

MARATHON

User's Manual



ORCA
DIVE COMPUTERS

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After reading this manual, please take the time to read the accompanying booklet, Dive Computers & Diving Safety. The information you learn could save your life.

WARNING!

IMPROPER USE OF A DIVE COMPUTER CAN LEAD TO SERIOUS INJURY OR DEATH. USE OF THE MARATHON CANNOT GUARANTEE PREVENTION OF DECOMPRESSION SICKNESS, EVEN WHEN USED PRECISELY ACCORDING TO MANUFACTURER'S INSTRUCTION. IT CAN ONLY SERVE TO GIVE YOU A LOW, BUT NONETHELESS REAL POSSIBILITY OF GETTING DECOMPRESSION SICKNESS. YOU MUST BE WILLING TO ACCEPT THIS RISK TO USE THE MARATHON.

Do not use this instrument until you have read this manual and the accompanying booklet "DIVE COMPUTERS AND DIVING SAFETY."

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TABLE OF CONTENTS

Introduction.....	4
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Chapter 1

Definition of Terms	6
Other Terms found in this Manual	7

Chapter 2 -Operating Instructions

Power-Up.....	8
Surface Mode.....	10
Dive Mode.....	12
Decompression Diving	14

Chapter 3 -Sample Dive Profiles

A No-Decompression Dive	17
Back on the Surface	18
A Decompression Dive	19

Chapter 4 -Power System

Battery Care.....	20
Low Battery Warning System	20
Power "OFF" -Power Saving Feature.....	21
Insertion of Batteries.....	22

Chapter 5 -Special Situations and Safety

Adding a Margin for Safety	24
Repetitive Deep Dives.....	24
Altitude Considerations.....	25
Out of Range.....	25
Time Displays.....	26
Ascent Rate Alarms	26
Ceiling Penetration	27
Previous Dive History	27

Chapter 6 -Miscellaneous

Helpful Operating Notes	28
Holster Installation.....	28
Maintenance and Care	29
Background and Theory	30
Questions and Answers	32
Technical Specifications.....	36
Limited Warranty	38
User's Display Guide	39

INTRODUCTION

The MARATHON is an extremely sophisticated instrument. Much engineering has gone into keeping its display simple and free from confusing clutter. Bottom time is precious - it shouldn't be wasted staring at a lot of numbers or trying to figure out what they mean. The MARATHON presents you with only three numbers. When you are busy on a deep dive with little precious time left, you will appreciate your MARATHON's large numbers and simple format.

The size of this manual may look a little imposing. **DON'T PANIC!** Only a few pages are needed to describe the MARATHON and its use. The balance of the manual is devoted to safety considerations, unusual situations, special features, theory of operation and technical specifications.

Before you start, appreciate that a dive is no place to take your safety lightly. We'd like to keep you as a healthy and happy customer! Please read carefully this manual and the accompanying booklet, "DIVE COMPUTERS AND DIVING SAFETY." If you did not receive the booklet, call Orca (number in back) immediately and one will be sent to you free of charge.

Next, fill out and return your warranty card.

The MARATHON is designed for sport no-decompression diving. The numbers are large enough to read with a foggy mask, at night or in murky water. Before shipment, each instrument's water-tight integrity is tested to below 200 feet. Depth accuracy remains within 2 feet all the way down to 199 feet.

Although the MARATHON is designed for no-decompression diving, it is equipped with an important safety provision. If you accidentally go over your no-decompression limits, the MARATHON will not shut off. **It will give you the decompression information you need to decompress and get back to the surface.**

Calculations made by the MARATHON are based on the same Orca Decompression Model that has been in use for more than 9 years and (at this printing) almost 10,000,000 dives. On square profile dives, the Orca model will provide a dive that is more conservative than the U.S. Navy Tables. Yet on most sport dives, the Orca Model will give you more bottom time than the Navy Tables. This apparent contradiction works because most sport dives are multi-level. Sport divers rarely spend their entire dive at one depth. The MARATHON computes your Remaining No-Decompression Time (RNDT or **"SAFE TIME"**

REMAINING") by taking into account every depth change. To use the MARATHON safely, you MUST know how to interpret RNDT numbers and know how to add personal safety margins. Although safety margins will be discussed in this manual, they are examples only. You should select your own margins based on your condition and the degree of risk you wish to take. Remember that new information is continually being learned about diving physiology. The advice in this manual is based on the best information available at the time it was printed. It is your responsibility to stay up to date. Also, don't forget that diving is an activity that is not natural to humans and therefore many safety practices are not instinctive.

Reread the safety booklet occasionally and keep up your training with refresher courses.

Throughout this manual there will be warnings and notes as shown below:

WARNING!

Denotes advice which could hurt the diver if not followed.

NOTE: Denotes advice which could damage the dive computer if not followed.

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Chapter 1

Definition of Terms

The following is a list of terms and definitions associated with the MARATHON. Words in **BOLD** appear on the instrument face and words in **BOLD ITALICS** appear on the LCD:

CEILING ALARM - Flashes to warn you that you need decompression and therefore have a **CEILING** above which you may not ascend.

SAFE - CEILING - The shallowest depth to which you can ascend without exceeding your Theoretical Nitrogen Over-pressure Limit. **CEILING** is similar to a decompression stop depth except that decompression stop depths are usually expressed in 10 foot increments whereas **CEILING** is expressed in 1 foot increments.

SAFE - TIME REMAINING - Also known as RNDT (Remaining No Decompression Time), the MARATHON uses the term **SAFE TIME REMAINING** for simplicity. **SAFE TIME REMAINING** is the Remaining No-Decompression Time available during the present or a future dive.

SAFE - WAIT TO FLY - Indicates the minimum time that must pass before you can fly in a pressurized aircraft without exceeding your Theoretical Nitrogen Over-pressure Limit. See Chapter 5: Special Situations and Safety.

ELAPSED TIME - SURFACE INTERVAL - Time elapsed since surfacing at the end of last dive.

ELAPSED TIME - LAST DIVE - Duration underwater during previous dive; sometimes erroneously referred to as "bottom time."

ELAPSED TIME - (Shown underwater) - Time since descending below 6 feet on current dive.

OVER-RANGE - Seen as **OR** on the display, this indicates that you have exceeded the normal operating depth (200') of the MARATHON.

WARNING!

Once the operating range has been exceeded, the instrument readings may no longer be valid.

ASCEND SLOWER - Flashes to warn you that you are ascending too rapidly.

Other Terms Found in this Manual

Surface Mode - The method of operation when the MARATHON is on the surface.

Dive Mode - The method of operation when the MARATHON is on a dive.

Power **OFF** - Automatic shut-down of the instrument to conserve power. This message is displayed after all residual nitrogen has cleared and the computer has not been in dive mode in the last 60 minutes.

Repetitive Dive - Any dive made when body tissues still contain residual nitrogen from an earlier dive. See: Special Situation and Safety.

Theoretical Nitrogen Over-Pressure Limit - The limit of calculated excess nitrogen allowed to be present in your tissues without decompression being mandatory.

CHAPTER 2

OPERATING INSTRUCTIONS

POWER-UP

The easiest way to learn how a Marathon works is to power it up. On Marathon, the battery door (located at the lower left corner of the unit) is also the power switch. Turning the battery door fully clockwise will turn the unit on. To turn off the Marathon, turn the door counterclockwise until the unit turns off.

NOTE: Turn the door fully clockwise when turning on. Do not stop turning when you see the display light up -continue turning until the door stops. Also, when turning off the unit, turn the door counterclockwise until the unit turns off -do not continue to turn the door after the display has gone blank.

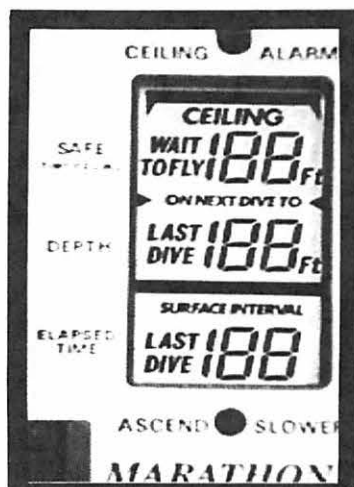


Figure 1

WARNING!

WHEN YOU FIRST TURN THE MARATHON ON, YOU MUST BE ON THE SURFACE.

CHECK ALL DISPLAY SEGMENTS

Upon powering up, the Marathon will check all of its computing circuits. It will sequentially light all segments on the LCD and turn on the warning lights, allowing you to verify that all are working (Figure-1).

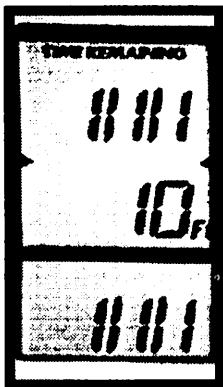


Figure 2

SOFTWARE VERSION

Next, the software version number (in this case Version 1.0) is displayed in the center window. (Figure-2)

ALPHA MESSAGES

The MARATHON then sequentially displays all "alpha" messages for 1 second each. Since you will rarely see some of these messages, they are shown at each power-up so that they will be familiar to you if and when they occur during diving operation.

The alpha messages are: LOw battery(Figure 3), computEr Error (Figure 4), Out of Range (Figure 5) and Go Up, meaning begin your ascent now (Figure 6).

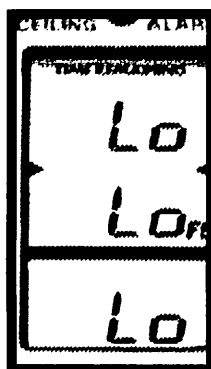


Figure 3

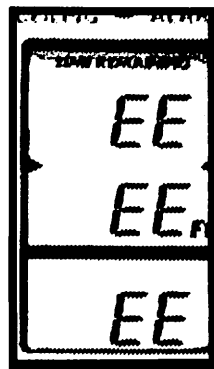


Figure 4

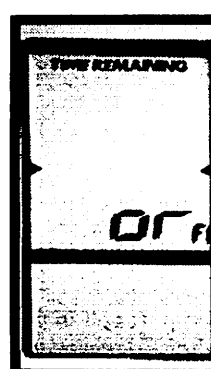


Figure 5



Figure 6

BATTERY VOLTAGE AND SURFACE PRESSURE

CEILING — ALARM

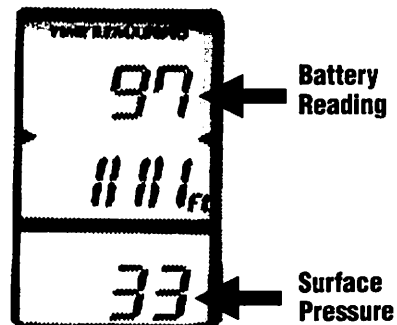


Figure 7

The MARATHON then reads its battery voltage and establishes the ambient surface pressure (Figure 7). New batteries show a number of above 95.

Pressure is determined by taking 5-8 readings of the transducer circuits, 1/4 seconds apart. The "ASCEND SLOWER" light flashes briefly at each reading. At this point in the power-up, battery condition is displayed for 2 seconds in the top window and the transducer reading is displayed as a number in the bottom window. The bottom number displayed (usually referred to as the "initiating" number) is ambient pressure in fsw. If the reading is greater than 36 or less than 16, the computer will not accept these values as a valid surface pressure and will not proceed further. If you turn the unit on underwater, the initiating number will be greater than 36 and the unit will not continue past this section. You must be on the surface to properly initiate the Marathon.

SURFACE MODE (DIVE PLANNING)

Once the Marathon has completed its checklist, it goes into SURFACE MODE and begins counting surface time. Surface time is displayed in the **ELAPSED TIME** window. The **SAFE** and **DEPTH** windows are used to display the Scrolling Dive Table.

The Scrolling Dive Table is a slowly changing display in the top two windows that shows you how much **SAFE TIME REMAINING** (Remaining No-Decompression Time) you may spend at various depths on your **NEXT DIVE**. The Marathon calculates and displays **SAFE TIME REMAINING** at depths from 30 to 130 feet in steps of 10 feet. The display tells how long you could stay at each displayed depth if you were there presently. (See Special Situations and Safety for warnings about repetitive diving.)

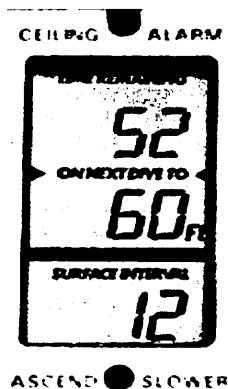


Figure 8

The times shown take into account any residual nitrogen you may still have since your last dive.

When the time is greater than 199 minutes, it is shown in hours, with an "H". Rounding is in the direction of safety; the precise, actual number is held internally for use in calculation. In the example shown (Figure 8), your **SAFE TIME REMAINING** would be 52 minutes on your **NEXT DIVE** to a **DEPTH** of 60 feet. The **ELAPSED TIME** on the surface is 12 minutes.

After each cycle through the depths, the display changes for 9 seconds to a log of your last dive (figure 9). Notice that the window legends have changed. Now the **SAFE** window shows **WAIT TO FLY** - the minimum time that you must wait before flying on a commercial airliner with an 8000 foot cabin pressure. Here again, the time is in minutes unless an "H" indicates hours. The lower two windows show a record of your **LAST DIVE** - the maximum **DEPTH** and total **ELAPSED Dive TIME** on your last dive. Figure 9 is an example of a display showing that you must **WAIT TO FLY** at least 7 HOURS; the maximum **DEPTH** of the last dive was 108 feet; with an **ELAPSED** dive **TIME** of 30 minutes. After nine seconds of this display, the scrolling **NEXT DIVE** table will begin again from 30 fsw. You are now ready to dive!

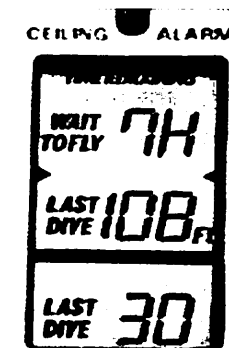


Figure 9

WARNING!

Do not turn your Marathon off after a dive. Wait until TIME TO FLY indicates 0 or the OFF message is displayed.

DIVE MODE

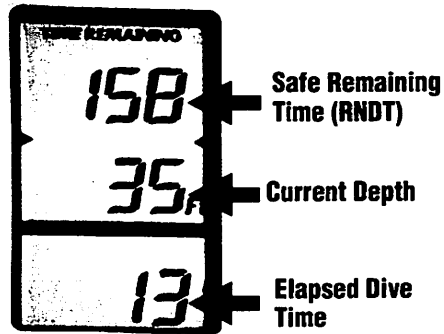


Figure 10

First, a word of caution. The MARATHON's power saving feature will automatically turn it to "power-off" when the surface **ELAPSED TIME** is greater than 60 minutes and no tissue is calculated to contain nitrogen (See Figure 11). During repetitive diving, this "power-off" time will range from 1 to 10 hours after the **WAIT TO FLY** time has dropped to 0. Therefore, unless you have just turned your unit ON, be extra careful when you start your dive. When you get in the water, get in the habit of ALWAYS checking to be sure that your MARATHON has entered DIVE Mode.

Now you are ready to enter the water. The MARATHON will stay in SURFACE Mode until you descend below 6 feet. Below 6 feet, the MARATHON goes into DIVE Mode and changes the information it displays. All the screen legends and LEDs are off. The upper window, **SAFE TIME REMAINING**, tells you how long you may remain at the present depth until one or more of your tissues reach their Theoretical Nitrogen Over-pressure Limit. In other words, this is your Remaining No-Decompression Time. As long as you have **SAFE TIME REMAINING** greater than 0, you are on a No-Decompression dive.

By ascending, your **SAFE TIME REMAINING** will increase, thus showing credit for the off-gassing which occurs during the shallow portions of the dive. Descending will cause **SAFE TIME REMAINING** to decrease, reflecting the increased rate of nitrogen loading you would be experiencing. The first appearance of a **SAFE TIME REMAINING** will occur as you descend below 12 feet. The first reading will be in hours, displayed as HH (greater than 19 hours) or as a number followed by an H. As you descend lower, the reading will eventually become all numbers, indicating that **SAFE TIME REMAINING** is now in minutes. (A more complete explanation of time displays is in the Special Situations and Safety section of chapter 5.)

The middle window of the MARATHON is **DEPTH**, which reads in feet of sea water. The depth reading is temperature compensated and accurate to within 2 feet down to 199 feet. If you descend below 199 feet, MARATHON goes into over-range condition (See: Special Situations and Safety).

The bottom window, **ELAPSED TIME**, is the Dive Timer, which activates when you go below 6 feet and turns off when you ascend above 4 feet. It will only reset if you spend more than 10 minutes on the surface, so surfacing briefly during a dive will not disturb your dive timer logbook reading. The Dive Timer does halt, however, while on the surface, restarting when you descend again below 6 feet.

Figure 10 shows a screen for a diver at 35 feet. He has 158 minutes of **SAFE TIME REMAINING** left and has been below 6 feet for 13 minutes.

When you begin returning to the surface, your rate of ascent is very important to safety. The MARATHON monitors your ascent rate. If you come up too fast, the MARATHON flashes its depth number and illuminates the "**ASCEND SLOWER**" LED. Should that happen, **HALT YOUR ASCENT!** Wait until the LED goes out and the numbers stop flashing. This will happen when your proper maximum ascent rate catches up to where you are. Then restart your ascent, but a little slower. Try to adjust your ascent rate so that you do not trigger the "**ASCEND SLOWER**" alarm.

WARNING!

Significantly exceeding the recommended rate of ascent can cause serious injury or death.

Orca agrees with the developing thought that in addition to following the safe ascent speed, you should stop for at least 5 minutes at 10 feet before surfacing. This stop will give your tissues some important extra time for out-gassing and greatly reduce your chances of getting decompression sickness.

Back on the surface, the MARATHON returns to its SURFACE Mode, showing you the record of your last dive and the no-decompression times for your next dive. Observe the **SAFE WAIT TO FLY** time. If you plan another dive within **SAFE WAIT TO FLY** time plus 10 hours, leave your MARATHON on. It will continue computing your nitrogen saturation state in preparation for your next dive.

If you descend again within 10 minutes of surfacing, the **ELAPSED** dive **TIME** will restart where it left off, adding new time to the last dive time. (This is in accord with standard practice that treats two close-together dives as a single dive.)

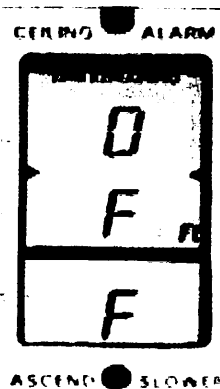


Figure 11

After a dive, if your MARATHON is still on when your nitrogen levels have been calculated to be back to within safe limits, it will turn itself to the power-saving POWER-OFF mode. This can occur up to 10 hours after **SAFE WAIT TO FLY** becomes 0.

If you turn your MARATHON on, and do not go diving, it will turn itself OFF (Figure 11) in 60 minutes.

Decompression Diving With The Marathon™

WARNING!

DECOMPRESSION DIVING CAN BE EXCEEDINGLY DANGEROUS. IT SHOULD BE ATTEMPTED ONLY BY SPECIALLY TRAINED DIVERS WITH PROPER EQUIPMENT AND ADEQUATE SAFEGUARDS.

You should not attempt decompression diving with the MARATHON. While the Marathon will provide information to help get you out of a decompression situation, it does not give all of the information we consider necessary for decompression diving (such as Time Required for Decompression). No attempt is made in this manual to explain the many considerations essential to safe decompression diving. The information here is provided for emergency use only.

Although primarily a no-decompression instrument, the MARATHON does have the capability to calculate a **SAFE CEILING** below which to decompress.

When the **SAFE TIME REMAINING** has dropped to 0, the upper window will change to display **SAFE CEILING**. The word "**CEILING**" will appear above the top number (obscuring "**TIME REMAINING**") and the **CEILING ALARM** LED will begin flashing (see Figure 12).

The **CEILING** is in feet of sea water, just like the **DEPTH**. At first the **CEILING** will be shallow, but the longer you stay, the deeper it will become. If your **DEPTH** is more than 12 feet below the **CEILING**, the message "**go up**" will flash on the screen every three seconds (see figure 13). To decompress, simply ascend at the proper ascent rate until your depth is between 2 and 12 feet under the **CEILING**. When you are in the proper decompression zone, the "**go up**" indication will disappear. As you rise, the **CEILING** itself will start to rise.

When the decompression debt is paid off, the **CEILING** will clear, and the display will revert to the normal **SAFE TIME REMAINING** form. (Remember, above 12 feet, the **SAFE TIME REMAINING** will be blank.) When the **CEILING** clears you can exit the water (although we recommend staying for at least another 5 minutes at 10 feet).

WARNING!

NEVER ASCEND ABOVE YOUR CEILING. If you do, you risk serious injury or even death.

If you should ascend above the **CEILING**, the top two windows will flash alternately until you have again descended below the **CEILING** or the **CEILING** calculations have caught up to your present depth. Also, all the time you spend above your **CEILING** is counted as dive time. The MARATHON will not go into SURFACE Mode if you have a **CEILING**, even if you are back on the boat. Finally, if you do ascend above your **CEILING**, don't dive again until you can be sure that any bubbles formed in your body have dissipated. (See: Special Situations and Safety)

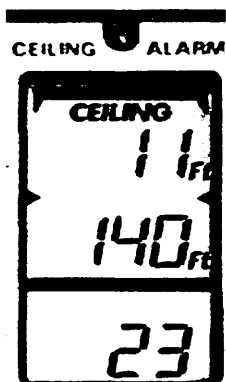


Figure 12

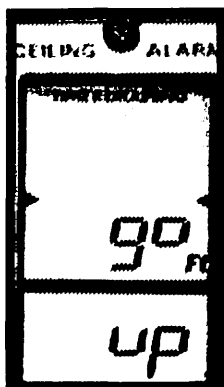


Figure 13

CHAPTER 3

SAMPLE DIVE PROFILES

Example 1: A No-Decompression Dive

Note that in these examples, the **SAFE TIME REMAINING** number shown by the MARATHON represents a limit with a certain degree of risk. Our diver here will subtract his personal safety margin from the limit shown on the unit because he is concerned about the effects of being out of shape physically.



Figure 14

In figure 14 (left) we see the MARATHON in SURFACE Mode prior to our first dive of the day. Notice that our **ELAPSED TIME** on the surface (**SURFACE INTERVAL**) since turning the unit on is 6 minutes. Using the scrolling repetitive screen (also Figure 14), we plan a dive to 70 fsw for 22 minutes to observe an old wreck (since the **SAFE TIME REMAINING** is 31 minutes, we are using a 9-minute safety margin).

Now let's start our descent. During our descent the MARATHON displays the **ELAPSED TIME** under water, our present **DEPTH**, and the **SAFE TIME REMAINING**.

As we reach the wreck site, we find that the hulk is upright and we decide to stay at the deck level; about 50 feet. Thanks to the MARATHON, this change presents no problem, it automatically calculates our new **SAFE TIME REMAINING**. At this point, the unit displays a **SAFE TIME REMAINING** of another 61 minutes, our depth is 52 feet and a total of 8 minutes has elapsed since we began the dive (Figure 15).

We take some pictures of the wreck's native inhabitants and begin our ascent back to the surface with a margin of 10 minutes of **SAFE TIME REMAINING** left. If we exceed our safe ascent rate, the depth display will flash along with the "ASCEND SLOWER" light.



Figure 15

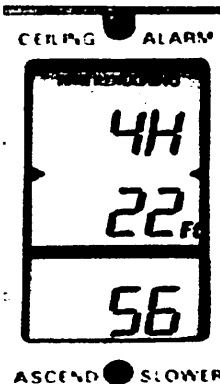


Figure 16

We have now ascended to 22 fsw with a total elapsed dive time of 56 minutes. Notice (Figure 16) that our new **SAFE TIME REMAINING** is 4H - four hours.

Example 2: Back on the Surface

We reach the surface in slightly more than six minutes, having been careful to follow the safe ascent rate all the way up and stop for 5 minutes at 10 feet. The MARATHON is now in **SURFACE** mode giving us a complete record of all our dive information. Observe (Figure 17) that the **LAST DIVE** screen shows that we descended to a maximum depth of 58 fsw in a total dive time of 58 minutes. We also see from the MARATHON's top window that we must **WAIT TO FLY** for at least 8 hours (See: Special Situations and Safety).

Alternating with the **LAST DIVE** screen is the Scrolling Dive Table (NEXT DIVE screen). This information gives us the ability to plan a next dive with all our **SAFE TIME REMAINING** limits known in advance. In this example, our **SAFE TIME REMAINING** is 72 minutes at 40 fsw. We have been on the surface for 14 minutes (Figure 18).

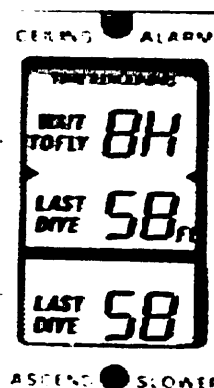


Figure 17

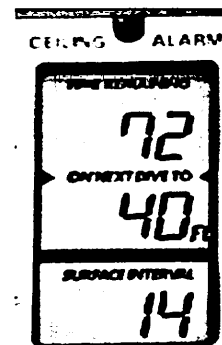


Figure 18

Example 3: A Decompression Dive.

Remember, the **MARATHON** is not a decompression computer. This example is provided so that you will understand what happens to your instrument if you accidentally get yourself in a situation requiring decompression.

Here we have entered a situation requiring decompression. The MARATHON begins flashing "go up" (Figure 19).

The flashing "go up" will alternate with present dive information. Notice that we no longer have a **SAFE TIME REMAINING**, but instead the MARATHON displays a **CEILING** of 14 feet (Fig. 20). We must be careful on our ascent not to ascend too close to the **CEILING**. The optimum decompression zone is from the **CEILING** limit to 10 feet below the **CEILING** Limit. To decompress optimally, ascend at the proper ascent rate to within 10 feet of to the **CEILING** depth displayed and hold there until the **CEILING** is gone.

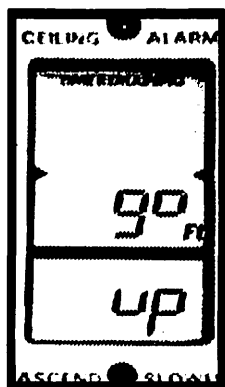


Figure 19

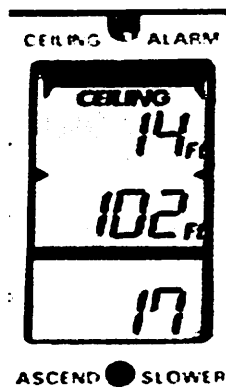


Figure 20

WARNING!

Any diver entering into a decompression situation should go through a 10fsw safety stop in addition to decompression.

WARNING!

NEVER ASCEND ABOVE YOUR **CEILING** LIMIT. If you do ascend above your **CEILING** Limit, don't dive again until you can be sure that any bubbles that may have formed in your body have dissipated. If you develop any symptoms of decompression sickness, consult a doctor immediately.

Depth	Safe No-Decomp Time
30	3 Hours
40	133 minutes
50	75 minutes
60	52 minutes
70	39 minutes
80	31 minutes
90	24 minutes
100	19 minutes
110	13 minutes
120	10 minutes
130	9 minutes

Table of Depths and Corresponding
No-Decomp Times

CHAPTER 4

MARATHON POWER SYSTEM

Battery Care

The MARATHON uses a user replaceable, non-rechargeable, high charge density battery. (We decided against a rechargeable battery for safety reasons. After a period of use, the lifetime of a rechargeable battery can drop dramatically and result in a surprising loss of power.)

If the MARATHON is left off, the battery will still retain much of its power even after 7 years on the shelf. The most severe drain on the MARATHON battery occurs when the unit is left on and used daily. Under these conditions, the battery can be expected to last for about 40 weeks of continuous use.

The Low Battery Warning System

The MARATHON has a unique warning system designed to give you many days' advance notice of impending need to change the battery. You should always carry a spare battery in a water proof container with your dive equipment. Change your battery at the first opportunity after the MARATHON begins to continuously flash a single "**LO**". On a local trip, you can probably finish out the week. But, attempting to stretch your battery life could result in an underwater power loss, terminating your dive. Also, the colder the water temperature, the greater the likelihood of unexpected power loss near the end of battery life. See page 23 for more on cold testing your battery.

The first "**LO**" indication flashes only when the MARATHON is in surface mode. The "**LO**" will be suppressed underwater, so that the display remains clean and uncluttered. All other functions of the MARATHON are normal. The Marathon should continue to operate for approximately 168 hours.

The second level of warning is signaled by two "**LO**" indications; one in the top and one in the middle window. At this level, the unit enters a power saving mode and disables the LED indicators. The double "**LO**" is not suppressed underwater - it will alternate with the normal display for 1/2 second every 3 seconds. All other functions will work normally and the Marathon should continue to operate for another 24 hours.

The third and final warning shows three "**LO**" indications; one in each window. At this point, there may be no more than a few hours of battery life left and the unit will no longer allow you to begin a dive. If you are underwater, the unit will perform and display all its normal calculations and allow you to complete the dive. When you get to the surface, there will be enough battery life left to finish the computations from a saturated dive and give you a **WAIT TO FLY** number.

Do not begin a new dive with "Lo Lo Lo" flashing. If you turn on the MARATHON when the battery is in "Lo Lo Lo," the unit will do its check and then freeze showing only the triple "Lo." A fresh battery will last approximately 40 weeks at 70°F. At 50°F, it will last 20 weeks.

Safety Note: High charge density batteries rebound somewhat during periods of non-use. The battery life times given here are worst-case situations involving continuous, first time use. Depending on the battery use history, actual time remaining between the various "LO" indications could be greater or less than described above.

Power-Off - Power Saving Feature

WARNING!

TO USE THE MARATHON AFTER IT BEGINS SHOWING "OFF OFF" YOU MUST RESTART IT BY TURNING IT OFF AND BACK ON.

The MARATHON has an automatic Power-Off feature designed to save battery life and prevent an accidental turn on from draining the batteries. This feature will turn the instrument to Power-Off if it has been on the surface for at least an hour and it has computed the body to be free of all excess residual nitrogen.

WARNING!

If you turn on your MARATHON more than one hour before you submerge on your first dive, it may go into Power-Off and you may not notice until after you have submerged.

To avoid this possibility (and to save your battery), we recommend not turning on your MARATHON until shortly before your first dive. Or, if it has been on for an extended period before your first dive, recycle the unit before you get in the water by turning it off and back on. Note, however, that if the MARATHON is on when you get into the water, it will stay on.

Insertion of the Batteries and Sealing the Battery Door

The MARATHON operates on a special 9-volt, Lithium cell. They are available from your dive shop or the ORCA Service Center (215-444-9080). These batteries will provide over 7000 hours of continuous running time per set of cells - 40 weeks if used continuously, but more than two or three years of use for the average sport diver.

To open the battery compartment, unscrew the battery door and rotate it all the way counterclockwise until the threads disengage (about 7 full turns). Then pull. Cleanliness at this point is very important. The battery door seal is the only normal threat to the MARATHON's watertight integrity.

Insert the battery "-" end first (that is with the "+" end towards the battery door). BE CAREFUL! Improper battery installation can result in rapid discharge of the battery (MARATHON itself is protected). If batteries are installed incorrectly, MARATHON will not turn on properly.

Inspect the O-ring on the battery door. It should be clean and lightly greased with SILICONE grease only. If necessary, remove the O-ring, clean the groove, and put a coating of silicone grease on it (see figure 21).

NOTE: Vaseline or petroleum grease will damage the case and void the warranty.

Replace the door by pushing it in as far as it will go. Be careful here. Push just hard enough to get the "O" ring into the case and slide the door in until you feel the threads meet. **DON'T JAM THE THREADS!** Engage the threads by gently pushing and turning. When the threads catch, screw down the door clockwise until the door stops. If it doesn't turn on, check that the battery was installed with the right polarity.

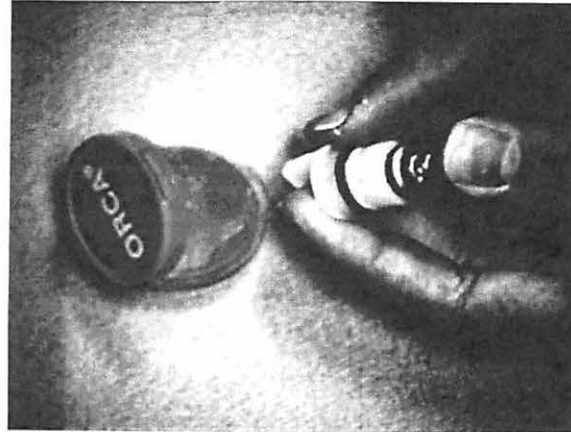


Figure 21

Cold Testing to Determine Battery Life

Batteries last one-half as long in cold water when compared to use in warm water. If you plan on diving in cold water, it is a good idea to determine if you should change the batteries before you go diving.

To determine the condition of your batteries, make sure that the batteries are at room temperature (approximately 72°F/22°C) and turn-on the computer. Read the battery level (see figure 7, page 10), record the number and turn the Marathon off by turning the battery door counter-clockwise, until the display goes blank.

Place the Marathon in a cold environment like your refrigerator (approximately 45°F/7°C) for a period of at least two hours. After you have "chilled" the batteries, turn on the computer and read the battery level number. If the difference between the "warm" battery level and the "chilled" battery level is greater than 10, then the batteries are probably in the second half of their lives, and should be changed if diving in cold water.

Examples:

#1:

Warm batteries: 112

Cold batteries: 108

It's OK to go dive in cold water

#2

Warm batteries: 81

Cold batteries: 64

Change batteries before diving in cold water.

CHAPTER 5

Special Situations and Safety

Adding a margin for safety.

The **SAFE TIME REMAINING** and **CEILING** numbers calculated by the MARATHON give generally less risk than U.S. Navy Tables. However, we are finding that even that degree of risk is not suitable for some sport divers. It also is becoming apparent that some people are unusually vulnerable to decompression sickness. Unfortunately there is not yet enough data to know how much a given safety margin reduces risk. Data is being collected that should eventually give answers to these questions. In the meantime, we recommend that you consider carefully the degree of risk you wish to take and use appropriate safety margins.

Safety margins should be applied in 4 places:

1. **During the Ascent** - by slowing ascent rate (adding a decompression stop to all dives),
2. **Between Dives** - by increasing the minimum surface interval between repetitive dives,
3. **During the Dive** - by ascending before **SAFE TIME REMAINING** reaches 0, and
4. **Before Flying** - by extending your SAFE WAIT TO FLY time.

Repetitive deep dives.

Data on the safety of deep dives made in rapid succession is very sparse. Until more information is available, sport divers should not make repeated dives deeper than 80 feet unless the surface interval between dives is greater than 1 hour. For dives deeper than 100 feet or after the third or later dive in a series, the interval should be even longer.

Altitude Considerations and High Altitude Diving.

If you increase your altitude rapidly (such as a flight from sea level into the mountains), your tissues will have more nitrogen than the surrounding atmosphere and you will be more vulnerable to the bends. Don't go diving in a mountain lake until you have allowed your tissues to equilibrate at altitude for at least 24 hours. This caution applies to diving at a HIGHER altitude than where you have dwelt and where your tissues are equilibrated. Descents from a high residence altitude to a LOWER altitude pose no problem.

The MARATHON can be used successfully at altitudes up to 2000 feet. For diving at altitudes above 2000 feet, special considerations apply for which the MARATHON was not designed.

Out of Range

THIS SITUATION SHOULD APPLY ONLY TO PROFESSIONAL DIVERS WHO ARE USING THE MARATHON AS A BACKUP ON DEEP DIVES. Needless to say, the MARATHON is not designed for diving below 199 feet. Taken below 199 fsw, the MARATHON will display "or," or out of range, while you are there. Upon returning within range, "or" will flash every three seconds for the remainder of the dive to remind you of this excursion.

Below 199 feet, the MARATHON cannot make accurate pressure readings for the decompression calculations. Calculations made when the unit is below 199 feet assume that the depth is below 208 feet. But the actual depth is unknown. Therefore, when the MARATHON is showing "or" none of the calculations should be considered valid. For this reason the "or" will continue to be displayed even in surface mode until the unit goes into Power-Off or is turned off.

Special Situations and Safety (cont.)

Time Displays

All times are in minutes unless followed by an H. If the MARATHON needs to display a time longer than 19 hours (19H), it will be displayed as HH. For a time longer than 42 hours, the display window will be blank. The only situation in which you are likely to see either HH or a blank will be as a **SAFE TIME REMAINING** when you are near the surface. At a depth of 12 feet or less, **SAFE TIME REMAINING** will always be blank (indicating infinity).

Ascent Rate Alarm

The maximum safe ascent rate varies according to depth. As you approach the surface, your ascent rate should slow down. This is because as you get closer to the surface, each foot of ascent represents a greater percentage change in pressure. Part of the Orca Model's success lies in its variable ascent rate. Be careful not to exceed your allowed ascent rate.

The MARATHON monitors your ascent rate. If you exceed the rate in the following chart, the MARATHON flashes its depth number and the "ASCEND SLOWER" LED. If you significantly exceed your safe ascent rate, don't dive again until at least 24 hours has passed. IF YOU HAVE CREATED BUBBLES, YOUR INSTRUMENT READINGS WILL BE INVALID FOR YOUR BODY UNTIL THE BUBBLES HAVE DISSIPATED.

DEPTH	Maximum Allowed Ascent Rate
0-60 Feet	20 Feet per minute
60-120 Feet	40 Feet per minute
121-200 Feet	60 Feet per minute

CEILING Penetration

NEVER ASCEND ABOVE YOUR CEILING! If you do, you risk serious injury or even death. If you should ascend above the **CEILING**, the top two windows will flash alternately until you have again descended below the **CEILING** or the **CEILING** calculations have caught up to your present depth. Also, all the time you spend above your **CEILING** is counted as dive time, even if it is time above the surface. The **MARATHON** will not go into **SURFACE Mode** until the **CEILING** is cleared. Here again, if you significantly exceed your safe **CEILING** don't dive again until at least 24 hours have passed. You may have induced bubbles in your tissues which make **SAFE TIME REMAINING** calculations for future dives inaccurate. IF YOU HAVE CREATED BUBBLES, YOUR INSTRUMENT READING WILL BE INVALID FOR YOUR BODY UNTIL THE BUBBLES HAVE DISSIPATED.

Previous Dive History

When you first turn your **MARATHON** on, it assumes you have no excess nitrogen in your tissues. IF YOU HAVE BEEN DIVING IN THE 24 HOURS BEFORE YOU TURN YOUR **MARATHON** ON, YOU PROBABLY HAVE RESIDUAL EXCESS NITROGEN AND YOUR INSTRUMENT READINGS WILL BE INVALID.

Chapter 6

Helpful Operating Notes

1. The number in the top display window always has something to do directly with safety. In DIVE Mode, it tells you either the amount of remaining no-decompression time, or, if your elapsed dive time has already exceeded safe limits, the **CEILING** LED will light and the top window will show you the safe ascent depth. In SURFACE Mode the top window shows you either the **SAFE TIME REMAINING** you can spend at the indicated depth on your next dive or it shows you the minimum time you must wait before flying.
2. When changing the MARATHON batteries, residual nitrogen information is lost. The battery life is very long, but if you are diving continuously and need to change the batteries, you will need to skip a day of diving at some point in order to change the batteries. You should stop your diving before the unit displays the second **Lo (Lo Lo)**, note the **SAFE WAIT TO FLY** time, then change your batteries. It is safe to schedule your next dive by adding 10 hours to the noted **SAFE WAIT TO FLY** time.
3. NEVER ATTEMPT TO TURN THE MARATHON ON OR OFF UNDERWATER. Turning it ON will provide an erroneous surface reference. Turning it OFF will lose all dive information.

MARATHON Holster Installation

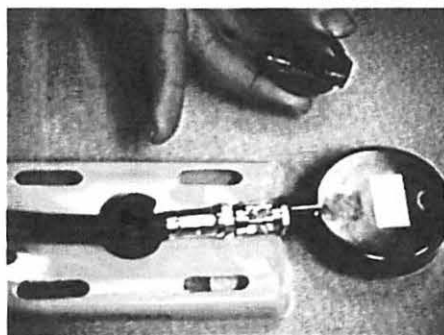


Figure 22

The MARATHON can be worn in a number of different ways. Most commonly, it is attached to the pressure hose with the hose clamp supplied or to the B.C. using a lanyard.

For installation of the MARATHON hose attachment you do not need any special tools or equipment. The holster is supplied with a hose clamp assembly which will allow you to easily and quickly mount the Marathon to your HP or BC inflator hose.

To install the holster onto your pressure hose simply remove the special nut from the clamp assembly. Place the screw section through the back of the holster and on the high pressure hose. Now replace the nut on the threaded screw with a series of clockwise turns. Turn on the air and then tighten down the screw. If you over-tighten the clamp before turning on the air, it may damage the hose when pressure is applied (some hoses swell considerably when pressurized).

Holsters are available in a variety of colors.

If you suspend your MARATHON from your vest with a lanyard, the holster need not be used.

Whether you attach the Marathon via a lanyard or use the holster, it is advisable to run a "zip-tie" or similar device through the lug located at the base of the Marathon and around the mounting hose.

Maintenance and Care

1. Never leave the MARATHON out in direct sunlight or in a potentially high temperature environment. This will cause the display to fade and possibly damage the electronic components inside the unit.
2. Remember to rinse the MARATHON in clean, fresh water and dry it after each use. Washing the exterior of the unit with mild soap and rinsing thoroughly is good for removing salt and stains. Store the Marathon in a safe place when not in use.
3. Avoid excessive shock to the unit such as dropping it.
4. Do not probe into the back of the MARATHON. This will disrupt the integrity of the seal and render the unit unwarrantable. Do not attempt to remove the case back.
5. The battery should be removed from the unit during long periods of inactive service. Inspect compartment for moisture and clean out if necessary.
6. Periodically inspect and grease the battery compartment door O-ring with a silicone grease. This will insure a proper seal and ease of operation.
7. If you do happen to flood the battery compartment, remove the battery and flush out the compartment immediately with fresh water or isopropyl (rubbing) alcohol. Return the instrument to the Orca Service Center (215-444-9080) for inspection and recertification.
8. Do not expose the MARATHON to solvents, petrochemicals, or strong cleaners. Do not use any grease on the "O" ring other than silicone grease.
9. Return your unit once a year to the ORCA Service Center (215-444-9080) for an Annual Performance Check.

Background and Theory

Calculating safe dive times is made complicated because when the human body is under pressure, it does not absorb nitrogen uniformly. In a dive, some tissues such as blood in the lung capillaries and the lung tissues themselves are directly exposed to the pressurized nitrogen and absorb it very quickly. Other tissues such as bone tissues are far removed from the pressurized gas and therefore absorb it very slowly. "Fast" tissues such as the lungs will reach equilibrium (saturation) in a matter of a few minutes, while "slow" tissues may take tens of hours. When the pressure is removed, of course, just the opposite occurs. Fast tissues degas quickly, slow tissues take hours.

In reality, there are not just two tissue speeds, but a continuous range of intermediate tissues between fast and slow.

Here is a somewhat simplified version of what happens during repetitive dives (the numbers are chosen to make the math easier): the first dive is relatively straightforward. The Orca model would allow you to stay 19 minutes on a no-decompression dive to 100 feet. However, let's make the first dive a decompression dive. Let's say you dive to 100 feet, stay 45 minutes and return to the surface making the required decompression stops. On the surface before you started your dive, your tissues were equilibrated with air (mostly nitrogen) at 1 atmosphere (an "atmosphere" is the normal pressure at sea level = 14.7 psi or about the same as 33 fsw). At 100 feet, the gas pressure in your lungs was 4 atmospheres and your tissues tried to absorb enough new nitrogen to become equilibrated at this new pressure. Your fast tissues picked up the gas pretty quickly, but because you were at pressure only 45 minutes, your intermediate and slower tissues picked up less - perhaps only 20% as much as the fast tissues. During the time that it took you to ascend to the surface, your fast tissues out-gassed quickly, causing no problem.

Your slower tissues, however, lost very little of their newly absorbed nitrogen. In this example, some of your slower tissues (actually your intermediate tissues) picked up and held enough extra nitrogen to be significantly charged when you reached the surface. In fact, even after you have been on the surface for 30 minutes, your intermediate tissues will have lost only a small percentage of their new nitrogen¹.

¹ Gas transmission and absorption is directly proportional to differential pressure (delta P). The delta P between slow tissues at surface equilibration and 100 fsw starts out at 3 atmospheres and diminishes with gas take-up. Back on the surface, the delta P between tissues loaded with the maximum permitted nitrogen level and ambient is substantially less than 1.2 atmosphere. Therefore, the in-gassing of your slower tissues that takes place when you first reach 100 feet is 5 to 10 times faster than the out-gassing that takes place when you reach the surface.

Now as you prepare for your next dive, your intermediate tissues are already "pre-charged". Let us assume you wish to make your second dive a no-decompression dive. If you start your second dive 30 minutes after finishing the first, your intermediate tissues are still close to having the maximum permitted nitrogen level. Obviously, on another dive to 100 feet, your allowed RNDT time would be significantly shorter. (In actual practice, don't use such a short surface interval between dives this deep).

If you make several more dives - even no-decompression dives - more and more of your slower tissues will become charged to their permitted limit, and longer and longer surface intervals will be required to allow even a short bottom stay.

Here is where conventional tables become hopelessly complex, and errors compound themselves. The situation becomes even more tangled if, instead of the simple dives described in our example, the dives are multilevel dives. Because the MARATHON uses calculations instead of tables, complicated dive profiles are not a problem.

The MARATHON mathematically models 12 different tissue speeds² and tracks the amount of nitrogen in each. By using the Orca Decompression Model³ to compare the tracked levels with the known limits the MARATHON is able to calculate how much margin actually remains in your most saturated tissues, and if they are over the limit, how shallow it is safe to ascend.

Once you have experienced the freedom and flexibility of diving with a MARATHON, your diving will take on a new measure of enjoyment.

² Tissue speeds are designated by their "half-time," which is the time it takes for a tissue to go 50% of the way from the old pressure to the new pressure. The Orca Model uses tissue half-times beginning with 5 minutes (10, 20, 40 eg.) up to 480 minutes (8 hours).

³ With the development of ultrasonic Doppler detectors, it became possible to detect the formation of minute bubbles in the bloodstream. The Orca Model is based on low-bubble limits as determined and verified by Doppler evaluation of venous gas emboli following multi-level dive profiles. Orca has conducted extensive studies to examine the effect of multi-level dives on human subjects. The results have shown that the profiles tested were safe to all divers exposed. See also Doppler Evaluation of Multilevel Dive Profiles by Karl E. Higgins, Proceedings of the Fourteenth International Conference on Underwater Education, Chicago, IL., November 3-6, 1983.

Chapter 6 (cont.)

Questions and Answers

Q. Can I get the bends while using the MARATHON?

A. Yes. There is always some risk. Using the MARATHON is not a guarantee against getting decompression sickness. There is no known method to guarantee against getting the bends except not diving. Even aquarium divers who never go below 30 feet occasionally get the bends. However, experience with the Orca Model in almost 9,000,000 dives strongly suggests that the MARATHON is the best protection available. You can reduce your risk even further by using safety margins. Be sure to read the accompanying safety booklet.

Q. Is the MARATHON affected by radio transmitters or radar?

A. Not normally. The MARATHON is rugged both physically and electronically.

However, you should keep both you and your MARATHON out of the "line of fire" of a boat's radar antenna, and at least 10 feet from a transmitting radio antenna. These requirements are not normally a problem with proper antenna installations.

Q. If I forget and get into the water without turning the MARATHON on, can I turn it on under water?

A. No! If you forget to turn your MARATHON on before you get in the water, hold it above the surface and turn it on. Wait until it has gone through its check routine and begins showing the repetitive dive tables (a wait of about 15 seconds). Then you may submerge and begin your dive.

Q. Different parts of the display seem to flash for different reasons. How can I remember what means what?

A. The flashing display is intended to call your attention to the instrument and advise you that you need to do something different from what you are doing. When your display starts flashing it will tell you what is wrong ("low battery," "over-range", or you have entered the regime requiring decompression and should "go up"). The other time that the display flashes is when you have exceeded your ceiling or ascent rate and the appropriate LED will tell you which.

Q. I am a weekend diver. How many dives can I expect from a set of batteries?

A. For a typical weekend diver you can expect years of operation.

Q. When is it safe to turn the MARATHON off?

A. When any one the following things happens:

a. When you will not dive again within the next 24 hours,

b. When you will not dive again until AFTER 10 hours past SAFE WAIT TO FLY time.

c. When the unit has turned to Power-Off ("OFF OFF").

Put another way, you will need to leave your MARATHON "ON" only when you plan to do multiple dives.

Q. I am on an extended diving vacation, making several dives each day. I have four days left and my MARATHON has started to show "Lo". Do I have to change the battery?

A. To be on the safe side, change the battery. With MARATHON, this will result in a loss of dive data, so you will have to wait 24 hours before diving again with your computer. You probably should have started your dive trip with a fresh battery. Water temperature could further reduce voltage during a dive, resulting in a loss of power.

Q. What if I accidentally turn my MARATHON off during a day of diving?

A. You will have lost your repetitive dive information and will not be able to dive again for another 24 hours. With the MARATHON battery door, it is difficult to turn it off accidentally.

Questions and Answers (cont.)

Q. Is there an easy way to check the calibration of my MARATHON?

A. Yes. Here is a method more accurate than most pressure chambers or pressure gauges: Measure out 30 feet of line and tie it along with a weight to your MARATHON. Turn the MARATHON off and back on to reset it, then lower it in calm water (deeper, naturally, than the line length!). Wait 30 seconds and retrieve. The **DEPTH LAST DIVE** should exactly equal the length of your line below water.

Q. Can the MARATHON be ON in the airplane?

A. Yes, the MARATHON emits no EMR that would interfere with aircraft avionics. Also, air travel will do no harm to the MARATHON.

Q. If I snorkel during a dive trip, should I use the MARATHON?

A. Yes, if there is a chance you will do free dives. It is important even when snorkeling to use your MARATHON. Even free dives can add to tissue nitrogen levels.

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Chapter 6 (cont.)

Technical Specifications

MARATHON is available in either Metric or English Models.

Decompression Model:

Algorithm.....Modified-Haldanean
Number of Tissue Groups.....Twelve
Tissue Half-Time Range.....5 minutes to 480 minutes
Tissue M Values.....Derived from No-Decompression
Limit that were determined by Doppler Studies, more
conservative than U.S. Navy M Values.
Decompression Functions.....Remaining
No-Decompression Times, Decompression Indicator
and Ceiling, Repetitive No-Decompression Time.

Depth Gauge:

Transducer.....0-100 psi absolute transducer,
temperature compensated
Accuracy.....+/-0.45 msw (+/-1.5 fsw)
Depth Display Range.....0-66 msw (0-199 fsw)
Depth Display Resolution.....+/-0.5 msw (+/-1 fsw)
Depth Functions.....Present Depth,
Maximum Depth Recorder,
Maximum Depth Display @ Surface

Dive Timer:

Accuracy.....+/-12.96 seconds per 24 hours
Range.....0-199 Minutes, then from 4H to 19H
Activation Depth.....1.85 msw (6.1 fsw)
Deactivated Depth.....1.2 msw (3.9 fsw)
Dive Timer Functions.....Present Dive Time,
Dive Time Recorder (Dive Time reset to 0 if a new dive
is started after surface interval is greater than 10
minutes)

Surface Interval Timer:

Accuracy.....+/-12.96 seconds per 24 hours
Range.....0 mins to 99 hrs, over 19 hrs displayed as HH

Flying After Diving:

Range.....0 mins to 24 hrs, over 19 hrs displayed as HH

Technical Specifications

Power:

Battery.....One 9 Volt 3x 1/2 AA High Charge
Density Power Cell
Duration.....40 weeks @ temperature 70°F,
20 weeks @ 50°F prior to "LO" indication
Low Power Indicators....."LO" after 40 weeks continuous
operation.
Replacement.....Unit must be off to replace battery
On/Off Switch.....Direction Contact Switch

Case:

Construction.....High Impact ABS Plastic
Battery Compartment Seal.....O-Ring
Dimensions.....4.5"L X 2.66"W X .75"H
View Window.....Polycarbonate
Weight.....5.5 ounces

Display:

Configuration.....1.4 X 2.6 Multiplexed LCD Display
Dimensions.....1.22"L X 2.3"W

(fsw = feet of sea water; msw = meters of sea water; °C = degrees Celsius;
Degrees Fahrenheit)

Specifications subject to change without notice

Copyright 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993 ORCA, Division of EIT, Inc.

LIMITED WARRANTY

The MARATHON is warranted to the original purchaser against defects in workmanship and materials for a period of one (1) year after the date of purchase. Failures due to abuse and neglect are specifically excepted from this warranty. This warranty is subject to and in accordance with the terms and conditions set forth below. **THIS WARRANTY IS EFFECTIVE ONLY IF THE WARRANTY CARD HAS BEEN COMPLETED AND RETURNED WITHIN 60 DAYS OF THE PURCHASE DATE.**

In the event of difficulty, return the unit to the Orca Service Center (215-444-9080). Pack the unit to protect it (please do not send accessories) and ship it to the Orca Service Center prepaid (Units sent "freight collect" will not be accepted.). **Be sure to enclose a written statement explaining the nature of the problem and the circumstances under which it occurred.** Units judged defective in workmanship or materials will be repaired or replaced at Orca's option and returned to sender, freight prepaid.

Abuse and neglect includes, but is not limited to, broken LCDs, cross-threaded battery doors and any failures due to lack of maintenance. Items subject to normal wear, including but not limited to the battery, protective holster and mounting clamp assembly, are not covered by this warranty. This limited Warranty shall apply only to the original Buyer of the unit, and shall not be effective with respect to units which have been used in rental, sharing, or similar multi-user arrangements.

Seller's and Manufacturers responsibility and liability is limited to replacement or repair. Replacement or repair shall include both the cost of materials and labor. Neither Seller nor Manufacturer shall be responsible to replace or repair any unit which has been damaged by improper or excessive use, alteration or tampering, accident or jolting, or any cause whatsoever other than defective workmanship or materials. It should be understood that the MARATHON is a sensitive electronic device which can be damaged if misused, abused, or subjected to extreme jolting or striking.

WARNING!

The MARATHON is intended only to provide a guide to divers, and should not be relied upon as the sole means of protection. The MARATHON CANNOT PREVENT DECOMPRESSION SICKNESS, EVEN WHEN USED PRECISELY ACCORDING TO MANUFACTURERS INSTRUCTION. IT CAN ONLY SERVE TO GIVE YOU A LOW, BUT NONETHELESS REAL POSSIBILITY OF DECOMPRESSION SICKNESS. YOU MUST BE WILLING TO ACCEPT THIS RISK TO USE THE MARATHON.

NOTES:

ACCESSORIES & PARTS

- Lenzgard Protective Cover -P/N: S90-GARD —Protects your Marathon from rocks, tanks and other objects. No more scratched displays and factured displays due to dropping a tank on your computer. Easily romoves to facilitate cleaning.
- Holster with hose clamp assembly -P/N: M90-0062 (black), M90-0063(yellow), M90-0064(pink) —allows users to attach the Marathon to their high-pressure or inflator hose.
- Lithium battery -P/N: S90-0100 —lasts over 7000hours of use in a Marathon or 7 years on the shelf in storage.
- ORCA Silicon Capsule -P/N: E65-9005 —Food grade silicon grease in a convenient container for use on battery door o-rings, etc.
- O-ring -P/N: M65-3001 —spare battery door o-ring.

-See your local ORCA dealer for these accessories and other ORCA products!

MARATHON DISPLAY GUIDE

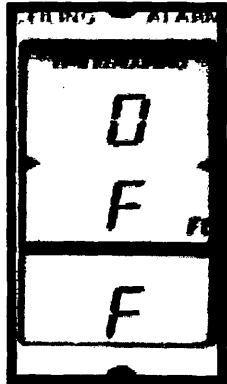


Figure 24

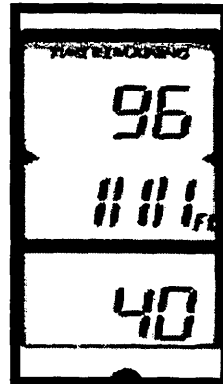


Figure 25

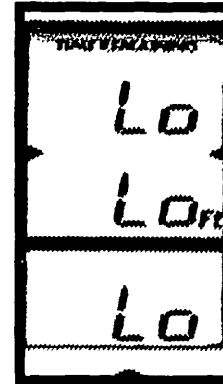


Figure 23

COMPUTER TURNED OFF, NO RESIDUAL NITROGEN

- Must Turn Switch Off, Then Back On Before Starting Next Dive, Computer will not Reset By Itself (Read Manual)

COMPUTER READING WRONG SURFACE PRESSURE

- If On The Surface, (init #=40), Return For Repair, LP XDCR
- If Underwater, Unit Must Be Turned On At The Surface Before Diving To Work Properly

LOW BATTERY VOLTAGE TO COMPUTER

- End of Battery Life
- Cold Batteries
- Foreign Material on Battery Contacts



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