

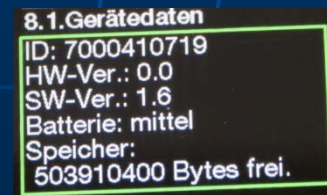
# On the reliability of dive computer generated run-times 26.07.2021, Part I

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DOI: 10.13140/RG.2.2.16260.65929



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Galileo 2 / G2:  
Hardware Version 0.0  
Software Version 1.6  
per 08/2021



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## Abstract:

in Part I we checked a simple run-time @bottom depth 42 m / bottom time 25 min. with 2 breathing gases (air & Trimix21/50) with the Scubapro/UWATEC G2 computer with various firmware releases from 2017 up to now (08 / 2021).

## Methods:

pls. cf. slides # 3 to 11, and References [1], [2] & [4], [5]

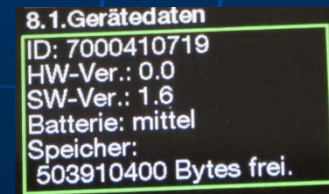
## Results:

there is variation in the TTS from 10 % up to 21 %, depending on breathing gas and user set conservatism

**Discussion / Recommendations:** pls. cf. slides # 12 & 13



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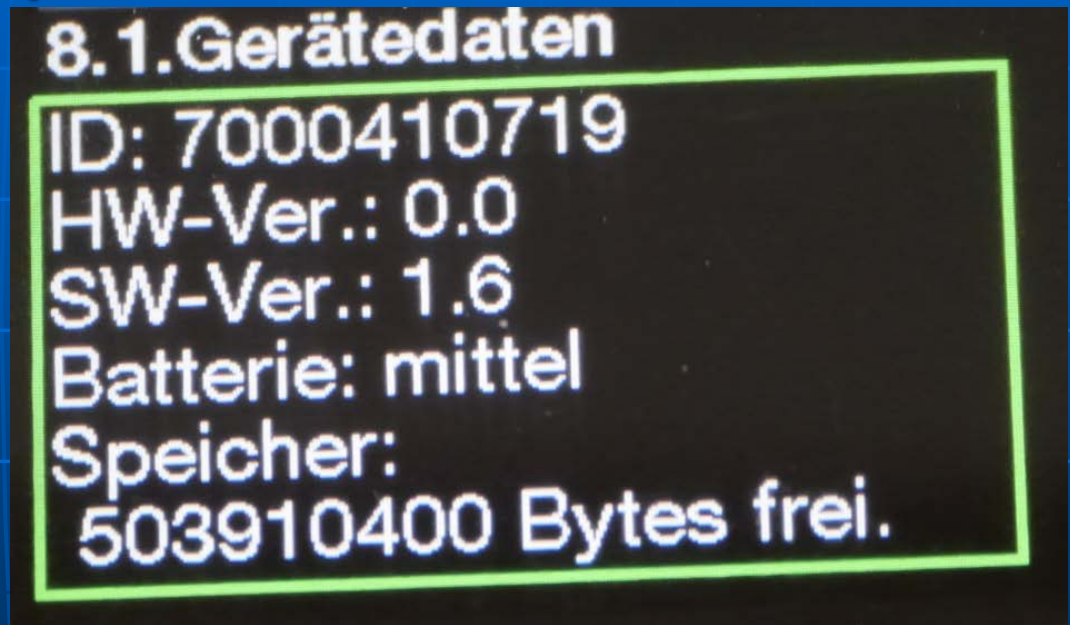


# Scubapro / UWATEC

## Galileo 2 / G2:

Firmware versions:  
from 1.2 up to 1.6

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**Dive Planner Menu / G2 (11. Tauchgangplaner)**  
**User adjustable conservatism: MB Level L = 0**  
**(Micro Bubble Level = 0, i.e. no gradient factors)**  
**Bottom depth: 42 m; NDL: 8 min**  
**bottom time 25 min @ Air →**  
**Result: TAT / TTS → 37 min (V1.6)**



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(\*) TAT = TTS: time-to-surface =  
sum of all stop times + ascent time (here ca. 6 min for the G2)



**Dive Planner Menu / G2: MB Level 0; depth: 42 m;  
bottom time 25 min @ Air →**

**TTS → 40 min (V1.2)**



**TTS → 47 min (V1.5)**



**TTS → 37 min (V1.6)**



(\*) TAT = TTS: time-to-surface =  
sum of all stop times + ascent time (here ca. 6 min for the G2)



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G2: MB Level	G2: V 1.2 TTS [min]		G2:V 1.5 TTS [min]		G2:V 1.6 TTS [min]
L0	40		47		37
L1	44		52		41
L2	50		58		47
L3	56		65		52
L4	63		73		59
L5	73		84		68
L6	87		100		82
L7	106		120		100
L8	132		146		127
L9	166		180		158



Comparison with a standard air  
diving table:

→ A.A. Bühlmann ZH-86 [3]

and a:

→ desktop deco software  
pls. cf. refs. [1], [2], [4]

## Additional Settings required for DIVE V 3\_10:

Source: [https://www.divetable.info/beta/D3\\_10.exe](https://www.divetable.info/beta/D3_10.exe)

→ „B“ : Buehlmann Depth Safety Factor

→ „AR“: ascent rate 7 m / min

### D3\_10 - [Graphic1]

```
maximale Ceiling: 8.20
Vorschlag Haldane 2:1 [m] = 16.0
Vorschlag Hills, B. A.: DEEP STOP [m] = 25
PDIS fuer TAU = 10 min: 34.60 [m]
PDIS fuer TAU = 20 min: 24.39 [m]
PDIS fuer TAU = 30 min: 18.50 [m]
Eingabe der Austauschstufe in Metern & cm: (m.cm):
    Austauschstufe ist zu hoch:
    niedriger wie Ceiling waehlen!

Deko Prognose:
9m Stopp Prognose Dekozeit: 4.0 Komp.#: 3
6m Stopp Prognose Dekozeit: 6.0 Komp.#: 4
3m Stopp Prognose Dekozeit: 18.0 Komp.#: 6
TTS = 34.0
was jetzt?
```



42	9	3				1	4
	12	3				4	7
	15	3			1	5	9
	18	3			4	6	13
	21	3		2	4	10	19
	24	3		3	6	16	28
	27	3		4	7	19	33
	30	3		2	4	9	24
							42

### Comparison with ZH-86 Table:

Source: [65], p. 227; i.e.:

<https://www.divetable.info/books/65.pdf>

"Tauchmedizin", Albert A. Bühlmann, Ernst B. Völlm (Mitarbeiter),  
P. Nussberger; 5. Auflage in 2002, Springer, ISBN 3-540-42979-4

**Comparison with other  
Scubapro/UWATEC Computers  
for the dive: 42 m / 25 min bottom time;  
each @ Air, @ MB-Level L0**

<b>Computertype:</b>	<b>TTS</b>	<b>Year (ca.)</b>
<b>TEC (1. Generation)</b>	<b>36</b>	<b>2003</b>
<b>TEC 2G</b>	<b>38</b>	<b>2007</b>
<b>Pro Ultra</b>	<b>40</b>	<b>2002</b>
<b>Aladin [2]</b>	<b>40</b>	<b>2014</b>
<b>Matrix</b>	<b>49</b>	<b>2016 (*)</b>
<b>Galileo 2 / G2</b>	<b>40</b>	<b>2017 (*) V 1.2</b>
<b>Galileo 2 / G2</b>	<b>47</b>	<b>2019 V 1.5</b>
<b>Galileo 2 / G2</b>	<b>37</b>	<b>2021 V 1.6</b>
<b>(*) Change from ZH-L 8 to ZH-L 16</b>		

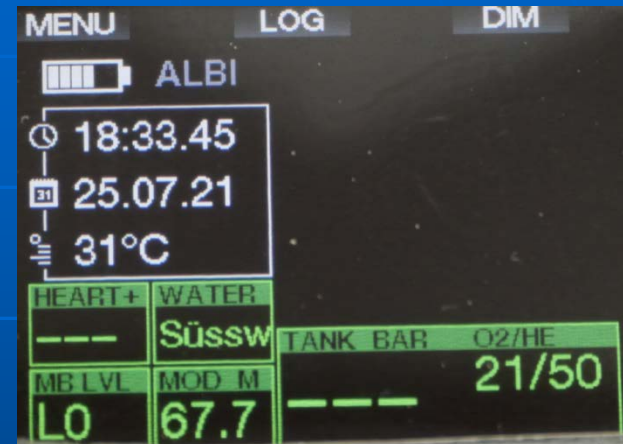
# TMX 21 / 50 Box Profile @ L0:

42 m / 25 min bottom time

V 1.2:

V 1.6:

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## Discussion / Recommendations:

Dive Computer Manufacturers should:

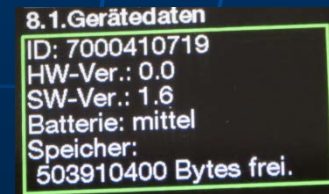
- reveal the used set of constants (i.e. used at run-time!)
- implement quality assurance procedures
- agree on a set of benchmarks, standardized for all players in the market
- or a public code-review

For diving activities outside the proven envelope (> 30 m, > 30 min) therefore the professional use of diving computers, for e.g. for military-, C&R-, HBOT, public services- & fish farming diving is strongly discouraged.

For reliable, professional use a certain safety-integrity level (**SIL**, according to IEC61508) as to be achieved.



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## Discussion / Recommendations:

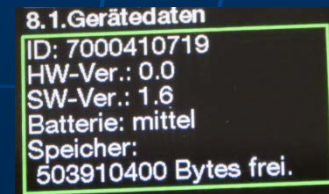
Since this unreliability is displayed in other scenarios as well, for eg. with mixed gas run-times, oxygen toxicity calculations, altitude diving adaptations and the like (pls. cf. refs. [5] & [6], and the [SNAFU series @ divetable.info](http://divetable.info) from 2017 to 2021) we will continue with similar products in Part II, t.b.d.

For civilian use (i.e. TEC / rec divers) outside the proven envelope, users should not rely on a sole source of information, instead consult :

- accepted dive tables
- verified / open desktop deco software products
- a 2nd./3rd. dive computer.



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## References:

- [1] Nurit Vered, Miri Rosenblat; Salm, Albi (2021):  
[https://www.researchgate.net/publication/349504991\\_Synopsis\\_Fact\\_Sheet\\_PoC\\_for\\_DIVE\\_Proof\\_of\\_Concept\\_for\\_a\\_free-shareware\\_decompression\\_suite](https://www.researchgate.net/publication/349504991_Synopsis_Fact_Sheet_PoC_for_DIVE_Proof_of_Concept_for_a_free-shareware_decompression_suite)
- [2] Salm, Albi (2020)  
<https://dx.doi.org/10.13140/RG.2.2.24608.20482/1>
- [3] → [65] Albert A. Bühlmann, Ernst B. Völlm (Mitarbeiter), P. Nussberger (5. Auflage in 2002) Tauchmedizin
- [4] Nurit Vered, Miri Rosenblat; Salm, Albi (2021):  
<https://dx.doi.org/10.13140/RG.2.2.28123.69924>

# On the reliability of dive computer generated run-times, Part I

## References:

[5] Salm, Albi (2017) **Dive Computer SNAFUs & Crashes**  
**[https://www.divetable.info/kap15\\_e.htm](https://www.divetable.info/kap15_e.htm)**

[6] Salm, Albi (2012) **Variation in the TTS: where do they come from?**  
International Journal of the Society for Underwater Technology, November  
2012: **SUT, Vol. 31, No. 1, pp. 43 - 47, 2012**