SM-75 SMART Modem

User's Manual

P/N M847-0060, Rev. B

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Preface

Congratulations on your purchase of a Benthos SM-75 Smart Modem Acoustic Release Technology (SMART) Modem! The SM-75 is *both* a full ocean depth release *and* an acoustic modem that employs the latest in digital signal processing technologies for reliable wireless digital communications underwater.

This manual provides information on setting up, testing and operating the SM-75. It is divided into the following 5 sections:

Section 1 - Overview reviews the release and modem components of the SM-75 and describes its construction.

Section 2 - Specifications lists the specifications for the release and modem functions of the SM-75 and the battery pack.

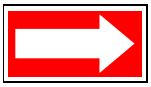
Section 3 - Setup, Deployment and Recovery provides instructions on how to unpack the SM-75, test the release mechanism, connect the SM-75 to an instrument, and deploy and recover the SM-75.

Section 4 - Maintenance and Troubleshooting provides instructions for cleaning and inspecting the SM-75, replacing the battery pack and troubleshooting some operational problems should they occur.

Section 5 - User Replaceable Parts provides a list of common user replaceable parts available from Benthos for the SM-75

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 SM-75 SMART Modem.

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 SM-75, or if you require service or support.

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1 Overview

The Benthos SM-75 Smart Modem Acoustic Release Technology (SMART) Modem is both a full ocean depth acoustic release plus an acoustic modem that provides reliable wireless digital communications with other deployed underwater instrument packages and surface or subsea platforms. It is self buoyant and completely self contained in a 13 or 17-inch glass sphere housing that is encapsulated in a yellow ribbed hard hat. It also includes an internal battery pack and an omnidirectional transducer that is specifically designed for full ocean depth applications. The SM-75 can transmit real time or stored data from connected instruments and sensors at baud rates up to 15,360 bits/sec. The SM-75 can also receive data at baud rates up to 2400 bits/sec, enabling it to function as a network repeater.

The SM-75, which is shown in Figure 1-1, combines the same reliable electrolytic dissolving wire ("burn wire") type release mechanism used in the Benthos Model TR-6000 Series Recoverable Acoustic Transponder with the same modem technology provided by the Benthos ATM-880 Series Acoustic Telemetry Modems. The Benthos ATM-891 Deck Box, which is shown in Figure 1-2, is used to communicate with the SM-75 and to acoustically release it. Telesonar PC, which is provided with the ATM-891, is a graphical users interface (GUI) software program that runs on a PC and provides a user friendly means of configuring and operating the release and the modem.

Operation as a Release

The SM-75 is designed for long range, deep or shallow water applications and can release loads as heavy as 227 kg (500 lb) at the full rated depth of 6700 m (22,000 ft). The SM-75 is shown deployed with a mooring in Figure 1-3. In addition, the SM-75 functions to assist in its own relocation as it can be commanded to operate as a transponder for measuring slant range. As a transponder, the SM-75 transmits replies to interrogation transmissions from the ATM-891 Deck Box, and the two-way travel time of the sound propagation is measured and converted into the one-way distance. Upon recovery, the SM-75 can be rearmed 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. In addition, 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.

Figure 1-1 The SM-75 SMART Modem

Figure 1-2 The ATM-891 Deck Box

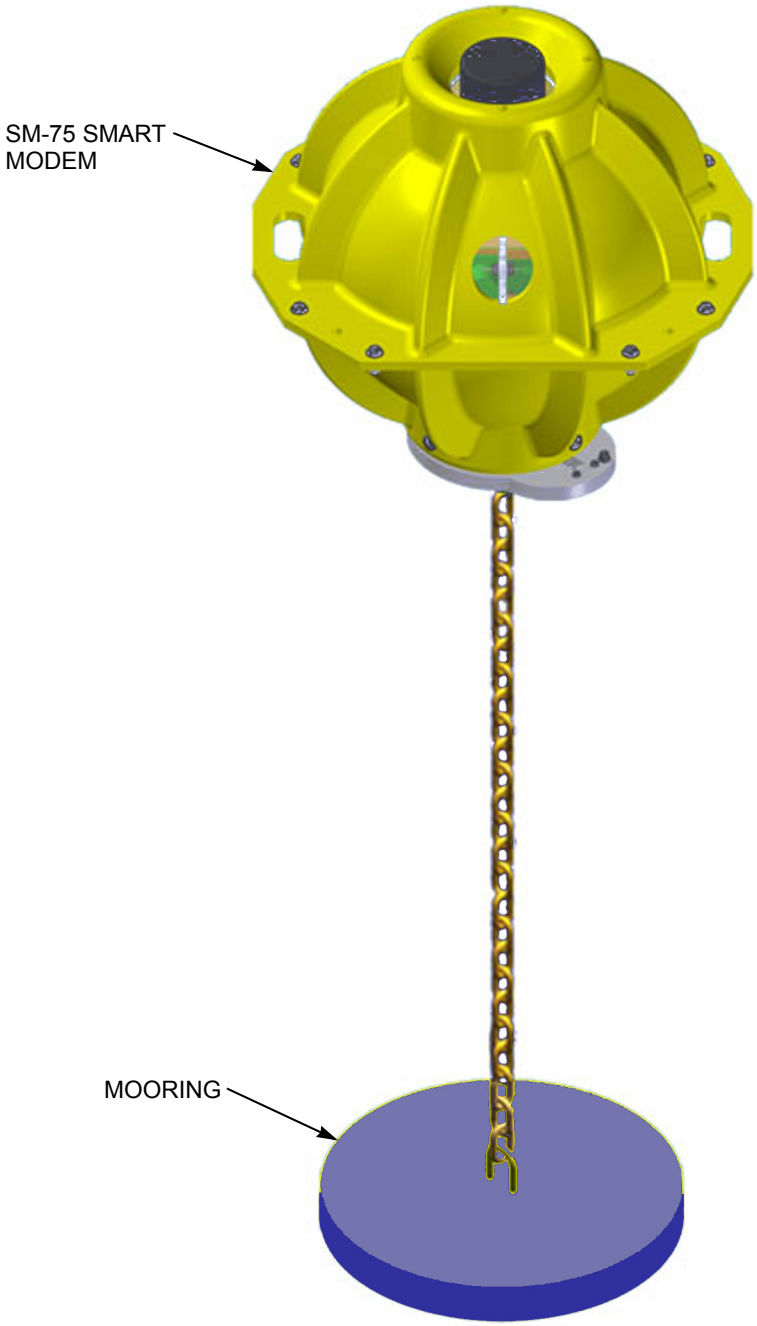
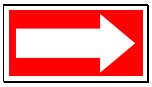


Figure 1-3 SM-75 Deployed with a Mooring

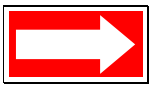
The SM-75 is released by a command from the ATM-891 Deck Box, which is connected over a serial interface to a host processor, usually a PC. The Release command, which is transmitted using the same secure and highly reliable modulation techniques used by the modem, is sent either by entering the command directly from the keyboard or by choosing the command from a menu in Telesonar PC. If entering directly from the keyboard, the computer must be set up to run a terminal program, such as ProComm Plus. The Release command requires both the address of the modem and its release code. The factory default address is 0, and the release code is the serial number of the SM-75 which is printed on the serial tag.



NOTE For information on how to enter the Release command, refer to Section 6, "Modem Operating Codes and Commands," of the "Acoustic Telemetry Modems User's Manual," and to Section 5, "Telesonar PC," for information on how to use Telesonar PC.

Operation as an Acoustic Modem

The SM-75 operates as an acoustic modem with the same functions as the Benthos ATM-880 Series Acoustic Telemetry Modems. It operates in the same operating modes, includes the same S Registers and executes the same commands. Plus it includes Release and Release Status commands. The modem uses an omnidirectional transducer that operates in the 9–14 kHz (LF) frequency band. This transducer provides omnidirectional transmit and receive beam patterns and is very effective in both deep and shallow water applications where the direction of the receiving transducer is not known or is not fixed. The modem also includes a power/serial connector that is accessible through the hard hat. This connector is used to input external power for powering the modem instead of using its internal battery pack, and to connect to either the RS-232 or RS-422 serial interface of an instrument or a PC. The modem inputs data from the instrument and outputs data to the instrument on the serial interface.



NOTE For detailed information on the Benthos ATM-880 Series Acoustic Telemetry Modems and how to operate them, refer to the "Acoustic Telemetry Modems User's Manual."

Construction

The SM-75 consists of a glass sphere instrument housing with a hard hat and attached release mechanism as shown in Figure 1-4. The housing is composed of two precision matched glass hemispheres with finely ground flat edges that are bound together with a band clamp assembly. The two halves are sealed with butyl rubber, and the sealant is covered with black vinyl tape. Inside the housing is a mounting plate to which are mounted a battery pack and the modem electronics chassis. Mounted directly to the outside surface of the housing are the transducer, the power/serial connector, two single-pin electrical penetrators, and a vacuum port. In addition, a removable magnet is attached to a bracket on the band clamp assembly and is accessible through the hard hat as shown in Figure 1-6 on page 1-7. The magnet is used to turn on the SM-75 when removed.

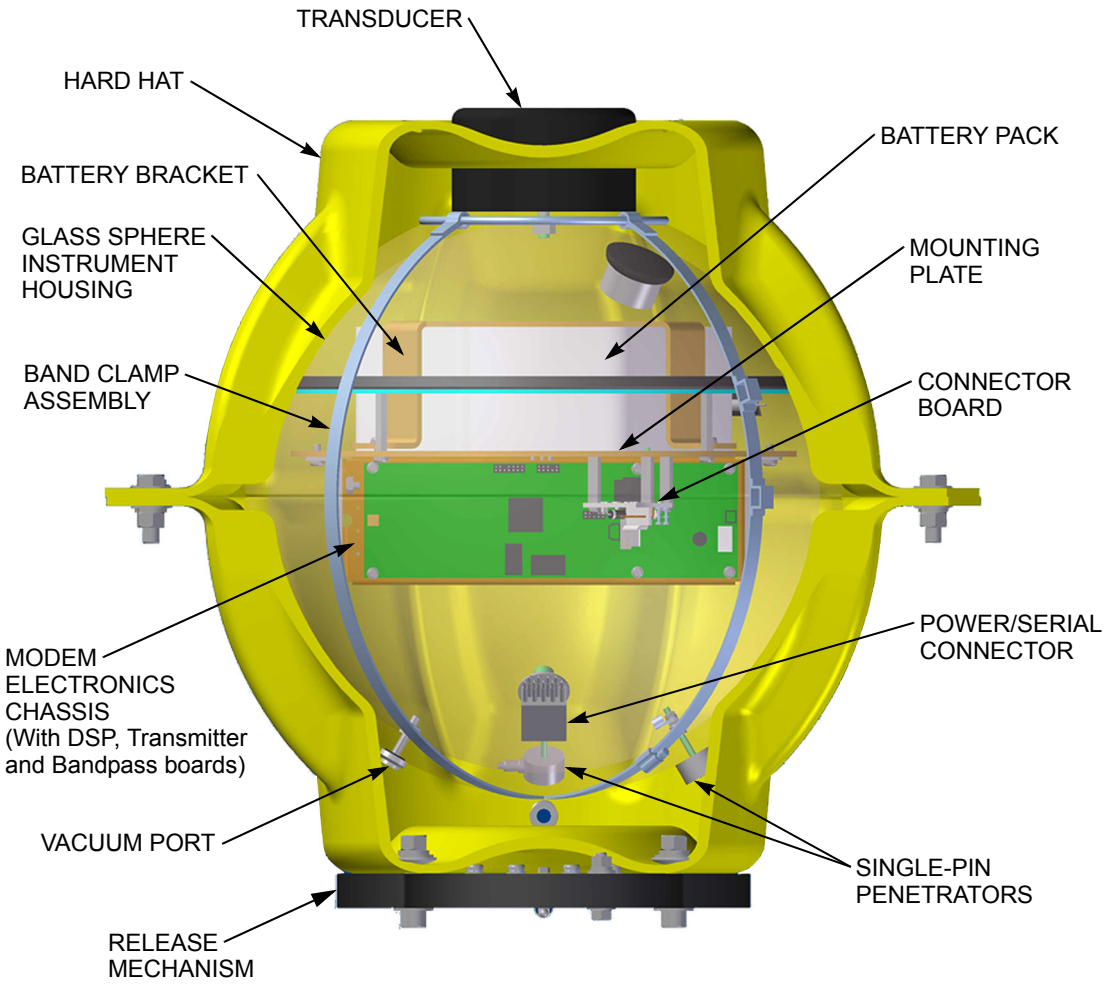


Figure 1-4 SM-75 Construction

Hard Hat

The yellow ribbed two-piece polyethylene hard hat encapsulates and protects the entire glass sphere instrument housing. The two halves of the hard hat are bolted together and cutouts are provided for the transducer, the magnet and the power/serial connector. The hard hat also provides the mounting platform for the release mechanism.

Transducer

The transducer is an omnidirectional piezoelectric ceramic ring contained in a polyurethane mold and is secured to the top hemisphere of the housing by a center tube that penetrates the housing. The transducer wires run through the tube and connect to the modem electronics.

Modem Electronics

The modem electronics consist of four circuit boards: the Connector board, the DSP board, the Transmitter board, and the Bandpass board. The Connector board is secured to the mounting plate with standoffs. The other three boards are secured to the modem electronics chassis which mounts to the mounting plate. Except for the battery pack, which connects to the Connector board, all the electrical connections are made to the boards on the modem electronics chassis.

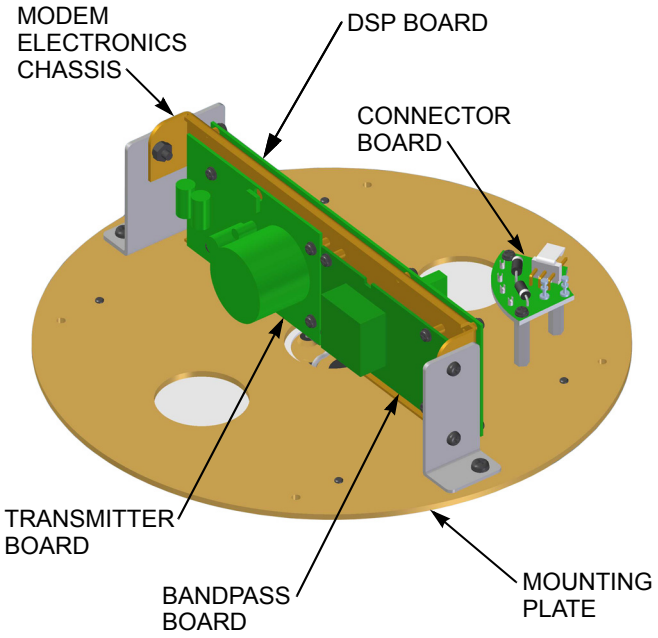


Figure 1-5 Modem Electronics with Connector, DSP, Transmitter and Bandpass Boards

Electrical Penetrators

There are three electrical penetrators: a 9-pin penetrator which is the power/serial connector, and two single-pin penetrators, which connect to the release mechanism.

Vacuum Port

The vacuum port can be used to partially evacuate the interior of the housing. It is typically used after reassembling the housing. Partial evacuation helps to hold the two hemispheres together along with the band clamp assembly. The vacuum port can also be used to release air into the housing to assist in separating the two hemispheres when disassembling.

Battery Pack

The battery pack is composed of 30 alkaline “D” cells that are wired as two sets of 15 series-connected cells in parallel, and includes attached wiring and a connector. The battery pack is secured to the mounting plate with a bracket, and the battery wires connect to the Connector board through a hole in the mounting plate.

Magnetically Activated Switch

A magnetically activated switch is attached to the inside surface of the glass housing as shown in Figure 1-6. A removable magnet is attached to a bracket on the band clamp assembly over the switch to maintain the switch in the open state. Removing the magnet closes the switch and turns the SM-75 on. An audible tone is also heard when the magnet is removed.

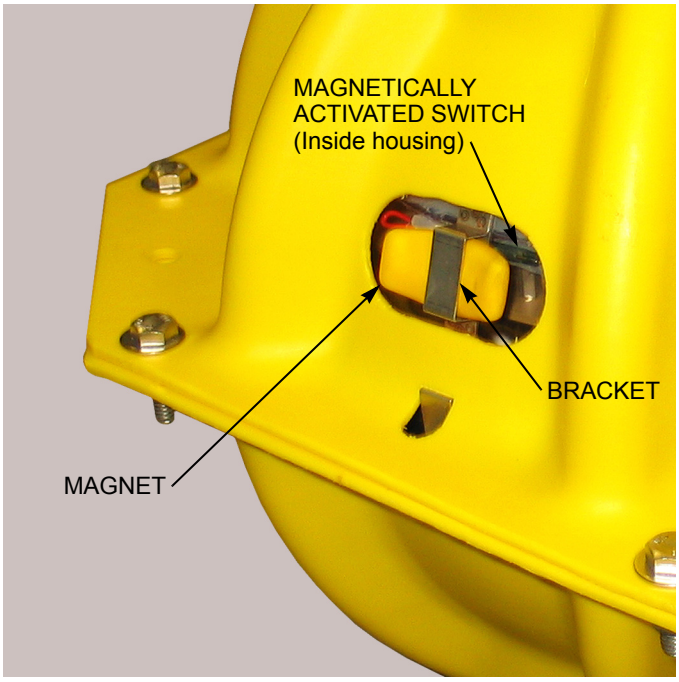


Figure 1-6 Magnetically Activated Switch and Magnet

Release Mechanism

The release mechanism includes a release base with a dissolving wire module, a release lever, and a drop link as shown in Figure 1-7 and Figure 1-8. The release lever also includes a replaceable tip. The release mechanism is attached directly to the bottom half of the hard hat. The dissolving wire module includes an Inconel wire loop that serves as the anode—and a ground bolt, which is shown in Figure 1-8, serves as the cathode—in an electrical circuit that is energized when the SM-75 is commanded to release. When energized, the wire loop dissolves, the release lever drops, and the drop link slides away, releasing the SM-75 from its mooring.

The dissolving wire module includes a single-pin connector pigtail that connects through a grommet protected hole in the hard hat to the connector of one of the two single-pin penetrators. The ground bolt is directly wired to the other single-pin penetrator through a grommet protected hole. Both penetrators connect to the modem electronics.

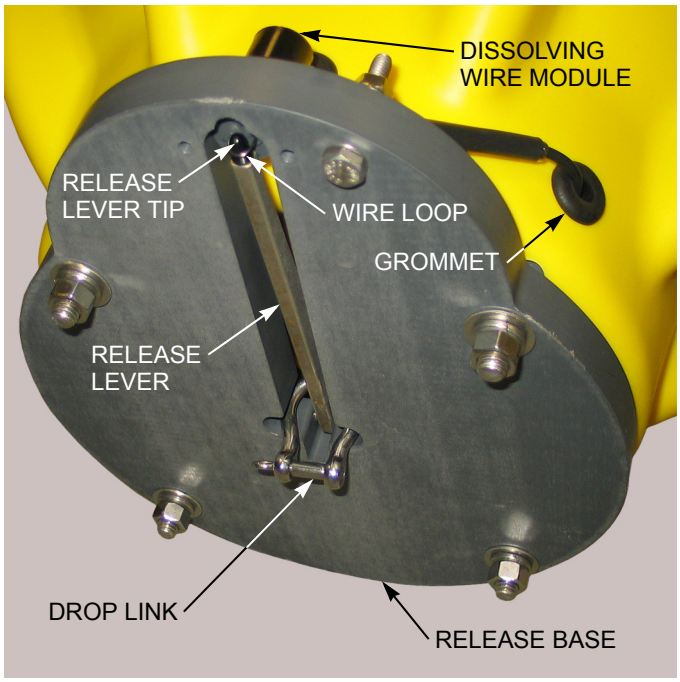


Figure 1-7 Release Base with Dissolving Wire Module, Release Lever and Drop Link

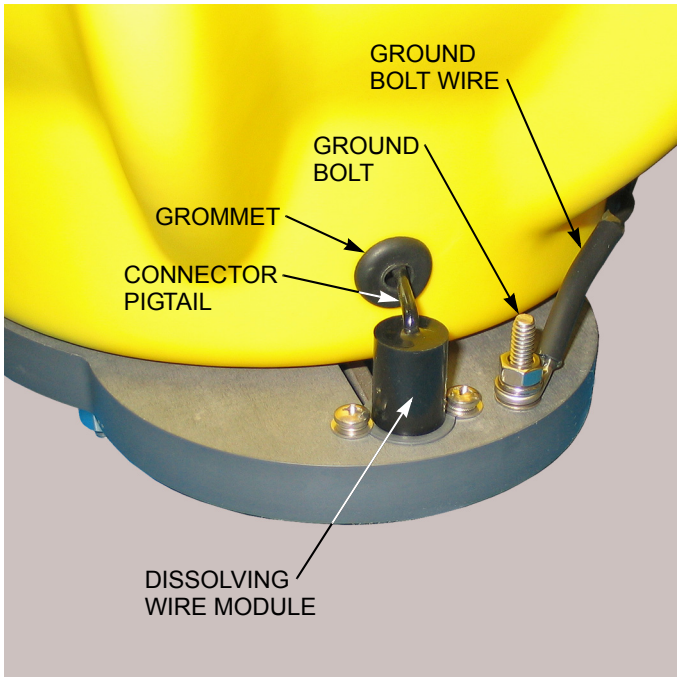


Figure 1-8 Dissolving Wire Module and Ground Bolt

2 Specifications

This section provides the specifications for the Benthos SM-75 SMART Modem. The specifications encompass separately the release and modem functions and the battery pack. All specifications are subject to change without notification.

Release

The specifications for the release primarily apply to the housing and to the release mechanism of the SM-75.

General

Housing:	Glass sphere inside a yellow ribbed hard hat
Release actuation:	Electrolytic dissolving wire (“burn wire”)
Rated load:	227 kg (500 lb)
Rated depth:	6700 m (22,000 ft)
Operator controls:	Magnet for power on/off
Operating life:	Up to 1 year depending on the number of replies and the amount of data transmitted and received by the modem

Physical Characteristics—SM-75 with 13-Inch Sphere Housing

Dimensions:	48.3 cm (19.0 in.) max dia by 44.5 cm (17.5 in.) maximum height
Weight in air:	18.2 kg (40 lb)
Net buoyancy:	2.3 kg (5 lb)

Physical Characteristics—SM-75 with 17-Inch Sphere Housing

Dimensions:	61.0 cm (24.0 in.) max dia by 57.2 cm (22.5 in.) maximum height
Weight in air:	27.3 kg (60 lb)
Net buoyancy:	13.6 kg (30 lb)

Modem

The specifications for the modem primarily apply to the electrical and transducer components of the SM-75. For information on the PSK and FSK modulation techniques and the processing features, refer the “Acoustic Telemetry Modems User’s Manual.”

General

Frequency band:	9–14 kHz (LF)
Data modulation:	PSK and MFSK
Baud rate:	2560–15,360 bits/sec (PSK transmit); 140–2400 bits/sec (MFSK transmit and receive)
Addressable modems:	100
Processing features:	Data redundancy 1/2 rate convolutional coding Multipath guard period
Operating temperature:	-5°C to 50°C
Storage temperature:	-45°C to 80°C (Refer also to "Battery Pack" on page 2-3.)
Serial interface:	RS-232/422 at 9600, 4800, 2400, or 1200 baud
Power/serial connector:	Subconn LPMCBH9M, for RS-232 and RSH422 serial interface and external DC input power

Flow control: RS-232—hardware RTS/CTS handshaking or software XON/XOFF

RS-422—software XON/XOFF handshaking

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

Power Requirements

Lowpower state current: 0.5 mA typical, 1.0 mA maximum

DSP/receiver current, active: 25 mA typical

Transmitter current, active: 1 A average, 3 A peak @ 21 V (MF, HF)
2 A average, 5 A peak @ 21 V (LF)

Transducer

Type: Built-in omnidirectional (LF)

Source level @ 22.5 V (typ.): 190 dB re 1 µPa @ 1 m

Source level @ 16.5 V, end of battery life (typ.): 187 dB re 1 µPa @ 1 m

Battery Pack

The battery pack used in the SM-75 is composed of 30 alkaline “D” cells, where two sets of 15 series-connected cells are wired in parallel.

Capacity: 28 A·h (445 watt·hr) @ 21°C

Open circuit voltage: 22.5 V

NOTE The energy capacity of a stored battery pack *decreases* with *increasing* temperature. To maintain relative freshness and optimal battery pack life during long term storage, always store a fresh battery pack, or a SM-75 with a fresh battery pack installed, in a cool environment. A storage temperature between 10°C and 25°C is recommended.

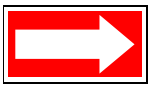
3 Setup, Deployment and Recovery

This section provides instructions on how to unpack the Benthos SM-75 SMART Modem, test the release mechanism, connect the SM-75 to an instrument, and deploy and recover the SM-75.

Unpacking and Inspection

The SM-75 is shipped with the following components:

- SM-75 with 13-inch glass sphere housing (P/N 011456)
  or
  SM-75 with 17-inch glass sphere housing (P/N 011636)
- Re-arming Kit (P/N A-210-226)
- Spare Parts Kit (P/N 011685)
- Power/Serial Cable (P/N C846-0020)
- User's Manual (P/N M847-0060)



NOTE A drop link, a dissolving wire module and a magnet are factory installed on the SM-75.

All items are carefully packed in a sealed box. Additional drop links, dissolving wire modules, battery packs and other components may be included, depending on the order. Carefully inspect the box for any signs of external damage and immediately report any damage to Benthos and to the freight carrier.

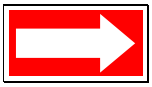
After inspecting the box, locate and remove the packing list, which is on the outside of the box. While referring to the packing list, carefully remove the contents of the box, checking the items against the packing list to verify that all the items on the list are included. Inspect the items for any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

Testing the Release Mechanism

An ATM-891 Deck Box, a remote transducer and a multimeter are required to test the release mechanism, which is tested in air by acoustic command. The ATM-891 must also be connected to a computer running Telesonar PC or a terminal program such as ProComm Plus.

To test the release mechanism:

1. Refer to Section 4, "Setup and Test," of the "Acoustic Telemetry Modems User's Manual" and set up the ATM-891 Deck Box.
2. Place the remote transducer used with the ATM-891 within a foot of the SM-75 transducer. Be sure no obstacles are between the transducers.
3. Attach the positive lead of the multimeter to the wire loop of the dissolving wire module. The wire loop is shown in Figure 1-7 on page 1-8.
4. Attach the negative lead of the multimeter to the ground bolt. The ground bolt is shown in Figure 1-8 on page 1-8.
5. Set the multimeter to a volts scale for measuring approximately 15 volts.
6. Remove the magnet from the bracket on the band clamp assembly. An audible tone will be heard. The magnet and its bracket are shown in Figure 1-6 on page 1-7.
7. Switch the AC ON/OFF switch on the front panel of the ATM-891 to ON, or switch on the DC power supply.



NOTE When testing the release mechanism, should the release mechanism not activate, vary the separation of the transducers. In addition, it may be required to change the transmit power level of the ATM-891 Deck Box, usually to a lower level. The transmit power level is set by using the Set Register command (ATSn=n) to change the setting of S Register 6 when using a terminal program. For instructions on how to use the Set Register command, refer to Section 6, "Modem Operating Modes and Commands," of the "Acoustic Telemetry Modems User's Manual." Refer also to Section 7, "Modem Operating Parameters (S Registers)" for information on the available transmit power level settings provided by S Register 6. If using Telesonar PC, refer to Section 5, "Telesonar PC," of the manual.

8. If using a terminal program, send the Release command by typing AT$Nn,m [Enter], where n is the address of the SM-75 and m is the release code. The factory default address is 0, and the release code is

the serial number of the SM-75 and is printed on the serial tag. If using Telesonar PC, refer to Section 5, "Telesonar PC," of the "Acoustic Telemetry Modems User's Manual" for instructions on how to send a Release command.

The message "Valid Release Code-Waiting for Burn..." should be displayed, and the multimeter should read approximately 14 volts for 10 minutes.

Connecting the SM-75 to an Instrument

Connecting the SM-75 to an instrument requires making the serial interface connections to the instrument and, if required, the DC power connections.

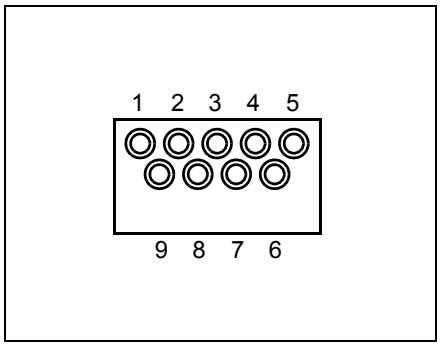
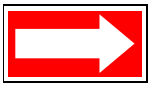


Figure 3-1 SM-75 Power/Serial Connector

The power and serial interface connections are made to the SM-75 using the power/serial connector which is accessible through the hard hat as shown in Figure 3-2. Either an RS-232 or an RS-422 serial interface connection can be made. The power/serial connector pin orientation is shown in Figure 3-1, and the pinout information is shown in Table 3-1. The power/serial connector is a 9-pin Subconn LPMCBH9M bulkhead connector which requires a Subconn MCLPIL9F mating connector pigtail. The SM-75 is shipped with a dummy connector plugged into the power/serial connector.

To connect the SM-75 to an instrument using the RS-232 or RS-422 serial interface, and if required, to external DC power, refer to the pinout information provided in Table 3-1 and to the connector information provided with the instrument. In addition, the power/serial cable, which includes a mating Subconn MCLPIL9F connector and a DB9 connector, is provided for connecting the RS-232 serial interface to a PC and to a DC power supply. The pinout information for this cable is shown in Table 3-2 on page 3-5. In addition, the red lead of the cable connects to Pin 1 (21–28 VDC), and the black lead, to Pin 3 (Common Ground) of the MCLPIL9F connector.



NOTE When the SM-75 is switched on, the internal batteries automatically power the SM-75 when there is no external power or if the external power drops below 22 VDC.

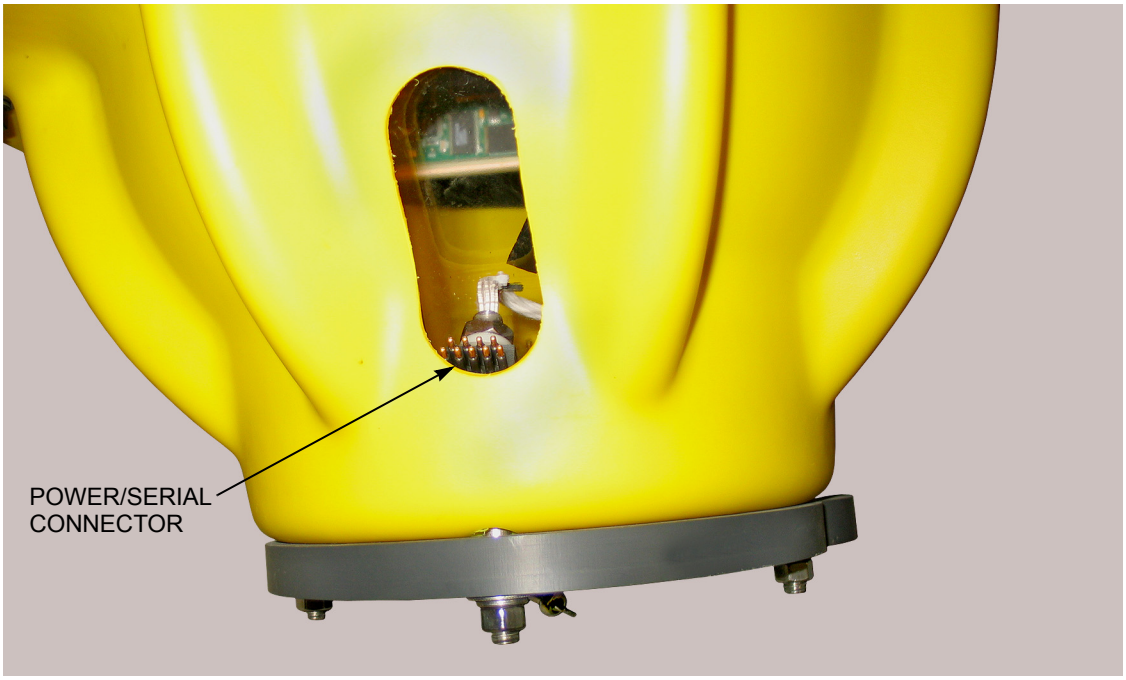


Figure 3-2 Location of the Power/Serial Connector

Table 3-1 SM-75 Power/Serial Connector Pinouts

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

NOTE Refer to Section 6, "Modem Operating Modes and Commands," of the "Acoustic Telemetry Modems User's Manual" for more information on the Device Enable output.

Table 3-2 SM-75 Power/Serial Cable Pin-to-Pin Connections

SM-75 POWER/SERIAL CONNECTOR			SIGNAL DIRECTION	PC DB-9 CONNECTOR		
PIN	LABEL	FUNCTION		PIN	LABEL	FUNCTION
3	GND	Common Ground		**5**	GND	Ground
6	RTS	Request to Send	Modem to PC	**8**	CTS	Clear to Send
8	RXD	Receive	PC to Modem	**3**	TXD	Transmit
9	TXD	Transmit	Modem to PC	**2**	RXD	Receive

Deploying the SM-75

Before deploying the SM-75, a new drop link and a dissolving wire module should be installed if they have been expended in a previous deployment. In addition, the status of the SM-75 should be checked, some important deployment considerations should be verified, and a few predeployment checks should be performed. After completing these tasks, verify that the magnet is removed, and then deploy the SM-75 and its mooring. Be careful to minimize impact loading on the release mechanism during deployment.

Installing a New Drop Link and Dissolving Wire Module

Three sets of drop links, dissolving wire modules and release lever tips are included in the Re-arming Kit. These components are shown in Figure 1-7 on page 1-8 and Figure 1-8 on page 1-8. Old dissolving wire modules can also be returned to Benthos for remolding new ones onto their connector pigtails.

To install a new drop link and dissolving wire module:

1. Remove the old dissolving wire module by removing the two screws that secure it.
2. If the release lever tip appears damaged, replace the tip by unscrewing it by hand and installing a new one.
3. Remove the grommet from the hard hat, and then slide out the connector pigtail, disconnect it and pull off the grommet.
4. Slide a new drop link over the release lever and install a new dissolving wire module, slipping the release lever tip through the wire loop.

5. Secure the dissolving wire module with the two screws.
6. Slide the grommet onto the new connector pigtail, and then connect the pigtail, slide it into the hard hat as far as it will go and install the grommet.

Checking the Status of the SM-75

The Release Status command can be sent to the SM-75 at any time to check its status, even after it has been released. The status information is displayed at the command prompt when using a terminal program, or as indicators when using Telesonar PC. The command prompt displays are the following:

Armed. Displayed when no Release command has been received and the dissolving wire module is currently not activated, or the dissolving wire module was activated for 10 minutes and is currently not activated.

Burn Wire Activated. Displayed when the dissolving wire module is currently activated.

Battery: LOW. Displayed when the battery is low and should be replaced.

Battery: OK. Displayed when the battery is not low and does not need to be replaced.

To check the status of the SM-75:

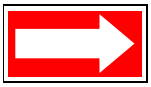
1. Refer to Section 4, "Setup and Test," of the "Acoustic Telemetry Modems User's Manual" and set up the ATM-891 Deck Box.
2. Place the remote transducer used with the ATM-891 within a foot of the SM-75 transducer. Be sure no obstacles are between the transducers.
3. Remove the magnet from the bracket on the band clamp assembly. The magnet is shown in Figure 1-6 on page 1-7.
4. Switch the AC ON/OFF switch on the front panel of the ATM-891 to ON, or switch on the DC power supply.
5. If using a terminal program, send the Release Status command by typing AT$Tn [Enter], where n is the address of the SM-75. If using Telesonar PC, refer to Section 5, "Telesonar PC," of the "Acoustic Telemetry Modems User's Manual" for instructions on how to send the Release Status command.

   The status should be displayed if using a terminal program, or if using Telesonar PC, corresponding indications in the Main window should be displayed.

Verifying Some Important Deployment Considerations

Before deploying the SM-75, verify the following important deployment considerations:

- The loading on the release mechanism is within the specified rating.
- The tether securing the SM-75 to the mooring is of sufficient length to avoid a collision with the mooring during deployment.
- The tether is properly and securely attached to the drop link and to the mooring.
- There will be a clear acoustic path to the surface within the specified maximum range, where this range is the slant range from the transmitting transducer on the surface to the SM-75.



NOTE For additional deployment considerations refer to Section 3, "Deployment Considerations" of the "Acoustic Telemetry Modems User's Manual."

Performing the Predeployment Checks

Before deploying the SM-75, perform the following predeployment checks:

- Inspect the SM-75 for possible damage from a previous deployment.
- Verify that the dissolving wire module and the ground bolt are properly installed and securely tightened.
- Verify that the ground bolt and its attached wire are not corroded.
- Verify that the drop link is free to slide away from the release lever.
- Test the release mechanism as described in "Testing the Release Mechanism" on page 3-2.
- Check the battery as described in "Checking the Status of the SM-75" on page 3-6.
- Verify that the magnet is removed.

WARNING The SM-75 cannot be released if the magnet is not removed. Before deploying the SM-75, verify that the magnet is removed.

Recovering the SM-75

An ATM-891 Deck Box and a remote transducer are required to recover the SM-75.

To recover the SM-75:

1. Refer to Section 4, "Setup and Test," of the "Acoustic Telemetry Modems User's Manual" and set up the ATM-891 Deck Box.
2. Lower the remote transducer used with the ATM-891 into the water.
3. Switch the AC ON/OFF switch on the front panel of the ATM-891 to ON, or switch on the DC power supply.
4. If using a terminal program, repeatedly send the Range command by typing ATRn [Enter], where n is the address of the SM-75, until the range can be acquired to the SM-75. If using Telesonar PC, refer to Section 5, "Telesonar PC," of the "Acoustic Telemetry Modems User's Manual" for instructions on how to acquire the range to the SM-75 using Auto Range.

WARNING The range is the slant, or direct, distance from the remote transducer to the SM-75, not the horizontal distance.

5. While continuing to acquire range, navigate the vessel to position it such that it will be easy to sight the SM-75 once it surfaces yet ensure it will surface a safe distance from the vessel.
6. If using a terminal program, send the Release command by typing AT$Nn,m [Enter], where n is the address of the SM-75 and m is the release code. If using Telesonar PC, refer to Section 5, "Telesonar PC," of the "Acoustic Telemetry Modems User's Manual" for instructions on how to send a Release command.

   If using a terminal program, 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 for 10 minutes, during which the SM-75 will continue to respond to acoustic commands if they are sent. For example, sending the Release Status command during this time, as described in "Checking the Status of the SM-75" on page 3-6, should display the message "Burn

Wire Activated," which acknowledges that the dissolving wire module is currently activated. In addition, sending the Release Status command always displays the message "Battery: OK" or "Battery: LOW."

After the 10 minute period, the message "Burn Wire Time Complete" should be displayed. At this time, sending the Release Status command should display the message "Armed."

4 Maintenance and Troubleshooting

This section encompasses the recommended care and maintenance procedures for the SM-75 SMART Modem. These tasks primarily involve general cleaning and inspection and replacing the battery pack. In addition, some troubleshooting recommendations are provided should the SM-75 not respond to commands or its release mechanism fails to function.

General Cleaning and Inspection

Cleaning and inspecting the SM-75 requires a source of clean, *fresh* water for washing. In addition, the following items are recommended:

- ***Silicone O-ring lubricant***
- ***Alcohol wipes***
- ***Cloths or paper towels***
- ***Mild, non-abrasive detergent***

After retrieving the SM-75, clean and inspect it as follows:

1. Wash down the SM-75 with fresh water and remove any debris that may have become attached to the housing.
2. Unplug the cable from the power/serial connector, inspect and clean the cable, and then clean the power/serial connector with an alcohol wipe.
3. Lubricate the power/serial connector pins with a light coat of silicone lubricant and install the supplied dummy plug.

NOTE Be especially careful not to get any lubricant on the face of the transducer as this will severely degrade its performance.

4. Clean the transducer with 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.

5. Carefully inspect the transducer for any signs of damage.
6. Using a cloth or paper towel, dry the SM-75 thoroughly.

Replacing the Battery Pack

Replacing the battery pack requires that the hard hat and glass housing be disassembled. The tools and materials required for this task are the following:

- ***(2) 3/4-inch adjustable wrenches***
- ***Phillips screw driver***
- ***Heat gun***
- ***Small roller***
- ***Cleaning alcohol***
- ***Lint free cloth***
- ***Butyl rubber sealant strip***
- ***Wide black vinyl tape***

The sealant strip and the vinyl tape are included in the Spare Parts Kit. The battery pack is also available from Benthos. Refer to Section 5, "User Replaceable Parts," for the part numbers.

Figure 4-1 Location of Hardware that Secures the Two Halves of the Hard Hat

To replace the battery pack:

1. Carefully lay the SM-75 down on its transducer.
2. Remove the magnet from the bracket on the band clamp assembly.
3. Using the two 3/4-inch adjustable wrenches, remove the eight sets of hardware that secure the two halves of the hard hat—eight each a bolt, a nut, a pair of flat washers, and a lock washer, as shown in Figure 4-1.

WARNING With the magnet removed the modem electronics and the transducer terminals may contain potentially harmful high voltages. Always keep hands and fingers away from these components.

4. Remove the bottom half of the hard hat, the half that includes the attached release mechanism, as shown in Figure 4-2.
5. Remove the glass housing from the top half of the hard hat and carefully rest the housing on the transducer as shown in Figure 4-3.
6. Loosen the two band clamp assembly adjustment screws and separate the band clamps.
7. Completely remove the black vinyl tape and the butyl sealant strip underneath the tape.

WARNING When separating the two glass hemispheres, be careful not to chip the finely ground flat edges of the seam between them.

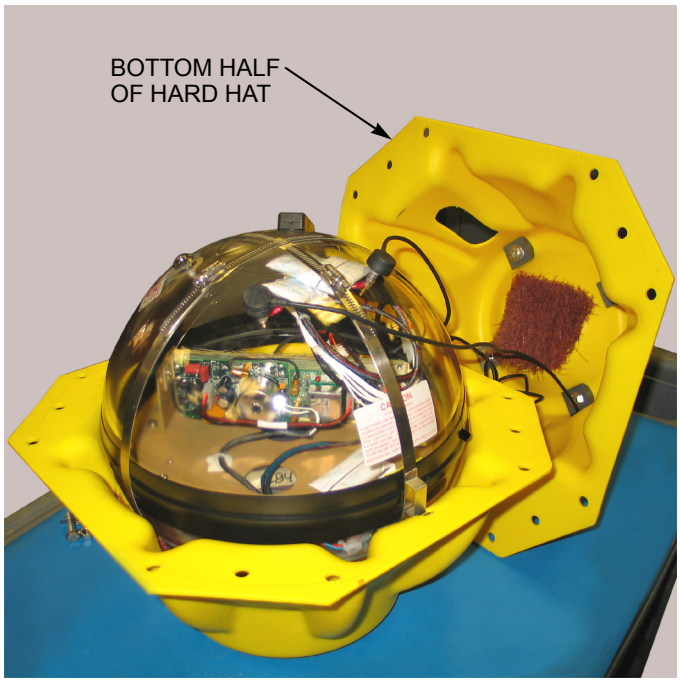


Figure 4-2 Removing the Bottom Half of the Hard Hat

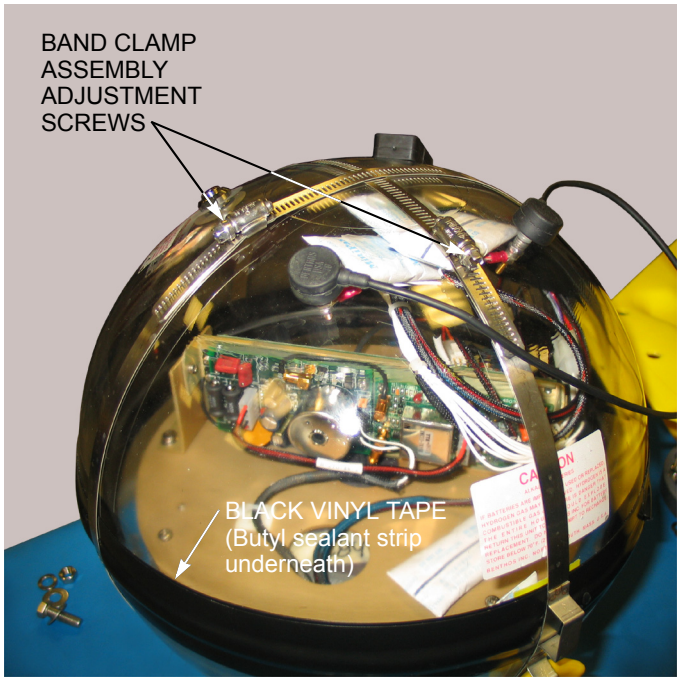


Figure 4-3 Band Clamp Assembly Adjustment Screws and Black Vinyl Tape

8. Separate the two hemispheres by tapping one of them with the palm of the hand.

   If tapping does not separate the hemispheres, temporarily remove the screw and O-ring from the vacuum port to release air into the housing.

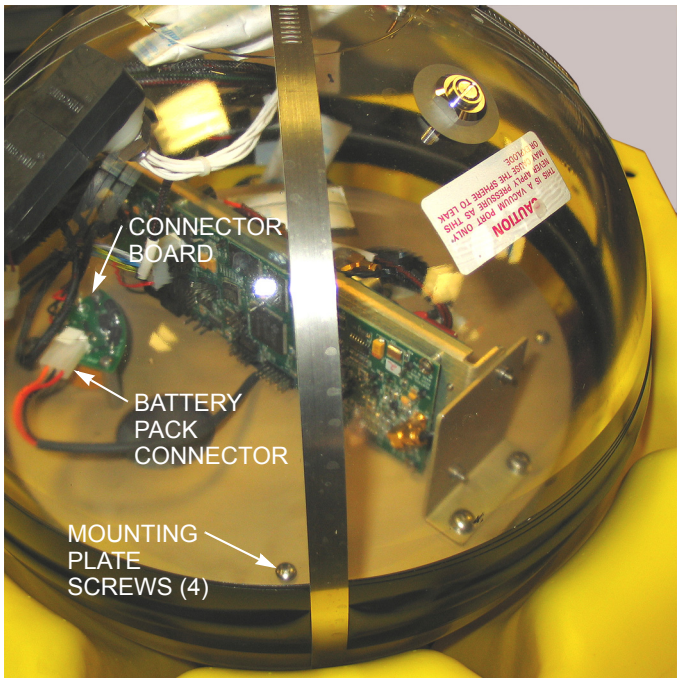


Figure 4-4 Mounting Plate Screws, Battery Pack Connector and Connector Board

WARNING The housing will leak if the screw and O-ring are not replaced. Replace them immediately.

9. Carefully set the bottom hemisphere—the one *without* the transducer—aside next to the other hemisphere with the seam edge facing up.
10. Remove the four mounting plate screws as shown in Figure 4-4.
11. Disconnect the battery connector from the Connector board, remove the mounting plate and turn it over such that the battery pack is facing up.
12. Remove the battery bracket mounting hardware—four each a screw and lock washer, as shown in Figure 4-5.

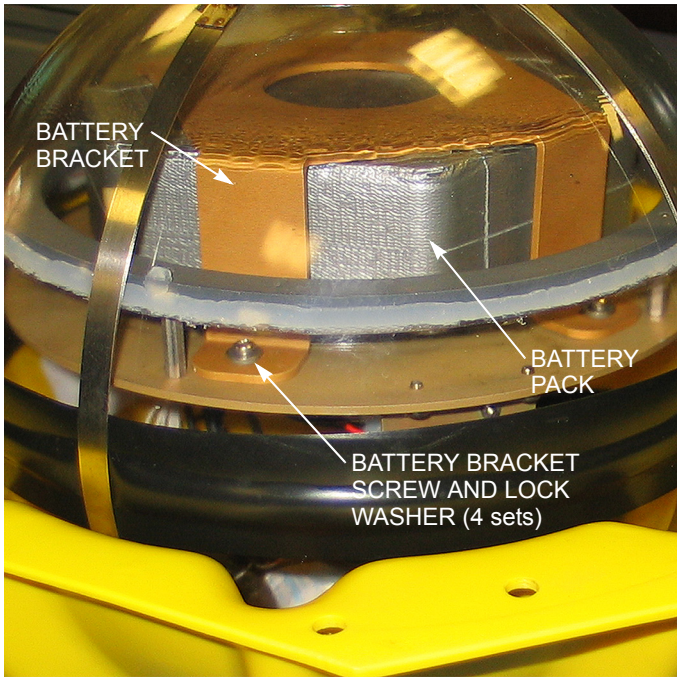


Figure 4-5 Battery Bracket Mounting Hardware, Battery Bracket and Battery Pack

13. Remove the bracket and the old battery pack, passing the battery connector through the hole in the mounting plate.
14. Install the new battery pack, passing the battery connector through the hole in the mounting plate, and secure it with the battery bracket and mounting hardware.
15. Turn the mounting plate over such that the battery pack is facing down, install it into the housing and secure it with the four mounting plate screws.
16. Connect the battery connector to the Connector board.
17. Clean the seam edges of both hemispheres using alcohol and a lint free cloth.
18. Place the bottom hemisphere back on the top hemisphere, positioning it such that the arrow markers on each hemisphere are aligned. Verify that the vacuum port screw and O-ring have been replaced.
19. Temporarily slide the two hemispheres slightly apart, and then use the heat gun to blow hot air into the housing for about 15 seconds.
20. Immediately slide the two hemispheres back together, realigning them with the arrow.
21. With the palm of the hand, gently tap the two hemispheres as necessary to get the best possible fit at the seam with no overhang and with the arrows aligned.
22. Clean both hemispheres thoroughly, particularly near the seam, using alcohol and a lint free cloth.
23. Wrap the butyl rubber sealant strip entirely around the seam, keeping the paper on the outside, and then cut the strip such that the two ends meet without overlapping.
24. While firmly holding the housing to keep the hemispheres from shifting, and without removing the paper on the sealant strip, use the roller to flatten the sealant strip along its entire length until it is about half its original thickness.
25. Remove the paper.
26. Wrap wide black vinyl tape three times around the seam, stretching the tape as it is being wrapped and centering it on the sealant strip.
27. Rub the tape smooth with the hand.
28. Tighten the band clamps, insert the housing back into the top half of the hard hat and secure the lower half using the eight sets of hardware.

Troubleshooting

If the SR-75 release mechanism fails to operate when testing it, or if the SM-75 does not respond to commands, check the following in the order presented:

1. Verify that the address and release code are being entered correctly. The factory default address is 0, and the release code is the serial number of the SM-75 which is printed on the serial tag.
2. Check the battery pack by sending the Release Status command as described in "Checking the Status of the SM-75" on page 3-6.
3. Move the remote transducer used with the ATM-891 and the SM-75 transducer farther apart or closer together
4. When using a terminal program, use the Remote Power command (AT$pn,m) to change the transmit power level, usually to a lower level. For instructions on how to use the Remote Power command, refer to Section 6, "Modem Operating Modes and Commands," of the "Acoustic Telemetry Modems User's Manual." If using Telesonar PC, refer to Section 5, "Telesonar PC," of the manual.
5. Check or replace the battery pack as described in "Replacing the Battery Pack" on page 4-2.

Should further help be required, contact Benthos directly. Refer to "Customer Service" on page vi for information on how to contact Benthos.

5 User Replaceable Parts

Below is a list of common user replaceable parts available from Benthos for the SM-75 SMART Modem. Refer to "Customer Service" on page vi for information on how to contact Benthos to order parts.

Table 5-1 SM-75 SMART Modem User Replaceable Parts

DESCRIPTION	PART NUMBER
Power/Serial Cable	C846-0020
Dummy Plug	011170
Battery Pack	C847-0003
Re-arming Kit (See below)	A-210-226
Spare Parts Kit (See below)	011685
Butyl Rubber Sealant Strip	0900-024
Wide Black Vinyl Tape	0903-013

The Re-arming Kit includes the following items:

- ***(3) Dissolving wire module***
- ***(3) Shackle***
- ***(3) Release lever tip***

The Spare Parts Kit includes the following items:

- ***(1) Magnet***
- ***(1) Butyl rubber sealant strip***
- ***(1) Roll wide black vinyl tape***