the end cap straight out from the housing. If required, rotate the end cap slightly while pulling. When clear of the housing, continue to pull the end cap out while pushing on the battery pack from the other end of the housing. Pull the end cap out far enough to access the 5-pin power connector on the top of the circuit board.
7. Disconnect the 5-pin power connector.
8. Cut the wire tie with wire cutters and remove the 10-pin serial cable connector by first pressing down on the locking sleeve tab to unlock it, then slide the locking sleeve along the wire harness out of the way, grab the cable connector, and gently pull to disconnect it.
9. Place the end cap assembly on a clean, flat surface.
10. Remove the battery pack by first pushing it out from the POWER/SERIAL connector end cap end and then removing it from the opposite end.
11. Refer to "Cleaning or Replacing an O-ring" on page 9-14 and clean or replace the O-rings on both end caps.
12. Insert the new battery pack into the housing from the remote transducer connector end cap end for an ATM-924 Acoustic Telemetry Modem, or from the transducer end cap end for an ATM-925 Acoustic Telemetry Modem.

13. Connect the 10-pin serial connector to the circuit board and secure it with the locking sleeve.
14. Connect the 5-pin serial connector to the circuit board.
15. Slide the chassis and the battery pack together into the housing, and then press the end cap into the housing, being careful not to pinch the wires.
16. Line up the three holes in the end cap with the three holes in the housing, and secure the end cap to the housing with the three hex head screws.
17. Connect the in-line connector that connects the battery pack to the connector on the POWER/SERIAL connector end cap, and then press the end cap into the housing, being careful not to pinch the wires.
18. Line up the three holes in the end cap with the three holes in the housing, and secure the end cap to the housing with the three hex head screws.

Changing the ATM-964 or ATM-965 Modem Battery Pack

For the ATM-964 and ATM-965 Acoustic Telemetry Modems, both end caps require removal when changing the modem battery pack. First, the top end cap for an ATM-964 or the transducer end cap for an ATM-965 must be removed, and then the POWER/SERIAL connector end cap.

To change the modem battery pack for an ATM-964 or ATM-965:

1. Turn the modem off by pulling the on/off switch all the way out. Refer to Figure 4-2 on page 4-8 for the location of the modem on/off switch.
2. Using a flat head screwdriver loosen the remote transducer connector end cap for an ATM-964 Acoustic Telemetry Modem or the stainless steel band clamp on the transducer end cap for an ATM-965 Acoustic Telemetry Modem. Slide the band clamp down along the housing out of the way.
3. With the modem on its side and resting on a flat surface, carefully pull the end cap straight out from the housing, far enough to access the connectors on the circuit board. If required, rotate the end cap slightly while pulling.
4. Disconnect the 5-pin power and 10-pin serial cable connectors that connect to the circuit board and set the end cap assembly aside.

5. Using a flat head screwdriver loosen the stainless steel band clamp on the POWER/SERIAL connector end cap. Slide the clamp down along the housing and out of the way.
6. Carefully pull the end cap straight out, completely removing it and the battery tray with the installed battery packs from the housing. If required, rotate the end cap slightly while pulling.
7. Remove one of the battery retainer bars by removing the four Phillips head screws that secure it.
8. One at a time remove the two battery packs from the battery tray, and then remove the electrical tape that secures the in-line connectors and disconnect them.
9. Install the new battery packs into the battery tray one at a time.
10. Connect the in-line connectors and wrap each of them with electrical tape.
11. Tuck the battery wires and the in-line connectors out of the way between the two battery packs.
12. Install the battery retainer bar and secure it with the four Phillips head screws.
13. Refer to "Cleaning or Replacing an O-ring" on page 9-14 and clean or replace the O-rings on both end caps.
14. Feed the wire harness through the housing and slide the battery pack into the housing until the gland seal O-ring on the end cap is against the housing. Be careful not to scrape the O-ring surface on the inside wall of the housing.
15. When the gland seal O-ring is against the housing, apply equal pressure against the end cap and press it into the housing until the face seal O-ring is firmly seated against the housing. If required, rotate the end cap slightly when pressing it into the housing.
16. Slide the stainless steel band clamp back into position between the end cap and the housing and tighten the clamp.
17. Connect the 5-pin power and 10-pin serial cable connectors to the circuit board.
18. Slide the chassis into the housing until the gland seal O-ring on the end cap is against the housing, being careful not to scrape the O-ring surface on the inside wall of the housing.

19. When the gland seal O-ring is against the housing, apply equal pressure against the end cap and press it into the housing until the face seal O-ring is firmly seated against the housing. If required, rotate the end cap slightly when pressing it into the housing.
20. Slide the stainless steel band clamp back into position between the end cap and the housing and tighten the clamp.

Changing the Real-Time Clock Battery

The subsea modems include a real-time clock battery for powering the real-time clock when the modem is powered down. To change the real-time clock battery, the modem requires disassembly, and the procedures for disassembling the ATM-914, ATM-915, ATM-924 and ATM-925; the ATM-916 and ATM-926; and the AM-964, ATM-965 and ATM-966 Acoustic Telemetry Modems are different.

The real-time clock battery is an Energizer CR1632 or equivalent and should be replaced after two years of modem off time or when the battery voltage is less than 2.7 VDC. To display the real-time clock battery voltage, use the `rtc_battery` command.

Changing the ATM-914, ATM-915, ATM-924, or ATM-925 Real-Time Clock Battery

For the ATM-914, ATM-915, ATM924, and ATM-925 Acoustic Telemetry Modems, both end caps require removal when changing the real-time clock battery. First, the POWER/SERIAL connector end cap must be removed, and then the transducer end cap for an ATM-915 and ATM-925 or the remote transducer connector end cap for an ATM-914 and ATM-924.

To change the real-time clock battery for an ATM-914, ATM-915, ATM924, or ATM-925:

1. Turn the modem off by pulling the on/off switch all the way out. Refer to Figure 4-2 on page 4-8 for the location of the modem on/off switch.
2. With the modem on its side and resting on a flat surface, use a 9/64 Allen wrench to remove the three socket head screws that attach the POWER/SERIAL connector end cap to the housing.
3. Carefully pull the end cap straight out from the housing. If required, rotate the end cap slightly while pulling.

4. Disconnect the in-line connector that connects the battery pack to the connector on the POWER/SERIAL connector end cap.
5. Using a 9/64 Allen wrench remove the three socket head screws that attach the remote transducer connector end cap for an ATM-914 or ATM-924 Acoustic Telemetry Modem, or the transducer end cap for an ATM-915 and ATM-925 Acoustic Telemetry Modem.
6. Carefully pull the end cap straight out from the housing. If required, rotate the end cap slightly while pulling. When clear of the housing, continue to pull the end cap out while pushing on the battery pack from the other end of the housing. Pull the end cap out far enough to access the 5-pin power connector on the top of the circuit board.
7. Disconnect the 5-pin power connector.
8. Remove the old real-time clock battery and dispose of it in accordance with local regulations. The battery is located on the edge of the DSP board. Refer to Drawing B-270-156 in Section 10, "Drawings," for its exact location.
9. Install the new real-time clock battery in the holder with the positive side of the battery facing up.
10. Refer to "Cleaning or Replacing an O-ring" on page 9-14 and clean or replace the O-rings on both end caps.
11. Connect the 5-pin serial connector to the circuit board.
12. Slide the chassis and the battery pack together into the housing, and then press the end cap into the housing, being careful not to pinch the wires.
13. Line up the three holes in the end cap with the three holes in the housing, and secure the end cap to the housing with the three hex head screws.
14. Connect the in-line connector that connects the battery pack to the connector on the POWER/SERIAL connector end cap, and then press the end cap into the housing, being careful not to pinch the wires.
15. Line up the three holes in the end cap with the three holes in the housing, and secure the end cap to the housing with the three hex head screws.

Changing the ATM-916 or ATM-926 Real-Time Clock Battery

For the ATM-916 and ATM-926 Acoustic Telemetry Modems, only the transducer end cap requires removal when changing the real-time clock battery.

To change the real-time clock battery for an ATM-916 or ATM-926:

1. Turn the modem off by pulling the on/off switch all the way out. Refer to Figure 4-2 on page 4-8 for the location of the modem on/off switch.
2. Using a 9/64 Allen wrench remove the three socket head screws that attach the transducer end cap.
3. Carefully pull the end cap straight out from the housing. If required, rotate the end cap slightly while pulling.
4. Disconnect the 5-pin power connector.
5. Remove the old real-time clock battery and dispose of it in accordance with local regulations. The battery is located on the edge of the DSP board. Refer to Drawing B-270-156 in Section 10, "Drawings," for its exact location.
6. Install the new real-time clock battery in the holder with the positive side of the battery facing up.
7. Refer to "Cleaning or Replacing an O-ring" on page 9-14 and clean or replace the O-rings on both end caps.
8. Connect the 5-pin serial connector to the circuit board.
9. Slide the chassis into the housing, and then press the end cap into the housing, being careful not to pinch the wires.
10. Line up the three holes in the end cap with the three holes in the housing, and secure the end cap to the housing with the three hex head screws.

Changing the ATM-964, ATM-965 or ATM-966 Real-Time Clock Battery

For the ATM-964, ATM-965 and ATM-966 Acoustic Telemetry Modems, only one end cap requires removal when changing the real-time clock battery—the top end cap for an ATM-964 or the transducer end cap for an ATM-965 or ATM-966.

To change the real-time clock battery for an ATM-964, ATM-965 or ATM-966:

1. Turn the modem off by pulling the on/off switch all the way out. Refer to Figure 4-2 on page 4-8 for the location of the modem on/off switch.
2. Using a flat head screwdriver loosen the remote transducer connector end cap for an ATM-964 Acoustic Telemetry Modem or the stainless steel band clamp on the transducer end cap for an ATM-965 or ATM-966 Acoustic Telemetry Modem. Slide the band clamp down along the housing out of the way.
3. With the modem on its side and resting on a flat surface, carefully pull the end cap straight out from the housing, far enough to access the connectors on the circuit board. If required, rotate the end cap slightly while pulling.
4. Disconnect the 5-pin power and 10-pin serial cable connectors that connect to the circuit board and set the end cap assembly aside.
5. Remove the old real-time clock battery and dispose of it in accordance with local regulations. The battery is located on the edge of the DSP board. Refer to Drawing B-270-156 in Section 10, "Drawings," for its exact location.
6. Install the new real-time clock battery in the holder with the positive side of the battery facing up.
7. Refer to "Cleaning or Replacing an O-ring" on page 9-14 and clean or replace the O-rings on both end caps.
8. Connect the 5-pin power and 10-pin serial cable connectors to the circuit board.
9. Slide the chassis into the housing until the gland seal O-ring on the end cap is against the housing, being careful not to scrape the O-ring surface on the inside wall of the housing
10. When the gland seal O-ring is against the housing, apply equal pressure against the end cap and press it into the housing until the face seal O-ring is firmly seated against the housing. If required, rotate the end cap slightly when pressing it into the housing.
11. Slide the stainless steel band clamp back into position between the end cap and the housing and tighten the clamp.

Changing the SDHC Card

If the SD Datalogger option ("-D") option was ordered, the modem includes an SDHC card and its carrier board which is the SDHC board. To change the SDHC card, the modem requires disassembly, and the procedures for disassembling the ATM-914, ATM-915, ATM-924 and ATM-925; and the AM-964 and ATM-965 are different.

Changing the ATM-914, ATM-915, ATM-924, or ATM-925 SDHC Card

For the ATM-914, ATM-915, ATM924, and ATM-925 Acoustic Telemetry Modems, both end caps require removal when changing the SDHC card. First, the POWER/SERIAL connector end cap must be removed, and then the transducer end cap for an ATM-915 and ATM-925 or the remote transducer connector end cap for an ATM-914 and ATM-924.

To change the SDHC card for an ATM-914, ATM-915, ATM924, or ATM-925:

1. Turn the modem off by pulling the on/off switch all the way out. Refer to Figure 4-2 on page 4-8 for the location of the modem on/off switch.
2. With the modem on its side and resting on a flat surface, use a 9/64 Allen wrench to remove the three socket head screws that attach the POWER/SERIAL connector end cap to the housing.
3. Carefully pull the end cap straight out from the housing. If required, rotate the end cap slightly while pulling.
4. Disconnect the in-line connector that connects the battery pack to the connector on the POWER/SERIAL connector end cap.
5. Using a 9/64 Allen wrench remove the three socket head screws that attach the remote transducer connector end cap for an ATM-914 or ATM-924 Acoustic Telemetry Modem, or the transducer end cap for an ATM-915 and ATM-925 Acoustic Telemetry Modem.
6. Carefully pull the end cap straight out from the housing. If required, rotate the end cap slightly while pulling. When clear of the housing, continue to pull the end cap out while pushing on the battery pack from the other end of the housing. Pull the end cap out far enough to access the 5-pin power connector on the top of the circuit board.
7. Disconnect the 5-pin power connector.

8. Remove the SDHC card. The card is located on the SDHC board next to the DSP board. Refer to Drawing B-270-504 in Section 10, "Drawings," for its exact location.
9. Install a newly reformatted SDHC card. The modem should always be deployed with a newly formatted SDHC card. When installing a new card, a Sandisk 32-GB SDHC card is recommended.



NOTE If planning to use an SDHC card other than a Sandisk 4 GB, or a card with a memory capacity other than 4 GB, contact Teledyne Benthos first. For information on how to contact Teledyne Benthos, refer to "Customer Service" on page vi.

10. Refer to "Cleaning or Replacing an O-ring" on page 9-14 and clean or replace the O-rings on both end caps.
11. Connect the 5-pin serial connector to the circuit board.
12. Slide the chassis and the battery pack together into the housing, and then press the end cap into the housing, being careful not to pinch the wires.
13. Line up the three holes in the end cap with the three holes in the housing, and secure the end cap to the housing with the three hex head screws.
14. Connect the in-line connector that connects the battery pack to the connector on the POWER/SERIAL connector end cap, and then press the end cap into the housing, being careful not to pinch the wires.
15. Line up the three holes in the end cap with the three holes in the housing, and secure the end cap to the housing with the three hex head screws.

Changing the ATM-964 or ATM-965 SDHC Card

For the ATM-964 and ATM-965 Acoustic Telemetry Modems, only one end cap requires removal when changing the SDHC card—the top end cap for an ATM-964 or the transducer end cap for an ATM-965.

To change the SDHC card for an ATM-964 or ATM-965:

1. Turn the modem off by pulling the on/off switch all the way out. Refer to Figure 4-2 on page 4-8 for the location of the modem on/off switch.

2. Using a flat head screwdriver loosen the remote transducer connector end cap for an ATM-964 Acoustic Telemetry Modem or the stainless steel band clamp on the transducer end cap for an ATM-965 Acoustic Telemetry Modem. Slide the band clamp down along the housing out of the way.
3. With the modem on its side and resting on a flat surface, carefully pull the end cap straight out from the housing, far enough to access the connectors on the circuit board. If required, rotate the end cap slightly while pulling.
4. Disconnect the 5-pin power and 10-pin serial cable connectors that connect to the circuit board and set the end cap assembly aside.
5. Remove the SDHC card. The card is located on the SDHC board next to the DSP board. Refer to Drawing B-270-504 in Section 10, "Drawings," for its exact location.
6. Install a newly reformatted SDHC card. The modem should always be deployed with a newly formatted SDHC card. When installing a new card, a Sandisk 32-GB SDHC card is recommended.



NOTE If planning to use an SDHC card other than a Sandisk 32 GB, or a card with a memory capacity other than 32 GB, contact Teledyne Benthos first. For information on how to contact Teledyne Benthos, refer to "Customer Service" on page vi.

7. Refer to "Cleaning or Replacing an O-ring" on page 9-14 and clean or replace the O-rings on both end caps.
8. Connect the 5-pin power and 10-pin serial cable connectors to the circuit board.
9. Slide the chassis into the housing until the gland seal O-ring on the end cap is against the housing, being careful not to scrape the O-ring surface on the inside wall of the housing.
10. When the gland seal O-ring is against the housing, apply equal pressure against the end cap and press it into the housing until the face seal O-ring is firmly seated against the housing. If required, rotate the end cap slightly when pressing it into the housing.
11. Slide the stainless steel band clamp back into position between the end cap and the housing and tighten the clamp.

Cleaning or Replacing an O-ring

When cleaning or replacing an O-ring, be aware of the following:

- Isopropyl alcohol should be used when cleaning an O-ring.
- Once an O-ring is cleaned and inspected, it should be immediately lubricated with silicone lubricant and installed. O-rings not installed immediately must be relubricated.
- Do not leave a lubricated O-ring sitting on a bench, as it will pick up contaminants.
- The purpose of the silicone lubricant is to allow the O-ring to move into its natural location, which is in the O-ring groove. The lubricant does not create the seal.
- Minimize any stretching when cleaning an O-ring.
- Do not force an O-ring over sharp corners or edges.
- Ensure that the O-ring, its groove and the O-ring surface of the housing are clean.
- When reassembling a housing, use a straight, longitudinal movement. Rotating the housing may cause the O-ring to pinch.

To clean or replace an O-ring:

1. Remove the O-ring using an O-ring removal tool or other suitable device. Be careful not to damage the O-ring.
2. Using isopropyl alcohol and a lint-free cloth or paper towel, thoroughly clean the O-ring groove and the O-ring surface inside the housing.
3. Carefully inspect the O-ring groove and the O-ring surface for any scratches, nicks or dirt and clean them again if necessary.
4. Allow the surfaces of the O-ring groove and the housing to thoroughly dry.
5. Clean the O-ring with a lint-free cloth or paper towel and a small amount of isopropyl alcohol. Do not use cotton or other materials that leave fibers behind. Avoid stretching the O-ring.
6. Inspect the O-ring for any scratches, cracks or nicks. Discard the O-ring if any of these conditions are present.

7. Using clean fingers, apply a *light*, even coat of silicone lubricant to the O-ring. Spread the lubricant evenly over the entire surface. If necessary, when working with a radial seal, a small amount of the same lubricant can be applied to the O-ring surface inside the housing where the O-ring will seal.



WARNING Apply only a thin coat of silicone lubricant. Too much lubricant could displace the O-ring when it is under pressure.

8. Install the O-ring into the O-ring groove.

Troubleshooting

If during the setup or deployment of an ATM-900 Series Acoustic Telemetry Modem or UDB-9400 Universal Deck Box, the modem does not appear to be functioning properly, use the troubleshooting guide in this section for assistance. The troubleshooting guide will help to quickly isolate a few basic operational problems that could occur. However, should further help be required, contact Teledyne Benthos directly. Refer to "Customer Service" on page vi for information on how to contact Teledyne Benthos.

The troubleshooting guide includes a list of symptoms along with a list of recommended checks designed to lead to the most likely cause.

There is no banner message displayed on the monitor of the host PC connected to a modem when the modem is switched on.

- A. Verify that the host PC serial port is configured correctly, with the correct baud rate, parity, number of data bits, and number of stop bits. Refer to "Setting up the Host Processor" on page 4-21.
- B. Verify that the terminal program communications software is running.
- C. Verify that the verbose level as determined from the Verbose configuration parameter is set to 01, 02 or 03. Refer to "Verbose" on page 8-27 for information on the Verbose configuration parameter.
- D. If the modem has an internal battery pack, verify that it has not been depleted.
- E. Verify that the RS-232 serial cable is configured correctly and that it is connected to the correct serial port on the host PC. Refer to "Setting Up the Modems" on page 4-9.

- F. Change the baud rate of the host PC serial port to 115,200. Turn off the modem, and while holding down Escape, turn it back on. The Boot Loader banner and prompt should appear as shown in "Reloading Software Applications" on page 4-26. If the banner and prompt do not appear, contact Teledyne Benthos. If they do appear, enter `reboot`. If the modem software application still does not boot up, then go to step G.
- G. From the boot loader prompt enter `Verify`. The message "Image ffs/modem.rom verifies OK" should appear. If this message does not appear, then reload the application as described in "Reloading Software Applications" on page 4-26.

The monitor of the host PC connected to a subsea modem displays the banner message when the modem is switched on, but there is no displayed response to commands entered from the keyboard of the host PC.

- A. Verify that the terminal program communications software echo feature, if it has one, is turned on.
- B. If the terminal program communications software does not have an echo feature, enter `@P1EchoChar`. If the response is "dis," then echo is disabled. Enter `@P1EchoChar=ena` to enable it.

There is serial communications with the local modem but no transmissions can be heard from the local modem after entering a command that requires the modem to transmit an acoustic command.

- A. If the UDB-9400 Universal Deck Box is the local modem, increase the volume setting.
- B. If the local modem is an UDB-9400 Universal Deck Box, or an ATM-914, ATM-924 or ATM-964 Acoustic Telemetry Modem, check the transducer connections.
- C. Verify that the verbose level as determined from the Verbose configuration parameter is set to 01, 02, or 03. Refer to "Verbose" on page 8-27 for information on the Verbose configuration parameter.

With the verbose level set to 01 or higher, errors—if any—will be displayed which will help in isolating the problem.
- D. Verify that the command is being sent correctly. Refer to Table 7-1 on page 7-2 for a list of the available commands and their syntax.
- E. If the modem is a subsea modem, verify that the modem battery pack has not been depleted.

There are errors or warning messages displayed prior to the banner message being displayed.

- A. Enter `rundiag` to run the diagnostic software application. The prompt "[DIAG] user:1>" should be displayed.
- B. At the prompt enter `post` to run the Power On Self Test (POST).
- C. Verify that the response is "PASS" is displayed for all the tests. If not, contact Teledyne Benthos.

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.

A feature key was purchased and factory installed but is now missing.

- A. Obtain the feature key from the "Feature Authorization Key Record," which is provided as an XML file with the modem. There is a unique key associated with every modem serial number. If the feature key is not available, contact Teledyne Benthos.
- B. Enter `rundiag` to run the diagnostic software application. The prompt "[DIAG] user:1>" should be displayed.
- C. Enter `setpriv update` to change privilege level to update.
- D. Enter `addkey <key>` where "<key>" is replaced with the feature key. Be sure to enter a single space before the feature key.
- E. Enter `showkeys`. If the feature key has been installed, it will be displayed.

10 Drawings

This section includes the outline and wiring drawings for the Teledyne Benthos ATM-900 Series Acoustic Telemetry Modems and UDB-9400 Universal Deck Box. Refer to these drawings when setting up and installing the modems.

Surface Modems

A-270-108	Outline, UDB-9400 Universal Deck Box
-----------	--------------------------------------

Subsea Modems

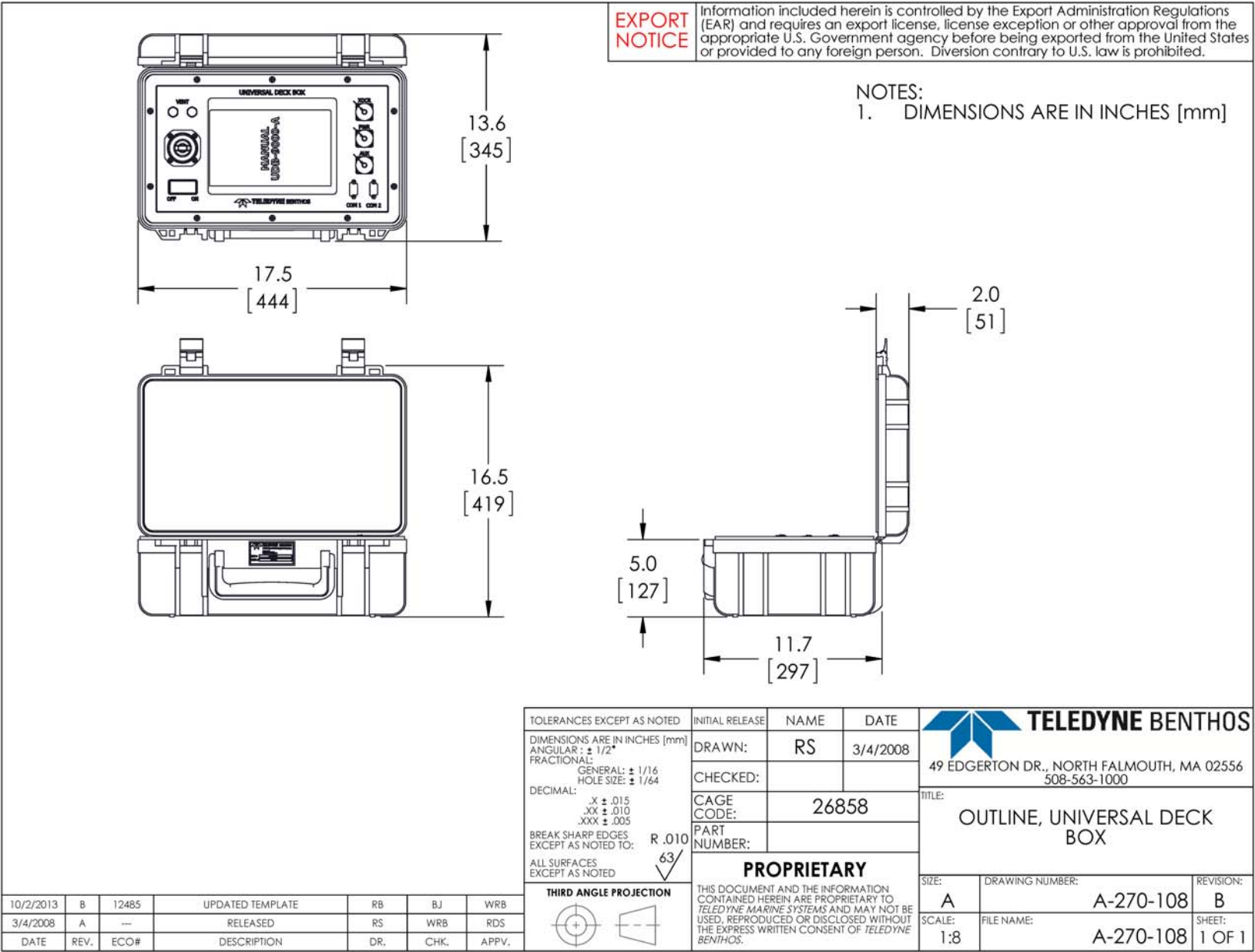
B-270-437	Outline, ATM-914 Modem
B-270-432	Outline, ATM-915 Modem
B-270-433	Outline, ATM-916 Modem
D-270-088	Outline, ATM-924 Modem
D-270-053	Outline, ATM-925 Modem
D-270-060	Outline, ATM-926 Modem
D-270-089	Outline, ATM-964 Modem
D-270-056	Outline, ATM-965 Modem
C-270-259	Outline, ATM-966 Modem

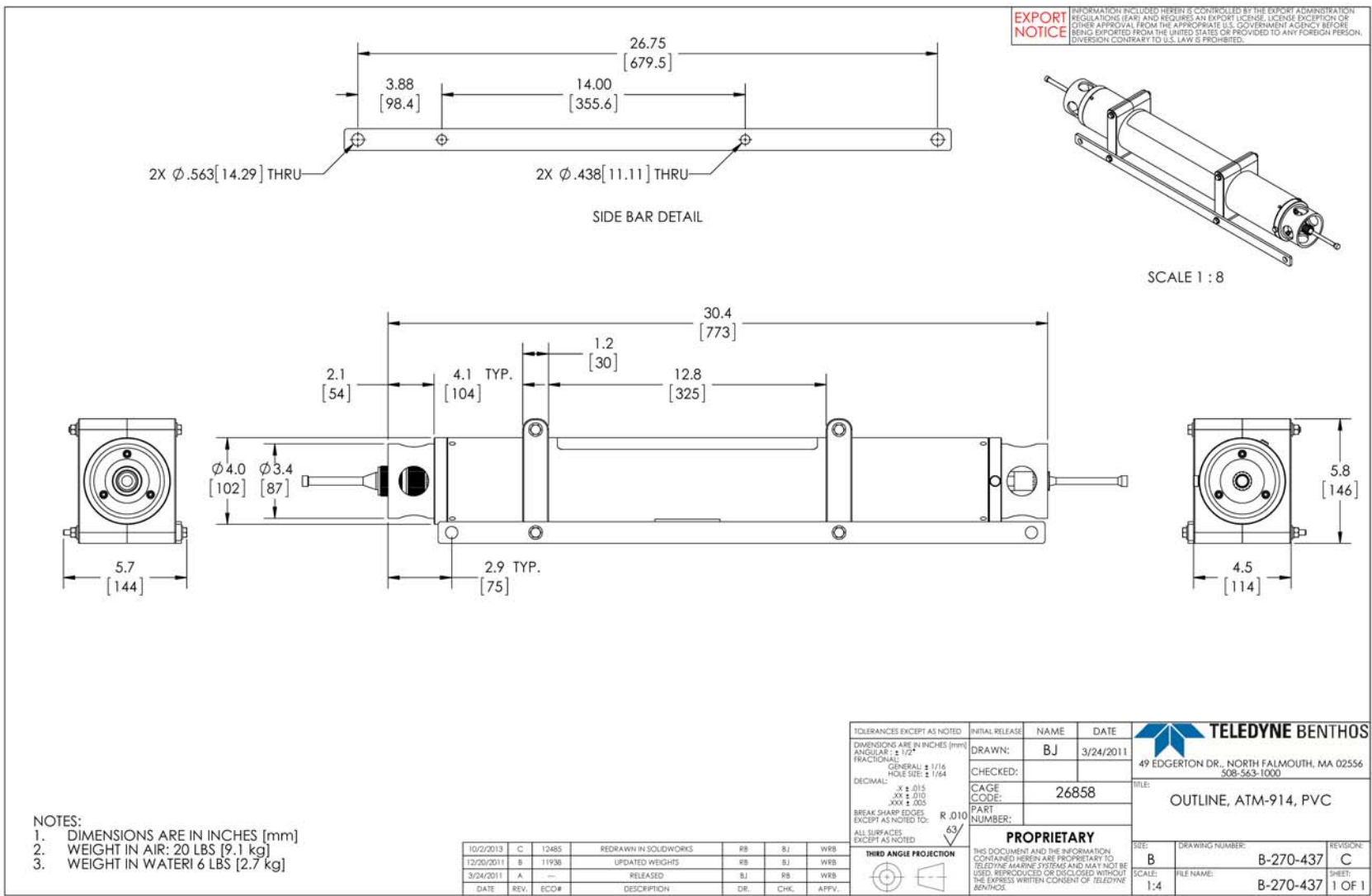
Modem Board Sets

B-270-156	Outline, ATM-900 OEM Board Set
B-270-504	Outline, ATM-900 OEM Board Set with SDHC
B-270-498	Outline, Coprocessor Board Pair

Remote Transducers

B-270-267	Outline, Remote LF Omnidirectional Transducer
B-270-509	Outline, Remote MF/Band C and Band C Omnidirectional Transducers
B-270-591	Outline, Remote LF Directional Transducer, LR2
B-270-592	Outline, Remote LF Directional Transducer, LA2
B-270-371	Outline, Remote MF Directional Transducer

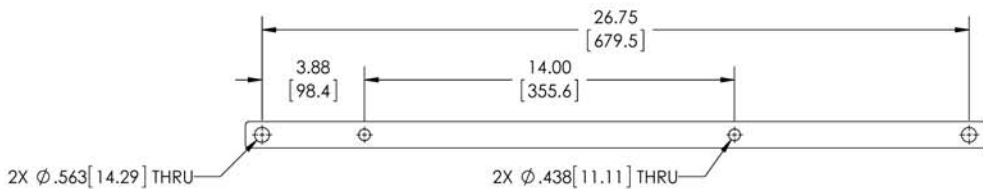




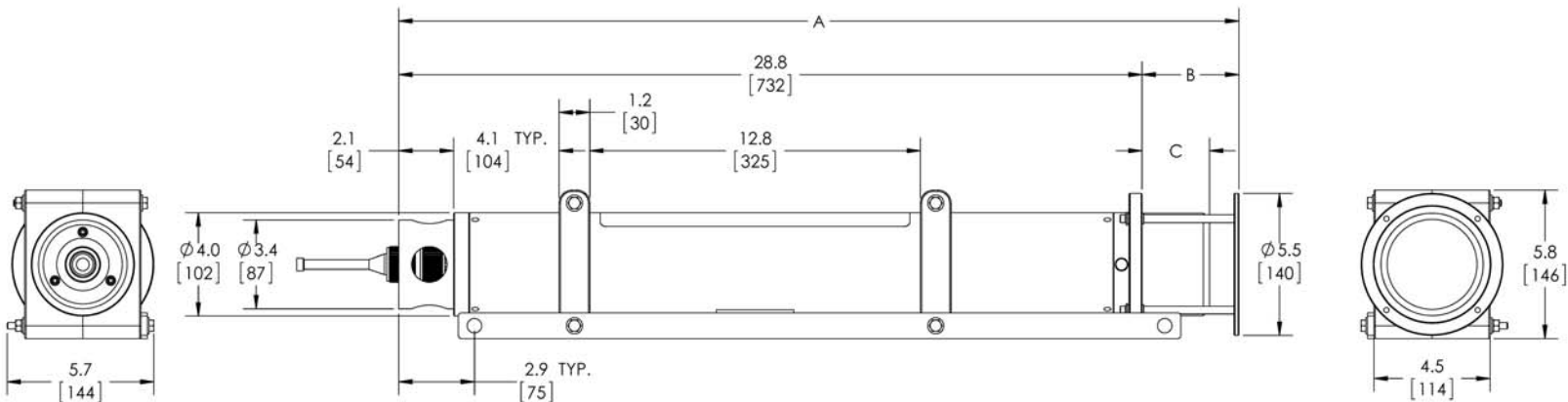
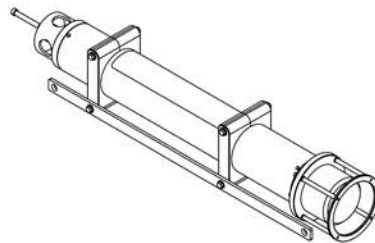
	A	B	C	WEIGHT IN AIR	WEIGHT IN WATER
LF OMNI	32.6 [827]	3.8 [95]	2.6 [66]	22 LBS [10.0 kg]	6 LBS [2.7 kg]
LF DIRECTIONAL	34.5 [876]	5.7 [145]	5.5 [140]	26 LBS [11.8 kg]	7 LBS [3.2 kg]
MF OMNI	32.6 [827]	3.8 [95]	2.0 [51]	21 LBS [9.5 kg]	5 LBS [2.3 kg]
MF DIRECTIONAL	34.5 [876]	5.7 [145]	5.4 [137]	27 LBS [12.2 kg]	8 LBS [3.6 kg]
BAND C	32.6 [827]	3.8 [95]	2.3 [57]	21 LBS [9.5 kg]	5 LBS [2.3 kg]

**EXPORT
NOTICE**

INFORMATION INCLUDED HEREIN IS CONTROLLED BY THE EXPORT ADMINISTRATION REGULATIONS (EAR) AND REQUIRES AN EXPORT LICENSE, LICENSE EXCEPTION OR OTHER APPROVAL FROM THE APPROPRIATE U.S. GOVERNMENT AGENCY BEFORE BEING EXPORTED FROM THE UNITED STATES OR PROVIDED TO ANY FOREIGN PERSON. DIVERSION CONTRARY TO U.S. LAW IS PROHIBITED.



SIDE BAR DETAIL

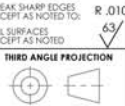


NOTES:

1. DIMENSIONS ARE IN INCHES [mm]
2. LF OMNI TRANSDUCER SHOWN

10/2/2013	C	12485	REDRAWN IN SOLIDWORKS	RB	BJ	WVB
12/20/2011	B	11936	UPDATED WEIGHTS	RB	BJ	WVB
3/23/2011	A	—	RELEASED	BJ	RB	WVB
DATE	REV.	ECOM	DESCRIPTION	DR.	CHK.	APPV.

TOLERANCES EXCEPT AS NOTED
DIMENSIONS ARE IN INCHES [mm]
FRACTIONAL:
ANGULAR: $\pm 1/2^\circ$
GENERAL: $\pm 1/16$
HOLE SIZE: $\pm 1/64$
DECIMAL:
X $\pm .015$
XX $\pm .010$
XXX $\pm .005$
BREAK SHARP EDGES
EXCEPT AS NOTED TO
ALL SURFACES
EXCEPT AS NOTED



INITIAL RELEASE
DRAWN: RS
1/19/2011
CHECKED:
CAGE CODE: 26858
PART NUMBER:

PROPRIETARY

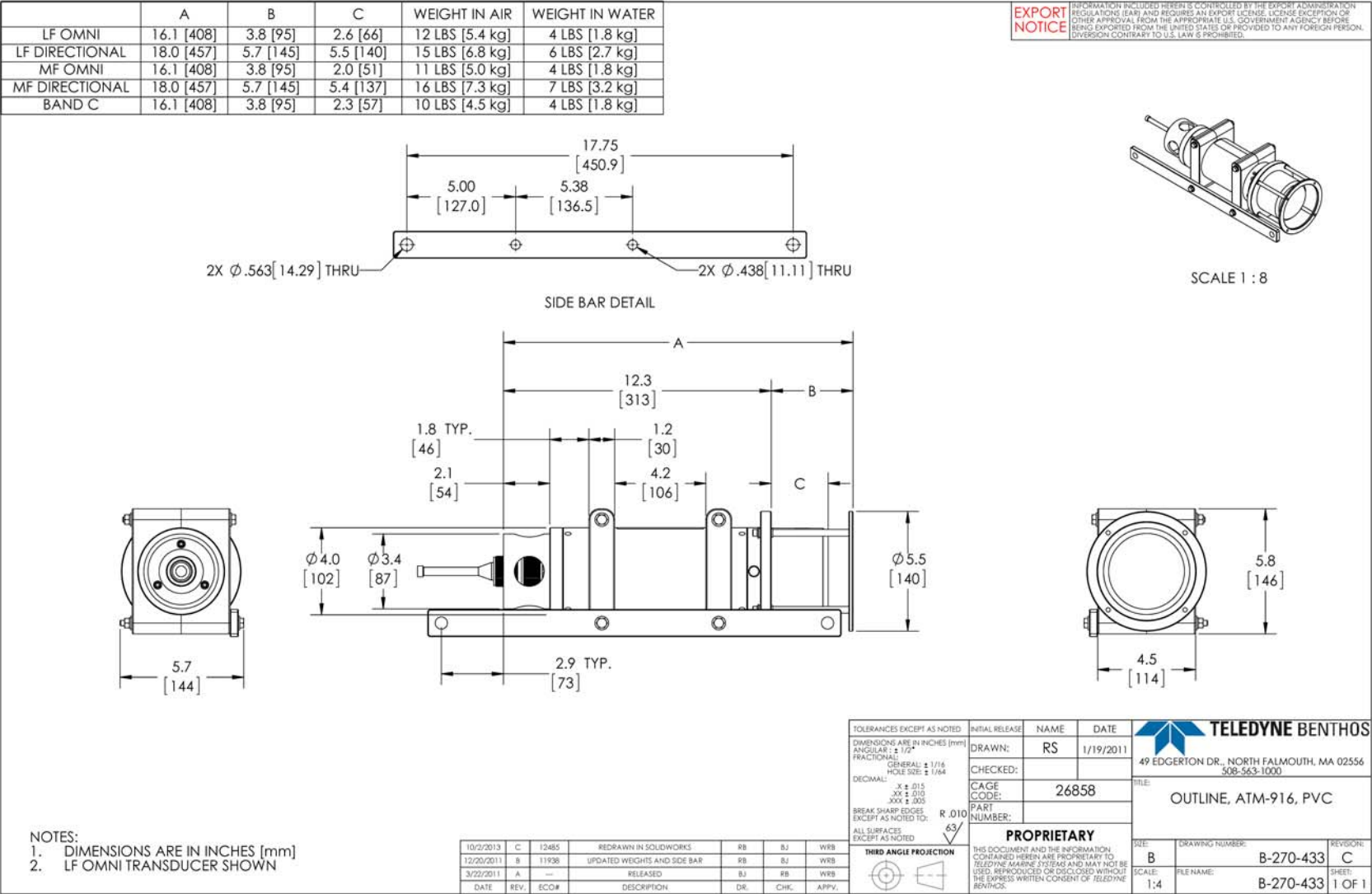
THIS DOCUMENT AND THE INFORMATION CONTAINED HEREIN ARE PROPRIETARY TO TELEDYNE MARINE SYSTEMS AND MAY NOT BE USED, REPRODUCED OR DISCLOSED WITHOUT THE EXPRESS WRITTEN CONSENT OF TELEDYNE BENTHOS.

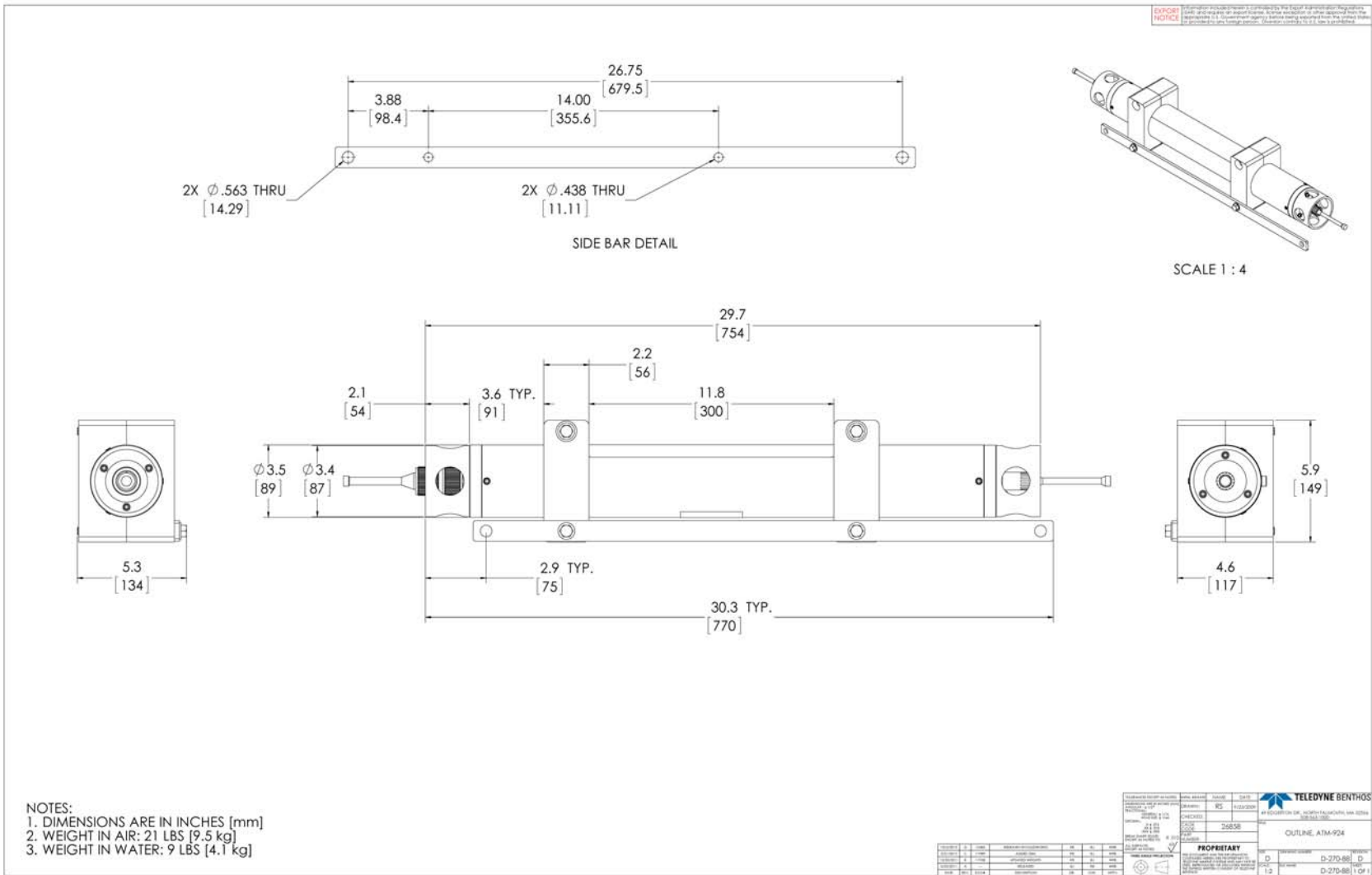
**TELEDYNE BENTHOS**

49 EDGERTON DR., NORTH FALMOUTH, MA 02556
508-563-1000

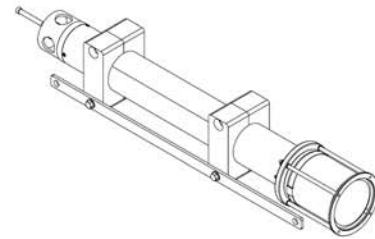
TITLE:
OUTLINE, ATM-915, PVC

SIZE: B
SCALE: 1:4
DRAWING NUMBER: B-270-432
FILE NAME: B-270-432
REVISION: C
SHEET: 1 OF 1





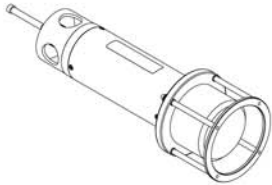
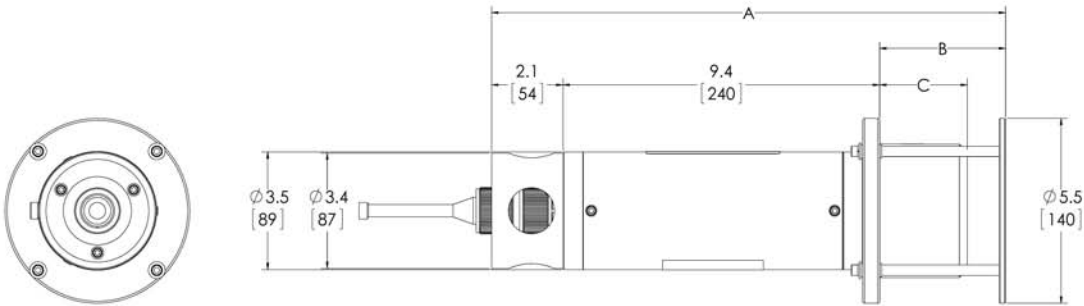
EXPORT NOTICE Information included herein is controlled by the Export Administration Regulations (EAR) and requires an export license, license exception or other approval from the appropriate U.S. Government agency before being reported from the United States or provided to any foreign person. Divulging contrary to U.S. law is prohibited.



SIDE BAR DETAIL

[illegible]

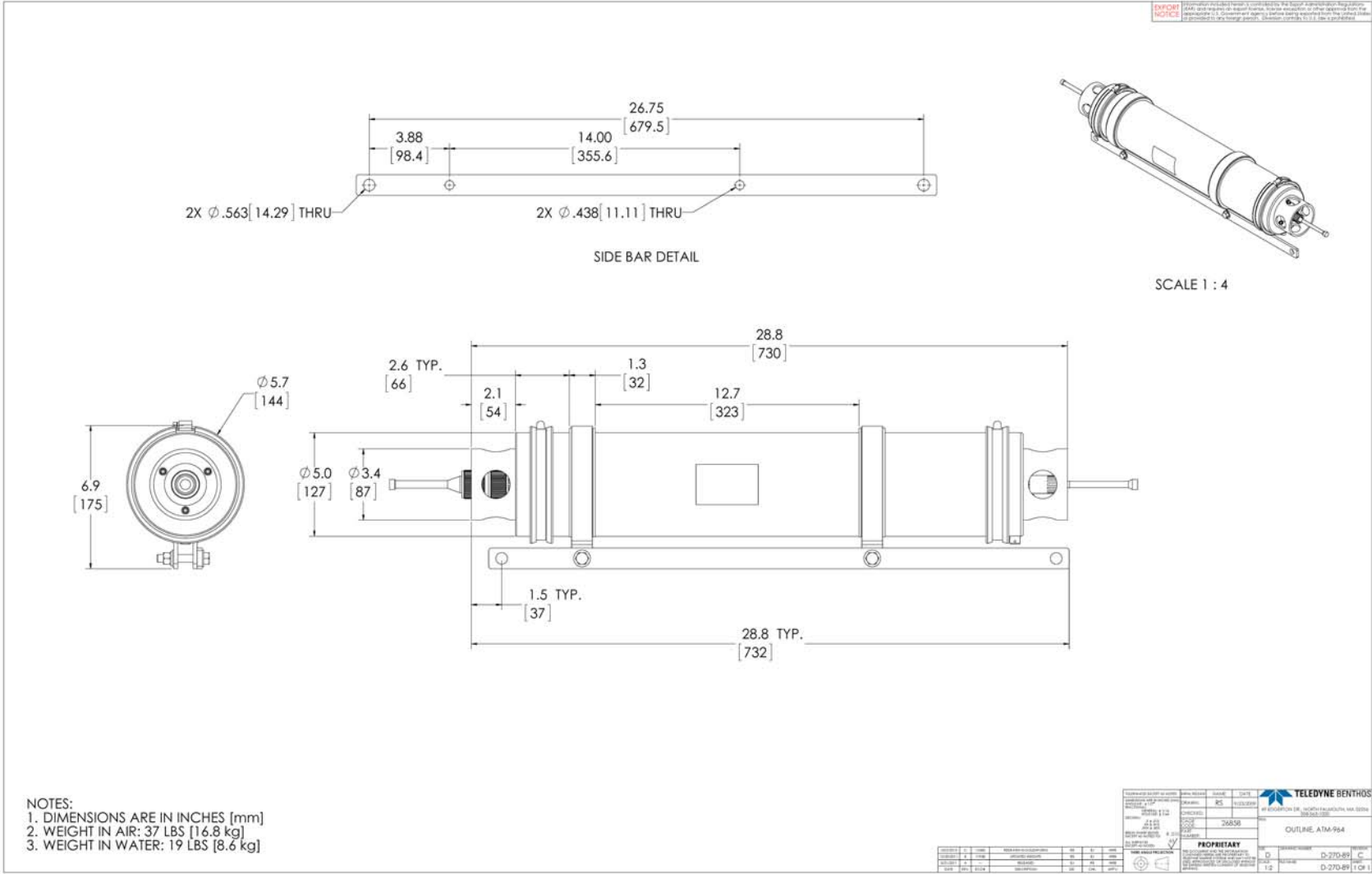
	A	B	C	WEIGHT IN AIR	WEIGHT IN WATER
LF OMNI	15.3 [389]	3.8 [95]	2.6 [66]	9 LBS [4.1 kg]	4 LBS [1.8 kg]
LF DIRECTIONAL	17.2 [438]	5.7 [145]	5.5 [140]	13 LBS [5.9 kg]	6 LBS [2.7 kg]
MF OMNI	15.3 [389]	3.8 [95]	2.0 [51]	8 LBS [3.6 kg]	3 LBS [1.4 kg]
MF DIRECTIONAL	17.2 [438]	5.7 [145]	5.4 [137]	14 LBS [6.4 kg]	7 LBS [3.2 kg]
BAND C	15.3 [389]	3.8 [95]	2.3 [57]	8 LBS [3.6 kg]	3 LBS [1.4 kg]



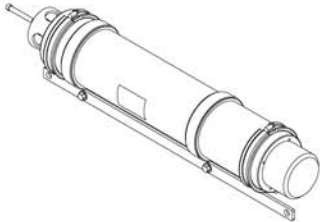
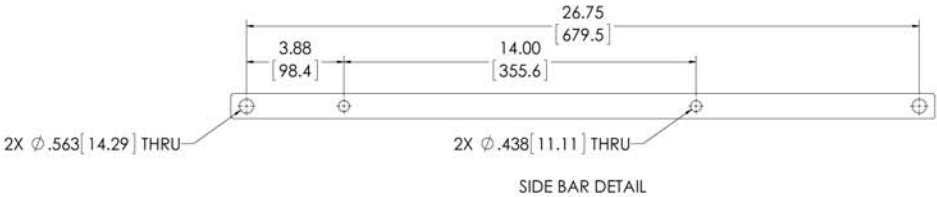
SCALE 1 : 3

NOTES:
1. DIMENSIONS ARE IN INCHES [mm]
2. LF OMNI TRANSDUCER SHOWN

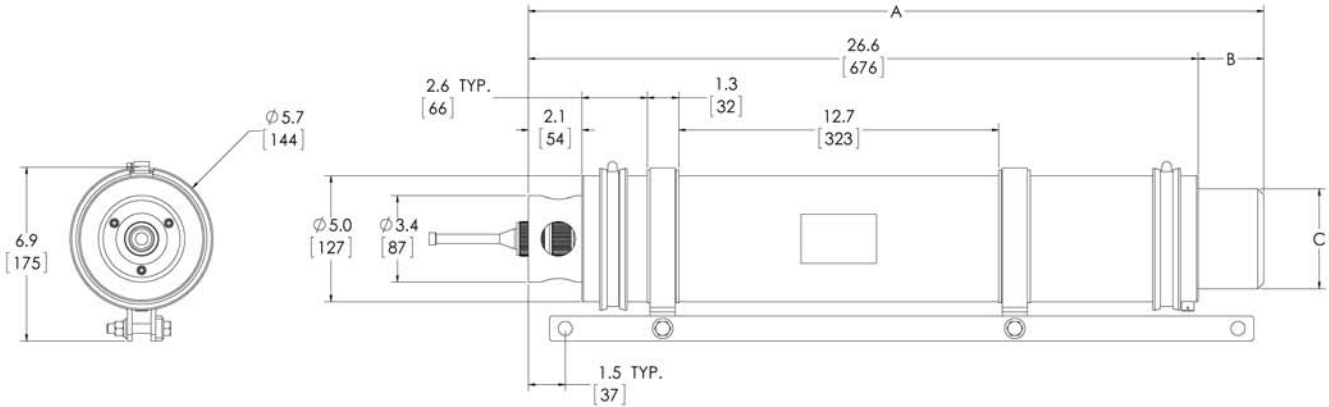
TELEDYNE BENTHOS	
Model: M-270-26	Part No: 26058
Material: 316L	Finish: 316L
Weight: 9 LBS [4.1 kg]	Volume: 0.001
Pressure: 0-100 PSI	Temperature: 0-100 °F
Output: 0-10 VDC	Power: 0-10 W
Frequency: 0-100 Hz	Response: 0-10 ms
Accuracy: ±0.5%	Repeatability: ±0.1%
Resolution: 0.1%	Linearity: ±0.1%
Drift: ±0.1%/yr	Stability: ±0.1%
Life: 10 years	Warranty: 1 year



	A	B	C	WEIGHT IN AIR	WEIGHT IN WATER
LF OMNI	29.2 [743]	2.6 [66]	4.0 [101]	38 LBS [17.2 kg]	20 LBS [9.1 kg]
LF DIRECTIONAL	32.2 [817]	5.5 [140]	4.6 [116]	42 LBS [19.1 kg]	21 LBS [9.5 kg]
MF OMNI	28.7 [728]	2.0 [51]	2.9 [73]	37 LBS [16.8 kg]	19 LBS [8.6 kg]
MF DIRECTIONAL	32.0 [814]	5.4 [137]	4.6 [116]	43 LBS [19.5 kg]	22 LBS [10.0 kg]
BAND C	28.9 [734]	2.3 [57]	2.8 [70]	37 LBS [16.8 kg]	19 LBS [8.6 kg]



SCALE 1 : 4



NOTES:
1. DIMENSIONS ARE IN INCHES [mm]
2. LF OMNI TRANSDUCER SHOWN

TELEDYNE BENTHOS

OUTLINE, ATA-965

PROPRIETARY

REVISIONS

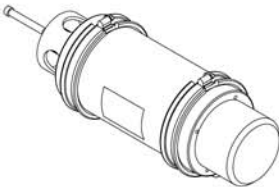
REV	DESCRIPTION	DATE
1	INITIAL DESIGN	10/24/2018
2	DESIGN CHANGES	11/14/2018
3	DESIGN CHANGES	12/11/2018
4	DESIGN CHANGES	12/11/2018
5	DESIGN CHANGES	12/11/2018
6	DESIGN CHANGES	12/11/2018
7	DESIGN CHANGES	12/11/2018
8	DESIGN CHANGES	12/11/2018
9	DESIGN CHANGES	12/11/2018
10	DESIGN CHANGES	12/11/2018
11	DESIGN CHANGES	12/11/2018
12	DESIGN CHANGES	12/11/2018
13	DESIGN CHANGES	12/11/2018
14	DESIGN CHANGES	12/11/2018
15	DESIGN CHANGES	12/11/2018
16	DESIGN CHANGES	12/11/2018
17	DESIGN CHANGES	12/11/2018
18	DESIGN CHANGES	12/11/2018
19	DESIGN CHANGES	12/11/2018
20	DESIGN CHANGES	12/11/2018
21	DESIGN CHANGES	12/11/2018
22	DESIGN CHANGES	12/11/2018
23	DESIGN CHANGES	12/11/2018
24	DESIGN CHANGES	12/11/2018
25	DESIGN CHANGES	12/11/2018
26	DESIGN CHANGES	12/11/2018
27	DESIGN CHANGES	12/11/2018
28	DESIGN CHANGES	12/11/2018
29	DESIGN CHANGES	12/11/2018
30	DESIGN CHANGES	12/11/2018
31	DESIGN CHANGES	12/11/2018
32	DESIGN CHANGES	12/11/2018
33	DESIGN CHANGES	12/11/2018
34	DESIGN CHANGES	12/11/2018
35	DESIGN CHANGES	12/11/2018
36	DESIGN CHANGES	12/11/2018
37	DESIGN CHANGES	12/11/2018
38	DESIGN CHANGES	12/11/2018
39	DESIGN CHANGES	12/11/2018
40	DESIGN CHANGES	12/11/2018
41	DESIGN CHANGES	12/11/2018
42	DESIGN CHANGES	12/11/2018
43	DESIGN CHANGES	12/11/2018
44	DESIGN CHANGES	12/11/2018
45	DESIGN CHANGES	12/11/2018
46	DESIGN CHANGES	12/11/2018
47	DESIGN CHANGES	12/11/2018
48	DESIGN CHANGES	12/11/2018
49	DESIGN CHANGES	12/11/2018
50	DESIGN CHANGES	12/11/2018
51	DESIGN CHANGES	12/11/2018
52	DESIGN CHANGES	12/11/2018
53	DESIGN CHANGES	12/11/2018
54	DESIGN CHANGES	12/11/2018
55	DESIGN CHANGES	12/11/2018
56	DESIGN CHANGES	12/11/2018
57	DESIGN CHANGES	12/11/2018
58	DESIGN CHANGES	12/11/2018
59	DESIGN CHANGES	12/11/2018
60	DESIGN CHANGES	12/11/2018
61	DESIGN CHANGES	12/11/2018
62	DESIGN CHANGES	12/11/2018
63	DESIGN CHANGES	12/11/2018
64	DESIGN CHANGES	12/11/2018
65	DESIGN CHANGES	12/11/2018
66	DESIGN CHANGES	12/11/2018
67	DESIGN CHANGES	12/11/2018
68	DESIGN CHANGES	12/11/2018
69	DESIGN CHANGES	12/11/2018
70	DESIGN CHANGES	12/11/2018
71	DESIGN CHANGES	12/11/2018
72	DESIGN CHANGES	12/11/2018
73	DESIGN CHANGES	12/11/2018
74	DESIGN CHANGES	12/11/2018
75	DESIGN CHANGES	12/11/2018
76	DESIGN CHANGES	12/11/2018
77	DESIGN CHANGES	12/11/2018
78	DESIGN CHANGES	12/11/2018
79	DESIGN CHANGES	12/11/2018
80	DESIGN CHANGES	12/11/2018
81	DESIGN CHANGES	12/11/2018
82	DESIGN CHANGES	12/11/2018
83	DESIGN CHANGES	12/11/2018
84	DESIGN CHANGES	12/11/2018
85	DESIGN CHANGES	12/11/2018
86	DESIGN CHANGES	12/11/2018
87	DESIGN CHANGES	12/11/2018
88	DESIGN CHANGES	12/11/2018
89	DESIGN CHANGES	12/11/2018
90	DESIGN CHANGES	12/11/2018
91	DESIGN CHANGES	12/11/2018
92	DESIGN CHANGES	12/11/2018
93	DESIGN CHANGES	12/11/2018
94	DESIGN CHANGES	12/11/2018
95	DESIGN CHANGES	12/11/2018
96	DESIGN CHANGES	12/11/2018
97	DESIGN CHANGES	12/11/2018
98	DESIGN CHANGES	12/11/2018
99	DESIGN CHANGES	12/11/2018
100	DESIGN CHANGES	12/11/2018

TELEDYNE BENTHOS

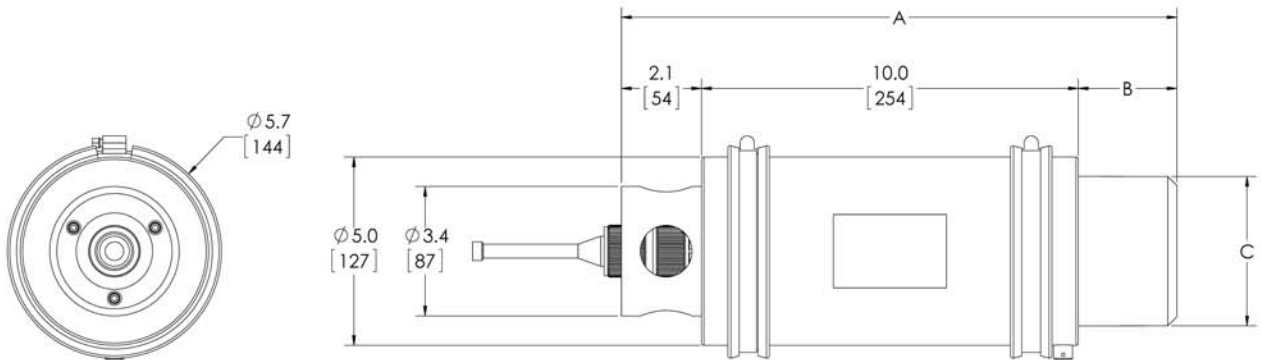
OUTLINE, ATA-965

	A	B	C	WEIGHT IN AIR	WEIGHT IN WATER
LF OMNI	14.7 [374]	2.6 [66]	4.0 [101]	16 LBS [7.3 kg]	7 LBS [3.2 kg]
LF DIRECTIONAL	17.6 [448]	5.5 [140]	4.6 [116]	19 LBS [8.6 kg]	9 LBS [4.1 kg]
MF OMNI	14.1 [359]	2.0 [51]	2.9 [73]	15 LBS [6.8 kg]	6 LBS [2.7 kg]
MF DIRECTIONAL	17.5 [445]	5.4 [137]	4.6 [116]	20 LBS [9.1 kg]	10 LBS [4.5 kg]
BAND C	14.4 [365]	2.3 [57]	2.8 [70]	14 LBS [6.4 kg]	6 LBS [2.7 kg]

EXPORT NOTICE Information included herein is controlled by the Export Administration Regulations (EAR) and requires an export license, license exception or other approval from the appropriate U.S. Government agency before being exported from the United States or provided to any foreign person. Diversion contrary to U.S. law is prohibited.

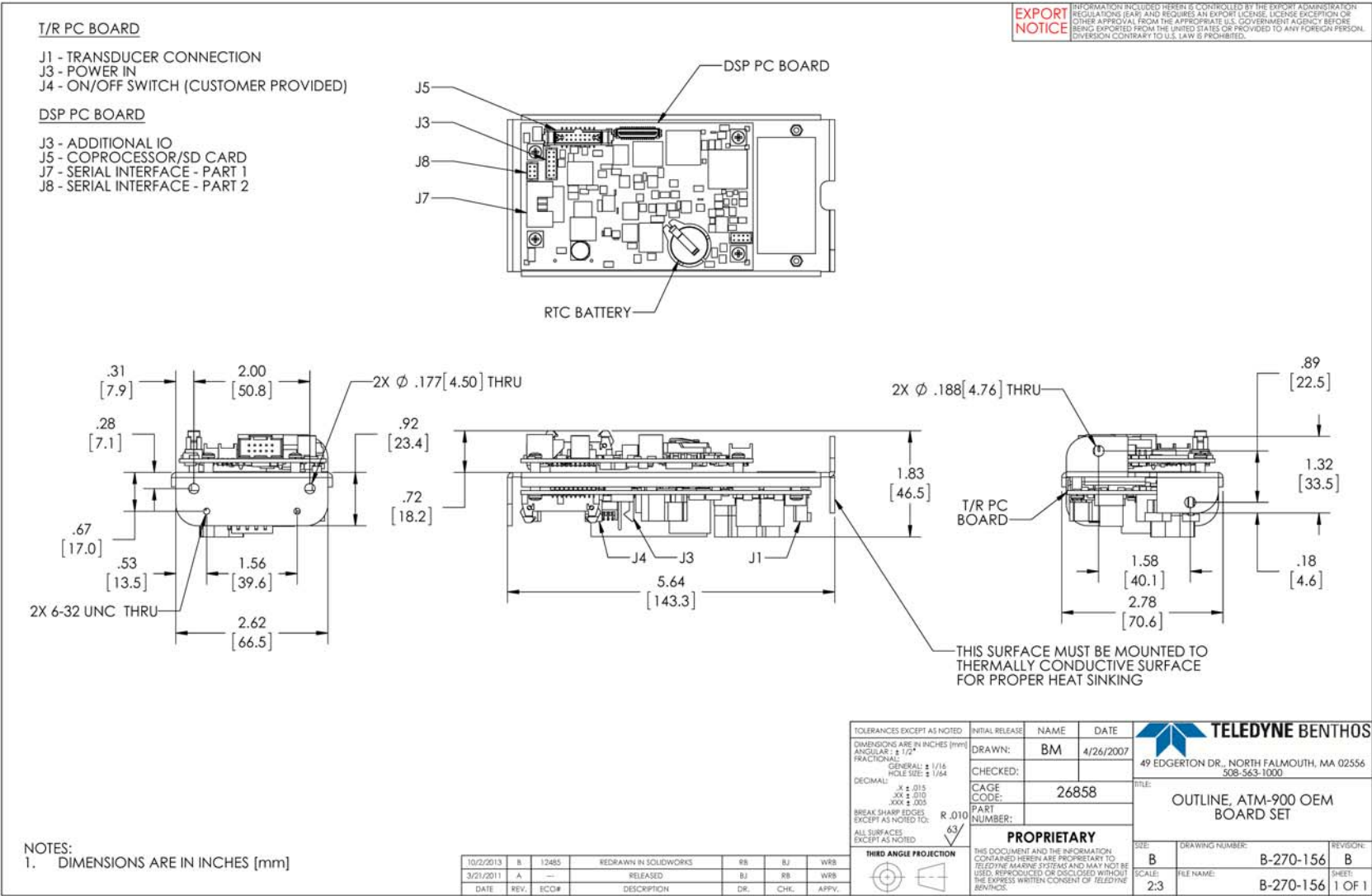


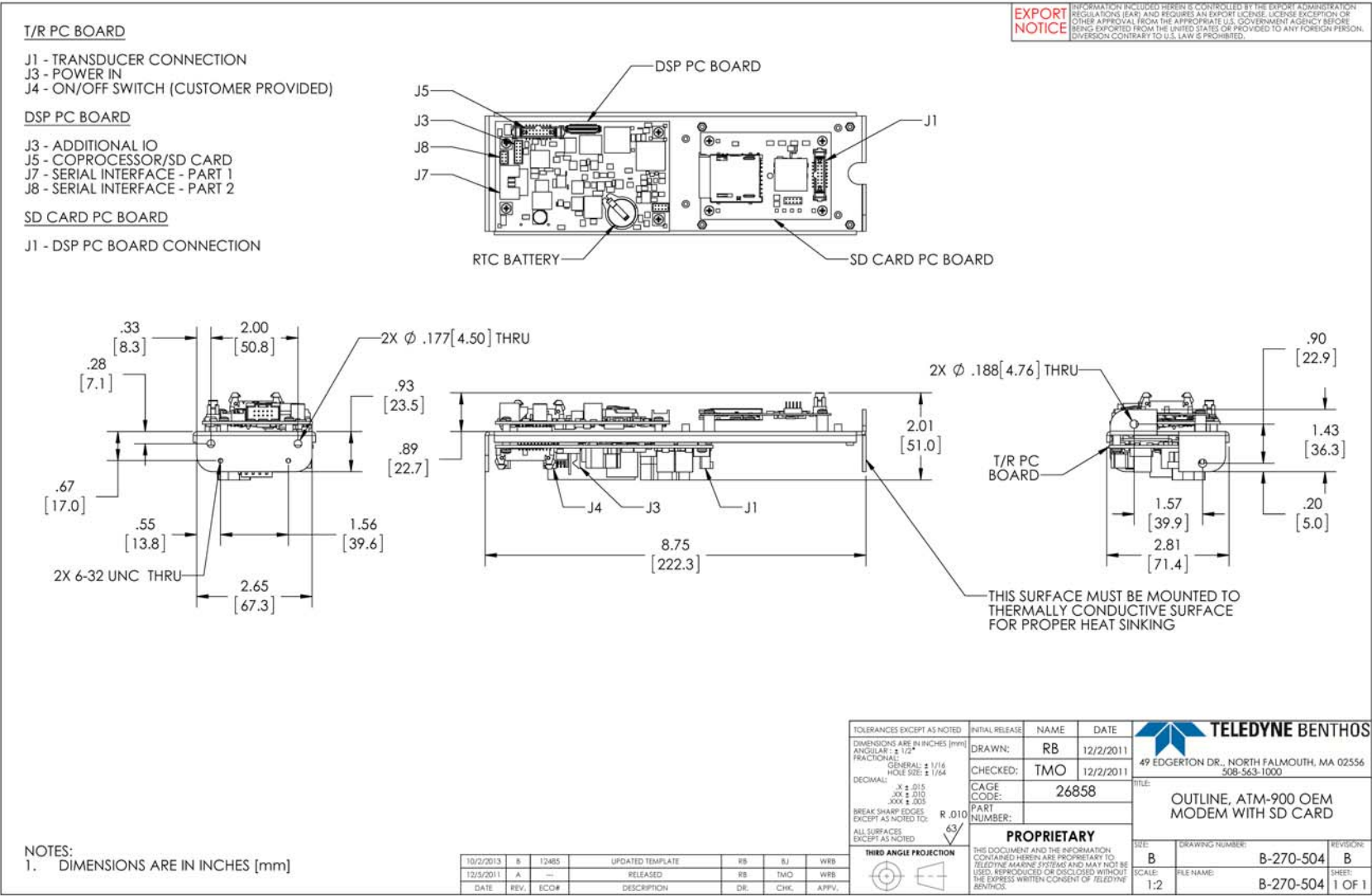
SCALE 1 : 4

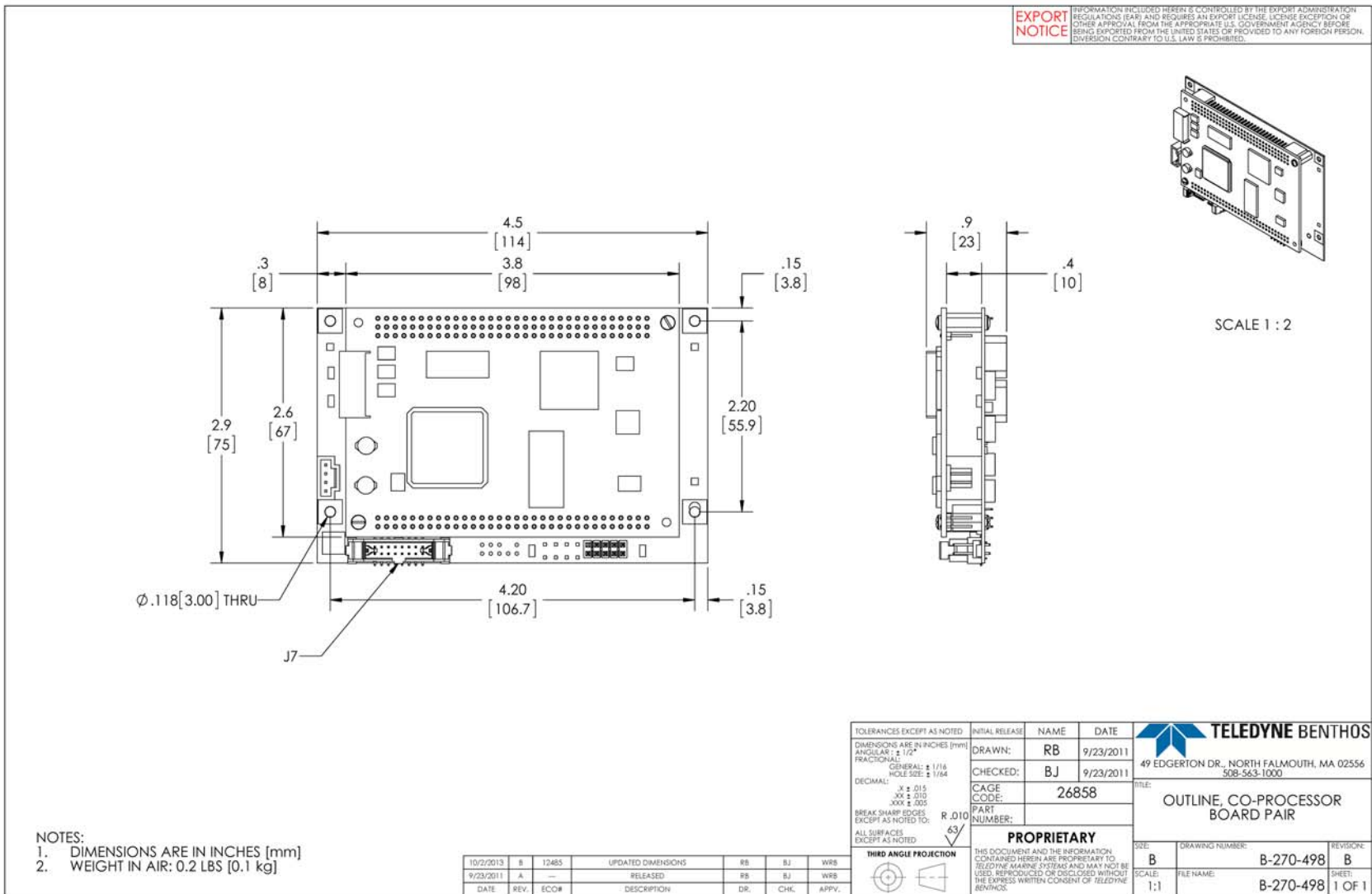


NOTES:
1. DIMENSIONS ARE IN INCHES [mm]
2. LF OMNI TRANSDUCER SHOWN

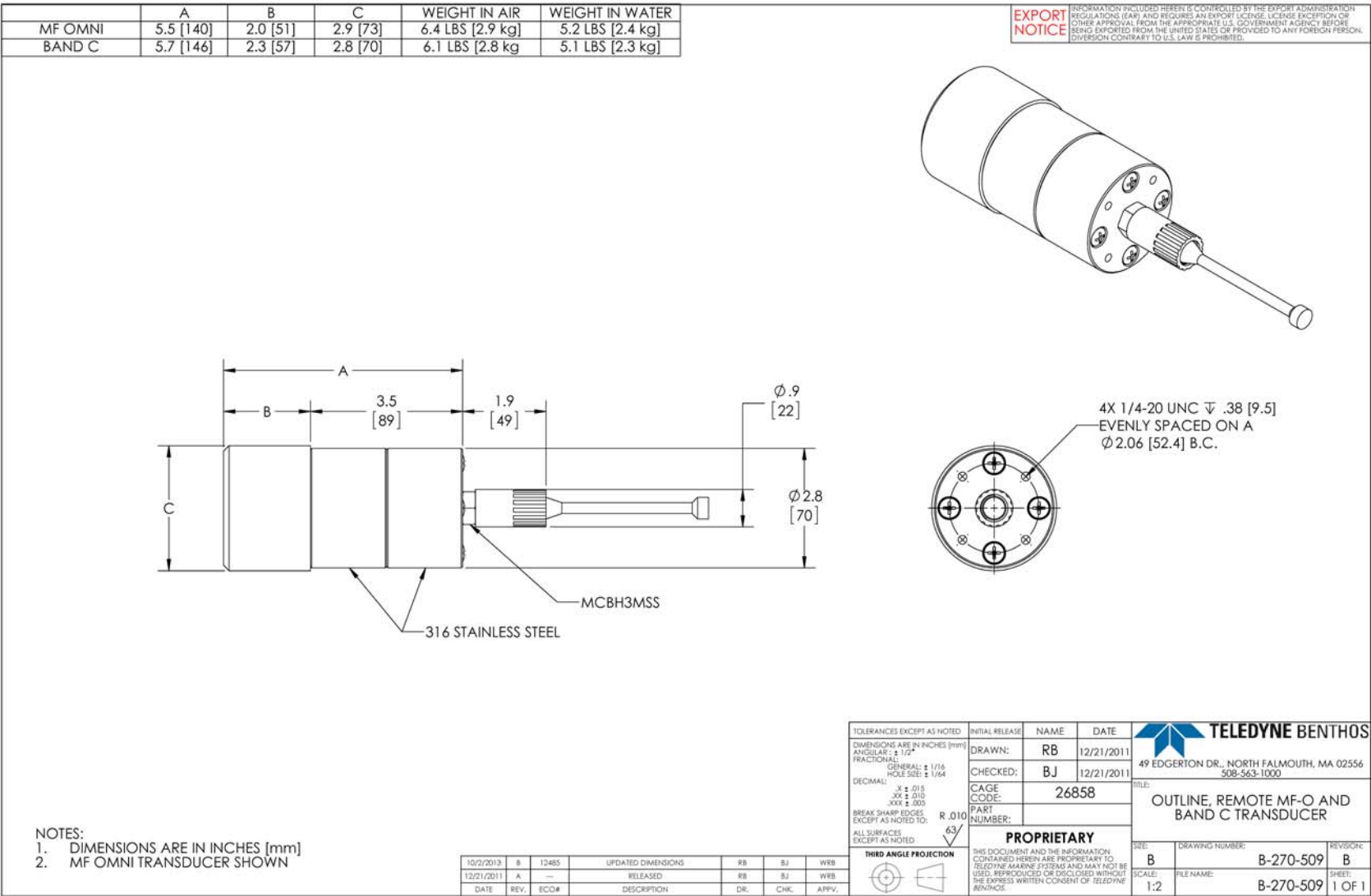
TOLERANCES EXCEPT AS NOTED: DIMENSIONS ARE IN INCHES (MM) UNLESS OTHERWISE SPECIFIED DECIMALS: .010 FRACTIONS: 1/16 HOLE SIZE: .001				DRAWN: RS CHECKED: 26858 DATE: 4/6/2010		TELEDYNE BENTHOS 49 EDGERTON DR., NORTH FALMOUTH, MA 02556 508-563-1000	
REVISIONS: 10/20/2013 C 12483 REDESIGN IN SOLIDWORKS RB BL WBS 12/20/2013 B 11989 UPDATE WEIGHTS RB BL WBS 3/25/2011 A --- RELEASED BL RB WBS				DATE: 12/20/2013 REV: B004 DESCRIPTION: RELEASED CHK: CHL AUX:		ITEM: C SCALE: 1:2 DRAWING NUMBER: C-270-259 FILE NAME: C-270-259 REVISION: C SHEET: 1 OF 1	

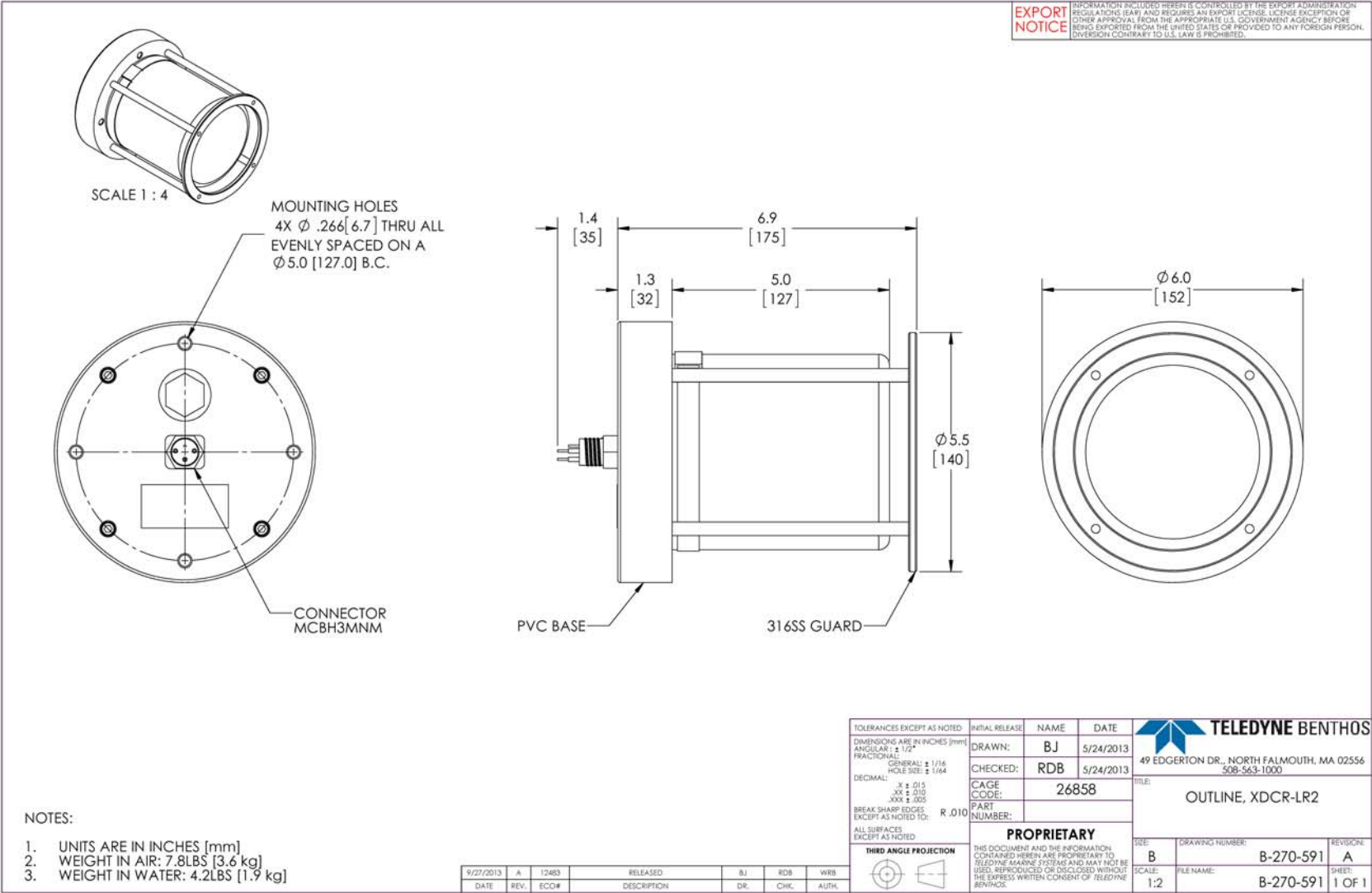


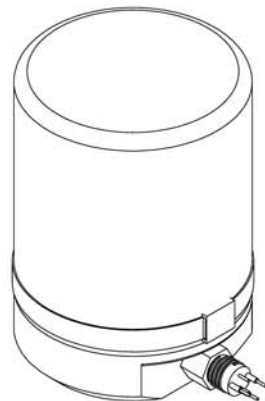




Technical drawing of a remote transducer assembly. The drawing includes a front view, a side view, and a detail view of the transducer head. Dimensions are provided in inches and millimeters. The front view shows an outer diameter of 6.0 inches (152 mm) and an inner diameter of 5.5 inches (140 mm). The side view shows a total length of 4.4 inches (113 mm) and a mounting flange diameter of 3.7 inches (94 mm). The detail view shows a circular transducer head with a diameter of 5.0 inches (127 mm) and four mounting holes spaced 6.75 inches (171 mm) apart. The drawing is labeled '316 STAINLESS STEEL' for the main body, 'PVC' for the mounting flange, and 'MCBH3M-MNM' for the transducer head. A scale of 1:4 is indicated.



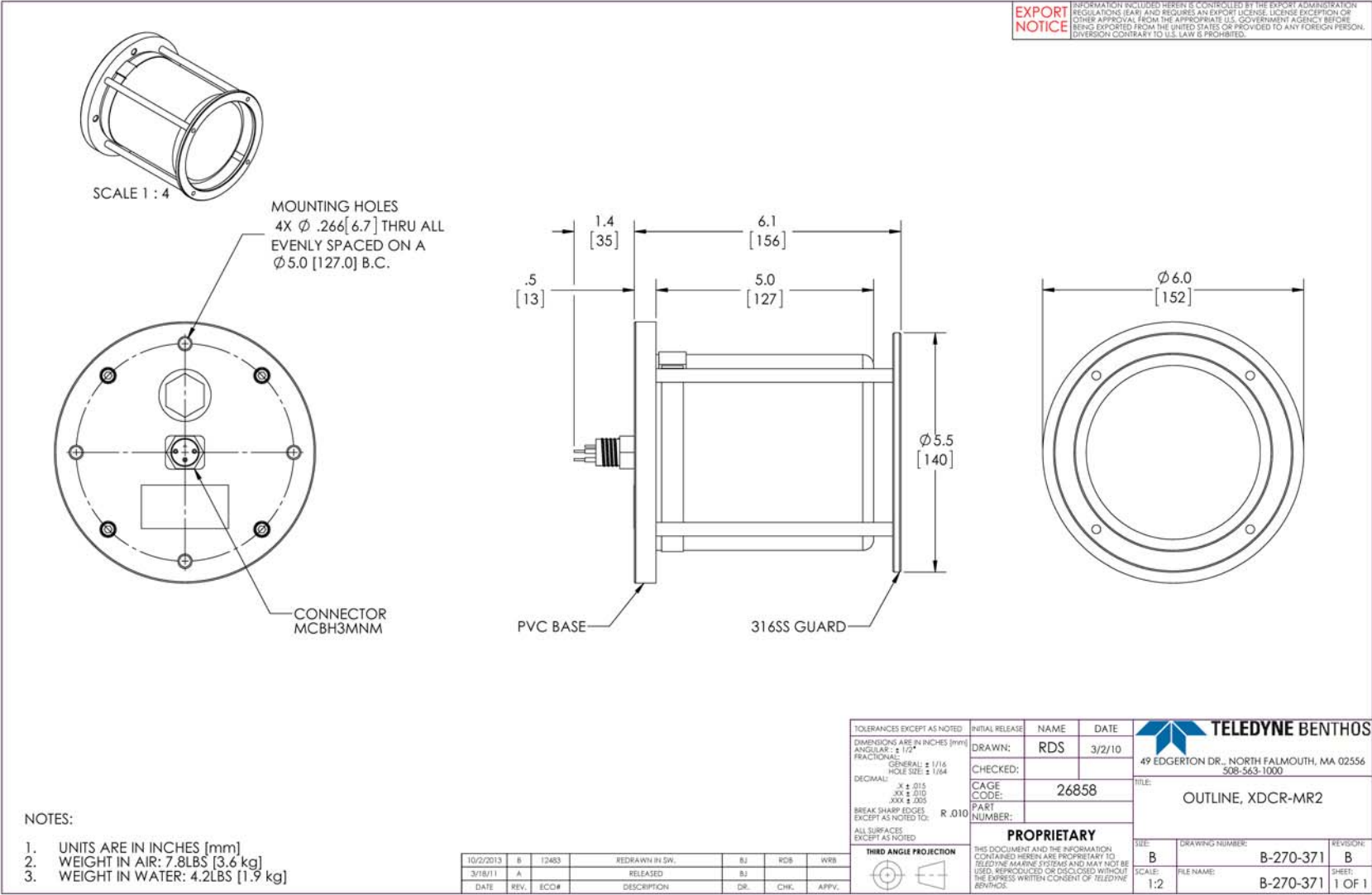




1. UNITS ARE IN INCHES [mm]
2. WEIGHT IN AIR: 6.1LBS [2.8 kg]
3. WEIGHT IN WATER: 2.5LBS [1.4 kg]

9/27/13	A	12483	RELEASED	BJ	ROB	WRB
DATE	REV.	ECO#	DESCRIPTION	DR.	CHK.	APPV.

TOLERANCES EXCEPT AS NOTED		INITIAL RELEASE		NAME		DATE		 TELEDYNE BENTHOS	
DIMENSIONS ARE IN INCHES (mm) ANGULAR: ± 1/12° FRACTIONAL: GENERAL: ± 1/16 HOLE SIZE: ± 1/64		DRAWN:		BJ		5/24/2013		49 EDGERTON DR., NORTH FALMOUTH, MA 02556 508-563-1000	
DECIMAL: .X ± .015 .XX ± .010 .XXX ± .005		CHECKED:		RDB		5/24/2013		TITLE: OUTLINE, XDCR-LA2	
BREAK SHARP EDGES EXCEPT AS NOTED TO: ALL SURFACES EXCEPT AS NOTED		R .010 43°		CAGE CODE:		26858			
				PART NUMBER:					
THIRD ANGLE PROJECTION 		PROPRIETARY THIS DOCUMENT AND THE INFORMATION CONTAINED HEREIN ARE PROPRIETARY TO TELEDYNE BENTHOS AND MAY NOT BE USED, REPRODUCED OR DISCLOSED WITHOUT THE EXPRESS WRITTEN CONSENT OF TELEDYNE BENTHOS				SIZE: B 1:2		DRAWING NUMBER: B-270-592 FILE NAME: B-270-592	
								REVISION: A SHEET: 1 OF 1	



11 Modem Spares, Accessories and Part Number Designator

This section comprises lists of the Teledyne Benthos ATM-900 Series Acoustic Telemetry Modems and UDB-9400 Universal Deck Box spares and accessories. Also included is a modem part number designator which provides an easy method for designating the specific part number for a modem when placing an order.

Modem Spares and Accessories

Table 11-1 through Table 11-6 in the following pages provide part number, descriptions and required quantities for spares and accessories for the ATM-9400, ATM-900, ATM-910, ATM-920, and ATM-960 Series Acoustic Telemetry Modems.

Table 11-1 UDB-9400 Universal Deck Box

PART NUMBER	DESCRIPTION	QTY PER UNIT
B-270-197-1	Deck Cable, 25-Meter	1
B-270-197-2	Deck Cable, 50-Meter	1
B-270-197-3	Deck Cable, 75-Meter	1
B-270-197-4	Deck Cable, 100-Meter	1
B-270-197-5	Deck Cable, 200-Meter	1
B-270-167-1	Transducer, LF Omnidirectional	1
B-270-167-2	Transducer, MF Omnidirectional	1
B-270-167-3	Transducer, Band C Omnidirectional	1
014337	Hull Mount Transducer Interface Box	1
B-270-171	Transducer, Protective Cage	1
000683	O-ring, Radial (Parker 2-233 N0674-70)	1
012620	Connector, Dummy	1
002017	Connector, Locking Sleeve	1
B-875-4	Cable, AC Power	1

Table 11-2 ATM-910 Series Acoustic Telemetry Modem Spares

PART NUMBER	DESCRIPTION	QTY PER UNIT
D-270-102	378 watt-hour alkaline battery pack	1
000683	O-ring, Radial (Parker 2-233 N0674-70)	4
B-270-408	16-Pin Programming Cable	1
008336	Connector, Dummy Plug	1
005855	Connector, Locking Sleeve	1
B-270-171	Transducer, Protective Cage	1

Table 11-3 ATM-920 Series Acoustic Telemetry Modem Spares

PART NUMBER	DESCRIPTION	QTY PER UNIT
D-270-102	378 Watt-hour Alkaline Battery Pack	1
000683	O-Ring, Radial (Parker 2-233 N0674-70)	2
B-270-408	16-Pin Programming Cable	1
008336	Connector, Dummy Plug	1
005855	Connector, Locking Sleeve	1
B-270-171	Transducer, Protective Cage	1

Table 11-4 ATM-960 Series Acoustic Telemetry Modem Spares

PART NUMBER	DESCRIPTION	QTY PER UNIT
001402	294 Watt-hour Alkaline Battery Pack	2
000679	O-Ring, Radial (Parker 2-241 N0674-70)	2
000677	O-Ring, Face (Parker 2-245 N0674-70)	2
B-270-408	16-Pin Programming Cable	1
008336	Connector, Dummy Plug	1
005855	Connector, Locking Sleeve	1

Table 11-5 ATM-900 Series Acoustic Telemetry Modem Spares

PART NUMBER	DESCRIPTION	QTY PER UNIT
012619	Transducer, Pigtail	1
007984	Cable, Power 12-36 VDC	1
007986	Cable, Serial Interface (Serial Port 1)	1
A-270-115	Cable, Serial Interface (Serial Port 2)	1
B-270-171	Transducer, Protective Cage	1

Table 11-6 Cables

PART NUMBER	DESCRIPTION	QTY PER UNIT
B-270-408	16-Pin Programming Cable	1
B-270-415-2	16-Pin Pigtail Cable, 2-Meter	1
B-270-415-3	16-Pin Pigtail Cable, 3-Meter	1
B-270-415-5	16-Pin Pigtail Cable, 5-Meter	1
B-270-415-10	16-pin pigtail cable, 10-Meter	1
B-270-415-25	16-pin pigtail cable, 25-Meter	1
B-270-415-50	16-pin pigtail cable, 50-Meter	1
B-270-415-100	16-pin pigtail cable, 100-Meter	1
B-270-415-200	16-pin pigtail cable, 200-Meter	1

Table 11-7 Upgrade Kits and Feature Keys

PART NUMBER	DESCRIPTION	QTY PER UNIT
B-270-503	SD Datalogger Upgrade Kit	1
B-270-511	PSK Coprocessor Upgrade Kit	1
K-270-B	Dual Serial Port Feature Key	1
K-270-M	LBL/Multi-Receive Feature Key	1
K-270-I	Acoustic Recorder Feature Key	1
K-270-W	Waveform Play Feature Key	1

Modem Part Number Designation

The ATM-900 Series Acoustic Telemetry Modems use an identification number scheme that allows the model number to be used as the part number. This method simplifies the ordering and support processes. To designate the part number for a modem specification, follow the legend shown in Figure 11-1.

