Specification of Suunto Eon/Solution Alpha/Solution Nitrox protocol & data format

Gary Lorensen (GLorensen@aol.com)
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Updates to this document can be found at http://members.aol.com/GLorensen/divecomp.html

Please send me your profile dumps so I can further analyze the format and improve this documentation.

This document describes the communications protocol and data format of the Suunto Eon, Solution Alpha, or Solution Nitrox dive computers. Most of the information was obtained by examining Eons, but it should apply to Solution Alpha and Nitrox as well. It does not address the Suunto Solution dive computer. It is addressed in a separate document.

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This information was compiled by me, Gary Lorensen, over a series of late night hacking sessions, by monitoring the serial port traffic between my Suunto Eon in its PC interface and my PC running dive log software from Suunto. I made a cool three-headed serial cable to break out the signals for monitoring on a second computer. The project originally started several years ago when I bought my Solution and PC interface. I found the DOS software cumbersome to use, and wanted to write a Windows version. When I contacted Suunto, they said there was no market for such software, they would not document the protocol or format, and that I could damage my dive computer by hacking it. After several hours of hacking, I gave up. Eventually I was introduced to Larry Sands, the author of the dive log software for Suunto. A very nice guy, but under NDA from Suunto, so he could not tell me anything. Finally I became a PalmPilot programmer, and saw a great opportunity to use the PalmPilot as a temporary data store and analysis tool for dive profiles. Upon re-examing the protocol for a few hours late one night, I was able to figure out much of the data format of the Solution. A few nights later I figured out the Eon. I deduced more of the format by examining the data sets from friends' Eons. Thank you to Steffen, Tim Ewing, Teppo, and Bret. If you are able to document more information regarding the format, please send a note back to me, so I can correct, clarify, and update the spec.

Communication protocol

Data transfer from the Suunto Eon through the PC interface to the serial port of the PC runs at 1200/8N2. There is an intial handshake, then a data block of 2305 bytes (256 byte header, 2048 bytes of profile data, 1 byte checksum). My Suunto PC interface needs Gnd, TxD, RxD, RTS, and DTR. If you are interfacing to a PalmPilot, note that the HotSync/cradle cable has the pins swapped.

The communications sequence looks like:

PC asserts DTR
PC sends   0x50
Eon sends 2305 bytes
{awful lot simpler than the Solution, isn't it?}

Data format

The 2305-byte data chunk read from the Suunto Eon is partitioned into a 256-byte header, a 2048-byte dive profile chunk, and a 1-byte checksum. Dive profiles are written one after another, obliterating previous dive profiles.

The 256-byte header

[0x00]	Always 0x00?
[0x01]	Always 0x00?
[0x02]	Total number of dives overwritten
[0x03]	Total minutes of diving (msb)
[0x04]	Total minutes of diving (lsb)
[0x05]	bits [7..0]:Maximum depth bits [8..1]
[0x06]	bit [7]:Maximum depth bit [0]?
	bits [6..0]:?
[0x07]	?
[0x08]	?
[0x09]	Current sampling interval, in seconds
[0x0A]	bits [5..4]: Altitude setting. A0=0x10, A2=0x30, A2=0x70 on an English unit Eon
	bits 3:maybe the metric flag
	bits 1:maybe the nitrox flag
[0x0B]	Current year modulo 100.
[0x0C]	Beginning of 20 byte personal info section?
[0xF4]	bits [7..4]: first digit of serial#/bits [3..0]:second digit of serial#
[0xF5]	bits [7..4]: third digit of serial#/bits [3..0]:fourth digit of serial#
[0xF6]	bits [7..4]: fifth digit of serial#/bits [3..0]:sixth digit of serial#

Notes:
- After spending more time examining dumps, I've concluded that the header does not include current temperature, time, and battery voltage information.
- I assume that among the undocumented fields, there is probably some nitrogen loading info if the dive computer is active.
- I have not confirmed the English/metric flag yet. Send me your profile dumps!
- I have not identified a pointer to the dive profile tail yet.

The 2048-byte dive profile section

The profile data is actually stored in successive **incrementing** addresses, and wraps from offset 0x8ff to 0x100. To find the oldest dive profile in memory, search for a value of 0x82, signifying the tail of the profile data. Then search incrementing addresses for 0x80, signifying the end of the partial chunk/beginning of oldest dive. The 0x80 end flag is followed by 2 additional bytes (temperature & end tank pressure). The next byte is the beginning of a profile record. There is no "remainder time" byte like in the Solution.

A dive profile record follows the format:

[profileoffset+0x00]	Surface interval since previous dive (minutes)
[profileoffset+0x01]	Surface interval since previous dive (hours)
[profileoffset+0x02]	Mystery 1/2
[profileoffset+0x03]	Sample interval, in seconds (20, 30, or 60)
[profileoffset+0x04]	Altitude setting. num*87-400 = altitude in feet
[profileoffset+0x05]	Start pressure, in Atm/2. num*29 = PSI
[profileoffset+0x06]	Year (BCD)
[profileoffset+0x07]	Month (BCD)
[profileoffset+0x08]	Day (BCD)
[profileoffset+0x09]	Hour (BCD)

[profileoffset+0x0A]   Min (BCD)
[profileoffset+0x0B]   Profile delta[0]
[profileoffset+0x0C]   Profile delta[1]
                .
                .
                .
[profileoffset+end-3]   Profile delta[n]
[profileoffset+end-2]   0x80
[profileoffset+end-1]   Temperature, in Celsius, 0x00 == -40 Celsius/Farenheit
[profileoffset+end]   End pressure, in Atm/2. num*29 = PSI

The profile entries are stored as 8-bit signed number deltas. Depth starts at 0 at time 0, and increases or decreases by the delta value. A profile delta value of 0x7D signifies a "slow" warning during ascent, and is not part of the profile depth or time calculations. A "slow" warning flag precedes the profile delta value that would display the warning on the dive computer. Note that it is possible to have a "slow" warning just prior to surfacing, in which case the "slow" warning flag (0x7D) would be followed immediately by the end flag (0x80). According to Teppo other warning flags include 0x7E:no decompression dive has turned into dec dive, and 0x7F:omitted ceiling. I do not know what other error warning values may exist. My friends and I follow safe diving practices, and have not exercised the emergency decompression capabilities of the Eon.

The temperature is stored in Celsius in the English Eons. The value is based at 0x00 = -40 degress Celsius, which I suppose it makes it easier to calculate Farenheit, since it just takes a simple multiple instead of a multiply & add. (-40 Celsius == -40 Farenheit)

By using the "Total dives overwritten" value in the header, you can generate an artificial serial# for each dive to automate tracking of which dives are new or if there are gaps in the data record.

-- Revision history ---------------------------------

Jan 5, 1999   - Corrected total dives/total dive time
Jan 30, 1999   - Added description of metric flag, possible nitrox flag, altitude setting, current year,
                      and maximum depth