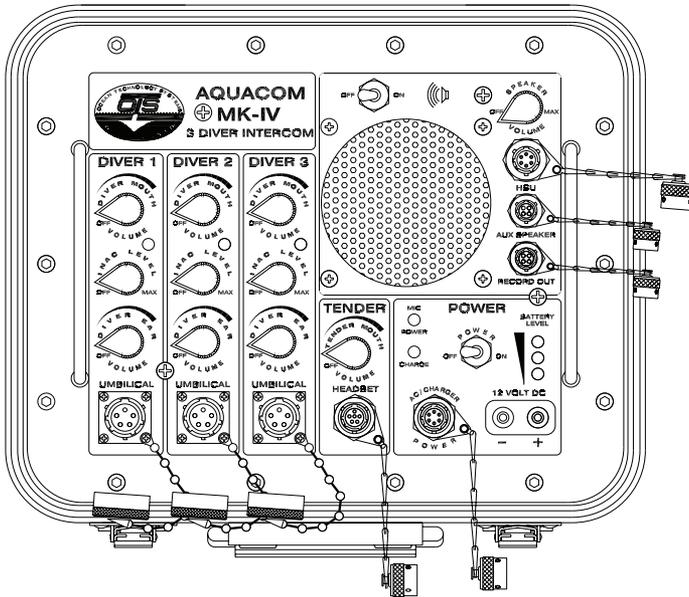# Aquacom®

MK-IV

3-DIVER INTERCOM

Full-Duplex Surface Station
for Underwater Communications

"Technology in Depth"

Undersea Systems International, Inc.
dba
Ocean Technology Systems

- NOTICE -

This manual and the information contained herein are provided for use as a maintenance and operation guide. No license or rights to manufacture, produce, and/or sell either the manual or articles described herein are given. Undersea Systems International, Inc., *dba* Ocean Technology Systems hereinafter referred to as OTS, reserves the right to change specifications without notice. It is recommended that all users read and fully understand this manual before using the MK-IV 3-Diver Intercom.

All statements, technical information, and recommendations herein are based on tests we believe to be reliable, but the accuracy or completeness thereof is not guaranteed; and the following is made in lieu of all warranties, expressed or implied, including the implied warranties of merchantability and fitness for purpose: Seller's and Manufacturer's only obligation shall be to replace such quantity of the product proved to be defective. Before using, the user shall determine the suitability of the product for intended use, and the user assumes all risk and liability whatsoever in connection therewith. Neither Seller nor Manufacturer shall be liable either in tort or in contract for any loss or damage—direct, incidental, or consequential—arising from the use of or the inability to use the product. No statement or recommendation not contained herein shall have any force or effect unless it is in an agreement signed by officers of the Seller and Manufacturer.

- IMPORTANT SAFETY NOTICE -

(Please read before using product.)

It is absolutely essential that all operators are properly trained and equipped and fully understand this user's manual before attempting to use the MK-IV 3-Diver Intercom.

While the MK-IV provides good underwater communications, it does not change or eliminate the potential hazards of diving!

> Refer to the Library page of our Web site, www.otscomm.com, for a list of any changes made to this manual since its publication.

506118-000 (J)

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SECTION 1

INTRODUCTION

Congratulations! You have just purchased one of the finest, state-of-the-art underwater communication systems available. The Aquacom® MK-IV 3-Diver Intercom allows open "round robin" communications through intercom lines among a surface tender with a headset (included) and up to three divers with earphone-microphone assemblies (sold separately). All users can speak and listen simultaneously, without the need for a push-to-talk system that would interrupt communications.

The MK-IV 3-Diver Intercom represents the latest generation of intercom technology with many useful features for outstanding performance, including an INAC (Inhalation Noise Attenuation Circuit) for reduction of diver inhalation noise; a MIL-spec speaker designed for high-quality sound; MIL-spec connectors for all communication connections; capability of both powered (preamplified) and non-powered microphones; remote speaker and record-out connections; GFCI and transformer isolation for enhanced diver safety; a durable, heavy-duty housing; and much more. In all, the MK-IV 3-Diver Intercom is second to none!

1.1   GENERAL

This manual contains much of the information you will need to know regarding the Aquacom® MK-IV 3-Diver Intercom communication system. Section 1 contains a table of specifications and an overview of the functions of the MK-IV.

Before operating the MK-IV 3-Diver Intercom, read this entire manual. In addition to the information presented on functions and operation, there are some important safety issues all users must be familiar with before using the MK-IV. If you have any questions, contact your local OTS dealer, or feel free to contact OTS directly (see page 28 for OTS contact information).

1.2   SPECIFICATIONS

Input voltage:	90–264 V AC, 47–63 Hz
Input current:	5 amps DC
Idle current:	125 mA
Audio power:	16 watts max (4 watts per diver, 2 watts each for tender headset and speaker)
Frequency response:	300–4000 Hz
Microphone input impedance:	(Non-powered) 150 ohms
Headphone impedance output:	300 ohms
Protection circuits:	*GFCI:* 10 mA through ground path *Thermal circuit breaker:* 2 A slow trip
Battery type:	Rechargeable, lead acid, 12 V, 5 Ah
Battery life:	14 hours continuous use (full charge)
Operating temperature:	-40°C to 50°C (-40°F to 122°F) (not charging batteries; not mains power) -40°C to 40°C (-40°F to 104°F) (w/ mains power and charging) *Note: Room temperature recommended for charging.*
Storage temperature:	–25°C to 65°C (–13°F to 149°F)
Cabinet material:	Molded composite
Front-panel material:	0.080" stainless steel, powder coated
Housing dimensions:	Height: *Lid on:* 14-1/2 inches *Lid off:* 8-1/2 inches Width: 14 inches Depth: 12-1/2 inches
Weight:	28 lbs.

SECTION 2

EQUIPMENT DESCRIPTION

2.1   PACKAGE DESIGN

The Aquacom® MK-IV 3-Diver Intercom is housed in a sturdy, impact- and rust-resistant fiberglass case with stainless steel latches. The case is opened with a counterclockwise rotation of the handles on the two butterfly latches that secure the lid; the lid can be fully opened and even removed easily at the hinge. The configuration of the multiple sets of feet on the case allows the unit to stand safely with the panel facing upward or forward.

The connectors and control knobs on the front panel are all military style and are therefore constructed to a high quality standard, providing ruggedness and durability for use in marine and other harsh environments.

The panel speaker meets military standard MIL-L-24296A and is built for durability and endurance under demanding environmental conditions. Its resistance to shock, vibration, and salt spray make it an excellent speaker for oceanic shipboard use.

2.2   INCLUDED WITH THE MK-IV

The following items are provided with the MK-IV:

- THB-16 tender headset with boom microphone (part no. 900298-032)
- AC power/charging cable (part no. 914081-000)
- Two (2) four-socket military-style (MS) connectors (OTS part no. 211106-000; industry part no. MS3116F8-4S)
- MK-IV 3-Diver Intercom user's manual (document no. 506118-000)
- Warranty card with the MK-IV unit's serial number (doc. no. 506014-000)

2.3   ADDITIONAL COMPONENTS, SOLD SEPARATELY

2.3.1   COMMUNICATION CABLES: Each diver requires an intercom cable for connection from his earphone and microphone to the MK-IV. Be sure to obtain the 5-pin military-style plug on one end that matches the diver umbilical receptacles (Section 2.4, Item 5) on the MK-IV (refer to Table 3, Item 1 in Section 4.2). The other end of the cable should have the connector for your particular earphone-microphone assembly.

2.3.1.1   ComRopes: OTS offers ComRopes consisting of communication cables bundled inside a durable yet flexible rope. Various lengths of ComRopes are available with connectors to match different earphone-microphone assemblies. Contact OTS or your local OTS dealer for information about available ComRopes for use with the MK-IV.

2.3.1.2   Spiral Four: This cable has been used extensively with military and commercial divers for many years. It has been available as military surplus but is becoming harder to find. However, there are some cable manufacturers that have duplicated this cable, and it is now available to the diving community.

The most important feature of this cable is the internal wires used for microphone and earphone circuits. Usually, there are two white and two brown or black cables, configured in a twisted pattern. ***Always connect the speaker or microphone to either the white pair or the black (brown) pair.*** If this is not done, electrical feedback (squeal) will occur. When connected correctly, the cable is balanced, and clear communication is possible.

(A) Non-powered, dynamic mic (ME-16R Hot-Mic® for Interspiro FFM)

(B) Non-powered, dynamic mic (Shure microphone for band mask or SuperLite® helmet)

(C) Powered (preamplified) microphone for Interspiro FFM

(D) Powered (preamplified) microphone for band mask or Super-Lite® helmet)

Figure 1. Examples of Standard and Preamplified Microphones

2.3.1.3   Shielded Cable: Another available cable contains at least one twisted, shielded balanced cable and a second twisted, shielded or unshielded pair. The unshielded pair is used for the earphones, while the balanced, twisted pair is used for the microphone. Unlike spiral four cable, little can go wrong with this system, provided the microphone is connected to the shielded, twisted, balanced cable.

2.3.2   DIVER MICROPHONES

See Figure 1 for examples of non-powered and powered (preamplified) microphones.

2.3.2.1   ME-16R Hot-Mic® (912086-000): The ME-16R Hot-Mic® (Fig. 1A) is a 150-ohm, water-resistant microphone element. It is a state-of-the art dynamic microphone element designed to give you long, trouble-free use and the highest intelligibility possible.

Although the Hot-Mic is trouble free, it should be maintained. Rinse it with freshwater after use to get all dirt, debris, or salt water from the grill. Dry it with a clean, soft towel. If the element ever needs to be replaced, it is easily removed by unscrewing the two small screws located on its base.

Getting the microphone wet does not harm it. However, the microphone element can only withstand an 8- to 10-foot depth/pressure differential. If you removed your diving FFM at the back of the boat and the microphone became wet, there would be no problem; but if the FFM with element dropped more than 8 to 10 feet into the water, the change in pressure probably would damage the microphone element. In tests we have taken off the FFM at 30 feet and replaced it, still at 30 feet, without any problem; but if one were to take off the FFM at 30 feet and drop down to 40 feet, the pressure difference may damage the microphone.

2.3.2.2   Super Mic® Depth Master: The Super Mic® offers patented technology* that overcomes a limitation of other microphones. It can be used at any depth and—unlike the Hot-Mic or many other microphones—can withstand changes in depth while submerged, so it will not be damaged if the diver needs to descend with the mask flooded (such as when a full-face mask is removed and stowed when the diver changes to another air system). It is a ceramic microphone with a compact, lightweight design and noise-cancelling properties, reducing background noises for clearer communications. When only the highest quality of intelligibility is required, the Hot-Mic is the preferred choice; but the Super Mic's intelligibility is sufficient for most diving situations.

To assure clear communications when using the Super Mic, it should be no more than 1/4 inch from the corner of the diver's mouth.

After each dive, clean the Super Mic by rinsing it with freshwater and drying it with a clean, soft towel. No other maintenance is required.

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*U.S. Patent no. 7,170,822; EU patent nos. 000458351-0001, -0002, -0003, -0004, -0005, -0006.

Note: Do not press on the microphone diaphragm; doing so may cause damage.

2.3.2.3   Powered, Preamplified Microphones: The MK-IV supports the use of preamplified microphones (Fig. 1C & D), which tend to be more durable and rugged and require less maintenance than standard microphones—although they often have lower fidelity, with somewhat diminished dynamic range and speech intelligibility. Powered microphones are available separately with two-contact connectors or can be custom-fitted with earphones, depending on your particular requirements. For information on available powered microphones, contact OTS or your local OTS dealer.

2.3.3   EARPHONE-MICROPHONE (EM) ASSEMBLIES: We offer our standard microphones integrated into earphone-microphone (EM) assemblies designed to fit the communication port of full-face masks (FFMs) produced by various manufacturers. Table 1 is a compatibility chart of some of the standard (non-powered) EM assemblies available for use with a ComRope connected to the MK-IV 3-Diver Intercom. *Note: If you have a diving helmet or mask that is not on the compatibility chart, contact OTS or your local OTS dealer for availability or for information on custom EM assemblies.*

The following are full descriptions of each of the EM assemblies listed in Table 1:

2.3.3.1   EMA-2 (911060-001): The EMA-2 EM assembly is designed for all Divator MKII ("AGA") full-face masks (FFMs). It has two ceramic earphones with holders, an ME-16R Hot-Mic, a Hi-Use® connector, and a push-to-talk (PTT) button. The assembly is installed into the Divator MKII FFM communication port.

2.3.3.2   EMA-2SM (911060-098): The EMA-2SM EM assembly is designed to be installed into all Divator MKII ("AGA") FFMs. It consists of two ceramic earphones with holders, a Super Mic, a Hi-Use® connector, and a PTT button. The assembly is installed into the Divator MKII FFM communication port.

2.3.3.3   EMX-2 (911060-008): The EMX-2 EM assembly is designed for the EXO-26 *original* FFM. It consists of two dynamic earphones, an ME-16R Hot-Mic, a Hi-Use® connector, and a PTT button.

2.3.3.4   EMX-2B (911060-026): The EMX-2B EM assembly is designed for the EXO-26 *standard* full-face mask. It is similar to the EMX-2 but fits the balanced-regulator version of the EXO-26 with an oral-nasal cavity.

2.3.3.5   EMO-2 (900096-686): The EMO-2 EM assembly is designed to be installed into the Ocean Reef NIRA Neptune FFM. It has two earphones with holders, a Hot-Mic, a Hi-Use® connector, and a PTT button. It is installed into a port on the side of the FFM.

2.3.3.6   EMH2-1 (911060-009): The EMH-1 EM assembly is optionally included with the HM-2 mouth mask. It has one head strap, one ceramic earphone, a Hot-

Table 1: Compatible EM Assemblies with Standard Microphones

Model Number	Part Number	Microphone	Earphones Single	Earphones Dual	Mask Type
EMA-2	911060-001	Hot-Mic®		X	All Divator MK II FFMs
EMA-2SM	911060-098	Super Mic®		X	All Divator MK II FFMs
EMX-2	911060-008	Hot-Mic®		X	EXO-26 original FFM
EMX-2B	911060-026	Hot-Mic®		X	EXO-26 standard FFM
EMO-2	900096-686	Hot-Mic®		X	Ocean Reef FFM
EMH2-1	911060-009	Hot-Mic®	X		HM-2 mouth mask
EMH2-1SM	911060-100	Super Mic®	X		HM-2 mouth mask
EMS-2	911060-017	Hot-Mic®		X	ScubaPro FFM
LAR V Adapter	900282-000	Dynamic mic	X		LAR V mouthpiece
EMD-2	911060-067	Hot-Mic®		X	M-48 SuperMask® FFM
EMD-2SM	911060-101	Super Mic®		X	M-48 SuperMask® FFM
EMDG-2	911060-076	ME-500		X	Dräger Panorama Nova Dive Mask
EMH1-1	900332-000	Hot-Mic®	X		HM-1 mouth mask
EMH1-1SM	900332-001	Super Mic®	X		HM-1 mouth mask
EMMT-1	911060-090	Hot-Mic®	X		Mantis FFM
EMMT-1SM	911060-102	Super Mic®	X		Mantis FFM
EMMT-2	911060-091	Hot-Mic®		X	Mantis FFM
EMMT-2SM	911060-103	Super Mic®		X	Mantis FFM

Mic, a Hi-Use® connector, and a PTT button (located on the HM-2 mask).

2.3.3.7 EMH2-1SM (911060-100): The EMH-1SM EM assembly is optionally included with the HM-2 mouth mask. It has a head strap, one ceramic earphone, a Super Mic, a Hi-Use® connector, and a PTT button (located on the HM-2 mask).

2.3.3.8 EMS-2 (911060-017): The EMS-2 is an EM assembly designed to be installed into a ScubaPro FFM. It consists of two earphones with holders, a Hot-Mic, a PTT button, and a Hi-Use® connector.

2.3.3.9 LAR V Adapter (900282-000): This adapter is placed between the inhalation hose and LAR V bite-mouth/DSV T-bit assembly. It is designed to allow basic words to be transmitted without the need for a full or half mask. It consists of one earphone, an ME-500 microphone, a Hi-Use® connector, and a PTT button.

2.3.3.10 EMD-2 (911060-067): The EMD-2 EM assembly is designed to be installed into the M-48 SuperMask® FFM. It consists of two earphones, earphone holders, a Hot-Mic, a Hi-Use® connector, and a PTT button.

2.3.3.11 EMD-2SM (911060-101): The EMD-2SM EM assembly is designed to be installed into the M-48 SuperMask® FFM. It consists of two earphones, earphone holders, a Super Mic, a Hi-Use® connector, and a PTT button.

2.3.3.12 EMDG-2 (911060-076): The EMDG-2 EM assembly is designed to be installed into the Dräger Panorama Nova Dive Mask. It consists of two earphones, earphone holders, an ME-500 microphone, a Hi-Use® connector, and a PTT button.

2.3.3.13 EMH1-1 (900332-000): The EMH-MAG2 EM assembly is designed to be installed into the HM-1 silicone half mask. It consists of one earphone, a Hot-Mic, a Hi-Use® connector, and a PTT button.

2.3.3.14 EMH1-1SM (900332-001): The EMH-MAG2SM EM assembly is designed to be installed into the HM-1 silicone half mask. It consists of one earphone, a Super Mic, a Hi-Use® connector, and a PTT button.

2.3.3.15 EMMT-1 (911060-090): The EMMT-1 EM assembly is designed to be installed into the Mantis FFM. It consists of one earphone, an earphone holder, a Hot-Mic, a Hi-Use® connector, and a PTT button.

2.3.3.16 EMMT-1SM (911060-102): The EMMT-1SM EM assembly is designed to be installed into the Mantis FFM. It consists of one earphone, an earphone holder, a Super Mic, a Hi-Use® connector, and a PTT button.

2.3.3.17 EMMT-2 (911060-091): The EMMT-2 EM assembly is designed to be installed into the Mantis FFM. It consists of two earphones, two earphone holders, a Hot-Mic, a Hi-Use® connector, and a PTT button.

2.3.3.18 EMMT-2SM (911060-103): The EMMT-2SM EM assembly is designed to be installed into the Mantis FFM. It consists of two earphones, two earphone holders, a Super Mic, a Hi-Use® connector, and a PTT button.

2.3.4 HHM-MKIV HAND-HELD MICROPHONE: As an alternative to the THB-16 headset, a hand-held microphone (the HHM-MKIV) is available. It should be used if the tender prefers to use the panel speaker instead of the headset's earphone to listen to received communications. Unlike use of the THB-16 headset, the PTT button on the HHM-MKIV must be pressed in order to transmit. This feature is useful if the tender does not want to transmit constantly.

2.3.5 UMBILICAL ADAPTERS: OTS offers adapters to interface to your current umbilical/communications cables. OTS offers a 6-pin to 5-pin (p/n 914085-000) military style adapter for use with Hydrocomm cables. Another available adapter is a double banana to 5-pin (p/n 914085-001) military connector for use with communication cables having standard double banana plug connectors.

2.4 FUNCTIONS

Figure 2 depicts the MK-IV panel with its controls and connections. The numbered text below is the key to the indexed items in Figure 2. Boldfaced text in all capital letters refers to the label on the panel.

1. **DIVER MOUTH VOLUME** (1 of 3): Volume control knob for listening to diver speech. Separate volume controls are provided for the three diver connections. Rotate the knob clockwise to increase and counterclockwise to decrease the volume.
2. **INAC indicator** (1 of 3): This red LED indicator illuminates to indicate when the INAC function is active, reducing noise levels. One indicator is provided for each diver.
3. **INAC LEVEL** (1 of 3): This knob controls the INAC sensitivity. A separate INAC control is provided for each diver. A clockwise rotation increases the sensitivity to shut off the diver transmission more readily in response to diver inhalation noise. A full counterclockwise turn past the detent shuts off the INAC.
4. **DIVER EAR VOLUME** (1 of 3): A knob is provided for adjustment of the receive volume for each diver earphone. Clockwise rotation increases and
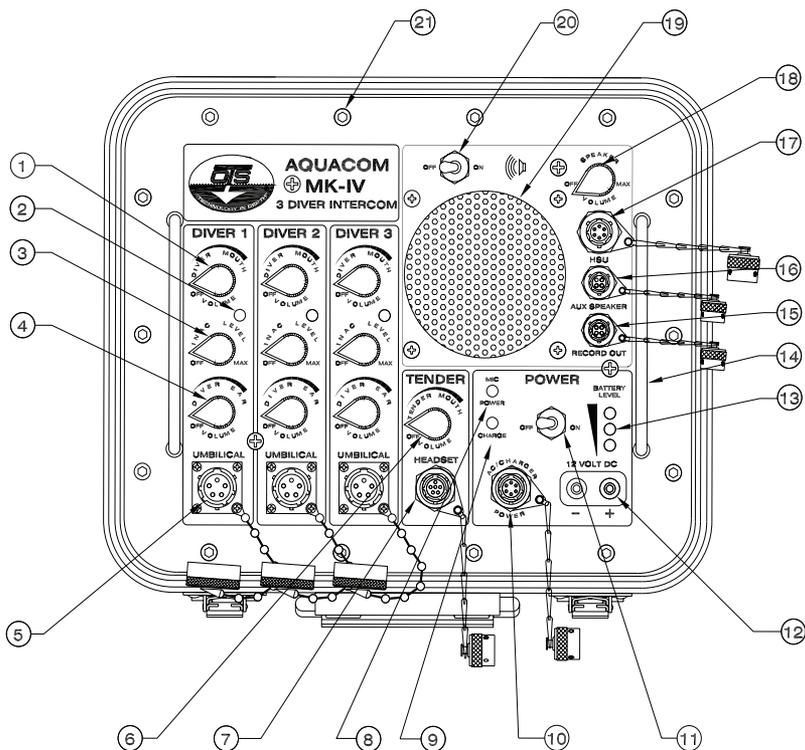

Figure 2. MK-IV Panel Layout

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counterclockwise rotation decreases the volume.

5. **UMBILICAL** (1 of 3): The five-socket military-style (MS) receptacles for connecting the cables from the diver earphone-microphone assemblies.

6. **TENDER MOUTH VOLUME:** This knob controls the output audio volume from the microphone on the tender headset (or optional HHM-MKIV hand-held microphone, sold separately). The setting affects the audio heard by all divers.

7. **HEADSET:** This six-contact, military-style (MS) receptacle accepts the connector from the supplied THB-16 tender headset or the optional HHM-MKIV hand-held microphone, sold separately.

8. **MIC POWER:** This LED illuminates red to indicate when the microphone type selection switch (see Section 4.1.2.3 and Fig. 4) is set to the "power mic" position, so that power is supplied to the microphone.

9. **CHARGE indicator:** When AC power is supplied (Item 9), this LED indicator illuminates red or green to indicate the charging status of the battery (see Section 3.1.1).

10. **AC/CHARGER power:** A four-pin military-style (MS) connector for providing external AC power to charge the battery (Section 3.1.1) or to operate the unit using AC power (Section 3.2).

11. **POWER switch:** A two-position toggle switch for turning on and off the MK-IV power.

12. **12 VOLT DC POWER:** A receptacle that accepts a double banana plug from a 12-volt DC power source, as an alternate to the internal battery or an AC power source.

13. **BATTERY LEVEL:** Three LEDs that illuminate to indicate the battery voltage level, as explained in Section 3.1.

14. **Handle** (1 of 2): Handles for lifting either the MK-IV unit (with the case open) or the panel out of the case.

15. **RECORD OUT:** A four-pin military-style (MS) plug for connecting a recording device (see Section 4.2, Step 5). The mating connector is provided with the MK-IV.

16. **AUX SPEAKER:** A four-pin military-style (MS) plug for connecting an external auxiliary speaker (see Section 4.2, Step 5). The mating connector is provided with the MK-IV.

17. **HSU:** A six-contact military-style (MS) receptacle for connecting a helium-speech unscrambler (HSU).

18. **SPEAKER VOLUME:** Control knob for adjusting the audio volume of the front-panel speaker (and an external speaker, if connected). A full counter-clockwise rotation past the detent turns off the speaker.

19. **Panel speaker:** The front-panel speaker for listening to the divers' communications without a headset.

20. **Speaker switch:** A switch for turning on and off the panel speaker (#19).

21. **Panel screw** (1 of 14): These fourteen #10-32 Phillips screws secure the panel to the case. They should be maintained at moderate tightness.

SECTION 3

SUPPLYING ELECTRICAL POWER

The MK-IV 3-Diver Intercom provides three options for power supply: the internal RB-1 battery, 90–240 volts AC power (at 50/60 Hz), or an external 12-volt DC power supply. The best option for you will depend on your particular application (see Section 4.2 for information on setup of the MK-IV).

3.1 BATTERY POWER

Inside the MK-IV is an RB-1 six-cell lead-acid battery, which supplies 12 volts at 5.0 amp-hours. The RB-1 is the latest in state-of-the-art battery technology, providing a long service life, high cycle life, superior reliability even under extreme conditions and use, and relative safety (minimal or no gassing under normal charging conditions). The RB-1 is recognized by Underwriters Laboratories (UL) as a component and meets UL1989.

Use the battery level indicator LEDs (Fig. 2, #13) to monitor the voltage level of the internal battery. The battery's charge status is indicated by the LEDs and beep tone sounds as described in Table 2. When the battery charge drops to approximately 6 volts, the MK-IV's power will shut off. Refer to Section 3.1.1 for information on recharging the battery.

3.1.1 BATTERY CHARGING: The MK-IV is equipped with an internal battery charger, so one only has to connect the MK-IV to an AC power source (per the instructions in Section 3.2) to recharge the battery.

Safety Precautions:

1. ***While charging the battery it is very important to open the MK-IV's lower safety vent*** (located on the front of the case's lower half when the panel faces upward) by unscrewing the ventilation valve fully counterclockwise. Ideally, while the batteries recharge, the MK-IV should be rotated 90 degrees onto the back of the case such that the valve is facing up; in the event of a charger

Table 2: Battery Voltage Indication

LED Color	LED Status	Beep Tone	Voltage[1]
Green	Solid	None	Above 9 V
Yellow	Solid	None	9 V
Red	Solid	Every 30 sec.	8 V
Red	Blinking	Every 30 sec.	7 V
Red	Blinking	Every 15 sec.	6.5 V

1. These values are approximate and should be used only as an estimate.

failure or defective battery cell, gasses released during charging can thus dissipate out of the unit through the vent (the released gasses are lighter than air and travel upward). Allow at least 20 minutes after charging for any gasses to dissipate before returning the unit to its operating position and closing the ventilation valve (by rotation fully clockwise, to prevent water entry).

2.   Because the ventilation port should be open while AC power is used and the battery recharges, the MK-IV should be operated in such a way as to minimize contact with splashing or spraying water. Operation away from direct contact with salt water or freshwater splashes or sprays is always recommended when operating 110/220-volt mains-powered electronics.

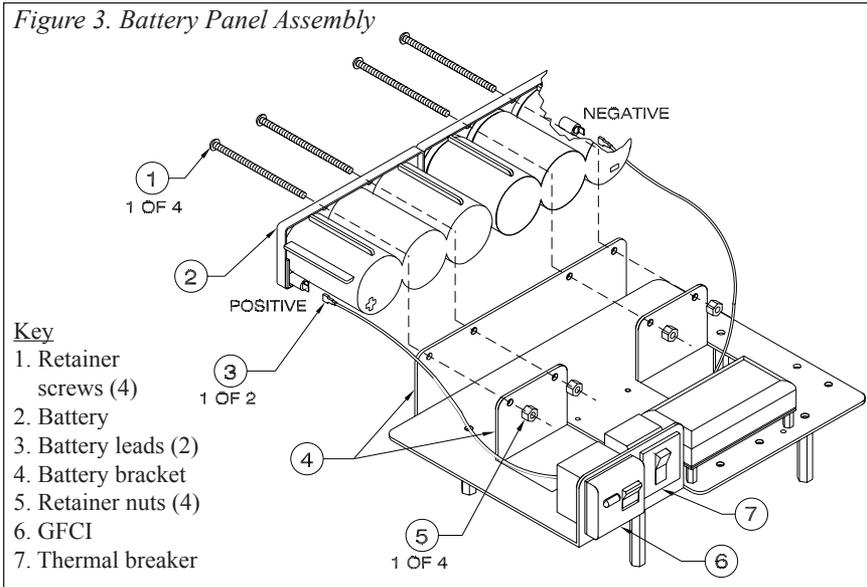A fully depleted battery can be recharged completely in about 3–5 hours.

While the battery is being charged and its voltage is below maximum, the charge indicator LED (Fig. 2, #9) illuminates *red* in color. When the battery has been completely recharged, the charger will enter trickle-charge mode to maintain maximal battery voltage, indicated by *green* illumination of the charge indicator LED.

3.1.2   BATTERY REPLACEMENT: The RB-1 battery should provide a long lifetime of service through many depletion and recharging cycles. Nevertheless, eventually the battery may cease maintaining an adequate charge; in this event you will have to replace the battery. Replacement RB-1 batteries (part no. 910319-000) are available from OTS or your local OTS dealer.

Follow these instructions to replace the RB-1 battery:

1.   Ensure the power switch (Fig. 2, #11) is toggled to the *off* position. If the unit is connected to an external power source, unplug the power cable from it.
2.   Disconnect all devices attached to the front panel.
3.   Using a #2 Phillips screwdriver, remove and set aside the fourteen panel screws (Fig. 2, #21) and neoprene seals.
4.   Using the two handles (Fig. 2, #14), remove the front panel. The MK-IV's internal hardware and electronics are attached to the panel, so it is fairly heavy and requires special care when being handled.
5.   Disconnect the battery leads (on opposite ends of the battery) (Fig. 3, #3) using a slotted screwdriver. *IMPORTANT NOTE: Always disconnect the negative (black) lead first to prevent accidental short-circuiting.*
6.   Remove and set aside the four screws (Fig. 3, #1) and lock nuts (#5) that secure the battery (#2) to the battery tabs (#4).
7.   Lift or slide out the battery from the tabs.
8.   Replace the battery with the new one, installing it with the terminals down and with the top of the battery (with the label) facing away from the electronics on the battery plate. The + and – signs should be oriented as illustrated in Figure 3.
9.   Replace the four screws and lock nuts. Tighten them securely without over-

Figure 3. Battery Panel Assembly

Key
1. Retainer
   screws (4)
2. Battery
3. Battery leads (2)
4. Battery bracket
5. Retainer nuts (4)
6. GFCI
7. Thermal breaker

tightening.

10. Connect the battery leads (red = positive, black = negative) as marked on the battery. *IMPORTANT NOTE: Always connect the positive (red) lead first.*

11. Reinstall the MK-IV panel, being careful not to contact the thermal breaker (Fig. 3, #7) and GFCI (#6) switches against the flange of the case (doing so might trip the switches). *(Note: The proper setting for both switches is to "ON," indicated on the GFCI switch as the* 1 *showing instead of the* 0 *and the adjacent indicator* C10 *colored* red *instead of* green*.)*

12. Secure with moderate tightness the panel to the case with the fourteen screws and seals.

13. Reconnect all devices to the front panel.

3.2   AC POWER

To operate the MK-IV using AC power, connect the supplied AC power/charging cable to the panel connector (Fig. 2, #10). Connect the cable's power plug to an AC power outlet that supplies 90–240 volts at 50/60 Hz. Operation of the unit with AC power will supply charging current to the battery. See Section 3.1.1 for safety precautions.

Note: The standard AC power cable has a plug compatible with the standard electrical outlets used in the U.S.A. However, if you need a plug for a different region of the world, appropriate power cords are available from OTS or your OTS dealer.
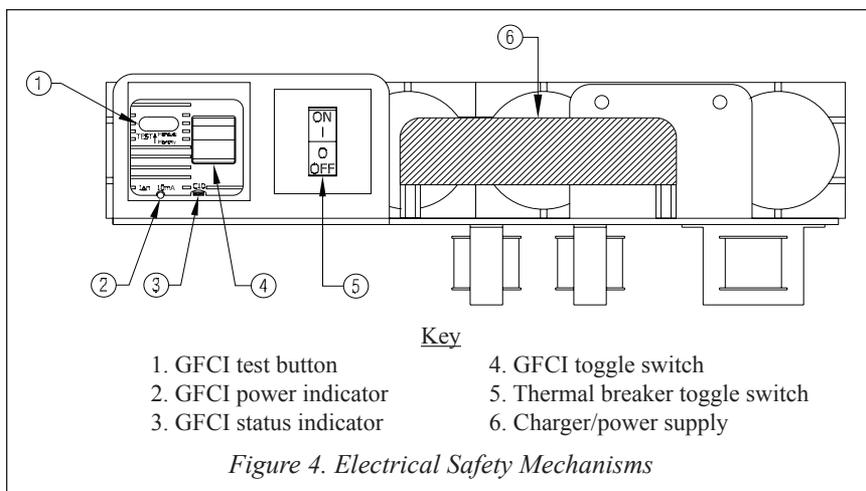
3.2.1   ELECTRICAL SAFETY MECHANISMS: The MK-IV provides two

mechanisms for electrical safety when AC power is used: a GFCI and a thermal breaker. These allow for the remote possibility of an electrical failure that could otherwise present a risk of electrical shock. Such an event is extremely unlikely, but if it were to occur, the safety mechanisms would immediately deactivate the unit's power as a precaution to prevent personal injury or damage to the MK-IV.

3.2.1.1   GFCI: The GFCI (ground fault circuit interrupter) protects the divers by immediately cutting off power to the unit in the unlikely event of a system failure, such as failure of the power supply (Fig. 4, #6), that could otherwise send excess AC current down the communications lines to the divers. The GFCI trips to deactivate the power when the AC current is diverted to a ground.

The GFCI can be accessed for troubleshooting or testing. To do so, it is necessary to remove the panel assembly (follow steps 1–4 of Section 3.1.2). ***IMPORTANT NOTE: Because of the possibility of electrical shock when the panel is opened, the GFCI should be accessed only by a qualified technician; furthermore, the MK-IV must be in a dry environment and on a stable surface.*** Refer to Figure 3, Item 6, for the location of the GFCI. A green LED (Fig. 4, #2) dimly illuminates to indicate the GFCI is active. A status window (Fig. 4, #3) shows a *red* color if the GFCI is active or *green* if it has been tripped to deactivate AC power.

When the GFCI trips, the unit's power is immediately deactivated, as indicated by the charging indicator LED's (Fig. 2, #9) turning off. Also, the GFCI switch (Fig. 4, #4) moves to the "off" position, the power indicator LED (Fig. 4, #2) turns off (although this can be difficult to determine because its illumination is very dim), and the GFCI status window shows a green color. The unit's power cannot be reactivated from an AC source until the GFCI is reset, although power can still be obtained from batteries or an external DC source.

Key
1. GFCI test button
2. GFCI power indicator
3. GFCI status indicator
4. GFCI toggle switch
5. Thermal breaker toggle switch
6. Charger/power supply

Figure 4. Electrical Safety Mechanisms

If AC power will be used, It is a good idea to test the GFCI before each use of the MK-IV, to verify that the fail-safe mechanism works for assurance of diver safety. *As explained previously, this test must be done away from water, to prevent risk of electric shock with the unit's panel opened; and it should be done only by a qualified technician.* To test the GFCI, press the "test" button (Fig. 4, Item 1) on the GFCI case. The power should immediately deactivate. (If it does not, contact OTS for assistance. Do not use the MK-IV until this problem is solved.) *IMPORTANT: Be sure to move the GFCI switch back to the "on" position, or the unit's power will not activate.*

3.2.1.2   Thermal Breaker: The thermal circuit breaker (Fig. 3, #7) monitors the amount of AC current passing through the circuit. If the internal power supply (Fig. 4, #6) were to fail, allowing excessive current to pass through, then the thermal breaker would trip, deactivating AC power to the unit.

If the thermal breaker trips, it must be reset before the MK-IV can be used again with AC power. To do so, the panel assembly must be removed (follow steps 1–4 of Section 3.1.2). *IMPORTANT NOTE: Because of the possibility of electrical shock when the panel is opened, the thermal breaker should be accessed only by a qualified technician; furthermore, the MK-IV must be in a dry environment and on a stable surface.* Refer to Figure 3, Item 7, for the location of the thermal breaker.

When the thermal breaker trips, the unit's power is immediately deactivated, as indicated by the charging indicator LED's (Fig. 2, #9) turning off. The unit's power cannot be reactivated from an AC source until the thermal breaker is reset, although power can still be obtained from batteries or an external DC source.

3.3   EXTERNAL DC POWER

To operate the MK-IV using an external 12-volt DC power source (such as a lead-acid battery of 5.0 Ah or other DC power supply), connect electrical cables via a standard double banana plug to the DC power receptacle (Fig. 2, #10) on the MK-IV front panel. Be sure to connect the negative lead to the black socket and the positive to the red.

If the voltage of the external DC power source falls below that of the internal battery, the MK-IV will begin to draw current from both power sources. Therefore, the battery level indicator (Fig. 2, #13) will monitor the voltage of both the internal battery and the external DC source.

SECTION 4

OPERATION

The Aquacom® MK-IV 3-Diver Intercom, while providing a variety of powerful functions and features, is relatively simple to set up and operate by following the instructions provided here.

4.1   ADJUSTMENTS AND CONTROLS

The MK-IV 3-Diver Intercom has various controls that allow you to customize and adjust the settings to your preference, to provide optimal communications for your situation. This section describes the available controls.

4.1.1   SYSTEM POWER: Once a power source is available (Section 3), the power switch on the front panel (Fig. 2, #11) toggles the unit's power on and off.

4.1.2   DIVER CONTROLS:

4.1.2.1   Diver Audio Volume Controls: The microphone and earphone audio signal volume levels are separately adjustable for each diver (Fig. 2, #1 and #4), so you can adjust the levels to provide the best combination for all divers and the tender to hear the communications comfortably.

4.1.2.2   INAC Control: The U.S. Navy first put the Inhalation Noise Attenuation Circuit (INAC) into use more than 20 years ago. The purpose of this circuit was to reduce inhalation noise produced by preamplified microphones that tend to boost high-frequency noise. This noise is loudest in some (but not all) diving masks and helmets.

Depending on the microphone-mask combination, the INAC does attenuate diver inhalation noise. However, if the microphone, mask, and regulator produce low noise levels, the INAC does not operate correctly, because the INAC relies on noise levels that are much higher than that of divers' speech. A diver's speech will be cut off if inhalation noise levels are insufficient for the INAC to function correctly. We therefore advise you to use the INAC only when warranted by inhalation noise levels; otherwise, the INAC controls should be set to the "off" position.

The INAC level control (Fig. 2, #3) allows you to turn on and off the INAC circuit and to adjust the INAC detection sensitivity for each diver. A higher sensitivity setting causes the INAC to turn off the diver's microphone more readily when in-halation is detected. Adjust the sensitivity for each diver such that speech is heard but inhalation breathing noise is not.

A red LED (Fig. 2, #2) is provided for each diver's INAC control; it illuminates to indicate that the INAC is active, reducing noise.

4.1.2.3   Microphone Type Selection: The MK-IV accommodates both powered,
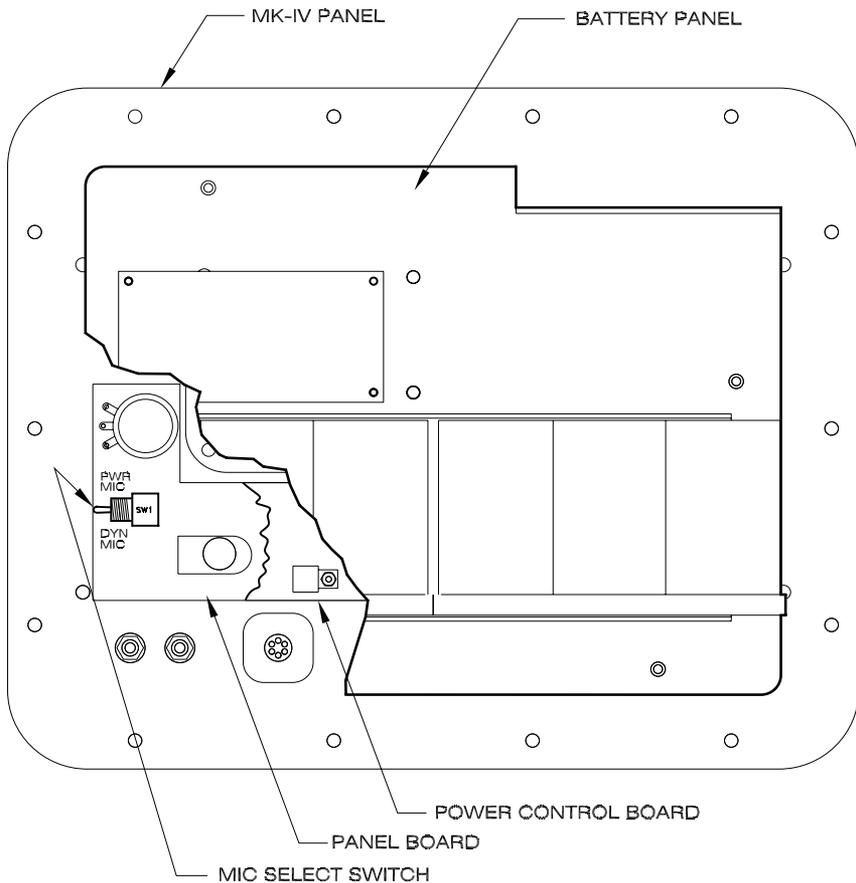
Figure 5. Location of Microphone Type Selection Switch

preamplified microphones and standard, non-powered microphones used by the divers. (See Section 2.3.2, and contact OTS or your local OTS dealer for information on our selection of preamplified and dynamic microphones.)

The MK-IV has a toggle switch to select the type of microphone used by the divers (Fig. 5). When the switch is set for use of a power mic, the red "mic power" indicator LED (Fig. 2, #8) on the panel illuminates. Power is sent to the microphone inputs, and amplification is reduced to accommodate the preamplified microphone. If a non-powered microphone (e.g., a Hot-Mic or Super Mic) is used while the microphone selection switch is in the "power mic" position, the microphone will still operate, but with less volume due to the reduced amplification. Current-limiting resistors in the circuit will prevent excessive current from flowing through low-impedance microphone elements. However, we do not recommend this operation.

To set the microphone type selection switch, follow these instructions:

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1. Ensure the power switch (Fig. 2, #11) is toggled to the *off* position. If the unit is connected to an external power source, unplug the power cable from the power source.
2. Disconnect all devices attached to the front panel.
3. Using a #2 Phillips screwdriver, remove and set aside the fourteen panel screws (Fig. 2, #21) and neoprene seals.
4. Using the two handles (Fig. 2, #14), remove the front panel. The MK-IV's internal hardware and electronics are attached to the panel, so it is fairly heavy and requires special care when being handled. Lay the panel upside down, with the panel controls facing downward.
5. Find the toggle switch for selecting the type of diver microphone. As illustrated in Figure 5, it is located on the left edge of the lower printed circuit board. The two switch positions are labeled "PWR" and "DYN."
6. Set the switch at the appropriate position for the type of microphone the divers will use: either "PWR" for powered, pre-amplified microphones or "DYN" (meaning "dynamic") for standard, non-powered microphones. *(Note: All divers must use the same type of microphone, powered or standard.)*
7. Reinstall the MK-IV panel, being careful not to contact the thermal breaker (Fig. 3, #7) and GFCI (#6) switches against the flange of the case (doing so might trip the switches). *(Note: The proper setting for both switches is to "ON," indicated on the GFCI switch as the* 1 *showing instead of the* 0 *and the adjacent indicator* C10 *colored* red *instead of* green*.)*
8. Secure with moderate tightness the panel to the case with the fourteen screws and seals.
9. Reconnect all devices to the front panel, as well as the external power source if used (see Section 4.2 for setup instructions).

4.1.2.4   Diver PTT Control: Most diver earphone-microphone assemblies have a push-to-talk (PTT) button that—for many communication systems—has to be pressed for the diver to transmit voice communications. However, because the MK-IV is a four-wire, "round robin" system, the diver microphone is constantly in transmission mode; so the PTT button is not used.

4.1.3   TENDER CONTROL: Control of tender communications is simple, with one tender control: the tender mouth volume control knob (Fig. 2, #6). It is used to adjust the audio volume output by the tender microphone (on the supplied headset or optional HHM-MKIV hand-held microphone, sold separately). Adjust the tender mouth volume level in coordination with the diver earphone volume levels (Section 4.1.2.1) to provide the optimal listening volume for each diver. A fully counterclockwise turn of the tender volume control past the detent deactivates the tender microphone, so no tender speech will be heard.

The tender headset listening volume is controlled via the diver microphone volume controls (Section 4.1.2.1); there is no separate audio volume control for the headset earphones.

The THB-16 tender headset has a push-to-talk (PTT) button below the earcup;

however, because the MK-IV is a four-wire system with constant intercom communications, the headset's PTT button is not used.

If you use the optional HHM-MKIV hand-held microphone (sold separately), press and hold down the PTT button on the microphone while speaking.

4.1.4   SPEAKER POWER AND VOLUME: The speaker volume control knob (Fig. 2, #18) adjusts the audio volume output from both the panel speaker (#19) and any external speaker connected to the auxiliary speaker jack (#16). If the tender prefers to listen only through the headset, the speaker on/off switch (#20) should be turned to the *off* position. If a remote speaker is used, it operates independently of the on/off switch (#20), and is still affected by the volume control knob.

4.2   SETUP

To prepare the MK-IV 3-Diver Intercom for use, follow these simple instructions:

1. *Electrical connector wiring:* If you plan to use system components or accessories not manufactured by OTS or not designed to be compatible specifically with the MK-IV, you will need to acquire the correct connectors and install them onto the cable or wiring harness of your equipment. Refer to Table 3 for a list of compatible connectors and for information for the wiring hookup for each device.

    Provided with the MK-IV are two 4-contact military-style (MS) receptacles for connection of a recording device and an external speaker. The two connectors are identical. If you are going to record communications or use an external speaker, make the wiring connections depicted in Table 3 (items 4 and 5) from the device's cable to the supplied MS connector.

2. *Battery charge:* If the internal battery is going to be used for powering the unit, ensure the battery is adequately charged by checking the battery level indicator LEDs (Section 3.1) or, if a completely full charge is needed, by connecting AC power and observing the color of the charge indicator LED (Section 3.1.1 and Table 2). If the battery is not sufficiently charged, recharge it per the instructions in Section 3.1.1.

3. *Diver microphone type selection:* Follow the instructions in Section 4.1.2.3 to select the type of microphone the divers will be using.

4. *Test of GFCI electrical safety mechanism:* If you are going to use the MK-IV with AC power, we recommend you test the GFCI according to the instructions in Section 3.2.1.1 (GFCI). *IMPORTANT NOTE: This step must be done in a dry environment (with no sea spray or standing water around) and should be done only by a qualified test technician, due to the safety risk associated with having the panel assembly open while AC power is supplied to the unit.*

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Table 3: Connectors and Wiring of External Devices

Item	Connection	Connector OTS P/N	Connector Industry P/N	Pin	Signal
1	Diver umbilicals	211218-000	MS3116E14-5P	A	Mic ground
				B	Mic signal
				C	Ear signal
				D	Ear signal
				E	Chassis ground
2	Tender headset	J070-5	MS3116E10-98P	A	Tender mic signal
				B	Tender mic return
				C	Tender ear signal
				D	Tender ear return
				E	Chassis ground
				F	No connection
3	AC/charger	J070	MS3116E10-6S	A	AC hot
				B	Neutral
				C	Chassis ground
				D	No connection
				E	No connection
				F	No connection
4	External speaker	211106-000	MS3116F8-4S	A	Source
				B	Ground
				C	No connection
				D	No connection
5	Record out	211106-000	MS3116F8-4S	A	No connection
				B	No connection
				C	Source
				D	Ground
6	HSU	J070-4	MS3116E10-6P	A	Signal in/out
				B	Ground
				C	Signal in/out
				D	Control
				E	Voltage 1 (12 V)
				F	Voltage 2 (5 V)

5. *Diver connections:* With the MK-IV power switch still in the *off* position, plug the communication cable (e.g., ComRope) from each diver into the diver umbilical connector on the panel (Fig. 2, #5). With multiple divers, note which diver is designated as Diver 1, Diver 2, etc.

6. *Tender connection:* Plug the headset or hand-held microphone connector into the headset jack (Fig. 2, #7).

7. *Auxiliary connections:* If you are going to use a recording device, a remote speaker, or a helium speech unscrambler (HSU), connect the device to the appropriate jack on the panel (Fig. 2, #15, #16 and #17).

8. *Power connection:* If an AC power source will be used to operate the MK-IV, follow the instructions in Section 3.2. If a DC source is to be used, follow the instructions in Section 3.3.

9. *Initial adjustments:* Turn all volume controls (diver mouth, diver ear, tender mouth, and external speaker) to a minimal setting. (Doing so will prevent ear damage in case the settings were previously too high.) Turn off (or to a minimal setting) the INAC for each diver.

10. *Power activation:* Before activating the unit's power, ensure the lower ventilation valve (on the front of the case) is completely closed (rotated fully clockwise). Turn on the system power (Section 4.1.1). Verify that one of the battery level indicator LEDs (Fig. 2, #13) illuminates (the green LED should illuminate in the presence of a battery or external DC power source of at least 10 volts). If an AC power source is used, the red charge indicator LED (Fig. 2, #9) will also illuminate. Sounds from all divers' microphones connected to the MK-IV can be heard.

11. *Final adjustments:* Before and during the dive, slowly adjust all volume levels as necessary to obtain the desired communication volumes. If interference from diver breathing noise is a problem, set the INAC level (Section 4.1.2.2) to the minimal sensitivity necessary to stop the interference while still allowing the divers' communications to be heard.

4.3 RECEPTION

Once the MK-IV 3-Diver Intercom is powered up, it communicates all sounds detected by the diver microphones. If necessary, use the INAC sensitivity controls to screen out diver inhalation breathing noise from each diver (Section 4.1.2.2).

Adjust all audio volumes to comfortable listening levels. The receive volume level of the tender headset is controlled by adjustments to the diver mouth volume levels; it does not have its own independent control.

4.4 TRANSMISSION

The tender should adjust the headset's boom microphone or hold the hand-held microphone so that it is close to his mouth (within 1/4 inch is best). To transmit voice communications, the tender should speak slowly, clearly, and directly into the microphone. Because the MK-IV is a four-wire "round robin" system, received communications can be heard while the tender is transmitting, and pressing the push-to-talk (PTT) button on the headset to transmit is unnecessary (although the PTT button on the optional hand-held microphone must be pressed).

4.5   RECORDING COMMUNICATIONS

If you would like to record the communications, attach one of the supplied MS connectors to the cable of the recording device according to the instructions provided in Step 5 of Section 4.2 (Setup). Plug the recorder connector into the panel (Fig. 2, #15). Ensure the recorder is recording when the MK-IV is operated. All sounds outputted to the speaker will be recorded at "line level."

4.6   AFTER THE DIVE

After each use, be sure to disconnect all the connectors from the MK-IV panel, and cover the panel connectors with the attached dust caps to protect them. If you have been using the battery for power, recharge the battery for the next use. Follow the preventive maintenance instructions presented in Section 5.1 to maintain your MK-IV in optimal condition.

If the MK-IV is going to be transported airborne, open both safety vents to depressurize the unit's interior during flight. The valves are located on the upper and lower halves of the case's front with the panel facing upward and are opened by fully counterclockwise rotation. Before using the MK-IV again, close the ventilation valves (by rotation fully clockwise) to prevent water from entering the case.

4.7   HELPFUL HINTS

These guidelines are provided to help you understand how best to use the MK-IV 3-Diver Intercom.

1. Before diving operations begin, check to ensure the microphone, earphone, and wiring connections are secure and operating properly. Ninety percent of all problems in underwater communications are due to a connection problem.

2. If you will use battery power, always check the battery power level before the dive, and recharge the battery if necessary.

3. Secure the MK-IV if using it on a vessel that is rolling about. Strain-relieve the umbilical(s) (diver intercom cables) so they will not pull on the MK-IV.

4. Ensure the umbilicals are dressed out so as not to trip anyone.

5. When talking to divers, keep in mind they have many things happening while underwater. It is best to get the diver's attention before giving him a message (e.g., "Alpha Diver, Alpha Diver, this is Topside, come in Alpha Diver"). The

diver should then respond to inform you that he is listening (e.g., "Topside, this is Alpha Diver, go ahead").

6. Avoid excessive tender-to-diver volume. Most of the time, when there is too much volume, the diver will hear distortion and ask for more volume!

7. Speak slowly in one brief, continuous sentence. Speaking in short sentences gives divers a chance to take a breath and still receive a clear message.

8. When communicating with divers, it is a good idea to have the divers repeat your messages to ensure they understood what you said. Also, repeat what you heard the divers say to ensure everyone is communicating accurately.

9. If this is the first time you or anyone on your team is using underwater communications, the team should get together to talk about the system. Practice alternative communications to allow for the event the communications system fails to function.

SECTION 5

MAINTENANCE AND TROUBLESHOOTING

5.1   PREVENTIVE MAINTENANCE

Although the Aquacom® MK-IV 3-Diver Intercom has a rugged design, it should be treated with care, as with any quality electronic equipment. The following should be done regularly or before every dive to prevent malfunction of the MK-IV:

1. Clean the MK-IV by wiping it free of dirt, debris, and water with a clean, soft cloth. Warm water with a small amount of nonabrasive soap is the recommended cleaning solution. Do not saturate the cloth or sponge; doing so may allow water to flow inside the case and cause damage.
    To clean the headset or optional hand-held microphone, use a mild soap solution, and wipe it dry.
2. Examine the exterior of the MK-IV to assure there is no damage.
3. Inspect the connectors and controls on the panel for signs of damage.
4. Check the connectors for bent or corroded pins.
5. Check the power cables for cuts and abrasions.
6. With the unit's power on, test the indicator LEDs to ensure they illuminate when they should.
7. Inspect the case gasket (underneath the panel) and the o-ring seal between the case and lid to assure they are clean and show no signs of deterioration.
8. Inspect the fourteen seals that are underneath the screws and washers (Fig. 2, #21) for signs of damage. Replace them as necessary (see the Appendix, p. 27, Item 5).
9. If the battery has not been used for a long time (we suggest six months), recharge it to maintain its life.

If your organization has established a formal Preventive Maintenance System (PMS) program, the steps above can be incorporated into your regular scheduled maintenance program but should be done frequently.

5.2   TROUBLESHOOTING

The MK-IV was designed as high-quality communications equipment. Nevertheless, as with any electronic equipment, failures occasionally may occur. Table 4 provides a list of some problems that might occur, possible causes, and our recommended solutions to attempt. If you are experiencing a performance failure of the MK-IV that is not mentioned in Table 4, or if you have attempted the suggested solutions and the failure persists, contact OTS or your local OTS dealer for consultation or repair (see p. 28 for OTS contact information).

If you need to replace any components or parts, refer to the Appendix for a list of spare parts and components available from OTS.

Table 4: Troubleshooting

Problem	Probable Cause	Remedy
No power	Battery exhausted	Recharge battery.
	Battery leads loose	Check battery connections.
	Defective ON/OFF switch	Change switch.
	Board connector not making contact	Clean pins.
	Open circuit on board	Repair or replace board.
	GFCI switch defective or tripped	Check GFCI switch.* "1" should show instead of "0," C10 indicator red instead of green.
	Thermal breaker switch defective or tripped	Check thermal breaker switch.* Should be set to "ON."
Battery does not charge (charge indicator LED does not illuminate).	Damaged power cord	Check power cord.
	GFCI switch defective or tripped	Check GFCI switch.* "1" should show instead of "0," C10 indicator red instead of green.
	Thermal breaker switch defective or tripped	Check thermal breaker switch.* Should be set to "ON."
Battery does not hold a charge.	Defective battery	Replace battery.
Power only for a short time when power switch is turned on.	Defective boot circuit or CPU chip	Replace board.
Does not operate on external DC power.	Incorrect polarity or insufficient voltage	Check voltage and polarity of DC power source.
Does not operate on AC power.	Defective AC power outlet	Check AC power source.

(cont.)

*See Section 3.2.1 (Electrical Safety Mechanisms) for information and instructions.

Table 4 (continued)

Problem	Probable Cause	Remedy
	Damaged power cord	Check power cord.
	GFCI switch defective or tripped	Check GFCI switch.*
	Thermal breaker switch defective or tripped	Check thermal breaker switch.*
No diver voice	Microphone type incompatibility	Check for correct dyn/power mic selection for type of microphones.
		Ensure all mics are of the same type.
	Poor diver and/or tender headset connections	Check diver and tender headset connections.
	If problem only with tender, defective or damaged headset	Check headset cable and connector.
	Loose diver connection at processor board	Check diver connector; clean or reconnect.
	Defective PCB	Replace board.
	Defective volume control	Replace control.
	Defective panel speaker	Replace speaker.
No tender voice	Poor tender headset connection	Check tender headset connection.
	Loose tender connection at processor board	Check tender connector; clean or reconnect.
	Defective board	Replace board.
	Weak battery	Recharge the battery.
No record-out function	Board connector not making contact	Clean pins or replace defective connector.

*See Section 3.2.1 (Electrical Safety Mechanisms) for information and instructions.

APPENDIX

SPARE COMPONENTS AND PARTS

Part Description	OTS P/N	U.S. Military P/N	Figure:Item
1) THB-16 tender headset with boom microphone	900298-032	N/A	N/A
2) AC power/charging cable	914081-000	N/A	N/A
3) RB-1 battery	910319-000	N/A	3:2
4) Panel screw	244004-000	N/A	2:21
5) Panel sealing washer	245051-001	N/A	N/A
6) Panel handles	243007-000	N/A	2:14
7) Panel connectors			
a) Diver umbilical connectors	211217-000	MS3112E14-5S	2:5
b) Tender headset connector	J070-1	MS3114E10-98S	2:7
c) AC/charger power connector	J070-2	MS3114E10-6P	2:10
d) 12-volt DC power connectors	*Red:* 211136-000	N/A	2:12
	Black: 211136-001	N/A	2:12
e) Record-out & aux. speaker connectors	211105-001	MS3114E84P	2:15,16
f) HSU	J070-3	MS3114E10-6S	2:17
8) Panel speaker	110052-000	N/A	2:19
9) Control knobs (pointed)	242018-000	MS91528	2:1,3,4,6,18
10) Bumper feet	248061-000	N/A	N/A
11) LED lens caps			
a) Red	H016	N/A	2:13
b) Yellow	H016-3	N/A	2:13
c) Green	H016-2	N/A	2:13
d) Clear	248060-000	N/A	2:8
12) Case (housing)	134145-000	N/A	N/A
13) Case gasket	282032-000	N/A	N/A
14) Case lid o-ring	282033-000	N/A	N/A

Undersea Systems International, Inc.
dba
Ocean Technology Systems

LIMITED WARRANTY

Ocean Technology Systems' Aquacom® MK-IV 3-Diver Intercom is fully warranted against defects in materials and workmanship for a period of one year from the time of purchase. Our obligation under this warranty is limited to the replacement of any part or parts that prove to our satisfaction to have been defective and that have not been misused or carelessly handled. Labor is warranted for one year from time of purchase. The complete unit and/or part must be returned to our factory, transportation charges prepaid. We reserve the right to decline responsibility where repairs have been made or attempted by other than an Ocean Technology Systems factory-trained service center or properly trained personnel. In no event shall Ocean Technology Systems be liable for consequential damages.

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