SBE 44

Underwater Inductive Modem (UIM)

With RS-232 Interface

User's Manual

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Manual Version #008, 01/31/03
UIM Firmware Version 1.5 & later
SIM Firmware Version 2.3 & later

Limited Liability Statement

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Table of Contents

Section 1: Introduction

This section includes contact information, Quick Start procedure, photos of a standard SBE 44 Underwater Inductive Modem (UIM) shipment, and shipping precautions.

About this Manual

This manual is to be used with the SBE 44 UIM.

It is organized to guide the user from installation through operation. We've included detailed specifications, command descriptions, maintenance information, and helpful notes throughout the manual.

Sea-Bird welcomes suggestions for new features and enhancements of our products and/or documentation. Please e-mail any comments or suggestions to seabird@seabird.com.

How to Contact Sea-Bird

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Business hours:
Monday-Friday, 0800 to 1700 Pacific Standard Time
(1600 to 0100 Universal Time)
Except from April to October, when we are on 'summer time'
(1500 to 0000 Universal Time)

Quick Start

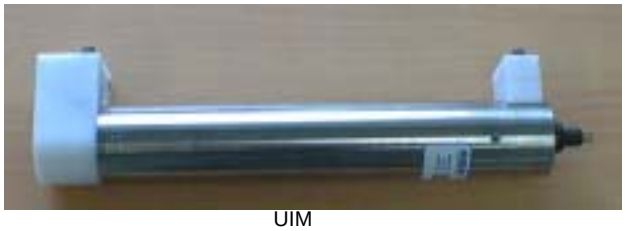
Follow these steps to get a Quick Start using the UIM.
The manual provides step-by-step details for performing each task:

1. Perform pre-check (*Section 3: Preparing UIM for Deployment*):
   A. Install batteries.
   B. Test power and communications, and set UIM ID.

2. Deploy UIM (*Section 4: Deploying and Operating UIM*):
   A. Install new batteries if necessary.
   B. Input system operating parameters.
   C. Deploying multiple UIMs: verify UIM set to *Prompt ID*.
   D. Install cable connecting UIM to serial instrument.
   E. Install UIM on mooring cable.
   F. Install Inductive Cable Coupler (optional) on mooring cable.
   G. Wire system.

Unpacking UIM

Shown below is a typical UIM shipment.



UIM

Batteries

User Manual

Software, and Electronic Copies of
Software Manuals and User Manual

Surface Inductive Modem (SIM) PCB
(one per mooring, optional)

I/O Cable
(only included with SIM)

Inductive Cable Coupler (ICC)
(optional with SIM, one per mooring)

25-pin to 9-pin adapter
(only included with SIM)

Serial Test Cable
(optional)

Shipping Precautions

Assembled battery pack

WARNING!
Do not ship assembled battery pack by commercial aircraft.

The UIM was shipped from the factory with the batteries packaged separately within the shipping box (not inside the UIM). Before attempting to communicate with the UIM, the batteries must be installed following the instructions in *Section 3: Preparing UIM for Deployment*.

IMPORTANT NOTE:
Depending on their classification, the shipment of lithium batteries is subject to safety regulations concerning Dangerous Goods or Hazardous Material imposed by the U.S. Department of Transportation (DOT) and the International Air Transportation Association (IATA). Other countries may also have their own regulations. The UIM uses a lithium battery pack comprised of six parallel 9-volt batteries. Each of the three cells in the 9-volt battery contains less than 2 grams of lithium. In this form, the batteries are not considered Dangerous/Hazardous Goods, and may be shipped without restriction if they are **NOT** connected together and they are packaged to prevent accidental shorting of the battery contacts.

When two or more 9-volt battery sticks are assembled into the instrument's battery pack (either inside or outside the instrument housing), they are connected in parallel and **ARE** classified as **Dangerous/Hazardous Goods**. The *assembled battery pack* does not comply with DOT and IATA regulations requiring battery packaging test documentation and therefore **MUST NOT BE SHIPPED VIA COMMERCIAL AIRCRAFT** (those governed by DOT or IATA), **INCLUDING PASSENGER AIRLINES, OR CARGO CARRIERS SUCH AS FEDEX, DHL, UPS, ETC**.

Batteries packed for shipment by commercial aircraft

If you will re-ship the UIM by commercial aircraft after you have finished testing:

1. Remove the battery pack assembly from the UIM.
2. Remove the batteries from the battery pack assembly.
3. Pack the batteries separately to prevent accidental shorting of the battery contacts.

Note:
All setup information is preserved in EEPROM when the batteries are removed.

Note:
Batteries must be removed before returning the instrument to Sea-Bird. Do not return used batteries to Sea-Bird when shipping the UIM for repair.

Section 2: Description of UIM

This section describes the functions and features of the UIM, including specifications, dimensions, and mooring requirements.

System Description

Note:
For detailed information on inductive modem systems, see *Real-Time Oceanography with Inductive Moorings*, at www.seabird.com under *Technical Papers*.

Note:
Half-duplex communication is **one-direction** at a time (i.e., you cannot send commands and receive data at the same time). For example, if the SIM commands a UIM to upload data from the serial instrument, nothing else can be done while the data is being sent – the data upload cannot be stopped, and commands cannot be sent to other UIMs on the line.

The SBE 44 Underwater Inductive Modem (UIM) makes it possible to integrate current meters, Doppler profilers, or other instruments having standard serial interfaces with MicroCATs or other instruments that communicate via Sea-Bird's inductive modem telemetry system. The UIM has a built-in inductive cable coupler (split toroid) and cable clamp, providing data communications without the need for electrical connections, and an easy and secure attachment to any point on a jacketed mooring wire. An underwater bulkhead connector on the end cap provides the serial data connection, an optional control line, and optional switched power out. Designed for moorings and other long duration, fixed-site deployments, UIMs have non-corroding titanium housings rated for operation to 7000 meters (23,000 feet).

When using the UIM, all that is required to link a computer or data logger to a serial instrument is a Surface Inductive Modem (SIM) PCB and a jacketed mooring wire. Communication between the PC or data logger and the SIM is full-duplex RS-232C (RS-485 optional). Commands and data are transmitted half-duplex between the SIM and the UIM. The UIM interprets the commands, relays correctly addressed commands to the serial instrument, and transmits replies from the instrument to the SIM.

The UIM transmits data over any insulated wire. Communication on a mooring is typically via the jacketed mooring wire. Laboratory bench testing may be performed by simply looping any insulated wire through the inductive core and connecting the ends of the wire to the SIM PCB. Cables up to 7000 meters (23,000 feet) long with impedances up to 4000 ohms can be used. The superiority of the DPSK telemetry system provides a high degree of immunity from *fishbite* or other cable degradation and permits pre-deployment testing when the mooring cable is wound on a spool (the wound cable forms an air coil with significant inductive impedance).

Each UIM has a unique programmable address (ID), allowing up to 100 UIMs (or other instruments compatible with the Sea-Bird inductive modem) to be attached to a single mooring cable. Upon receipt of a global wakeup command, the SIM sends a tone for two seconds, waking all the UIMs on the cable. When the UIM receives a command containing its unique ID, it relays the command to the serial instrument and then transmits the reply over the inductive link. A 30 Kbyte FIFO buffer allows the UIM to interface to serial instruments at 300, 600, 1200, 2400, 4800, or 9600 baud while transmitting the data at 1200 baud over the inductive modem link. Programmable setup parameters stored in EEPROM include timeout values, control signal logic, and sensor response termination logic, allowing the UIM to interface to a wide variety of instruments without requiring custom programming. A global power-off command returns all the UIMs to a quiescent (sleep) stand-by state. The UIM automatically returns to the quiescent state if there is no line activity for a user-specified length of time.

Data can be requested and transmitted from the serial instrument in several ways, including:

- **Relay command** – sends a user-defined command string, character, or break recognizable by the serial instrument. This command is sent to a specific UIM, which transmits the character string / break to the serial instrument. The serial instrument replies to the UIM, which immediately transmits the reply to the UIM, SIM, and computer/controller. Use a Relay command when you want data from a particular serial instrument, and do not want to synchronize with data from other serial instruments.

- **Get Data command** – sends a user-defined character string recognizable by the serial instrument. Get Data can be global (sent to all UIMs on the cable) or local (sent to a specific UIM). The UIM transmits the character string to the serial instrument. The serial instrument replies to the UIM, which holds the reply in a buffer. Another command gets the reply from a specific UIM and transmits it to the SIM and computer/controller. Use the global Get Data command when you want synchronized data from each UIM (and attached serial instrument) on the cable.

The UIM's internal battery uses camera-type lithium cells in a 9-volt, 7.2 Ampere-hour pack. The UIM can be externally powered, and can provide power to the serial instrument from either the external source or its internal battery pack, via the switched power output pin on the bulkhead connector.

The UIM is supplied with a powerful Win 95/98/NT/2000/XP software package, SEASOFT-Win32, which includes:

- **SEATERM** - terminal program for easy communication with the UIM (via the SIM) and data retrieval.

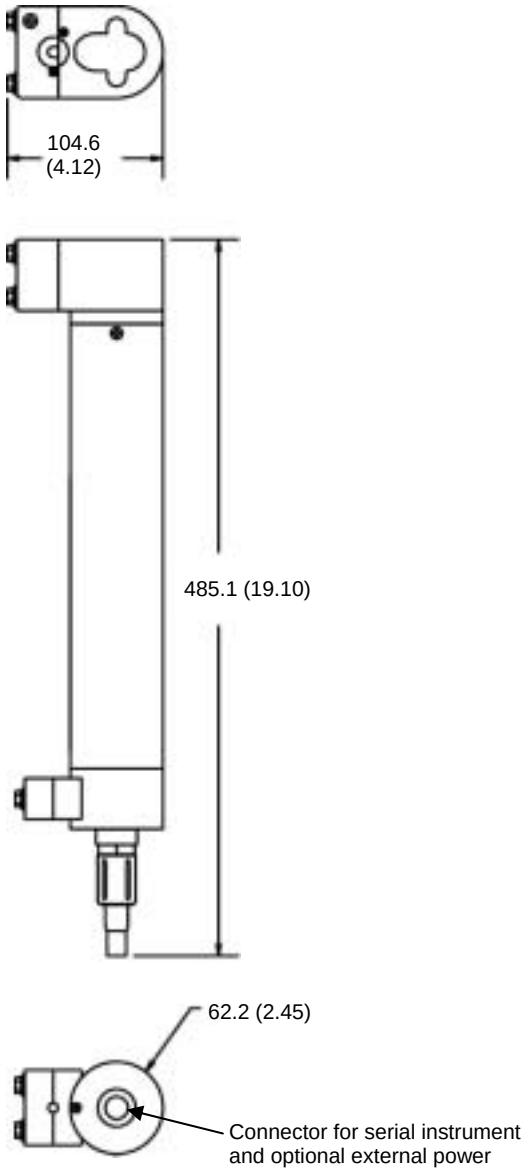
Notes:
- Sea-Bird also supplies a DOS software package, SEASOFT-DOS, which can be used with the UIM. SEASOFT is designed to run on IBM compatible computers (XT/AT/386/486/Pentium). These programs usually perform correctly when run under Windows. However, this manual details only the use of the Windows software with the UIM.
- Help files provide detailed information on the use of SEATERM.
- A separate software manual on CD-ROM contains detailed information on the setup and use of SEASOFT-DOS.

Specifications

Standard Internal Batteries	Nominal 7.2 Ampere-hour pack consisting of six 9-volt lithium batteries. When removed from UIM and battery pack, and batteries packed separately, batteries can be shipped without hazardous material restrictions.
Current	Quiescent Current: < 100 microamps Operating Current: 10 milliamps
Materials	Titanium pressure case rated at 7000 meters (23,000 feet)
Serial Instrument Interface	RS-232 standard
Weight	*In water:* 2.1 kg (4.7 lbs) *In air:* 3.2 kg (7.1 lbs)

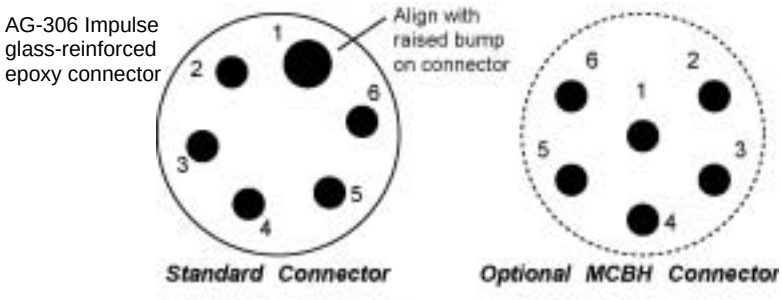
Dimensions

Dimensions in millimeters (inches).



Bulkhead Connector

Note:
See *Appendix V: UIM Interface PCB Configuration* for details on required jumper settings for switched power out and control signal.



Pin	Description
1	Common
2	RS-232C Receive from serial instrument
3	RS-232C Transmit to serial instrument
4	Switched power out (optional)
5	Control signal (optional)
6	External power in (10-20 VDC) (optional)

External Power (optional)

The UIM can be powered from an external source through pin 6 on the bulkhead connector. The UIM's internal battery pack is diode-OR'd with the external source, so **power for the UIM** is drawn from whichever voltage source is higher. The UIM can also be operated from the external supply without having the lithium batteries installed.

Power for the serial instrument (if connecting to pin 4, switched power out, on the bulkhead connector) is drawn from the UIM's battery pack or from the external power source, depending on the setting of jumper J2 on the UIM Interface PCB. See *Appendix V: UIM Interface PCB Configuration* for details.

Surface Inductive Modem (SIM)

A Surface Inductive Modem (SIM) PCB is required for communication with the UIM. The SIM must be supplied with 7 to 25 volts DC power. The SIM's operating current is approximately 60 milliamps when the modem is active.

The user's computer or buoy controller can be interfaced via RS-232 (optional RS-485) serial port to the SIM. The standard interface protocol between the user's computer/controller and SIM is 1200, 2400, 4800, or 9600 baud (user-selectable); 8 data bits; no parity; RS-232C; with echoing of characters.

The SIM impresses (*modulates*) the mooring cable with a DPSK signal that is encoded with commands received from the computer/controller. The encoded signals are *demodulated* by UIMs coupled to the mooring cable. Replies from UIMs are similarly coupled to the mooring cable and *demodulated* by the SIM.

The DPSK communication link between the SIM and UIM(s) is half-duplex, so talking and listening is sequential only (cannot send and receive at the same time). Although the data link between the SIM and computer/controller is established at 1200, 2400, 4800, or 9600 baud, the DPSK modem communication between SIM and UIMs always operates at 1200 baud. Communication between the UIM and serial instrument is user-selectable at 300, 600, 1200, 2400, 4800, and 9600 baud.

Mooring Cable and Wiring Requirements

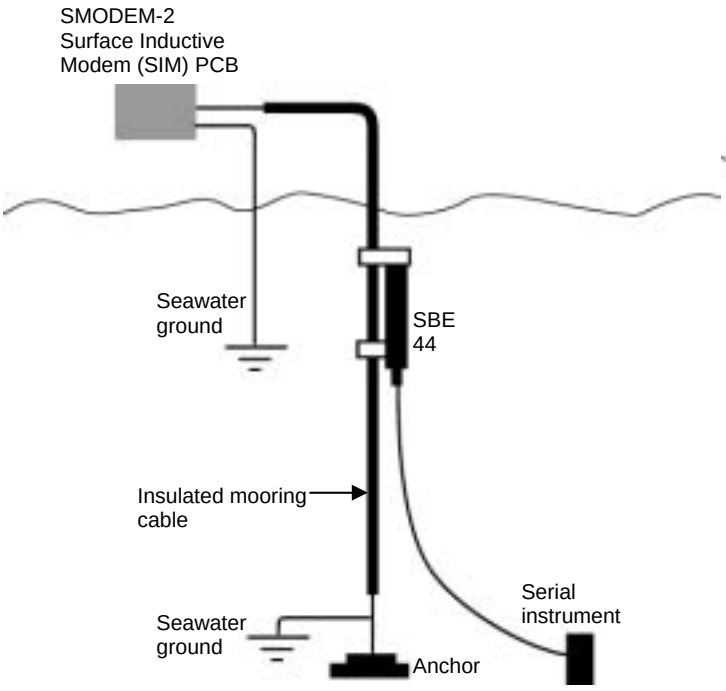
Note:
See *Appendix IV: SIM Hookup and Configuration* for wiring details.

The UIM can mechanically accommodate mooring cables up to 16 mm (0.63 inches) in diameter. Clamps for specific cable diameters are available, or can be supplied on a custom basis. Suitable mooring cables use steel wire rope with a polypropylene or polyethylene insulating jacket. The SIM operates without data errors using up to 7000 meters (23,000 feet) of 3 mm (0.12 inches) or larger cable.

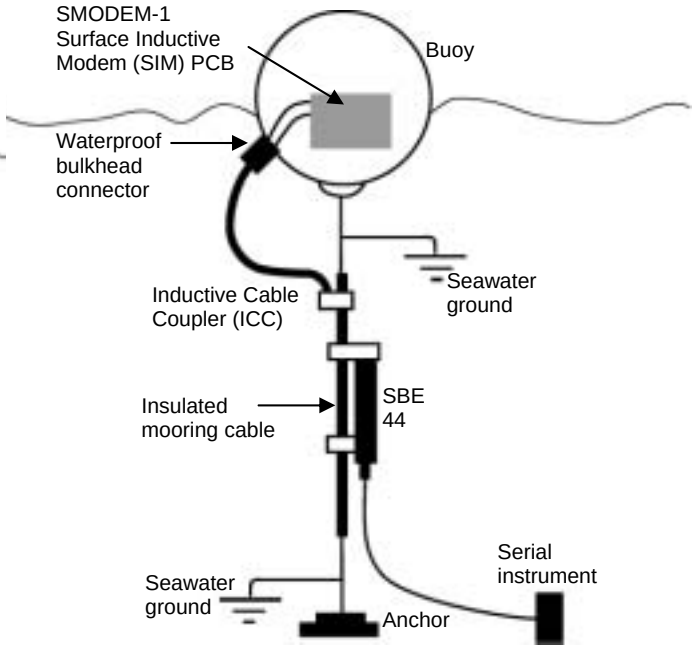
The mooring cable must provide connection to seawater ground below the deepest UIM. This connection is readily provided by leaving a section of cable uninsulated, or terminating it with a metallic rigging terminal, thimble, or clevis.

The mooring cable must also provide for connection to the SIM:

- In a direct connection (typical cable-to-shore applications), the bottom end of the wire is grounded to seawater, and the top end remains insulated to the connection to the SIM. A second wire from the SIM connects to seawater ground, completing the circuit.
- In typical surface buoys it is often preferable to connect the jacketed mooring wire to the buoy with a length of chain, grounding the jacketed wire to seawater at each end. An Inductive Cable Coupler (ICC) connects the SIM to the jacketed wire above the uppermost UIM and below the point where the wire is grounded.



Direct Connection



Connection with ICC

Note:
These illustrations are schematic only. The serial instrument, shown on the ocean floor, is usually clamped to the insulated mooring cable at the desired depth.

Section 3: Preparing UIM for Deployment

This section describes installation of the battery pack, installation of software, testing power and communications, and setting the UIM ID.

Battery Installation

WARNING!
Do not air-ship the UIM with batteries installed.
See Shipping Precautions in *Section 1: Introduction*.

Description of Batteries and Battery Pack

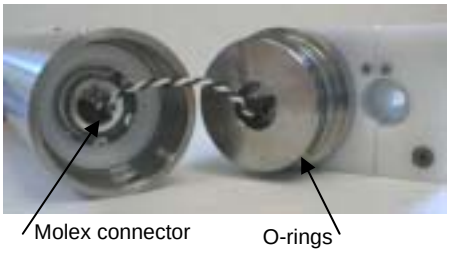
Sea-Bird supplies six 9-volt (nominal 1.2 amp-hour) batteries, shipped with the UIM in a separate bag. Since they use solid-cathode cells and contain a total of less than 2 grams lithium metal, these batteries are not *hazardous material* as defined by IATA or the US DOT. They are free of shipping restrictions, but shipment of the *assembled* battery pack is governed by the Hazardous Material Regulations.

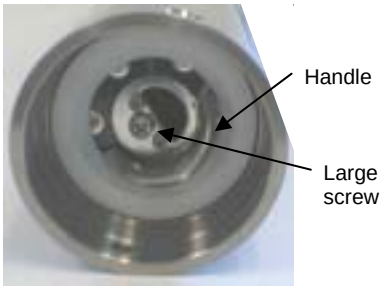
In addition to the six 9-volt batteries, the assembled battery pack consists of:
- a brass sleeve with lower printed circuit board (PCB) containing banana jacks
- upper PCB containing banana plugs

No soldering is required when assembling the battery pack, because the batteries use the banana plugs and jacks as (+) and (-) terminals.

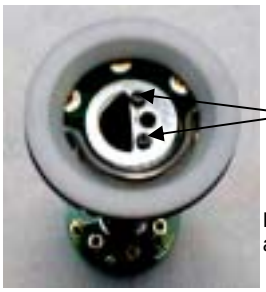
Installing Batteries

1. Remove the modem end cap:
   A. Wipe the outside of the modem end cap and housing dry, being careful to remove any water at the seam between them.
   B. Remove the two flat Phillips-head titanium machine screws. Do not remove any other screws from the housing.
   C. Remove the end cap by pulling firmly and steadily on the plastic cable mounting bracket/inductive coupler. It may be necessary to twist or rock the end cap back and forth or use a non-marring tool on the edge of the cap to loosen it.
   D. The end cap is electrically connected to the electronics with a 3-pin Molex connector. Holding the wire cluster near the connector, pull gently to detach the female end of the connector from the pins.
   E. Remove any water from the O-ring mating surfaces inside the housing with a lint-free cloth or tissue.
   F. Put the end cap aside, being careful to protect the O-rings from damage or contamination.

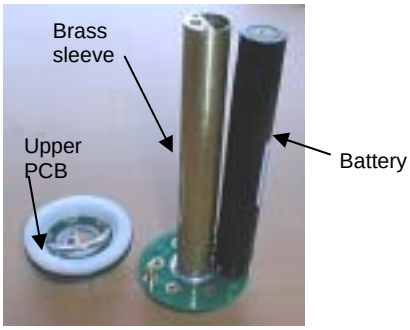




2. Remove the battery pack assembly from the housing:
   A. Remove the large Phillips-head screw and lock washer from the upper PCB.
   B. Lift the battery pack assembly straight out of the housing, using the handle.



3. Remove the two small Phillips-head screws and lock washers from the upper PCB, and lift the upper PCB off the brass sleeve.



4. Insert each 9-volt battery onto the lower PCB, one at a time, banana plug end (+) first. Ensure each battery is fully inserted.

5. Re-install the upper PCB:
   A. Press the upper PCB onto the battery pack assembly, aligning the screw holes and mating banana plugs to the batteries. Ensure the banana plugs are fully inserted into the batteries.
   B. Re-fasten the upper PCB to the battery pack assembly with the two small screws and lock washers.

6. Replace the battery pack assembly in the housing:
   A. Align the D-shaped opening in the upper PCB with the D-shaped notch on the shaft. Lower the assembly slowly into the housing, and once aligned, push gently to mate the banana plugs on the battery compartment bulkhead with the lower PCB.
   B. Secure the assembly to the shaft using the large Phillips-head screw and lock washer. Ensure the screw is tight to provide a reliable electrical contact.

7. Re-install the modem end cap:
   A. Remove any water from the O-rings and mating surfaces in the housing with a lint-free cloth or tissue. Inspect the O-rings and mating surfaces for dirt, nicks, and cuts. Clean as necessary. Apply a light coat of O-ring lubricant (Parker Super O Lube) to the O-rings and mating surfaces.
   B. Plug the female end of the 3-pin Molex connector onto the pins, with the flat portion of the female end against the flat portion of the 'D' cutout. Verify the connector is properly aligned – a backward connection will prevent communication with the computer.
   C. Carefully fit the end cap into the housing until the O-rings are fully seated.
   D. Re-install the flat Phillips-head titanium screws to secure the end cap.

Software Installation

Note:
It is possible to use the UIM without SEATERM by sending direct commands from a dumb terminal or terminal emulator, such as Windows HyperTerminal.

If not already installed, install SEATERM and other Sea-Bird software programs on your computer using the supplied software CD:
1. Insert the CD in your CD drive.
2. Double click on **Seasoft-Win32.exe**.
3. Follow the dialog box directions to install the software.

The default location for the software is c:/Program Files/Sea-Bird. Within that folder is a sub-directory for each program.

Power and Communications Test and Setting UIM IDs

The power and communications test will verify that the system works, prior to deployment. Testing requires a computer (*Computer #1*) to send commands to the SIM, and requires connection of the UIM's bulkhead connector:

- to the serial instrument you intend to use when deployed, **or**
- to a second computer to simulate the serial instrument (*Computer #2*)

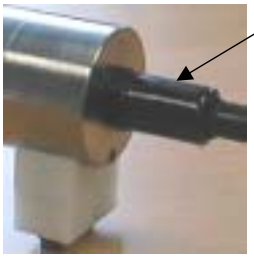
Test Setup

1. Loop insulated wire through the UIM's modem coupling core to simulate a mooring cable. Connect the test wire ends to the SIM's mooring cable terminals (JP4). Connection polarity when testing is not important. (See *Appendix IV: SIM Hookup and Configuration* for detailed information.)

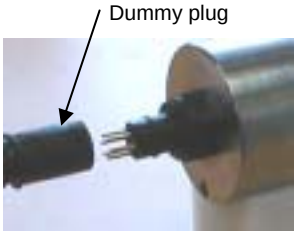
Note:
Important! For Normal Deployed operation, re-install the jumper across J5.

2. On the SIM, remove the jumper on J5 (see *Appendix IV*). This inserts a 1K resistor in series with the inductive loop and reduces signal amplitude, preventing UIMs that are near, but not attached to, the inductive loop from responding to commands (especially important when sending ***ID=** command).

3. Connect the SIM to a 7-25 VDC power supply. Approximately 60 milliamperes are required. **Do not turn on the power supply yet**.



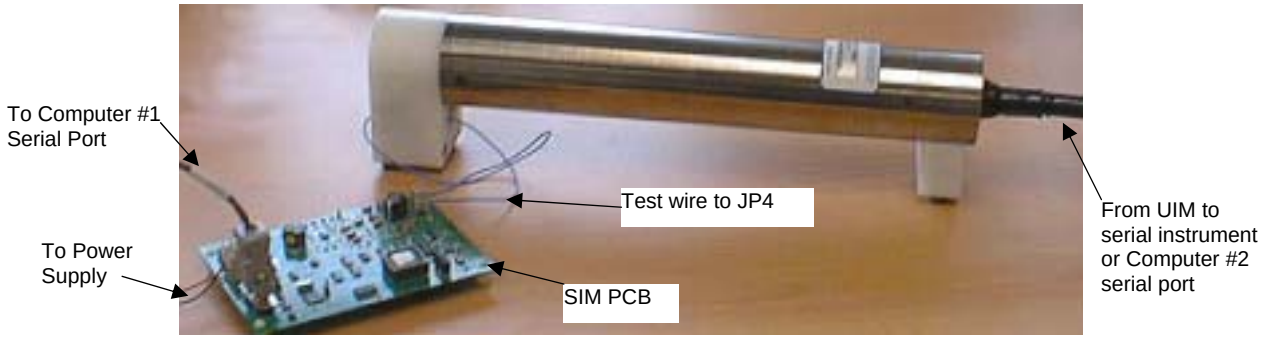
4. Connect the SIM to Computer #1's serial port using the 9-pin to 25-pin cable supplied with the SIM. A 25-to-9 pin adapter is supplied for use if the computer has a 9-pin serial port.



5. If a dummy plug and locking sleeve is installed on the connector: By hand, unscrew the locking sleeve from the UIM's bulkhead connector. **If you must use a wrench or pliers, be careful not to loosen the bulkhead connector instead of the locking sleeve**. Remove the dummy plug from the UIM's bulkhead connector by pulling the plug firmly away from the connector.

6. Install the serial instrument cable or the test cable:
Standard Connector - align the raised bump on the side of the connector with the large pin (pin 1 - ground) on the UIM. **OR**
MCBH Connector – align the pins with the pins on the UIM.

7. Connect the other end of the serial instrument or test cable to the desired instrument or to Computer #2.



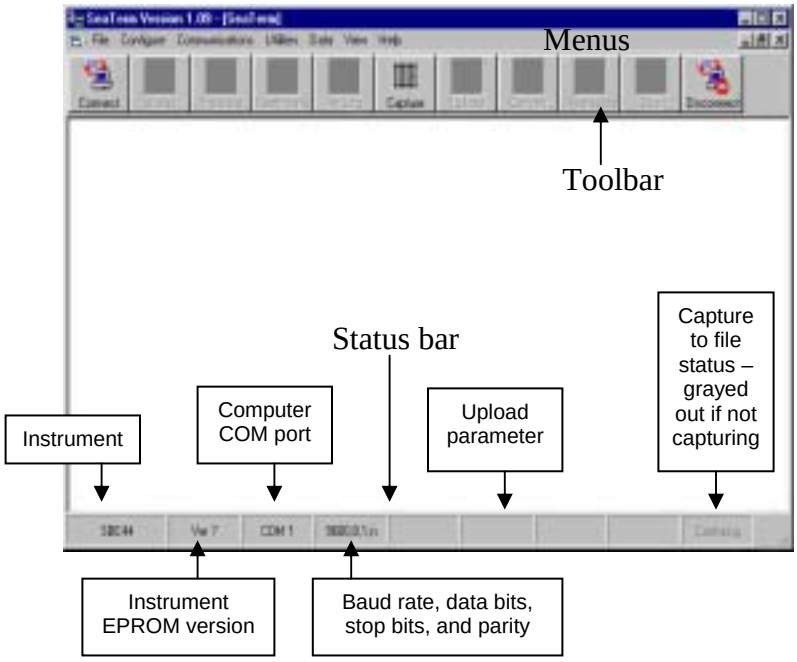
Test and Set UIM ID

Note:
See SEATERM's help files for detailed information on the use of the program.

1. **On Computer #1** - Double click on SeaTerm.exe. If this is the first time the program is used, the setup dialog box appears:

Select the instrument type (SBE 44) and the computer COM port for communication with the SBE 44. Click OK.

2. The main screen looks like this:



- Menus – Contains tasks and frequently executed instrument commands.
- Toolbar – Contains buttons for frequently executed tasks and instrument commands. All tasks and commands accessed through the Toolbar are also available in the Menus. To display or hide the Toolbar, select View Toolbar in the View menu. Grayed out Toolbar buttons are not applicable.
- Command/Data Echo Area – Echoes a command executed using a Menu or Toolbar button, as well as the instrument's response. Additionally, a command can be manually typed in this area, from the available commands for the instrument. Note that the instrument must be *awake* for it to respond to a command (use the Connect button on the Toolbar to wake up the instrument).
- Status bar – Provides status information. To display or hide the Status bar, select View Status bar in the View menu.

Note:
There is at least one way, and as many as three ways, to enter a command:
- Manually type a command in Command/Data Echo Area
- Use a menu to automatically generate a command
- Use a Toolbar button to automatically generate a command

Note:
Once the system is configured and connected (Steps 3 through 5 below), to update the Status bar:
- on the Toolbar, click Status; or
- from the Utilities menu, select Instrument Status.

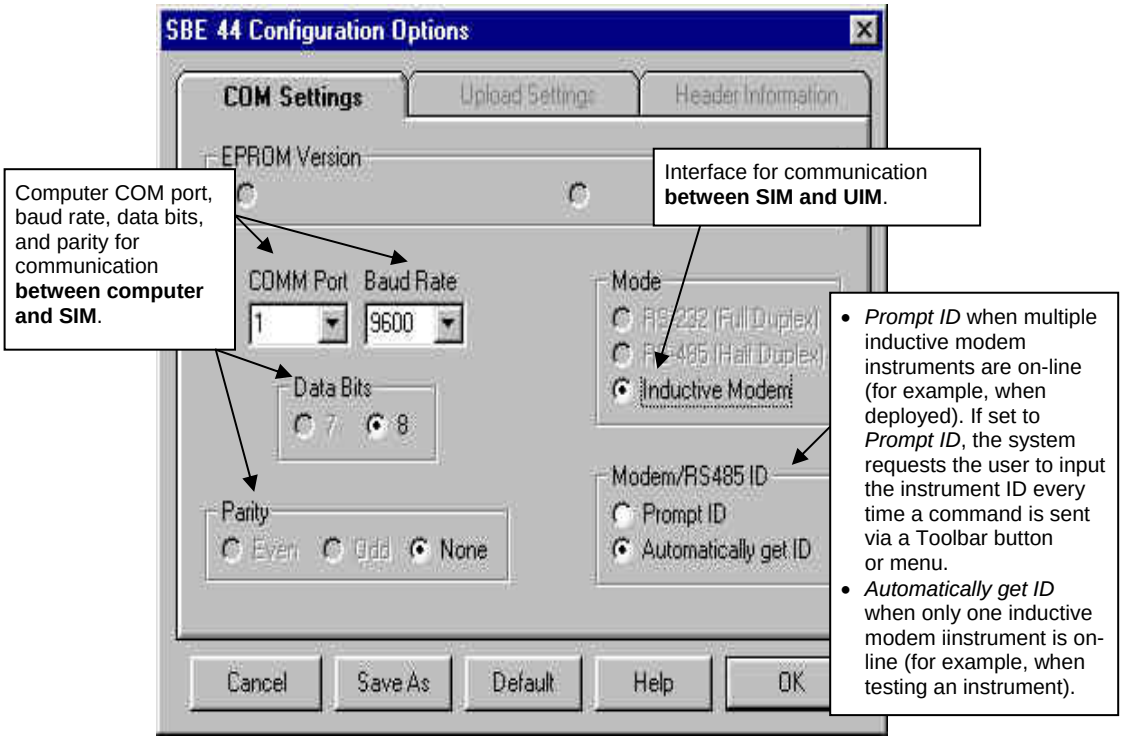
SEATERM sends the status command, which displays in the Command/Data Echo Area, and updates the Status bar.

Following are the Toolbar buttons applicable to the UIM:

Toolbar Buttons	Description	Equivalent Command*
Connect	Re-establish communications by sending wakeup tone to **all** UIMs. Computer responds with S> prompt. UIMs *go to sleep* after user-programmable timeout (**!iiTIMEOUT** – default is 120 seconds) without communication from computer have elapsed.	**PWRON**
Status	Display instrument setup status (timeout settings, power-up settings, etc.).	**!iiDS**
Capture	Capture instrument responses on screen to file. File has .cap extension. Press Capture again to turn off capture. Capture status displays in Status bar.	—
Disconnect	Free computer COM port used to communicate with UIM. COM port can then be used by another program.	—

*See *Command Descriptions* in *Section 4: Deploying and Operating UIM*.

3. In the Configure menu, select SBE 44. The dialog box looks like this:



Make the selections in the Configuration Options dialog box:

- **COMM Port**: COM 1 through COM 10, as applicable
- **Baud Rate**: 1200, 2400, 4800, or 9600, as applicable
- **Data Bits**: 8
- **Parity**: None
- **Mode**: Inductive Modem
- **Modem/RS485 ID**: Automatically get I.D.

Click OK to overwrite an existing configuration file, or click Save As to save the configuration as a new filename.

Note:
When deploying on a mooring cable with multiple UIMs, change **Modem/RS485 ID** to **Prompt ID** after testing is complete.

Note:
The display shows *37* because the SIM was originally developed for the SBE 37-IM MicroCAT.

4. Turn on the SIM power supply (if already on, turn it off and then on again). The display looks like this:

```
37 SURFACE MODEM V 2.3
S>
Sending wake up tone, wait 4 seconds
S>
```

This shows that correct communications between the computer and the SIM has been established, and the SIM has sent the wake-up signal to the UIM.

If the system does not respond as shown above:

- Click the Connect button on the Toolbar.
- Verify the correct instrument was selected in the Configure menu and the settings were entered correctly in the Configuration Options dialog box. Note that the baud rate is documented on the Configuration Sheet.
- Check cabling between the computer, the SIM, and the UIM.

5. Click the Connect button on the Toolbar. This allows the system to use the *Automatically get ID* feature when using the Toolbar keys or menus.

Note:
The SIM and UIM have timeout algorithms designed to:

- restore control to the computer if an illegal command is sent
- conserve battery energy if too much time elapses between commands

If the system does not appear to respond, see *Timeout Descriptions* in *Section 4: Deploying and Operating UIM* for details.

6. Confirm the UIM has responded to the wake-up signal by typing **ID?** and pressing the Enter key. The display looks like this:

```
id=01
```

where 01 is the number set at the factory or by the previous user. See the Configuration Sheet for the factory-set identification (ID) number. Note that the ID is stored in the UIM's EEPROM and can be changed so that multiple UIMs on a single mooring each have a unique ID.

Press the Enter key to get the S> prompt.

7. Display UIM status information by typing **!iiDS** (ii=UIM ID) and pressing the Enter key. The display looks like this:

```
SBE 44 UNDERWATER MODEM V 1.5
sensor baud rate = 9600
break character length = 500 milliseconds
time out after 30 seconds without receiving a valid command
termination character is 62, char =>
Relay Command Settings:
  relay termination characters = <CR><LF>
  total time for response = 15 seconds
  wait 0 milliseconds before sending the command
  halt relay after a gap of 1000 milliseconds between characters
GDATA Command Settings:
  total time for response = 30 seconds
  wait 0 milliseconds before sending the command
  halt acquisition after a gap of 1000 milliseconds between characters
  GDATA command string = NO STRING
include gdata reply delay in datann reply
do not enable control line on power up
enable control line before relaying command
enable control line before sending GDATA command
do not switch power to sensor on power up
switch power to sensor before relaying command
switch power to sensor before sending GDATA command
```

Press the Enter key to get the S> prompt.

Note:
Steps 8 through 10 apply if you are connected to a second computer for testing purposes. If you are connected to the sensor (serial instrument), test the system using the commands described in *Command Descriptions* in *Section 4: Deploying and Operating UIM*.

8. **On Computer #2** – Set up Computer #2 as if it was an SBE 37 communicating with RS-232:
   A. Double click on SeaTerm.exe.
   B. If the setup dialog box appears, select the instrument type (**SBE 37**) and the computer COM port for communication with the SBE 37. Click OK.
   C. In the main screen's Configure menu, select **SBE 37**.
   D. Make the selections in the Configuration Options dialog box:
      - **COMM Port**: COM 1 through COM 10, as applicable
      - **Baud Rate**: (baud rate reported as **sensor baud rate** from Computer #1 in Step 7)
      - **Data Bits**: 8
      - **Parity**: None
      - **Mode**: RS-232 (Full Duplex)
      - **Modem/RS485 ID**: (not applicable)

      Click OK to overwrite an existing configuration file, or click Save As to save the configuration as a new filename.

9. **On Computer #1** – Type **#iiSENSORTEST** (ii=UIM ID).

10. **On Computer #2** – Display should show **SENSORTEST**. Immediately begin typing on Computer #2. The characters will echo on Computer #1, until one of the following end-of-relay conditions are met:
    - SIM times out (default for total time allowed for reply is 20 seconds)
    - UIM times out (default for total time allowed for reply is 15 seconds)
    - UIM receives a termination character (default is >)
    - UIM detects a gap between received characters in the reply (default is 1000 milliseconds), which acts as a termination character

The remaining steps refer to commands on **Computer #1**.

11. Each UIM on a mooring must have a unique ID for communicating with the SIM and computer:
    A. Set the UIM ID by typing ***ID=ii** (ii= user-assigned ID number) and pressing the Enter key.
    B. The computer responds by requesting verification, requiring you to again type ***ID=ii** and press the Enter key.
    C. Record the ID for future reference.
    D. Press the Enter key to get the S> prompt.
    E. Click the Connect button on the Toolbar. This allows the system to use the *Automatically get I.D.* feature when using the Toolbar keys or menus.

12. Command the UIM to go to sleep (quiescent state) by typing **PWROFF** and pressing the Enter key.

Note:
Important! When testing and ID setting is complete for all the UIMs, re-install the J5 jumper on the SIM PCB.
The jumper must be installed for Normal Deployed operation.

The UIM is ready for deployment.

Section 4: Deploying and Operating UIM

This section provides instructions for deploying the UIM.
It also includes a discussion of system operation, example sets of commands, and detailed command descriptions.

Setup for Deployment

1. Install new batteries or ensure the existing battery pack has enough capacity to cover the intended deployment. See *Section5: Routine Maintenance* for details on installing new batteries.

2. Program the UIM for the intended deployment (*see Section 3: Preparing UIM for Deployment* for connection information; see information in this section on operation and commands):

   A. Establish the system operating parameters.

   B. If the system will have multiple underwater inductive modems on the mooring cable (SBE 44 UIMs and/or SBE 37-IM MicroCATs, SBE 16/16*plus* IMs), verify the UIM is set to *Prompt ID* to allow use of the Toolbar buttons and Menus:
      1) In the Configure menu, select SBE 44.
      2) Click on the COM Settings tab.
      3) For Modem/RS485 ID, click on *Prompt ID*.
      4) Click OK or Save As.

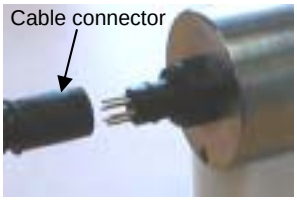
UIM Deployment

The UIM comes with pre-installed Sea-Bird mounting brackets.

1. Attach the mounting brackets to the insulated mooring cable:
   A. Open each mounting bracket by unthreading the two large titanium hex bolts.
   B. Place the insulated mooring cable inside the brackets' grooves.
   C. Reinstall each bracket half with the hex bolts.
   D. Verify that the two halves of the modem coupling toroid have come together evenly.

2. Verify that the hardware and external fittings are secure.

CAUTION:
Do not use WD-40 or other petroleum-based lubricants, as they will damage the connectors.

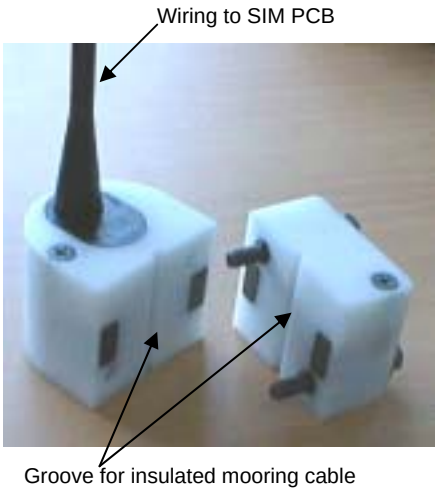


3. Install the serial instrument cable on the UIM:
   A. Lightly lubricate the inside of the cable connector with silicone grease (DC-4 or equivalent).
   B. **Standard Connector** (shown in photos) - Install the cable connector, aligning the raised bump on the side of the connector with the large pin (pin 1 - ground) on the UIM. Remove any trapped air by *burping* or gently squeezing the plug/connector near the top and moving your fingers toward the end cap. **OR**
   MCBH Connector – Install the cable connector, aligning the pins
   C. Place the locking sleeve over the connector. Tighten the locking sleeve finger tight only. **Do not overtighten the locking sleeve and do not use a wrench or pliers.**

4. Attach the other end of the cable to the serial instrument.

5. Deploy the UIM.

System Installation and Wiring



For system installation and wiring details, refer to:
- *Mooring Cable and Wiring Requirements* in *Section 2: Description of UIM.*
- *Appendix IV: SIM Hookup and Configuration*.

Installing Optional Inductive Cable Coupler (ICC)

1. Loosen the two titanium hex head bolts connecting the two halves of the ICC. Pull the halves apart.

2. Place the two halves of the ICC around the insulated mooring cable, with the cable inside the groove.

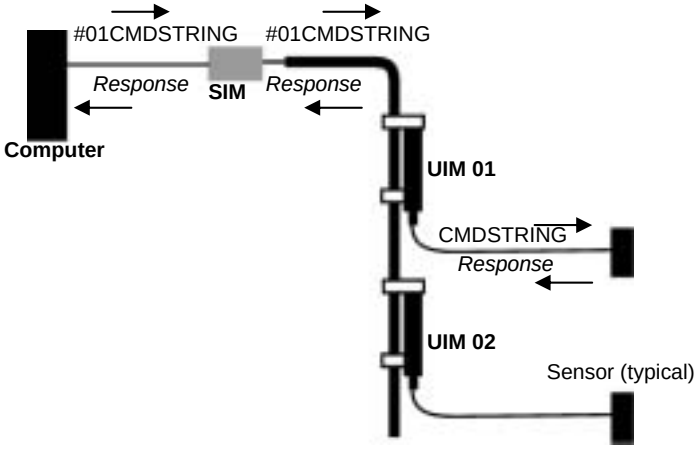
3. Re-tighten the hex bolts, securing the insulated mooring cable in the ICC.

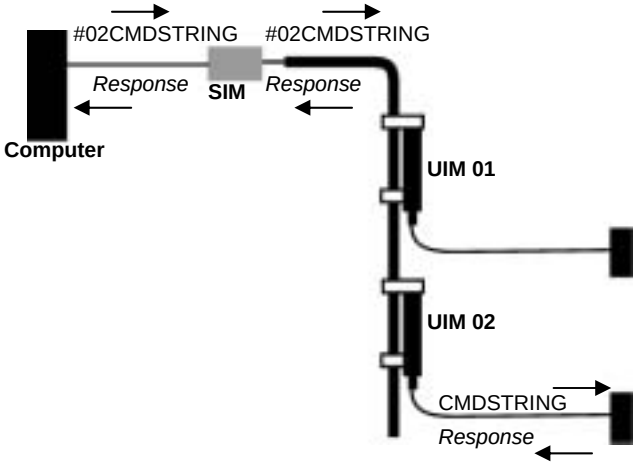
Operation Description

Commands sent to the SIM can be directed to the SIM, the UIM, or the serial instrument (sensor). A command prefix that includes the UIM ID (ii) directs commands to a specific UIM. Global commands do not require a prefix and are recognized by all UIMs attached to the same inductive cable.

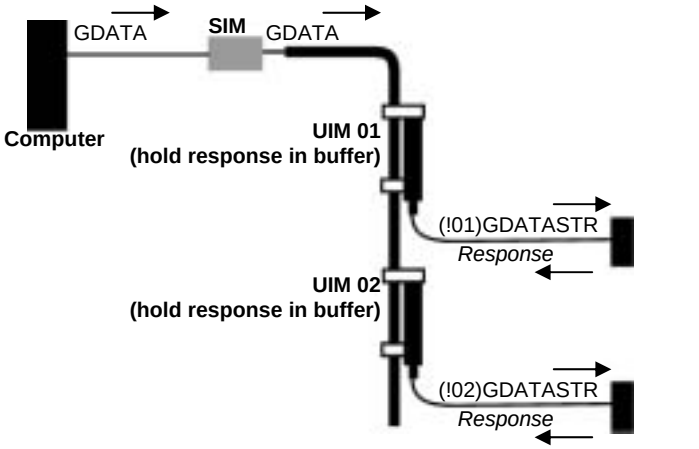
Data can be requested and transmitted from the sensor in several ways:

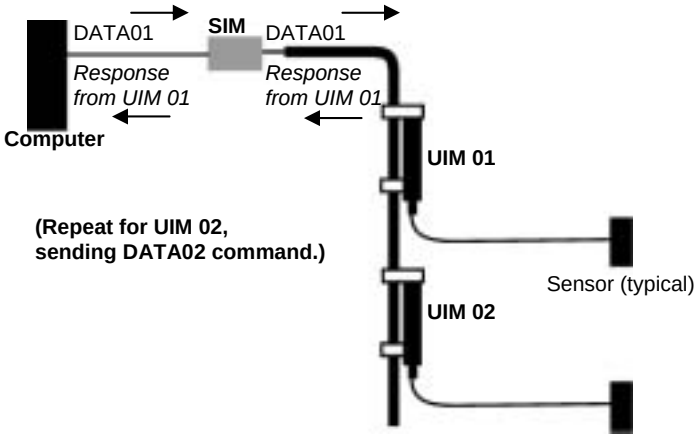
- A Relay command sends a user-defined command (a command string, character, or break character) recognizable by the sensor. This command is sent to a specific UIM, which transmits the character string/break to the sensor. The sensor replies to the UIM, which immediately transmits the reply to the UIM, SIM, and computer/controller. Use a Relay command when you want data from a particular sensor at a particular time, and do not need to synchronize with data from other sensors.
  Relay commands include **#iiCMDSTRING** (command string), **!iiSENDCHARW=x** (decimal value of character), and **!iiSENDBREAK** (break character). The use of **#iiCMDSTRING** is illustrated below; the other commands work in a similar manner.





- A Get Data command sends a pre-defined (by the user) character string recognizable by the sensor. A different character string can be pre-defined for each UIM (and associated sensor). Get Data can be global (sent to all UIMs on the cable) or local (sent to a specific UIM). The UIM transmits the character string to the sensor. The sensor replies to the UIM, which holds the reply in a buffer. The **DATAii** command gets the reply from a specific UIM and transmits it to the SIM and computer/controller. Use the global Get Data command (**GDATA**) when you want synchronized data from each UIM on the cable.





Operating Modes

Note:
See *Appendix V: UIM Interface PCB Configuration* for jumper settings for standard, switched power out, and control signal modes.

The UIM has three basic operating modes that affect how power is provided to the serial instrument:

- **Standard –** The serial instrument is powered independent of the UIM. The instrument can be set up for continuous logging (if applicable), or intermittent commands to take samples can be sent through the UIM.

- **Optional Switched Power Out (pin 4 on bulkhead connector) –** The serial instrument is powered by the UIM's internal batteries or by optional external power input to the UIM (pin 6). In this mode, power is applied to the instrument:
  - On command (when **!iiSWPWRON** command sent)
  - Automatically when UIM powers on (if **!iiAUTOSWPWRPON=Y**), **or**
  - Automatically when a
    Relay command (if **!iiAUTOSWPWRRELAY=Y**) or
    Get Data command (if **!iiAUTOSWPWRGDATA=Y**) is sent.

  This mode is not compatible with continuous logging by the instrument, because power is removed from the instrument when the UIM enters the quiescent (sleep) state.

- **Optional Control Signal (pin 5 on bulkhead connector) –** The control signal can be 0 to 5 Volt or open collector, and is used to turn the serial instrument power on and off. In this mode, the control signal is enabled:
  - On command (when **!iiCNTLON** command sent)
  - Automatically when UIM powers on (if **!iiAUTOCNTLON=Y**), **or**
  - Automatically when a
    Relay command (if **!iiAUTOCNTLRELAY=Y**) or
    Get Data command (if **!iiAUTOCNTLGDATA=Y**) is sent.

  This mode is not compatible with continuous logging by the instrument, because the control line is disabled when the UIM enters the quiescent (sleep) state.

For each mode, data stored in the serial instrument's memory can be uploaded through the UIM and SIM. Uploading data may require temporarily resetting system timeouts, to allow sufficient time for data transfer.

Commands can be used in various combinations to provide a high degree of operating flexibility. Review the operating modes, the examples, and the commands described in *Command Descriptions* before setting up your system.

Relay Command Operation

Action	Response		
	Standard Mode	**Optional Switched Power**	**Optional Control Signal**
1. UIM powers on	-	If **!iiAUTOSWPWRPON=Y**, apply power to sensor.	If **!iiAUTOCNTLPON=Y**, enable control line to sensor.
2. UIM receives a command with its ID to be sent to sensor (#iiCMDSTRING, where CMDSTRING is command recognizable by sensor)	-	If **!iiAUTOSWPWRRELAY=Y**, apply power to sensor.	If **!iiAUTOCNTLRELAY=Y**, enable control line to sensor.
	Wait **!iiRSTARTWAIT** milliseconds. Send command to sensor. Send reply to SIM until a Relay timeout condition is met.		
	-	If **!iiAUTOSWPWRRELAY=Y**, remove power from sensor.	If **!iiAUTOCNTLRELAY=Y**, disable control line to sensor
3. UIM powers down	-	If power not already removed from sensor, remove power from sensor.	If control line not already disabled, disable control line.

Get Data Command Operation

Action	Response		
	Standard Mode	**Optional Switched Power**	**Optional Control Signal**
1. UIM powers on	-	If **!iiAUTOSWPWRPON=Y**, apply power to sensor.	If **!iiAUTOCNTLPON=Y**, enable control line to sensor.
2. UIM receives a global Get Data command (GDATA) or a Get Data command with its ID (!iiGDATA)	-	If **!iiAUTOSWPWRGDATA=Y**, apply power to sensor.	If **!iiAUTOCNTLGDATA=Y**, enable control line to sensor.
	Wait **!iiGSTARTWAIT** milliseconds. Send command to sensor (as defined by **!iiGDATASTR=S**). Accept reply until a Get Data timeout condition is met. Store reply in UIM buffer.		
	-	If **!iiAUTOSWPWRGDATA=Y**, remove power from sensor.	If **!iiAUTOCNTLGDATA=Y**, disable control line to sensor
3. UIM receives Dataii command	Send data held in UIM buffer. Note that data in buffer is erased when UIM powers down.		
4. UIM powers down	-	If power not already removed from sensor, remove power from sensor.	If control line not already disabled, disable control line.

Examples

Shown below are examples of the three basic operating modes for a system with two UIMs (IDs 01 and 02) on a mooring cable. Note that the UIM's response to each command is not shown in the examples.

Example: ***Standard Operating Mode*** (user input in bold)

Example 1: Get Data Operation

Send wakeup tone to all UIMs. Pre-define data string to be sent to sensor when Get Data command is used. Data string can be any command understood by sensor (in example, TS is shown for sensor connected to UIM 01; SL is shown for sensor connected to UIM 02). Send power-off command to all UIMs.

S>**PWRON**
S>**!01GDATASTR=TS**
S>**!02GDATASTR=SL**
S>**PWROFF**

Send wakeup tone to all UIMs. Get data from each sensor using the global Get Data command, and store sensor reply in each UIM's buffer. Send data from each UIM to SIM and computer/controller. Send power-off command to all UIMs.

S>**PWRON**
S>**GDATA**
S>**DATA01**
S>**DATA02**
S>**PWROFF**

Example 2: Relay Command Operation

Send wakeup tone to all UIMs. Define data string to be sent to sensor now. Data string can be any command understood by sensor (in example, TS is shown for sensor connected to UIM 01; SL is shown for sensor connected to UIM 02). Sensor reply is sent to SIM and computer/controller. Send power-off command to all UIMs.

S>**PWRON**
S>**#01TS**
S>**#02SL**
S>**PWROFF**

Example: ***Switched Power Mode*** (user input in bold)

Note: Switched power mode requires connection of serial instrument to pin 4 on UIM bulkhead connector.

Example 1: Get Data Operation

Send wakeup tone to all UIMs. Pre-define data string to be sent to sensor when Get Data command is used. Data string can be any command understood by the sensor (in example, TS is shown for sensor connected to UIM 01; SL is shown for sensor connected to UIM 02). Set up each UIM to switch power on to sensor automatically before relaying Get Data command string. Send power-off command to all UIMs.

S>**PWRON**
S>**!01GDATASTR=TS**
S>**!02GDATASTR=SL**
S>**!01AUTOSWPWRGDATA=Y**
S>**!02AUTOSWPWRGDATA=Y**
S>**PWROFF**

Send wakeup tone to all UIMs. Get data from each sensor using global Get Data command, and store sensor reply in each UIM's buffer. Send data from each UIM to SIM and computer/controller. Send power-off command to all UIMs.

S>**PWRON**
S>**GDATA**
S>**DATA01**
S>**DATA02**
S>**PWROFF**

Example 2: Relay Command Operation

Send wakeup tone to all UIMs. Set up each UIM to switch power on to sensor automatically before sending a Relay command. Send power-off command to all UIMs.

S>**PWRON**
S>**!01AUTOSWPWRRELAY=Y**
S>**!02AUTOSWPWRRELAY=Y**
S>**PWROFF**

Send wakeup tone to all UIMs. Define data string to be sent to sensor now. Data string can be any command understood by the sensor (in example, TS is shown for sensor connected to UIM 01; SL is shown for sensor connected to UIM 02). Sensor reply is sent to SIM and computer/controller. Send power-off command to all UIMs.

S>**PWRON**
S>**#01TS**
S>**#02SL**
S>**PWROFF**

Example: ***Control Line Mode*** (user input in bold)

Note: Control line mode requires connection of serial instrument to pin 5 on UIM bulkhead connector

Example 1: Get Data Operation

Send wakeup tone to all UIMs. Pre-define data string to be sent to sensor when Get Data command is used. Data string can be any command understood by the sensor (in example, TS is shown for sensor connected to UIM 01; SL is shown for sensor connected to UIM 02). Set up each UIM to enable control line automatically before relaying Get Data command string. Send power-off command to all UIMs.

S>**PWRON**
S>**!01GDATASTR=TS**
S>**!02GDATASTR=SL**
S>**!01AUTOCNTLGDATA=Y**
S>**!02AUTOCNTLGDATA=Y**
S>**PWROFF**

Send wakeup tone to all UIMs. Get data from each sensor using global Get Data command, and store sensor reply in each UIM's buffer. Send data from each UIM to SIM and computer/controller. Send power-off command to all UIMs.

S>**PWRON**
S>**GDATA**
S>**DATA01**
S>**DATA02**
S>**PWROFF**

Example 2: Relay Command Operation

Send wakeup tone to all UIMs. Set up each UIM to enable control line automatically before sending a Relay command. Send power-off command to all UIMs.

S>**PWRON**
S>**!01AUTOCNTLRELAY=Y**
S>**!02AUTOCNTLRELAY=Y**
S>**PWROFF**

Send wakeup tone to all UIMs. Define data string to be sent to sensor now. Data string can be any command understood by the sensor (in example, TS is shown for sensor connected to UIM 01; SL is shown for sensor connected to UIM 02). Sensor reply is sent to SIM and computer/controller. Send power-off command to all UIMs.

S>**PWRON**
S>**#01TS**
S>**#02SL**
S>**PWROFF**

Timeout Descriptions

Both the SIM and UIM have timeout algorithms. Set the timeouts to allow proper operation of your serial instrument while minimizing the amount of time the system is tied-up waiting for a response.

SIM Timeouts

SIM timeouts restore control to the computer if no reply is received from the UIM (for example, upon sending an illegal command) within a specified length of time. This allows new commands to be sent. There are two user-programmable SIM timeouts:

Note:
If power is removed from the SIM, the SIM timeouts reset to their default values.

- **DATANNMAX** – timeout that applies to the **DATAii** command only. Default is 1000 milliseconds.
- **RELAYMAX** –timeout that applies to all other commands. Default is 20 seconds.

When using RS-232 between the SIM and computer, control of the SIM can be re-established sooner than the timeout by pressing the Esc key and then the Enter key. When the S> prompt is displayed, new commands can be sent.

UIM Timeouts

There are several user-programmable UIM timeouts.

UIM Power Down Timeout

If the UIM does not receive a command for **!iiTIMEOUT** seconds (ii=UIM ID), the UIM communication circuits power down to prevent exhaustion of its batteries. Default is 120 seconds. **To re-establish control, send the PWRON command or click the Connect button on the Toolbar.**

Send Command String, Send Character, and Send Break Relay Command Timeouts

There are three user-programmable Relay command timeouts, which are used to determine when the sensor reply to a Relay command is complete:

- **!iiTERMCHAR** – If the UIM receives a termination character, it ignores any additional characters received. Default is 62 (‘>’).
- **!iiRTERMMAX** – If the UIM detects a gap between received characters in the reply, it is interpreted as a termination character, and the UIM ignores any additional characters received. Default is 2 seconds.
- **!iiRTOTALMAX** – After a total of **!iiRTOTALMAX** seconds, the UIM ignores any additional characters received. Default is 15 seconds.

Get Data Command Timeouts

There are three user-programmable Get Data command timeouts, which are used to determine when the sensor reply to a Get Data command is complete. These are applicable to both the global Get Data command (**GDATA**) and the Get Data command sent to a specific UIM (**!iiGDATA**):

- **!iiTERMCHAR** – If the UIM receives a termination character, it ignores any additional characters received. Default is 62 ('>').
- **!iiGTERMMAX** – If the UIM detects a gap between received characters in the reply, it is interpreted as a termination character, and the UIM ignores any additional characters received. Default is 2 seconds.
- **!iiGTOTALMAX** – After a total of **!iiGTOTALMAX** seconds, the UIM ignores any additional characters received. Default is 15 seconds.

Command Descriptions

This section describes commands and provides sample outputs.
See *Appendix III: Command Summary* for a summarized command list.

When entering commands:

- Input commands to the UIM in upper or lower case letters and register commands by pressing the Enter key.
- The UIM sends `? CMD` if an invalid command is entered.
- If the system does not return an `S>` prompt after executing a command, press the Enter key to get the `S>` prompt.
- If a new command is not received within **!iiTIMEOUT** (default is 120 seconds) after the completion of a command, the UIM returns to the quiescent (sleep) state.
- If in quiescent state, re-establish communications by clicking the Connect button on the Toolbar or entering the **PWRON** command to get an `S>` prompt.

SIM Commands

SIM commands are directed to the Surface Inductive Modem, to set it up for operation with the Underwater Inductive Modem.

PWRON — Send wakeup tone to **all** UIMs. Equivalent to Connect button on Toolbar.

PWROFF — Send power-off command to **all** UIMs. Main power turned off and UIMs placed in quiescent (sleep) state. Any data in UIM buffer is erased.

DS — Display SIM firmware version and status.

Note:
The response to the **DS** command shows *SBE 37* because the SIM was originally developed for the SBE 37-IM MicroCAT.

Example: (user input in bold)

```
S>DS
SBE 37 SURFACE MODEM V 2.3
wait time for dataNN response = 1000 msec
wait time for relay command response = 20
```

Note:
The SIM's baud rate (set with **BAUD=**) must be the same as SEATERM's baud rate (set in the Configure menu).

BAUD=x — **x**= baud rate between SIM and computer/controller (1200, 2400, 4800, or 9600). Default 9600.

DATANNMAX=x — **x=** timeout (0-65535 milliseconds) that applies to **DATAii** command only. If no reply is received within **x**, control is returned to computer and other commands can be sent. Default 1000 milliseconds.

Note:
DATANNMAX and **RELAYMAX** reset to their default values if power is removed from the SIM.

RELAYMAX=x — **x=** timeout (0-3276 seconds) that applies to all other commands. If no reply is received within **x**, control is returned to computer and other commands can be sent. Default 20 seconds.

ECHOON — Echo characters received from computer (default) - computer monitor will show entered commands as you type.

ECHOOFF — Do not echo characters received from computer - computer monitor will not show entered commands as you type.

ID Commands

Only one UIM can be on-line when sending these commands.

ID? — Display UIM ID (ID = ii, where ii= 0-99).

***ID=ii** — Set UIM ID to ii, where ii= 0-99. This command must be sent twice, because computer requests verification.
If more than one UIM is on-line when sending this command, all UIMs on-line will be set to same ID.

UIM and Sensor Commands

UIM Status Commands

UIM Status commands are preceded by **!ii** (ii = UIM ID).

!iiDS — Display UIM firmware version and status. Equivalent to Status button on Toolbar.

Example: (user input in bold)

```
S>!01DS
SBE 44 UNDERWATER MODEM V 1.5
sensor baud rate = 9600
break character length = 500 milliseconds
time out after 30 seconds without receiving a valid command
termination character is 62, char=>
Relay Command Settings:
  relay termination characters =  <CR><LF>
  total time for response = 15 seconds
  wait 0 milliseconds before sending the command
  halt relay after a gap of 1000 milliseconds between characters
GDATA Command Settings:
  total time for response = 30 seconds
  wait 0 milliseconds before sending the command
  halt acquisition after a gap of 1000 milliseconds between characters
  GDATA command string = NO STRING
include gdata reply delay in datann reply
do not enable control line on power up
enable control line before relaying command
enable control line before sending GDATA command
do not switch power to sensor on power up
switch power to sensor before relaying command
switch power to sensor before sending GDATA command
```

!ii*EETEST — Test UIM's EEPROM as troubleshooting tool, and reset all parameters to default values. **Before performing this test, record all parameters, so they can be reentered after test if desired.**

UIM General Setup Commands

All UIM General Setup commands are preceded by **!ii** (ii = UIM ID).

Note:
The following parameters for communication between the UIM and sensor cannot be modified:
- Data bits – 8
- Stop bits – 1
- Parity – none

!iiBAUD=x

x= baud rate for serial communication **between UIM and sensor** (300, 600, 1200, 2400, 4800, or 9600). Default 9600.

!iiRELAYTERMCHAR=x

x= decimal value (0-255) of **command termination character**. This allows user to specify what is appended to sensor command string for both Send Command String and Get Data commands. See *Appendix VI: Character Map and Values* for characters and decimal values.
If **x=CRLF** (default), UIM appends carriage return and line feed to relayed string.
If **x=NONE**, UIM does not append anything to relayed string.

Examples: (user input in bold)

```
S>!01RELAYTERMCHAR=CRLF
relay termination characters=<CR><LF>

S>!01RELAYTERMCHAR=100
relay termination character set to 100, char = d

S>!01RELAYTERMCHAR=NONE
no relay termination character
```

!iiTERMCHAR=x

x= decimal value (11-122) of **sensor reply termination character**. If UIM receives a termination character, it ignores any additional characters received from sensor. Default is 62 (decimal value for '>'). See *Appendix VI: Character Map and Values* for characters and decimal values. If **!iiTERMCHAR=NONE**, termination character checking is disabled.

!iiTIMEOUT=x

x= UIM timeout (30-1800 seconds). If no commands or replies are received for **x**, UIM automatically enters quiescent (sleep) state. **When UIM enters quiescent state, any data held in its buffer is erased**. Default 120 seconds.

Relay Commands

These commands set up the controls for and send commands relayed from the UIM to the sensor. A Send Command String, Send Character, or Send Break command is sent to one UIM, which transmits it to the connected sensor. Unlike a Get Data command, the sensor response to these commands is sent immediately to the UIM, SIM, and computer/controller. Use a Relay command when you want to obtain data from a particular instrument at a particular time, and are not interested in synchronizing with data from other instruments.

Relay Setup Commands

These setup parameters apply to Send Command String, Send Character, and Send Break commands. Relay setup commands are preceded by **!ii** (ii = UIM ID).

!iiRSTARTWAIT=x — **x=** command transmission delay after setting control line or switched power (0-32767 milliseconds). Delaying transmission allows sensor to wake up before relaying command if **!iiAUTOSWPWRRELAY=Y** or **!iiAUTOCNTLRELAY=Y**. Default 0.

!iiRTERMMAX=x — **x=** termination timeout for sensor reply (0-32767 milliseconds). Gap of **x** after 2 characters have been received acts as termination character – characters sent by sensor after gap are ignored. Default 1000 milliseconds.

!iiRTOTALMAX=x — **x=** total time allowed for sensor reply (0-600 seconds). Characters sent by sensor after **x** are ignored. Default 15 seconds.

Send Command String Command

This command is preceded by **#ii** (ii = UIM ID).

#iiCMDSTRING — Command UIM to send character string defined by **CMDSTRING** to sensor. **CMDSTRING** can be any character string recognized by sensor. UIM can append carriage return and line feed or character (defined by **!iiRELAYTERMCHAR**). Response is sent through UIM to SIM and computer/controller.

Send Character Commands

Send Character commands allow you to send a single character (including a *non-printing* character) to a sensor. These commands are preceded by **!ii** (ii = UIM ID). Termination character parameter **!iiRELAYTERMCHAR** does not apply to these commands.

!iiSENDCHARW=x — Command UIM to send character defined by decimal value **x** to sensor. Character can be any command recognized by sensor. Response is sent through UIM to SIM and computer/controller.

!iiSENDCHAR=x — Command UIM to send character defined by decimal value **x** to sensor. Character can be any command recognized by sensor. **Command should be one that does not require response; UIM does not accept any response from sensor, and is immediately ready to accept another command.**

Examples: (user input in bold)
S>**!01SENDCHARW=101**
(send lower case e; wait for a reply from sensor)

S>**!01SENDCHAR=100**
(send lower case d; do not wait for reply from sensor)

Send Break Commands

These commands set up and send a break character, which may be a signal to some types of sensors to send data. All Break Character commands are preceded by **!ii** (ii = UIM ID).

!iiBREAKLEN=x — **x=** length of break character (0-32750 milliseconds). Default 1000 milliseconds.

!iiSENDBREAK — Command UIM to send break character, as defined by **!iiBREAKLEN**, to sensor. Termination character parameter **!iiRELAYTERMCHAR** does not apply to this command. Response is sent through UIM to SIM and computer/controller.

Get Data Commands

These commands set up controls for and transmit Get Data commands. **GDATA** or **!iiGDATA** cause the sensor command pre-defined by **!iiGDATASTR=S** to be sent from the UIM to the sensor. The sensor reply is held in the UIM buffer until the **DATAii** command is sent. Use the global Get Data command (**GDATA**) to obtain synchronized data from all sensors connected to UIMs on the mooring cable.

Get Data Setup Commands

Get Data Setup commands are preceded by **!ii** (ii = UIM ID).

!iiGSTARTWAIT=x

x= command transmission delay (after setting control line or switched power) (0-32767 milliseconds). Delaying transmission allows sensor to wake up before relaying command if **!iiAUTOSWPWRGDATA=Y** or **!iiAUTOCNTLGDATA=Y**. Default 0.

!iiGTERMMAX=x

x= termination timeout for sensor reply (0-32767 milliseconds). Gap of **x** after 2 characters are received acts as termination character – characters sent by sensor after gap are ignored. Default 1000 milliseconds.

!iiGTOTALMAX=x

x= total time allowed for sensor reply (0-600 seconds). Characters sent by sensor after **x** are ignored. Default 30 seconds.

!iiINCGDATADELAY=x

x=Y (default): In **DATAii** reply, include number of 0.1-second ticks received while waiting for **GDATA** or **!iiGDATA** reply. This may be helpful in verifying sensor/ buoy controller clock synchronization.

x=N: Do not include number of ticks.

!iiGDATASTR=S

S= character string sent to sensor (can be any command recognized by sensor) in response to **GDATA** or **!iiGDATA**. UIM can append carriage return and line feed or a character (defined by **!iiRELAYTERMCHAR**) to string. **!iiGDATASTR=** followed by Enter key disables sending string. Default no string (disabled).

Get Data Commands

Note:
Any data in the UIM buffer is erased when the UIM enters quiescent (sleep) state. Always send the **DATAii** command to transmit the data in the buffer before the UIM timeout (**!iiTIMEOUT**) automatically puts the UIM to sleep and before sending the **PWROFF** command to put the UIM to sleep.

GDATA

Command **all** UIMs to send character string defined by **!iiGDATASTR** to sensor. Each UIM holds sensor reply in buffer until receiving **DATAii**.

!iiGDATA

Command UIM with ID=**ii** to send character string defined by **!iiGDATASTR** to sensor. UIM holds sensor reply in buffer until receiving **DATAii**.

DATAii

Get data obtained with **GDATA** or **!iiGDATA** from buffer of UIM with ID = **ii**. Response sent to SIM and computer/controller.

Switched Power Setup Commands

Note:
See *Appendix V: UIM Interface PCB Configuration* for required jumper settings on the UIM's Interface PCB.

These commands set up the controls for optional switched power operation (pin 4 on bulkhead connector). All Switched Power Setup commands are preceded by **!ii** (ii = UIM ID).

!iiSWPWRON	Switch power on to sensor now. Power to sensor remains on while UIM remains awake. When UIM enters quiescent (sleep) state, power to sensor switches off.
!iiSWPWROFF	Switch power off to sensor now.
!iiAUTOSWPWRPON=x	**x=Y**: Switch power on to sensor automatically each time UIM powers on. When UIM enters quiescent (sleep) state, power to sensor switches off automatically. Note that entering this command **does not** switch power on now. **x=N** (default): Do not switch power on to sensor automatically each time UIM powers on.
!iiAUTOSWPWRGDATA=x	**x=Y**: Switch power on to sensor automatically before sending Get Data command string (**!iiGDATASTR**) to sensor. Power to sensor switches off automatically when sensor response ends. **x=N** (default): Do not switch power on to sensor automatically before sending Get Data command to sensor.
!iiAUTOSWPWRRELAY=x	**x=Y**: Switch power on to sensor automatically before sending Relay command (**#iiCMDSTRING**, **!iiSENDCHARW=x**, **!iiSENDCHAR=x**, or **!iiSENDBREAK**) to sensor. Power to sensor switches off automatically when sensor response ends. **x=N** (default): Do not switch power on to sensor automatically before sending Relay command to sensor.

Control Line Setup Commands

Note:
See *Appendix V: UIM Interface PCB Configuration* for required jumper settings on the UIM's Interface PCB.

These commands set up the controls for optional control line operation (pin 5 on bulkhead connector). All Control Line Setup commands are preceded by **!ii** (ii = UIM ID).

!iiCNTLON	Enable control line to sensor now. Control line to sensor remains enabled while UIM remains awake. When UIM enters quiescent (sleep) state, control line to sensor is disabled.
!iiCNTLROFF	Disable control line to sensor now.
!iiAUTOCNTLPON=x	**x=Y**: Enable control line to sensor automatically each time UIM powers on. When UIM enters quiescent (sleep) state, control line to sensor disables automatically. Note that entering this command **does not** enable control line now. **x=N** (default): Do not enable control line to sensor automatically each time UIM powers on.
!iiAUTOCNTLGDATA=x	**x=Y**: Enable control line to sensor automatically before sending Get Data command string (**!iiGDATASTR**) to sensor. Control line to sensor disables automatically when sensor response ends. **x=N** (default): Do not enable control line to sensor automatically before sending Get Data command string to sensor.
!iiAUTOCNTLRELAY=x	**x=Y**: Enable control line to sensor automatically before sending Relay command (**#iiCMDSTRING**, **!iiSENDCHARW=x**, **!iiSENDCHAR=x**, or **!iiSENDBREAK**) to sensor. Control line to sensor disables automatically when sensor response ends. **x=N** (default): Do not enable control line to sensor automatically before sending Relay command to sensor.

Recovery

WARNING!
Pressure housings may flood under pressure due to dirty or damaged o-rings, or other failed seals, causing highly compressed air to be trapped inside. If this happens, a potentially life-threatening explosion can occur when the UIM is brought to the surface.

If the UIM is unresponsive to commands or shows other signs of flooding or damage, carefully secure the instrument in a location away from people until it has been determined that abnormal internal pressure does not exist.

Contact Sea-Bird for assistance with procedures for safely relieving internal pressure.

1. Rinse the UIM with fresh water.

2. If immediate redeployment is not required:
   - Remove the UIM's batteries (all setup parameters will be saved in EEPROM), **or**
   - Leave the UIM with batteries in place and in a quiescent state (**PWROFF**). Because the quiescent current required is less than 100 microamps, the batteries can be left in place without significant loss of capacity (less than 20% loss per year).

3. If immediate redeployment is required and the batteries are exhausted, install new batteries. See *Section 5: Routine Maintenance* for replacement of batteries.

Section 5: Routine Maintenance

This section reviews corrosion precautions, battery replacement, and connector mating and maintenance.

Corrosion Precautions

All exposed metal is titanium; other materials are plastic. No corrosion precautions are required, but avoid direct electrical connection of the UIM housing to mooring or other dissimilar metal hardware. Rinse the UIM with fresh water after use and prior to storage.

Replacing Batteries

Note:
Batteries must be removed before returning the UIM to Sea-Bird. Do not return used batteries to Sea-Bird when shipping the UIM for repair.

1. Remove the modem end cap and battery pack assembly, as described in *Installing Batteries* in *Section 3: Preparing UIM for Deployment*.

2. Remove the upper PCB from the assembly as follows:
   A. Remove the two small Phillips-head screws and lock washers from the upper PCB.
   B. Carefully pry the upper PCB away from the batteries, gently going around the circle of batteries to avoid bending the banana plugs.

3. Remove the existing batteries and replace with new batteries, banana plug end (+) first. Ensure each battery is fully inserted.

4. Re-install the upper PCB, replace the battery pack assembly, and reinstall the end cap as described in *Installing Batteries* in *Section 3: Preparing UIM for Deployment*.

Connector Mating and Maintenance

CAUTION:
Do not use WD-40 or other petroleum-based lubricants, as they will damage the connectors.

A mated connector does not require periodic disassembly or other attention. Inspect a connector that is unmated for signs of corrosion product around the pins. When remating:

1. Lightly lubricate the inside of the dummy plug/cable connector with silicone grease (DC-4 or equivalent).

2. **Standard Connector -** Install the plug/cable connector, aligning the raised bump on the side of the plug/cable connector with the large pin (pin 1 - ground) on the UIM. Remove any trapped air by *burping* or gently squeezing the plug/connector near the top and moving your fingers toward the end cap. **OR**
   MCBH Connector – Install the plug/cable connector, aligning the pins.

3. Place the locking sleeve over the plug/cable connector. Tighten the locking sleeve finger tight only. **Do not overtighten the locking sleeve and do not use a wrench or pliers.**

Verify that a cable is installed before deployment.

Glossary

Battery pack - Six 9-volt (nominal 1.2 amp-hour) batteries, each containing lithium cells of the type commonly used in cameras. The battery pack also includes two small PCBs and a brass sleeve.

Character String - A group or sequence of characters, with no internal spaces. Letters of the alphabet, numbers, and punctuation symbols are characters.

ICC – Inductive Cable Coupler, which clamps to the insulated mooring cable and transfers the inductive signal on the wire to the SIM PCB installed inside the buoy or elsewhere.

PCB – Printed Circuit Board.

Scan – One data sample.

SEASOFT-DOS – Sea-Bird's complete DOS software, includes software for communication, real-time data acquisition, and data analysis and display.

SEASOFT-Win32 – Sea-Bird's complete Win 95/98/NT/2000/XP software package, which includes software for communication, real-time data acquisition, and data analysis and display. SEASOFT-Win32 includes **SEATERM**, SeatermAF, SEASAVE, SBE Data Processing, and Plot39.

SEATERM - Sea-Bird's Win 95/98/NT/2000/XP software used to communicate with the UIM through the SIM.

Sensor – See Serial Instrument.

Serial Instrument – An instrument connected serially to the UIM. Typical instruments with standard serial interfaces that are used with the UIM include current meters and Doppler profilers.

SIM - Surface Inductive Modem PCB, used to interface between the computer serial port and inductive modem UIMs or other compatible sensors (such as the SBE 37-IM MicroCAT or the inductive modem version of the SBE 16 / 16*plus*).

UIM - SBE 44 Underwater Inductive Modem.

Appendix I: Functional Description

Sea-Bird's Inductive Modem telemetry system uses a DPSK data transmission method that overcomes most of the disadvantages of Frequency Shift Keyed (FSK) transmission, resulting in superior transmission efficiency and much lower error rates. The Sea-Bird system uses a carrier frequency of 4800 Hz, permitting four cycles of carrier frequency during the time allotted to each data bit (i.e., 1200 baud).

The encoding scheme is straightforward: if the next bit is a one, the phase of the carrier is inverted (shifted 180 degrees); if the next bit is a zero, the carrier phase does not change. With DPSK, both the modulation and demodulation hardware are extremely simple. Modulation requires only an OR gate and flip-flop, and demodulation is inherently coherent (bit energy is averaged rather than spot-sampled) using minimal hard logic, a shift register implementing a one-bit delay being the principle component. Further advantages are that the transmission of all zeros creates a single coherent frequency (4800 Hz) that is readily detected in IM instruments as the *wake up* signal, and that - unlike FSK - the connection polarity of the transformers used for coupling does not matter.

Appendix II: Electronics Disassembly/Reassembly

Disassembly

1. Remove the modem end cap and battery pack following instructions in *Installing Batteries* in *Section 3: Preparing UIM for Deployment*.

2. The electronics are on a sandwich of three rectangular PCBs. These PCBs are assembled to a bulkhead that can be seen at the bottom of the battery compartment. To remove the PCB assembly:
   A. Use a long screwdriver (#1 screwdriver) to remove the Phillips-head screw at the bottom of the battery compartment. The Phillips-head screw is a 198mm (7.8 in.) threaded rod with Phillips-head.
   B. Pull out the PCB assembly using the PVC pylon post. The assembly will pull away from the 10-position edge connector used to connect to the sensors.

Reassembly

1. Sight down into the UIM housing to find the hole into which the Phillips-head screw threads. The hole is at the bottom of the housing, next to the edge connector. The small-diameter brass sleeve between two of the PCBs guides the screw into the hole. Align this sleeve with the hole.

2. Guide the PCB assembly into the housing and push the assembly until the edge connector is fully inserted. A gentle resistance can be felt during the last 3 mm (1/8 inch) of insertion as the PCB assembly mates to the edge connector.

3. Drop the Phillips-head screw into the hole and tighten gently.

4. If it is difficult to align the cards, obtain a 305mm (12 in.) length of 6-32 threaded rod.
   A. Thread the end of this rod into the hole at the bottom of the housing (next to the edge connector).
   B. Slide the PCB assembly's small diameter brass sleeve down the rod. The rod will help guide the assembly into the proper position.
   C. Push the assembly until the edge connector is fully inserted. After the PCB assembly has been fully inserted, remove the rod.
   D. Drop the Phillips-head screw into the hole and tighten gently.

5. Reinstall the battery pack and modem end cap following instructions in *Installing Batteries* in *Section 3: Preparing UIM for Deployment*.

Note:
If the rod will not tighten, the PCBs have not fully mated or are mated in reverse.

Note:
Before delivery, a desiccant package is inserted in the housing and the electronics chamber is filled with dry Argon gas. These measures help prevent condensation. To ensure proper functioning:
1. Install a new desiccant bag each time you open the electronics chamber. If a new bag is not available, see *Application Note 71: Desiccant Use and Regeneration (drying)*.
2. If possible, dry gas backfill each time you open the housing. If you cannot, wait at least 24 hours before redeploying, to allow the desiccant to remove any moisture from the housing.

Note that opening the battery compartment does not affect desiccation of the electronics.

Appendix III: Command Summary

FUNCTION	CATEGORY	COMMAND	DESCRIPTION
SIM Commands	-	**PWRON**	Send wakeup tone to **all** UIMs.
		PWROFF	Send power off command to **all** UIMs, turn off transmitter. UIMs enter quiescent (sleep) state. Any data in UIM buffer is erased.
		DS	Display SIM firmware version and status.
		BAUD=x	**x=** baud rate between SIM and computer/controller (1200, 2400, 4800, or 9600). Default 9600.
		DATANNMAX=x	**x=** timeout (0-65535 milliseconds) that applies to **DATAii** only. If no reply received within **x**, control returned to computer and other commands can be sent. Default 1000 milliseconds.
		RELAYMAX=x	**x=** timeout (0-3276 seconds) that applies to all other commands. If no reply received within **x**, control returned to computer and other commands can be sent. Default 20 seconds.
		ECHOON	Echo characters received from computer (default).
		ECHOOFF	Do not echo characters.
ID Commands	**UIM ID** Only one UIM can be on line when sending these commands.	**ID?**	Display UIM ID (ID=ii, where ii=0-99)
		***ID=ii** If more than one UIM on line when setting ID, all UIMs will have same ID.	Set UIM ID to ii, where ii=0-99. Command must be sent twice, because computer responds by requesting verification.
UIM and Sensor Commands	**UIM Status** Commands preceded by **!ii** (ii=UIM ID).	**!iiDS**	Display firmware version and system setup information.
		!ii*EETEST	Test UIM's EEPROM as a troubleshooting tool, and reset all parameters to default values.
	UIM General Setup Commands preceded by **!ii** (ii=UIM ID).	**!iiBAUD=x**	**x=** baud rate for serial communication between UIM and sensor (300, 600, 1200, 2400, 4800, or 9600). Default 9600.
		!iiRELAYTERMCHAR=x	**x=** decimal value (0-255) of command termination character to specify what is appended to sensor character string for Send Command String and Get Data commands. If **x=CRLF** (default), appends carriage return and line feed. If **x=NONE**, appends nothing.
		!iiTERMCHAR=x	**x=** decimal value (11-122) of sensor reply termination character. If UIM receives termination character, ignores any additional characters. If **x**=**NONE**, termination character checking disabled. Default 62 (>).
		!iiTIMEOUT=x	**x=** UIM timeout (30-1800 seconds). If no commands or replies received for **x**, UIM enters quiescent (sleep) state. Any data in UIM buffer erased. Default 120 seconds.

FUNCTION	CATEGORY	COMMAND	DESCRIPTION
UIM and Sensor Commands (continued)	**Relay Commands:** ***Relay Setup*** Commands preceded by **!ii** (ii=UIM ID).	**!iiRSTARTWAIT=x**	**x=** command transmission delay after setting control line or switched power (0-32767 milliseconds). Default 0 milliseconds.
		!iiRTERMMAX=x	**x=** termination timeout for sensor reply (0-32767 milliseconds). Gap of **x** after 2 characters received acts as termination character. Default 1000 milliseconds.
		!iiRTOTALMAX=x	**x=** total time allowed for sensor reply to (0-600 seconds). Default 15 seconds.
	Relay Commands: ***Send Command String*** Command preceded by **#ii** (ii=UIM ID).	**#iiCMDSTRING**	Command UIM to send character string defined by **CMDSTRING** to sensor. **CMDSTRING** can be any command recognized by sensor. UIM can append carriage return and line feed or character to string (see **!iiRELAYTERMCHAR=**). Response sent through UIM to SIM and computer/controller.
	Relay Commands: ***Send Character*** Commands preceded by **!ii** (ii=UIM ID). **!iiRELAYTERMCHAR** does not apply to these commands.	**!iiSENDCHARW=x**	Command UIM to send character defined by decimal value **x** to sensor. Character can be any command recognized by sensor. Response sent through UIM to SIM and computer/controller.
		!iiSENDCHAR=x	Command UIM to send character defined by decimal value **x** to sensor. Character can be any command recognized by sensor. **UIM does not accept any response from sensor.**
	Relay Commands: ***Send Break*** Commands preceded by **!ii** (ii=UIM ID). **iiRELAYTERMCHAR** does not apply to these commands.	**!iiBREAKLEN=x**	**x=** break character length (0-32750 milliseconds). Default 1000 milliseconds.
		!iiSENDBREAK	Command UIM to send break character (defined by **!iiBREAKLEN=**) to sensor. Response sent through UIM to SIM and computer/controller.

FUNCTION	CATEGORY	COMMAND	DESCRIPTION
UIM and Sensor Commands (continued)	**Get Data Commands:** ***Setup*** Commands preceded by **!ii** (ii=UIM ID). Set up controls and timeouts for Get Data (**GDATA** or **!iiGDATA**) commands. Get Data commands cause sensor command pre-defined by **!iiGDATASTR=S** to be sent to sensor. Sensor reply held in UIM buffer.	**!iiGSTARTWAIT=x**	**x=** command transmission delay after setting control line or switched power (0-32767 milliseconds). Default 0 milliseconds.
		!iiGTERMMAX=x	**x=** termination timeout for sensor reply (0-32767 milliseconds). Gap of **x** after 2 characters received acts as termination character. Default 1000 milliseconds.
		!iiGTOTALMAX=x	**x=** total time allowed for sensor reply (0-600 seconds). Default 30 seconds.
		!iiINCGDATADELAY=x	**x=Y**: In **DATAii** reply, include number of 0.1-second ticks received while waiting for **GDATA** or **!iiGDATA** reply. **x=N**: Do not include number of ticks.
		!iiGDATASTR=S	**S=** character string sent to sensor in response to **GDATA** or **!iiGDATA**. Character string can be any command recognized by sensor. UIM can append carriage return and line feed or character to string (see **!iiRELAYTERMCHAR**).
	Get Data Commands ***Get Data***	**GDATA** Global command to all UIMs.	Command all UIMs to get data from sensors. Each UIM holds data in buffer until receiving **DATAii** command.
		!iiGDATA Command to UIM with ID=ii (ii=0-99).	Command UIM to get data from sensor. UIM holds data in buffer until receiving **DATAii** command.
		DATAii Command to UIM with ID=ii (0-99).	Get data obtained with **GDATA** or **!iiGDATA** from buffer of UIM with ID=ii. Data sent to SIM and computer/controller.

FUNCTION	CATEGORY	COMMAND	DESCRIPTION
UIM and Sensor Commands (continued)	**Switched Power Setup** Commands preceded by **!ii** (ii=UIM ID). Set up controls for optional switched power operation (pin 4 on connector).	**!iiSWPWRON**	Switch power on to sensor now. Power remains on while UIM awake. When UIM enters quiescent (sleep) state, power to sensor switches off.
		!iiSWPWROFF	Switch power off to sensor now.
		!iiAUTOSWPWRPON=x	**x=Y**: Switch power on to sensor each time UIM powers on. When UIM enters quiescent (sleep) state, power to sensor switches off. **x=N** (default): Do not switch power on to sensor when UIM powers on.
		!iiAUTOSWPWRGDATA=x	**x=Y**: Switch power on to sensor before sending Get Data command string (**!iiGDATASTR**) to sensor. Power to sensor switches off when sensor response ends. **x=N** (default): Do not switch power on to sensor before sending Get Data command string.
		!iiAUTOSWPWRRELAY=x	**x=Y**: Switch power on to sensor before sending Relay command (**#iiCMDSTRING**, **!iiSENDCHARW=x**, **!iiSENDCHAR=x**, or **!iiSENDBREAK**) to sensor. Power to sensor switches off when sensor response ends. **x=N** (default): Do not switch power on to sensor before sending Relay command string.
	Control Line Setup All commands preceded by **!ii** (ii=UIM ID). Set up controls for optional control line operation (pin 5 on connector).	**!iiCNTLON**	Enable control line to sensor now. Power remains on while UIM awake. When UIM enters quiescent (sleep) state, control line to sensor disabled.
		!iiCNTLOFF	Disable control line to sensor now.
		!iiAUTOCNTLPON=x	**x=Y**: Enable control line to sensor each time UIM powers on. When UIM enters quiescent (sleep) state, control line to sensor disabled. **x=N**: Do not enable control line to sensor when UIM powers on.
		!iiAUTOCNTLGDATA=x	**x=Y**: Enable control line to sensor before sending Get Data command string (**!iiGDATASTR**) to sensor. Control line to sensor disabled when sensor response ends. **x=N**: Do not enable control line to sensor before sending Get Data command string.
		!iiAUTOCNTLRELAY=x	**x=Y**: Enable control line to sensor before sending Relay command (**#iiCMDSTRING**, **!iiSENDCHARW=x**, **!iiSENDCHAR=x**, or **!iiSENDBREAK**) to sensor. Control line to sensor disabled when sensor response ends. **x=N**: Do not enable control line to sensor before sending Relay command string.

Appendix IV:
SIM Hookup and Configuration

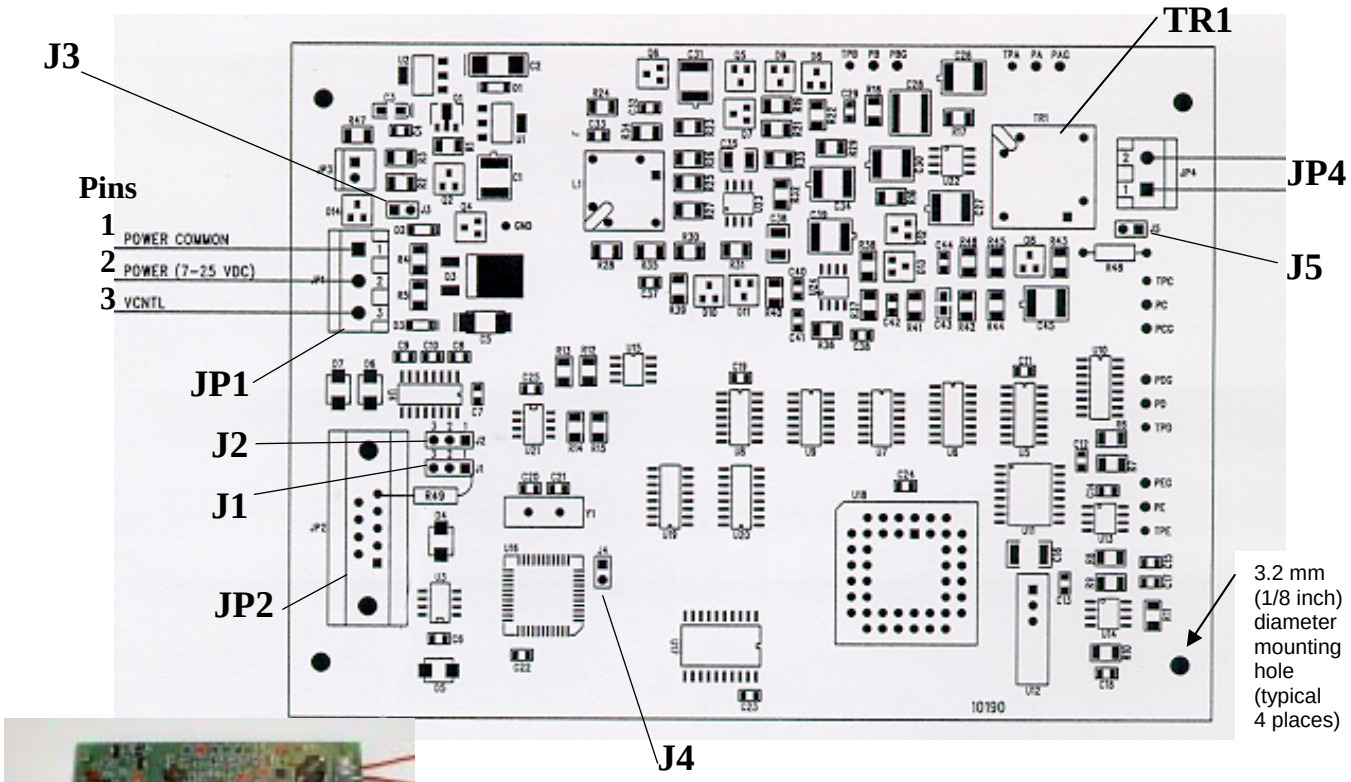


Photo shows SIM (SMODEM-2) for use without Inductive Cable Coupler. Standard SIM (SMODEM-1) for use with Inductive Cable Coupler is similar, but does not include TR1.

Dimensions:
PCB: 109 mm x 147.5 mm (4 1/4 x 5 3/4 inches)
Mounting holes: 90.5 mm x 138.1 mm (3 9/16 x 5 7/16 inches)

Power Connection

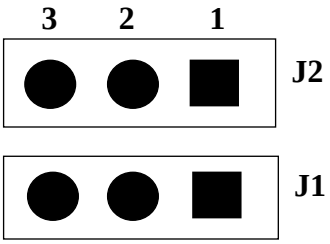
The SIM can be configured to power up in either of the following two modes:

- **Normal Power Switching (factory setting)** – The SIM runs when power is applied. Set up the SIM as follows:
  1. Connect Power Common to JP1 pin 1.
  2. Connect 7-25 VDC to JP1 pin 2.
  3. Verify there is no connection to JP1 pin 3.
  4. Verify jumper is across J3.

- **Logic Level Controlled Power Switching** – Power is always applied to JP1, pins 1 and 2. Voltage applied to JP1 pin 3 (VCNTL) switches power to the SIM. Set up the SIM as follows:
  1. Connect Power Common to JP1 pin 1.
  2. Connect 7-25 VDC to JP1 pin 2.
  3. Remove jumper on J3.

Note:
If VCNTL < 1 volt, SIM is Off (consuming < 100 microamps).
If VCNTL > 2 volts, SIM is On.

Interface Option Connection (J1, J2, and J4)

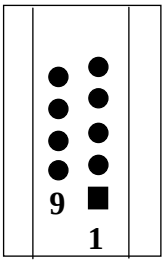


The SIM can be configured to accept RS-232 or RS-485:

- **RS-232 (factory setting)**
  1. Verify jumper is on J1 pins 2 and 3.
  2. Verify jumper is on J2 pins 2 and 3.
  3. Remove jumper on J4.

- **RS-485**
  1. Install jumper on J1 pins 1 and 2.
  2. Install jumper on J2 pins 1 and 2.
  3. Install jumper on J4.

I/O Connector Wiring (JP2)



Connect wires to JP2 as follows:

- **RS-232**
  1. **Pin 2** – RS-232 transmit from SIM to computer
  2. **Pin 3** – RS-232 transmit from computer to SIM
  3. **Pin 5** – Power Common

- **RS-485**
  1. **Pin 4** – RS-485 ‘A’
  2. **Pin 5** – Power Common
  3. **Pin 6** – RS-485 ‘B’

Inductive Mooring Cable Connection (JP4)

- **UIM installed with Inductive Cable Coupler (ICC) -**
  Connect wires from the ICC to JP4.

- **UIM installed without Inductive Cable Coupler -**
  Connect wires from the mooring cable and seawater ground to JP4.

Normal Deployed Operation (J5)

- **Normal Deployed Operation** – Ensure jumper on J5 is installed.

- **Instrument Setup and Lab Testing** - Remove jumper on J5.
  Removing the jumper on J5 inserts a 1K resistor in series with the inductive loop, reducing the signal amplitude. This prevents the UIMs in close proximity from responding to commands, which is especially important when sending the ***ID=** command.

Appendix V:
UIM Interface PCB Configuration

This appendix describes the jumper configuration on the **UIM's Interface PCB** (labeled 10219). See *Appendix II: Electronics Disassembly/Reassembly* for details on accessing the Interface PCB.

Standard Setup (no optional control signal or optional switched power out)

For standard configuration, Sea-Bird recommends that you remove the J1 and J2 jumpers.

Optional Control Signal (jumper J1 on Interface PCB)

The optional control signal (pin 5 on bulkhead connector) can be configured in either of the following modes:

- **5 Volt logic** – jumper J1 pins 1 and 2
- **Open Collector logic** – jumper J1 pins 2 and 3

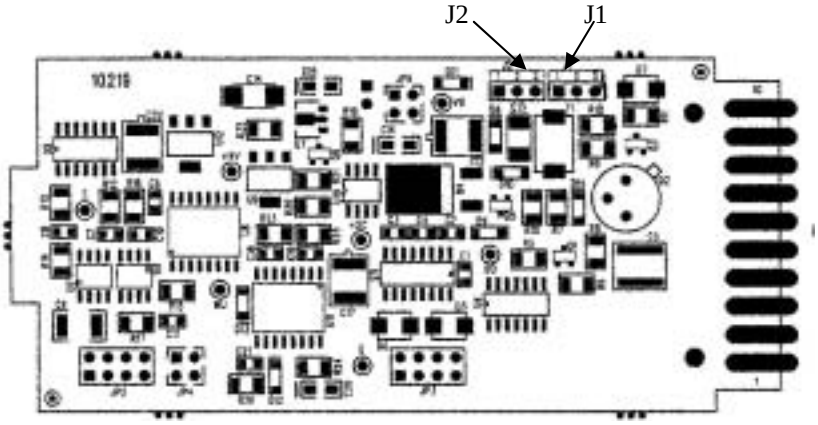
Optional Switched Power Out (jumper J2 on Interface PCB)

The optional switched power out (pin 4 on bulkhead connector) can be configured to power the serial instrument in either of the following modes:

Note:
External voltage (optional) is supplied to the UIM through pin 6 on the bulkhead connector.

- Power serial instrument **from UIM battery pack or external voltage** (draw power from whichever voltage source is higher) – jumper J2 **pins 1 and 2**

- Power serial instrument **from external voltage only** (regardless of which voltage source is higher) – jumper J2 **pins 2 and 3**



Appendix VI: Character Map and Values

The character map is used to set the sensor reply termination character (**!iiTERMCHAR**), as described in *Section IV: Deploying and Operating UIM*.

Screen Codes

Dec.	Hex	Sym.	Dec.	Hex	Sym.
0	00		32	20	
1	01	☺	33	21	!
2	02	☻	34	22	"
3	03	♥	35	23	#
4	04	♦	36	24	$
5	05	♣	37	25	%
6	06	♠	38	26	&
7	07	•	39	27	'
8	08	◘	40	28	(
9	09	○	41	29	)
10	0A	■	42	2A	*
11	0B	♂	43	2B	+
12	0C	♀	44	2C	,
13	0D	♪	45	2D	-
14	0E	♫	46	2E	.
15	0F	☼	47	2F	/
16	10	►	48	30	0
17	11	◄	49	31	1
18	12	↕	50	32	2
19	13	‼	51	33	3
20	14	¶	52	34	4
21	15	§	53	35	5
22	16	▬	54	36	6
23	17	↨	55	37	7
24	18	↑	56	38	8
25	19	↓	57	39	9
26	1A	→	58	3A	:
27	1B	←	59	3B	;
28	1C	∟	60	3C	<
29	1D	↔	61	3D	=
30	1E	▲	62	3E	>
31	1F	▼	63	3F	?

Screen Codes (cont.)

Dec.	Hex	Sym.	Dec.	Hex	Sym.
64	40	@	96	60	`
65	41	A	97	61	a
66	42	B	98	62	b
67	43	C	99	63	c
68	44	D	100	64	d
69	45	E	101	65	e
70	46	F	102	66	f
71	47	G	103	67	g
72	48	H	104	68	h
73	49	I	105	69	i
74	4A	J	106	6A	j
75	4B	K	107	6B	k
76	4C	L	108	6C	l
77	4D	M	109	6D	m
78	4E	N	110	6E	n
79	4F	O	111	6F	o
80	50	P	112	70	p
81	51	Q	113	71	q
82	52	R	114	72	r
83	53	S	115	73	s
84	54	T	116	74	t
85	55	U	117	75	u
86	56	V	118	76	v
87	57	W	119	77	w
88	58	X	120	78	x
89	59	Y	121	79	y
90	5A	Z	122	7A	z
91	5B	[	123	7B	{
92	5C	\	124	7C	|
93	5D	]	125	7D	}
94	5E	↑	126	7E	~
95	5F	_	127	7F	▒

Appendix VII: Replacement Parts

Part Number	Part	Application Description	Quantity in UIM
30900	Machine screw, 1/4-20 x 2” hex head, titanium	Secures mounting clamp	4
30633	Washer, 1/4” split ring lock, titanium	For screw 30900 (secures mounting clamp)	4
30634	Washer 1/4” flat, titanium	For screw 30900 (secures mounting clamp)	4
31019	O-ring 2-008 N674-70	For screw 30900 (retains mounting clamp hardware)	4
30859	Machine screw, 8-32 x 3/8” FH, titanium	Secures housing to end caps	5
30857	Parker 2-033E515-80 O-ring	Modem end cap and connector end cap O-ring	4
30149	Machine screw, 6-32 x 5/8 PH, stainless steel	Secures battery pack assembly to battery pylon	1
30243	Washer, #6 split ring lock, stainless steel	For screw 30149 (secures battery pack assembly to battery pylon)	1
30357	Machine screw, 2-56 x 1/4 PH, stainless steel	Secures battery pack’s upper PCB to brass sleeve	2
30986	Washer, #2 split ring lock, stainless steel	For screw 30357 (secures battery pack’s upper PCB to brass sleeve)	2
50243	Lithium battery set (6 sticks)	Power UIM	1
80677	9-pin DB-9P to 25-pin DB-25S I/O cable	From SIM to computer	1
17130	25-pin to 9-pin adapter	Connects 80677 I/O cable to 9-pin COM port on computer	1
80328 *	6-pin AG-206 to 25-pin DB-25S serial test cable, 2.4 m (8 ft) long	Connects UIM connector to computer for lab testing	-
17047 *	6-pin dummy plug	For storage	-
17043 *	Locking sleeve *	Locks cable or dummy plug in place	
60033	Spare hardware/ O-ring kit	Assorted hardware and O-rings	-

* For standard Impulse glass-reinforced epoxy connector

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