

Computers and Dive Tables

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South Carolina
Aquarium

South Carolina Aquarium Dive Operations

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It is the mission of the South Carolina Aquarium (SCA) Dive Team to provide excellence in animal care and husbandry, to actively support both the educational and conservation endeavors of the SCA, and to provide a memorable, positive guest experience to all those who visit our facility.

Training Schedule

- PowerPoint Presentation
 - > Statement of Understanding and Quiz required before in-water use
- GOT: 2 supervised dives

Training

- Dive computer training will include: Personal instruction and diver access to all literature supplied by the computer manufacturer, including display interpretation, proper operation and basic maintenance.

Training Cont.

- A written examination covering basic decompression theory, specifics on the computer to be used, computer diving safety and SCA guidelines for computer diving.

Effects of Compressed Gas on Divers

- Divers using compressed gas intake abnormal partial pressures of nitrogen or possibly oxygen in the case of enriched air (nitrox) use.
- Increased levels of nitrogen can lead to possible DCS issues and increased levels of oxygen can lead to oxygen toxicity

Planning a Dive

- Due to the issues of breathing compressed gasses mentioned in the previous slide, divers need to plan their dives to minimize risk
- Dive Tables are the original method for planning a dive
- Dive computers have evolved based off of dive tables and can give an instantaneous tracking of possible gas loads

J.S Haldane

- “Father of Decompression Theory”
- Physiologist appointed to develop decompression tables for the Royal Navy divers.
- Tables were based off of tissue saturation theory and experimentation on goats.

U.S Navy Tables

- Based on Haldanes tissue compartment work. 1907
- 1930's U.S navy researchers used human volunteers. It took until 1957 to publish the original Navy tables.
- 564 dives resulting in 26 case of decompression sickness
- 122 repetitive dives based on 61 profiles with 3 cases of bends.
- “M” values of supersaturation ratios for each compartment
- 5,10,20,40,80 and 120 minute tissues.
- Tables are based on actual dives using tissue compartment theory.

U.S. Navy Dive Table 3

Unlimited/No-Decompression Limits and Repetitive Group Designation Table for Unlimited/No-Decompression Air Dives-1999

Depth (feet/meters)	No-Decompression Limits (min)	Group Designation Letter																
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O		
10	3.0	unlimited	60	120	210	300	797	*										
15	4.6	unlimited	35	70	110	160	225	350	452	*								
20	6.1	unlimited	25	50	75	100	135	180	240	325	390	917	*					
25	7.6	595	20	35	55	75	100	125	160	195	245	315	361	540	595			
30	9.1	405	15	30	45	60	75	95	120	145	170	205	250	310	344	405		
35	10.7	310	5	15	25	40	50	60	80	100	120	140	160	190	220	270	310	
40	12.2	200	5	15	25	30	40	50	70	80	100	110	130	150	170	200		
50	15.2	100		10	15	25	30	40	50	60	70	80	90	100				
60	18.2	60		10	15	20	25	30	40	50	55	60						
70	21.3	50		5	10	15	20	30	35	40	45	50						
80	24.4	40		5	10	15	20	25	30	35	40							
90	27.4	30		5	10	12	15	20	25	30								
100	30.5	25		5	7	10	15	20	22	25								
110	33.5	20			5	10	13	15	20									
120	36.6	15			5	10	12	15										
130	39.6	10			5	8	10											
140	42.7	10			5	7	10											
150	45.7	5			5													
160	48.8	5				5												
170	51.8	5				5												
180	54.8	5				5												
190	59.9	5				5												

*Highest repetitive group that can be achieved at this depth regardless of bottom time

NAUI TABLES

- NAUI tables are derived from the Navy tables with additional safety factors.
- Breathing rates, body exertion, which are affected by, stress, temperature, age, weight, and many other factors make the tables less consistent

DIVE TABLES

TABLE 1 - END-OF-DIVE LETTER GROUP

WARNING: EVEN STRICT COMPLIANCE WITH THESE TABLES WILL NOT GUARANTEE AVOIDANCE OF DECOMPRESSION SICKNESS. CONSERVATIVE USAGE IS STRONGLY RECOMMENDED.

RNT RESIDUAL NITROGEN TIME
+ADT ACTUAL DIVE TIME
TNT TOTAL NITROGEN TIME
(USE THIS FIGURE TO DETERMINE END-OF-DIVE LETTER GROUP)

START DEPTH FEET	00	15	25	30	40	50	60	70	80	100	110	130	150
12 40	5	15	25	30	40	50	70	80	100	110	130	150	5
15 50		10	15	25	30	40	50	60	70	80			5
18 60		10	15	20	25	30	40	50	55	60			5
21 70		5	10	15	20	30	35	40	45	50	60	70	5
24 80		5	10	15	20	25	30	35	40	45	50	60	5
27 90		5	10	12	15	20	25	30	35	40	45	50	5
30 100		5	7	10	15	20	25	30	35	40	45	50	5
33 110			5	10	13	15	20	25	30	35	40	45	5
36 120			5	10	12	15	20	25	30	35	40	45	5
39 130			5	8	10	15	20	25	30	35	40	45	5

M. FT.	12 40	15 50	18 60	21 70	24 80	27 90	30 100	33 110	36 120	39 130	NEW GROUP
7	7	6	5	4	4	3	3	3	3	3	A
17	13	11	9	8	7	7	6	6	6	6	B
25	21	17	15	13	11	10	10	9	8	8	C
37	29	24	20	18	16	14	13	12	11	11	D
49	38	30	26	23	20	18	16	15	13	13	E
61	47	36	31	28	24	22	20	18	16	16	F
73	56	44	37	32	29	26	24	21	19	19	G
87	66	52	43	38	33	30	27	25	22	22	H
101	76	61	50	43	38	34	31	28	25	25	I
116	87	70	57	48	43	38	AVOID REPETITIVE DIVES OVER 100 FEET				J
138	99	79	64	54	47	K					
161	111	88	72	61	53						L

TABLE 3 - REPETITIVE DIVE TIMETABLE

NEW GROUP	A	B	C	D	E	F	G	H	I	J	K	L	
A	24:00	24:00	24:00	24:00	24:00	24:00	24:00	24:00	24:00	24:00	24:00	24:00	
B	0:10	3:20	4:50	5:49	6:35	7:06	7:36	8:00	8:22	8:51	8:59	9:13	
C		0:10	1:40	2:39	3:25	3:58	4:26	4:50	5:13	5:41	5:49	6:03	
D			0:10	1:39	2:38	3:24	3:57	4:25	4:49	5:12	5:40	6:02	
E				0:10	1:09	1:57	2:28	2:58	3:20	3:43	4:02	4:19	
F					0:54	1:29	1:59	2:23	2:44	3:04	3:21	3:36	
G					0:10	0:46	1:16	1:42	2:03	2:21	2:39	2:54	
H						0:45	1:15	1:41	2:02	2:20	2:38	2:53	
I						0:10	0:41	1:07	1:30	1:48	2:04	2:20	
J							0:40	1:06	1:29	1:47	2:03	2:19	
K							0:37	1:00	1:20	1:36	1:50	2:06	
L								0:36	0:59	1:19	1:35	1:49	
								0:10	0:34	0:55	1:12	1:26	
									0:33	0:54	1:11	1:25	
									0:10	0:32	0:50	1:05	
										0:31	0:49	1:04	
										0:10	0:29	0:46	
											0:28	0:45	
											0:10	0:27	
												0:26	
													0:10

TABLE 2 - SURFACE INTERVAL TIME (SIT) TABLE

00 LIGHT FACE NUMBERS ARE RESIDUAL NITROGEN TIMES (RNT)
00 BOLD FACE NUMBERS ARE ADJUSTED MAXIMUM DIVE TIMES (AMDT)
TIME RANGES IN HOURS : MINUTES
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#000331(Rev. 1/97)

PADI RDP

- Based on Haldanian system of tissue compartments.
- Used 60min tissue for control Vs. 120min
- Doppler monitored 743 dives 325 dive schedules
- Bubbles detected in 53 of the 743 dives
- No Cases of Bends arose in any test

Choosing a Dive Computer

- User friendliness
- Only vital information displayed
- Graphic representation of vital information
- The ability to change the no-deco limits
- The ability to change gas blends
- Mounting options
- Clear complete instructions and prompt cards

General Computer Use

- Each diver relying on a dive computer must have his/her own computer.
- On any given dive, both divers in the buddy pair must follow the more conservative computer.

General Computer Use

- If the dive computer fails or gives erroneous readings at any time during the dive, the dive must be terminated and appropriate surfacing procedures should be initiated immediately.
- The computer should be returned to Dive Operations and then the manufacturer and should not be used again until it has been repaired.
- Diver is restricted from diving until discussion with Dive Operations.

General Computer Use

- Computers designed for multi-day use with weak batteries can give misleading and dangerous information when used in multi-day situations. Only dive computers designed for multi-day diving with new batteries should be used in multi-day diving applications.

General Computer Use

- Once the dive computer is in use, it must not be switched with another computer and/or diver until it indicates that complete out-gassing has occurred or 24 hours have elapsed, whichever comes first.
- Divers diving on back to back days (<24hrs) must use the same computer

General Computer Use

- Ascent rates shall not exceed 30 ft./min. in the last 60 ft.
- Whenever practical, divers using a dive computer should make a safety stop between 15 and 25 feet for five minutes, especially for dives below 60 fsw.

General Computer Use

- Decompression diving is not allowed under the auspices of the SCA diving program. Dive computers must not be used to facilitate this type of diving.

General Computer Use

- Ascending profiles should always be used on a deep, multi-level dive.
- Repetitive dives should be planned with the **deepest dive first** and subsequent dives shallower than the one preceding.

General Computer Use

- Divers should avoid pushing bottom times to the computer's limits.
- These limits are model limits, they do not allow for environmental conditions or personal limitations (i.e., strenuous work, diver's age, previous injury, history of DCS, etc.).
- A safety factor should also be added to minimum surface intervals between dives.

General Computer Use

- Due to the additional bottom time allowed by the use of a dive computer, divers are more likely to encounter hypothermia and out-of-air situations. Special consideration of these possibilities should be observed while diving with a computer.

Sherwood Amphos

- The South Carolina Aquarium has chosen to use Sherwood Amphos computers



Activating the Dive Mode

- Amphos are designed to stay in “Watch mode” while not in use
- To change from watch mode to dive mode, press and hold the upper left button for 5 seconds
- Once activated, there is a 2 hour window before the computer will revert back to watch mode



To Use, or Not to Use

- In dive mode, if top right Dive is different than 0, chose another dive computer
- When diving, record the computer number on the dry erase and paper log

Good to Use



Used Yesterday



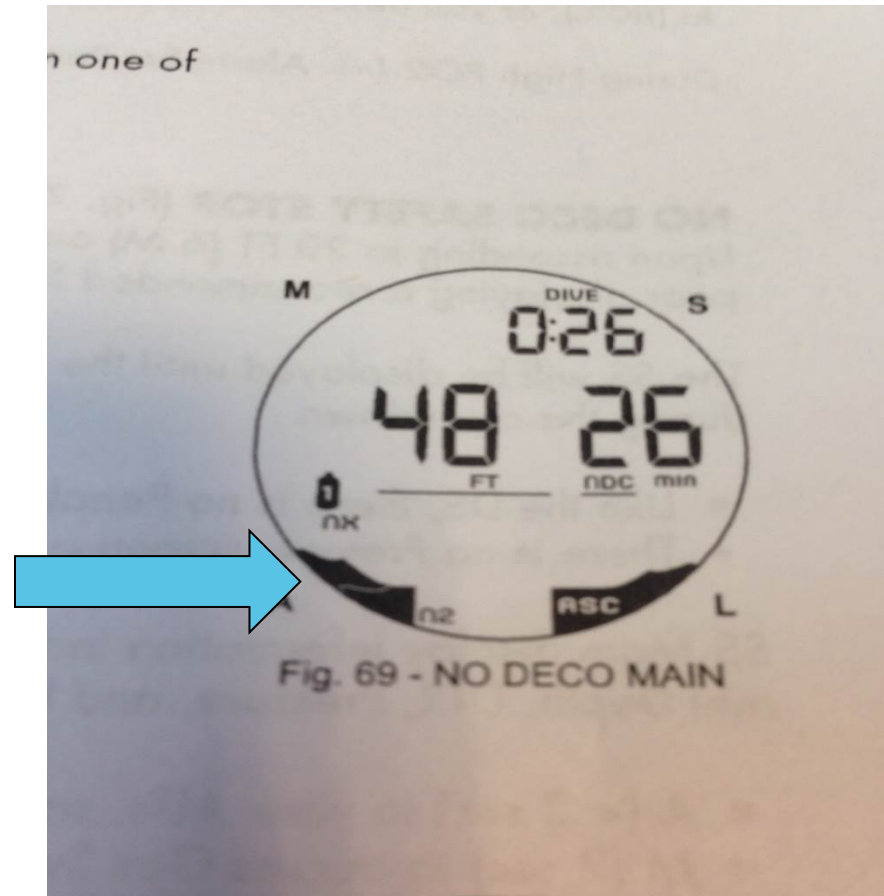
Wrist Mount

- Divers are required to wear computers as wrist mount
- There is an extension band with each computer.
- If you do not need the extension band, leave it hanging on the hook in the gear room



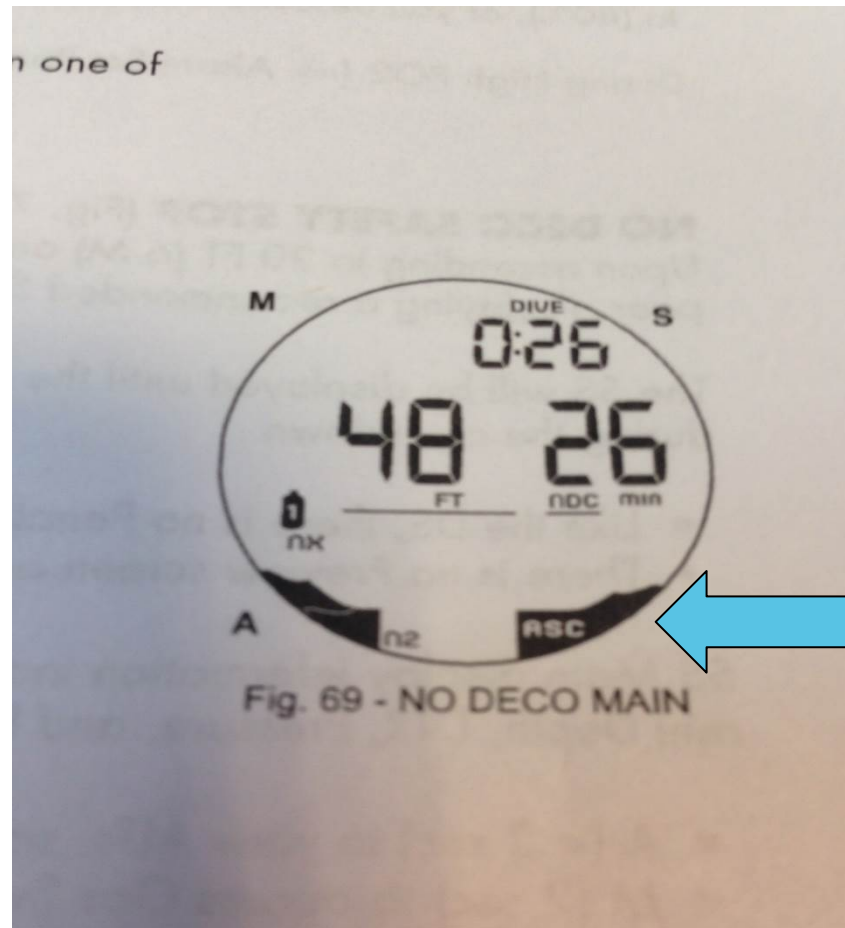
What does the computer tell you during a dive?

- Nitrogen load (N_2), represented by a bar graph on the lower left side of the display



What does computer tell you.....

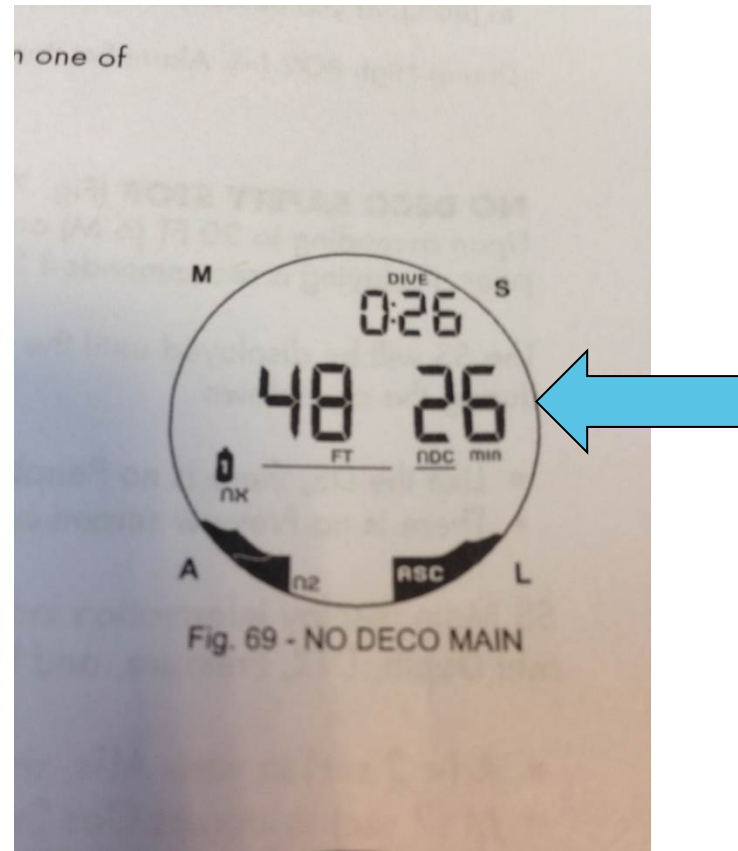
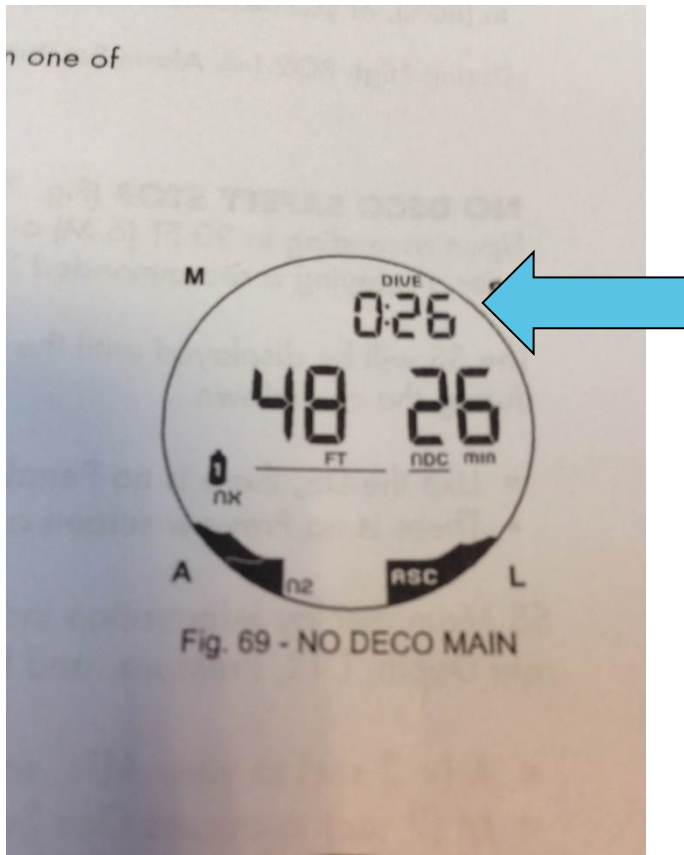
- Ascent rate (ASC) is represented by a bar graph on the lower right side of the computer



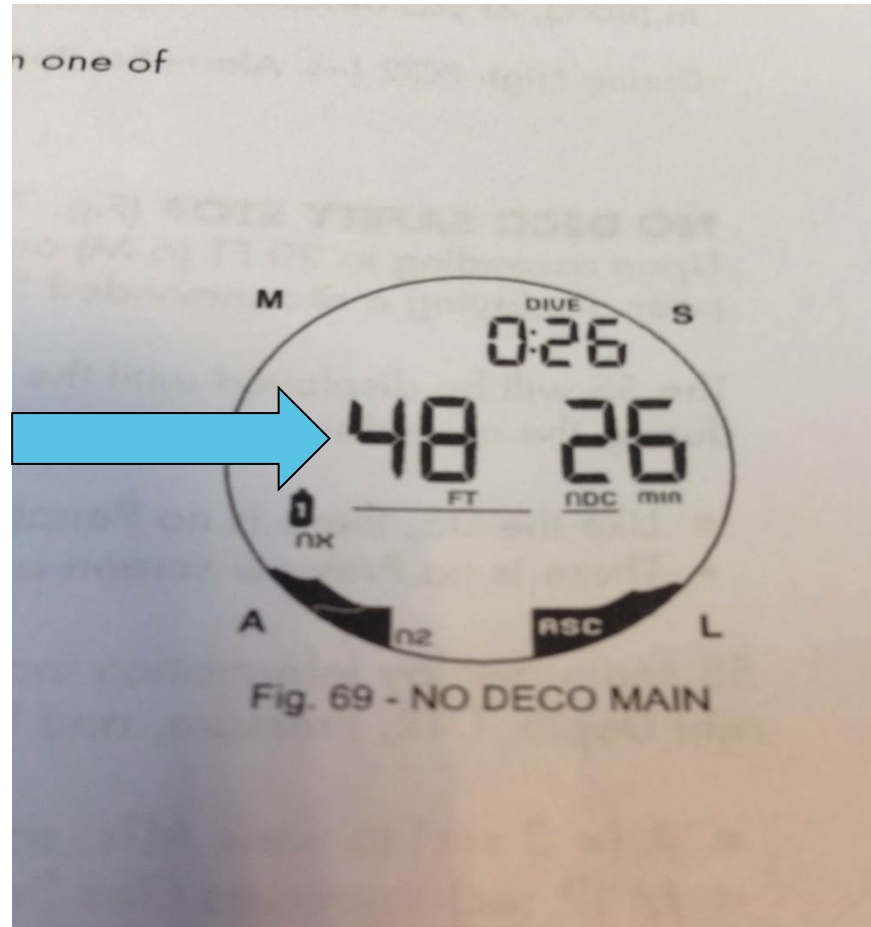
Bottom Time

Time Underwater

- Time until No-Deco Limit



Depth



Alarms

- Alarms are turned on.
- Ascent rate is going to be the most “common” alarm you hear.
- Always pay attention to your alarms.

Not Listening to Your Computer

- Any diver that goes over their No Decompression limits will need to have a discussion with Dive Ops.
- Dive Ops will monitor computers and download profiles for safety checks periodically

Safety Stops

- As always, safety stops of 3-5 minutes at 10-25' is required
- The computers will start a countdown for you when you get in this depth zone

Back light

- To activate the back light in dark dive conditions, press the lower right button



Logging Dives

- Dives will be logged as normal, with the exception of recording the computer number on the dry erase and paper log
- The online dive log will need the following option chosen
 - > **Decompression Planning: Computer - Sherwood**

End of the Day

- Quickly rinse the dive computers in freshwater and return them to their assigned number position
- Do not leave computers in the bottom of the disinfect/rinse buckets
- Team Leaders should confirm all gear has been returned to the gear room at the end of the day

In Water Training

- Divers will do two dives w/ computers to complete this training (Usually on dive day 1)
- Turn Computer on
- Monitor during your dive
- Debrief after with Dive Ops

