

CRUISE REPORT



R/V Aranda

Cruise 1/2017

Combine1/2017 Leg 1
18th – 23th January, 2017

This report is based on preliminary data and is subject to changes.

Cruise 1/2017, Combine1

18th – 23th January, 2017

Chief scientist: Harri T. Kankaanpää

INTRODUCTION

The main aim of the cruise was to monitor hydrography, nutrient situation and oil contamination in the Gulf of Finland as part of the HELCOM/MONAS Combine programme (Combine1), and the national MSFD programme for hydrography and harmful substances.

Altogether 23 stations were visited in the Gulf of Finland and the western entrance to the Gulf of Finland (Figure 1, Table 1).

At every station CTD (salinity, temperature, fluorescence, O₂ concentration profile and pressure), pH, ammonia/ammonium concentration and nutrient concentrations were measured using rosette-bottled samples. In addition to the CTD/rosette profile, these parameters were also measured from near-bottom water samples (1 m above the seafloor). Oil contamination was examined using subsurface water from one meter depth at selected stations. Additional samples for QA measurements were taken at station LL7. Novel *in situ* instruments for hydrographic measurements were also used.

The environmental set up prior to the cruise was strongly influenced by the easterly-wind-driven water circulation (inflow of deep water) in December 2016 and the high seas (efficient surface mixing) in mid-January 2017.

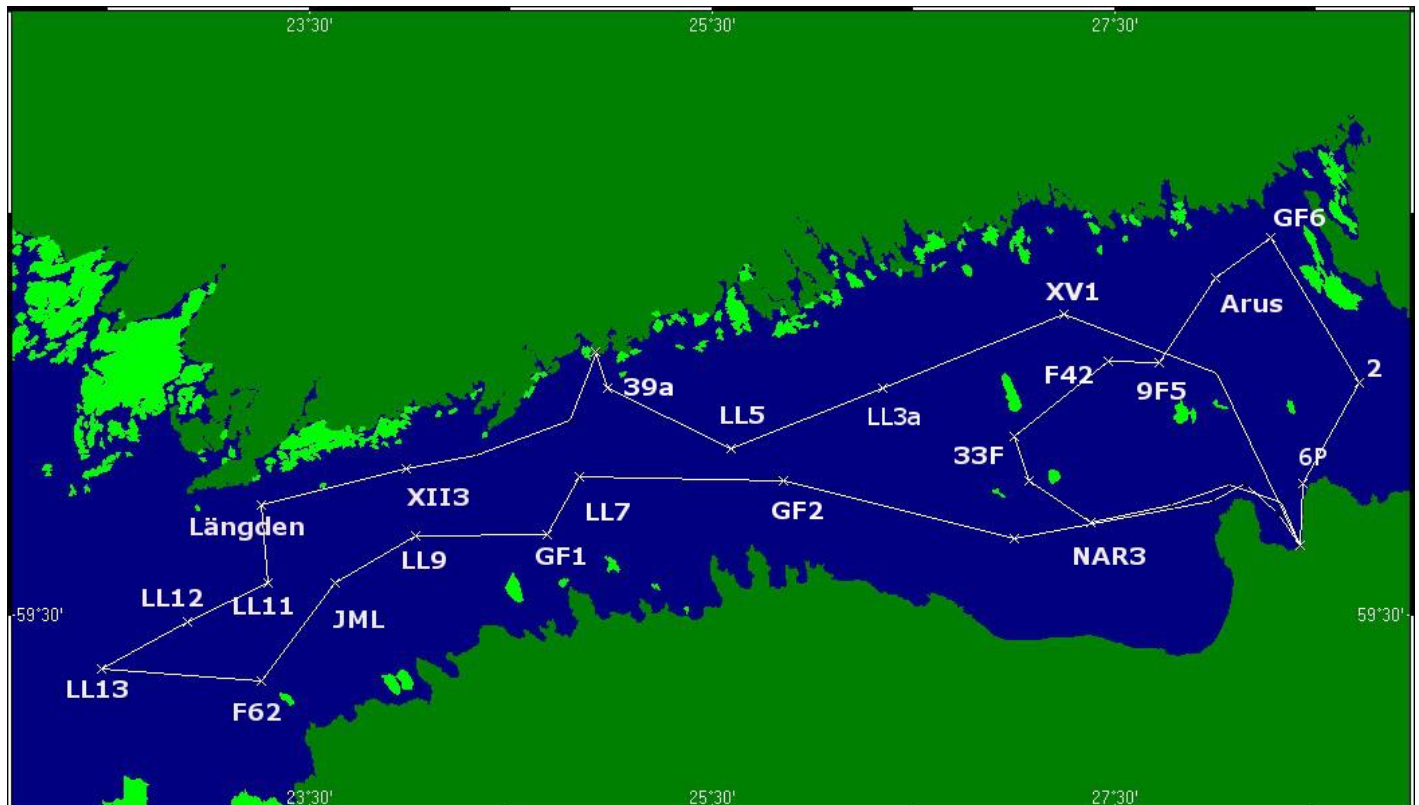


Fig. 1. Research stations and the approximate route of R/V Aranda during the cruise of Combine1 Leg within the Gulf of Finland and its western entrance during January 18 – 23, 2017.

SUMMARY OF CHEMICAL AND PHYSICAL STATUS

The hydrodynamic events during late 2016 effect together with the effective mixing had resulted in homogenisation of the uppermost section of the water column (CTD profiles in images) of and highly elevated phosphate and silicate concentrations (Figs. 2 and 3) in the upper layer of the water column. The increase in phosphate concentrations was notable in the central and especially the eastern Gulf of Finland. The same applied to silicate. Record-high phosphate concentrations in the uppermost water column were encountered in a few cases (e.g. XV1: 1.47 μM , F62: 0.95 μM and GF6: 1.47 μM).

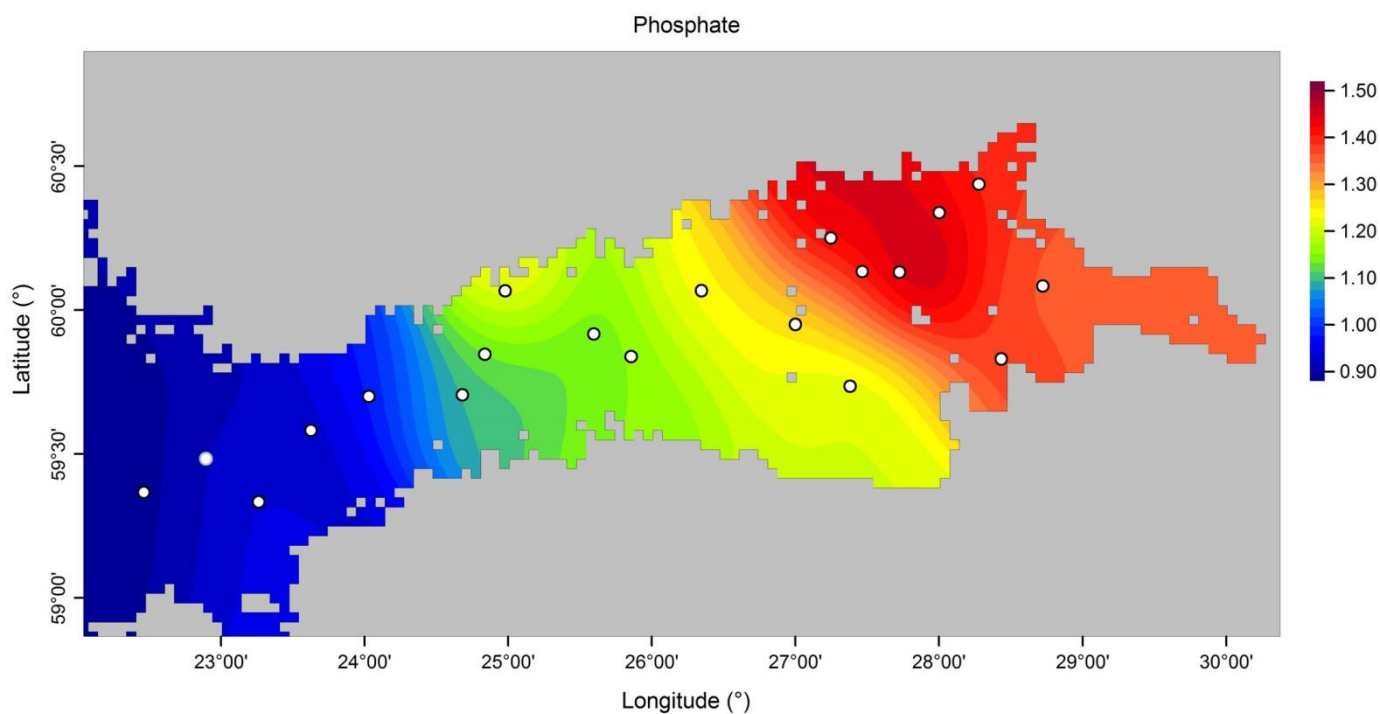


Fig. 2. Interpolated phosphate concentration values at 1 m depth. Scale unit is μM . Observation stations are marked with white circles.

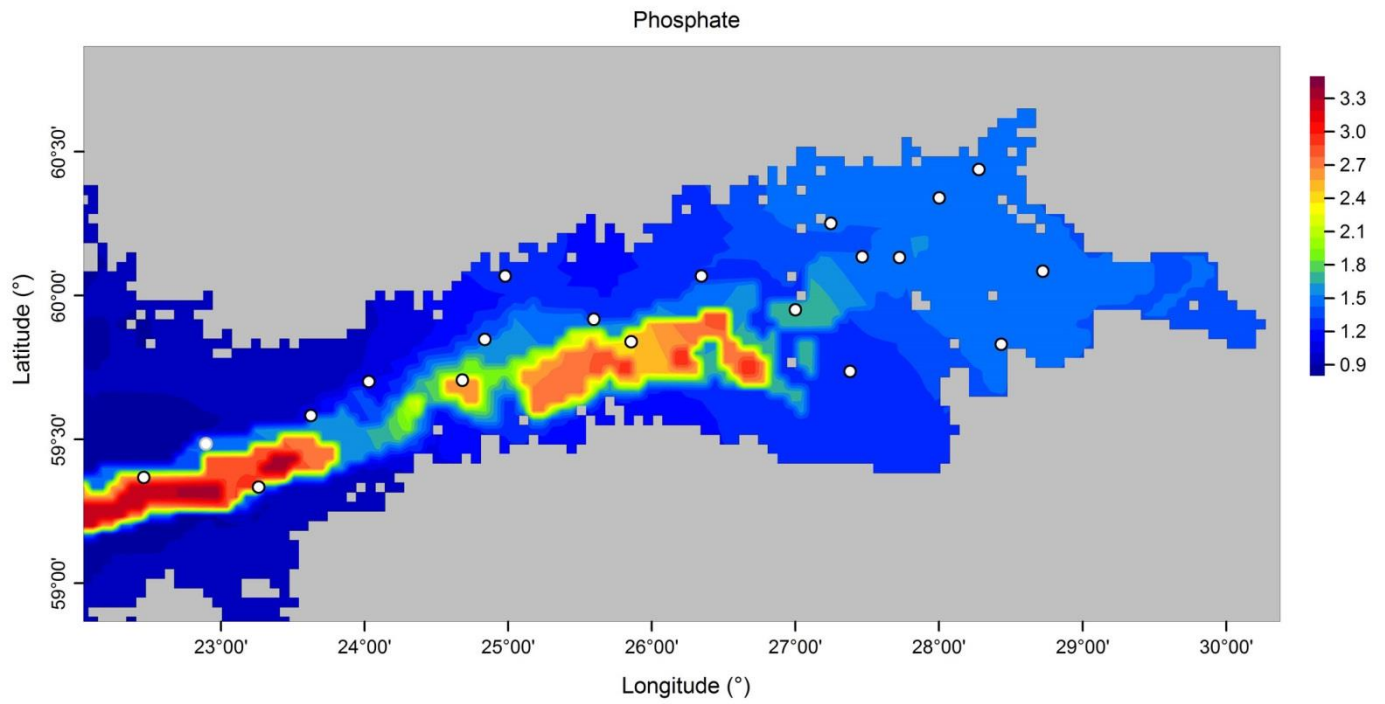


Fig. 3. Interpolated phosphate concentration values at 1 m above the seafloor. Scale unit is μM . Observation stations are marked with white circles.

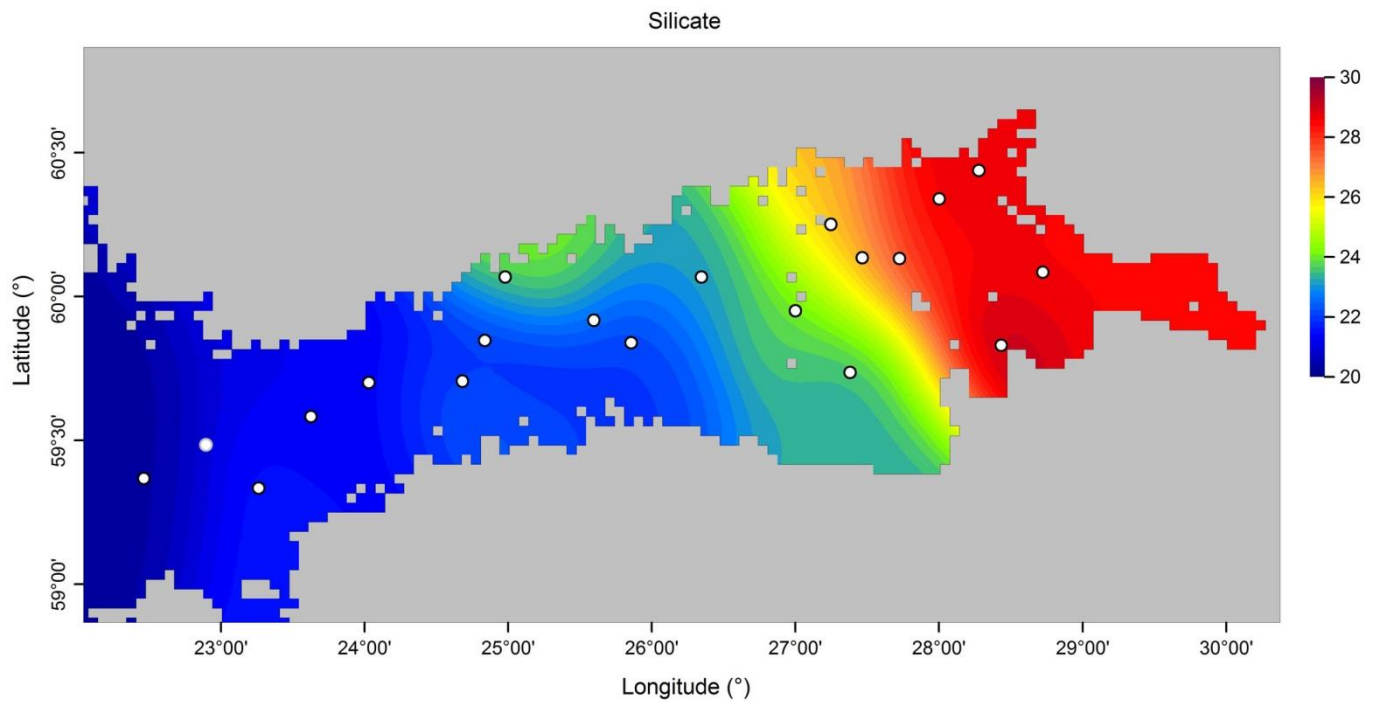


Fig. 4. Interpolated silicate concentration values at 1 m depth. Scale unit is μM . Observation stations are marked with white circles.

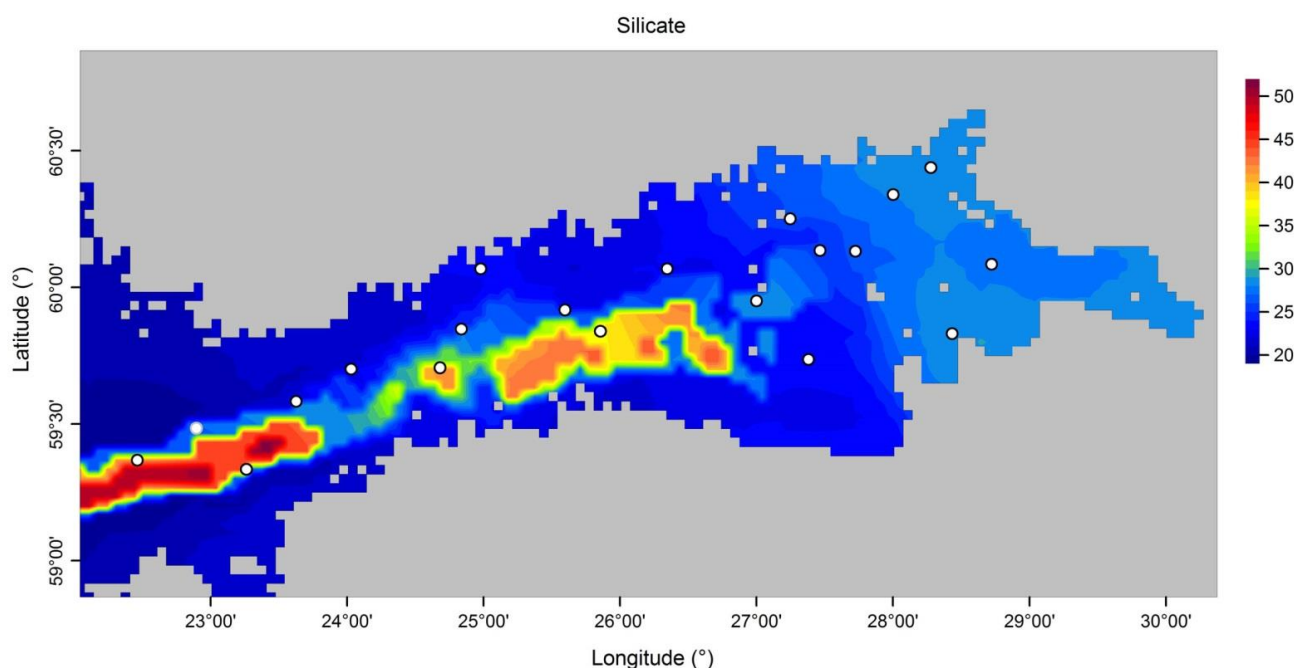


Fig.

5. Interpolated silicate concentration values at 1 m above the seafloor. Scale unit is μM . Observation stations are marked with white circles.

Oxygen conditions

Along the main Gulf of Finland depression, in the west and central areas, there was very little or no oxygen in the deep water layer. The areal coverage of near-bottom environments with less than 4 ml O_2/l had increased, extending more to the central Gulf of Finland compared to 2016. The western Gulf of Finland has remained hypoxic, but was now with higher oxygen concentrations compared to 2016. Toxic H_2S was not detected.

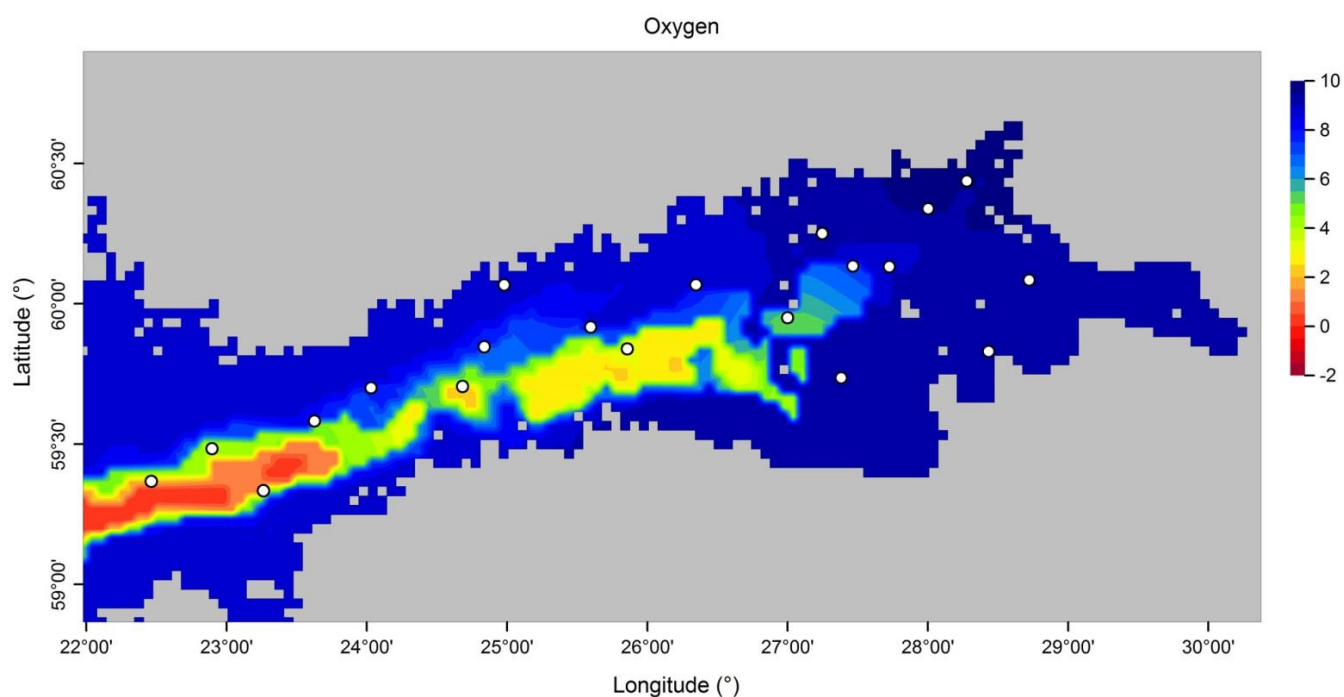


Fig. 6. Interpolated oxygen concentrations (ml O_2 / l seawater) at 1 m above seafloor. Observation stations are marked with white circles.

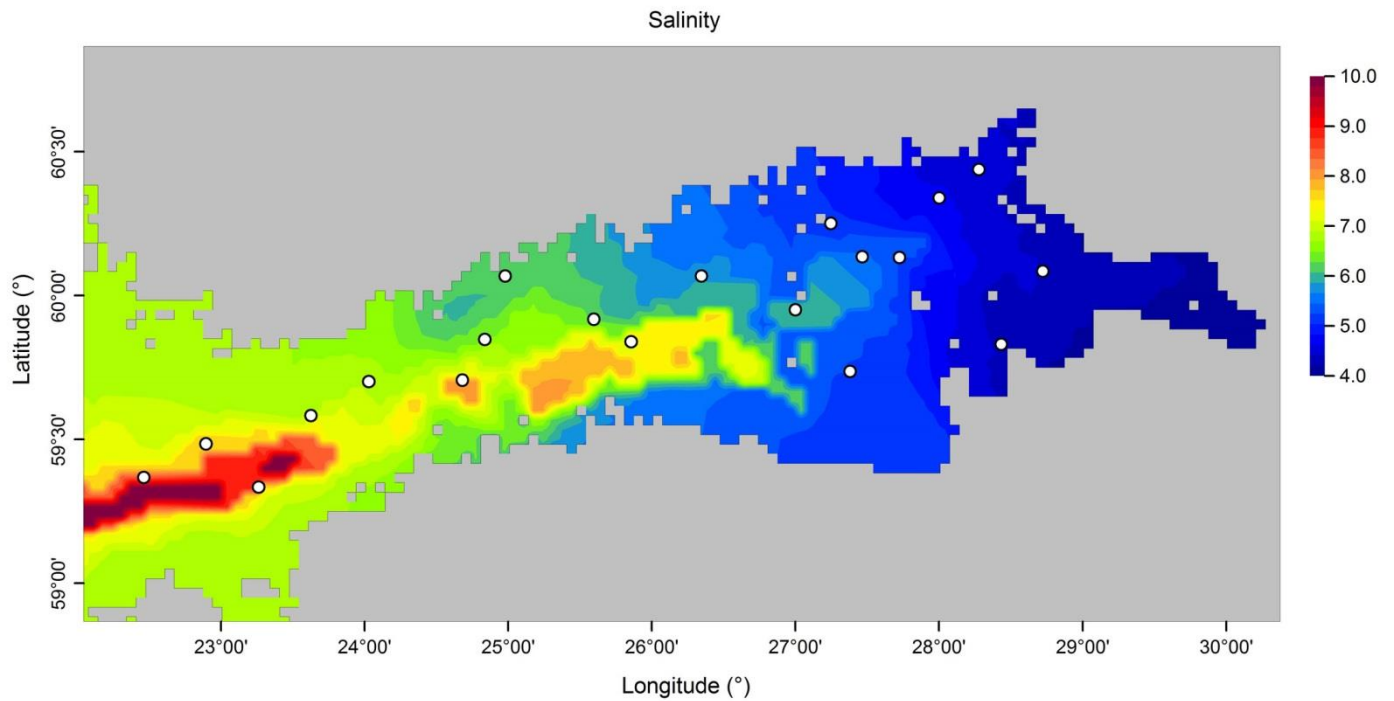


Fig. 7. Interpolated salinity values (PSU) at 1 m above seafloor. Observation stations are marked with white circles

The largest near-bottom salinities were overall somewhat diluted compared to situation in 2016. At the same time, the near-bottom salinities outside the main depression showed small increase

Oil In the uppermost water column

The concentrations of dissolved and dispersed oil at 1 m depth were all below the $1.0 \mu\text{g l}^{-1}$ threshold value set by the Intergovernmental Oceanographic Commission . The concentrations were at a level that has been typical for the winter season, i.e. between 0.1 and $0.6 \mu\text{g l}^{-1}$.

OBSERVATION STATIONS AND MEASUREMENTS

Total number of stations during the cruise was 23. Activities are listed in Table 1.

Station	CTD	Hydrography pH, O ₂ , H ₂ S, SAL NH ₃ /NH ₄ ⁺	H ₂ S/pH/T/O ₂ sond	Nutrients	Oil samples	Miscellaneous
39A	X	X	X	X		surface water for laboratory experiments
LL5	X	X		X		
LL3A	X	X		X	X	
XV1	X	X		X		
6P	X	X		X		
2	X	X		X	X	
GF6	X	X		X	X	
Arus	X	X		X		
9F5	X	X		X		
F42	X	X		X	X	
33F	X	X		X		
NAR3	X	X		X		
GF2	X	X	X	X	X	
LL7	X	X		X	X	Quality station; parallel oil samples
GF1	X	X		X		
LL9	X	X		X		
JML	X	X		X		
F62	X	X	X	X		
LL13	X	X	X	X		
LL12	X	X		X	X	
LL11	X	X		X		
LÅNGDEN	X	X		X		
XII3	X	X		X		

Table 1. List of stations and monitoring activities.

Operational use of the *in situ* pH/H₂S/T/P/O₂ probe

The sond was used to to examine operational monitoring. Data on *in situ* pressure, pH, [H₂S], T and [O₂] were gathered in the central and western Gulf of Finland and the Gulf of Finland entrance area.



Figure 8. Group photo of the scientific crew during the Combine 1 Leg 1, 2017 cruise. From left to right: Riikka Hietala, Eva Luostarinen, Susanna Hyvärinen, Pekka Kosloff, Jere Riikonen, Tanja Kinnunen, Ilkka Lastumäki, Harri Kankaanpää, Irina Andrejeva and Jan-Erik Bruun.

SCIENTIFIC STAFF

Chief scientist: Kankaanpää Harri T.

Participants: Bruun Jan-Erik
Hyvärinen Susanna
Kinnunen Tanja
Luostarinen Eva
Lastumäki Ilkka
Riikonen Jere
Hietala Riikka
Kosloff Pekka
Andrejeva Irina

Master: Jaakko Helanto

Departure from Helsinki on Wednesday January 18, 2017 at 10:11 local time

Arrival to Helsinki on Monday January 23, 2017 at 11:15 local time

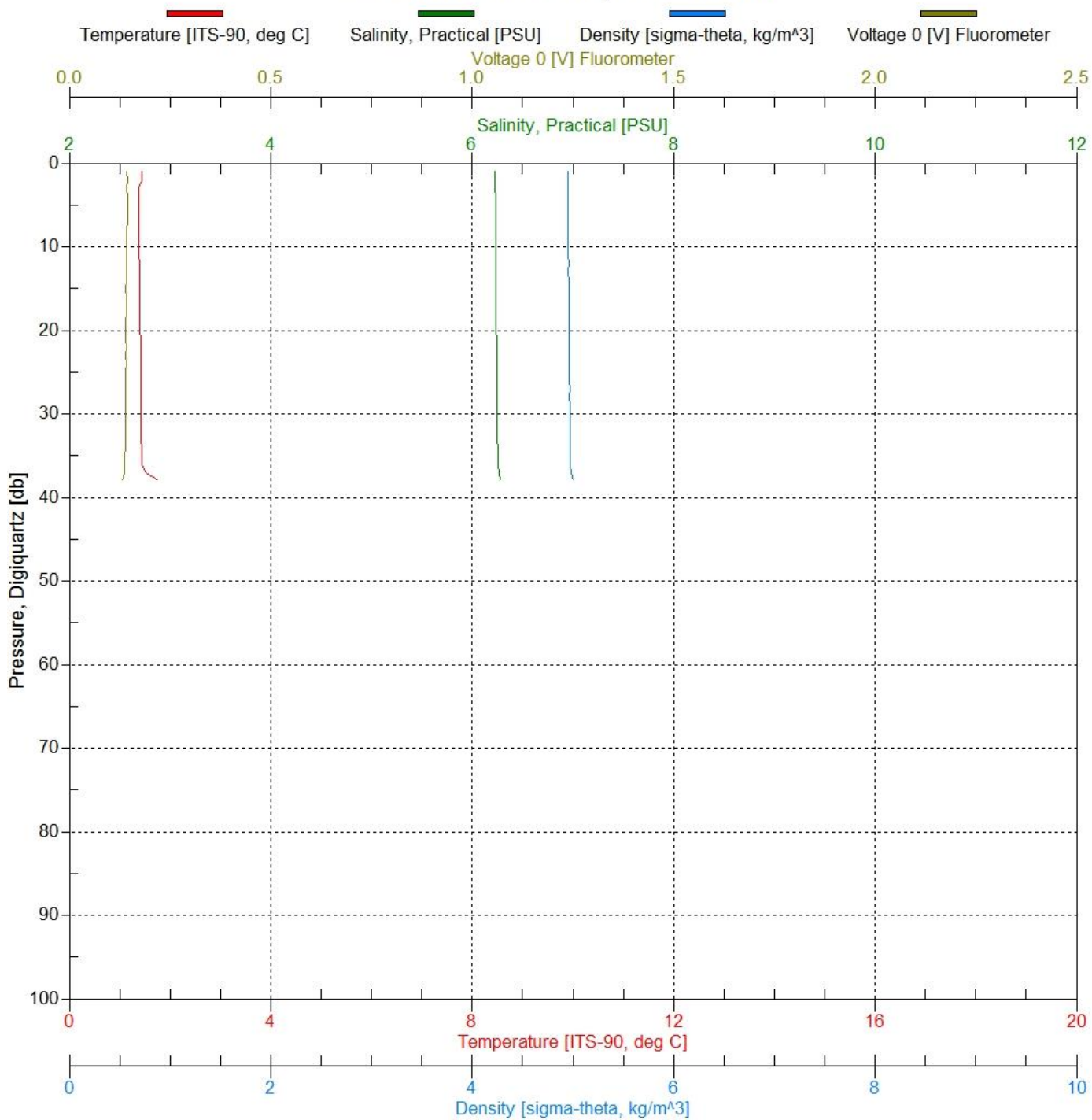
Harbours visited: Ust-Luga, January 19, 2017 at 08.30 Finnish time; Ust-Luga, January 20, 2017 at 20:00 Finnish time.

LIST OF STATIONS (coordinates are in WGS-84)

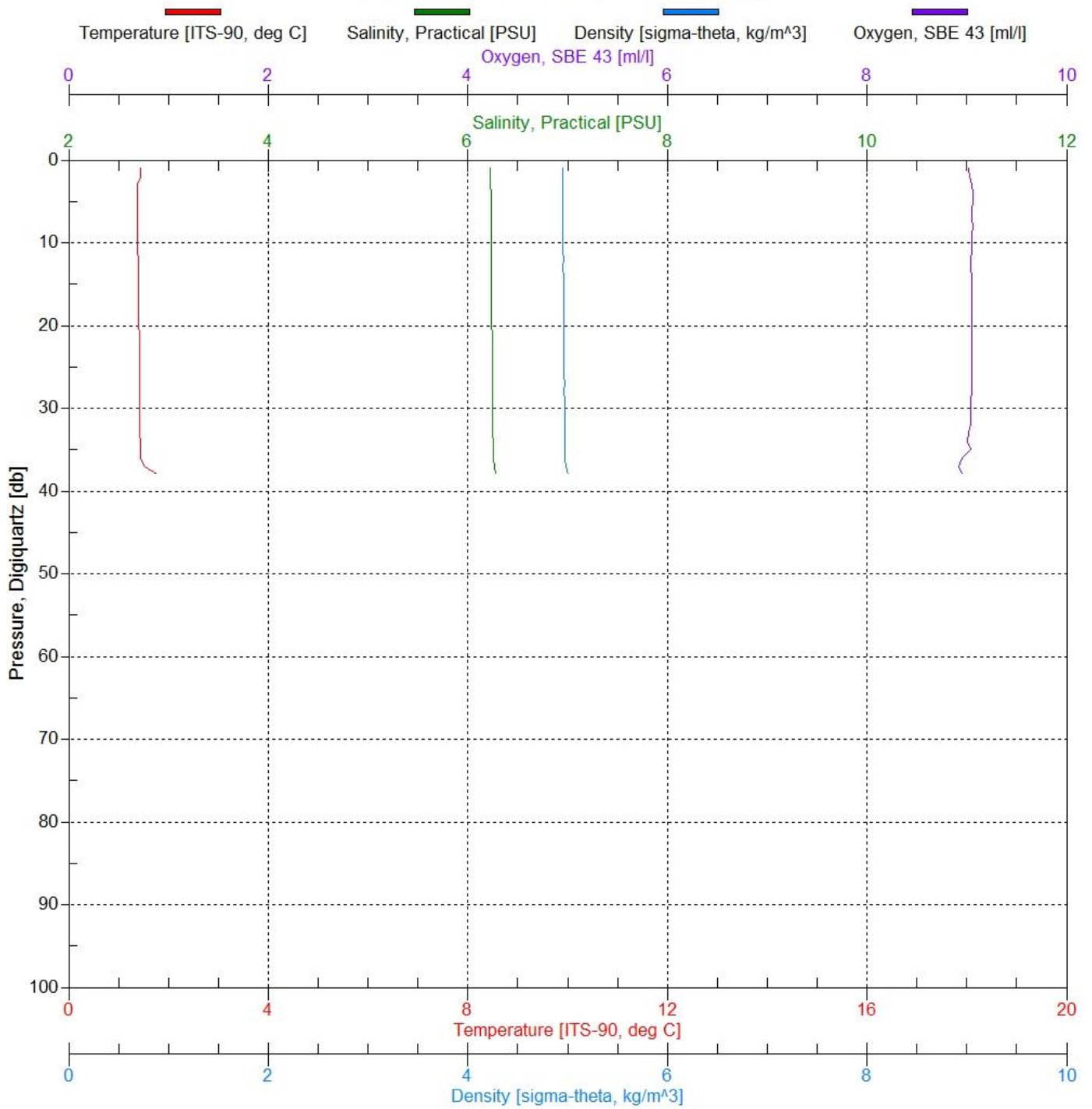
Index	Station	Lat/Lon)	depth	Date	Time (UTC)
01 0034	39A	N60.0401 E024.5881	43.00	20170118	0915
01 0035	LL5	N59.5500 E025.3581	67.00	20170118	1355
01 0036	LL3A	N60.0403 E026.2081	68.00	20170118	1730
01 0037	XV1	N60.1500 E027.1482	63.00	20170118	2100
01 0038	6P	N59.4980 E028.2600	28.00	20170119	1331
01 0039	2	N60.0504 E028.4335	39.00	20170119	1630
01 0040	GF6	N60.2031 E028.0011	44.00	20170119	2115
01 0041	ARUS	N60.2623 E028.1666	26.00	20170119	2347
01 0042	9F5	N60.0790 E027.4350	50.00	20170120	0247
01 0043	F42	N60.0804 E027.2794	64.00	20170120	0450
01 0044	33F	N59.5700 E027.0000	70.00	20170120	0720
01 0045	NAR3	N59.4413 E027.2290	69.00	20170120	1032
01 0046	GF2	N59.5031 E025.5141	85.00	20170121	0715
01 0047	LL7	N59.5079 E024.5027	102.00	20170121	1420
01 0048	LL7LAATU	N59.5079 E024.5027	102.00	20170121	1645
01 0049	GF1	N59.4230 E024.4093	84.00	20170121	1940
01 0050	LL9	N59.4202 E024.0182	67.00	20170121	2321
01 0051	JML	N59.3491 E023.3762	80.00	20170122	0207
01 0052	F62	N59.2001 E023.1581	95.00	20170122	0600
01 0053	LL13	N59.2200 E022.2781	104.00	20170122	1252
01 0054	LL12	N59.2901 E022.5381	82.00	20170122	1805
01 0055	LL11	N59.3501 E023.1781	68.00	20170122	2025
01 0056	LANGDEN	N59.4661 E023.1577	57.00	20170122	2237
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Appendix 1. CTD profiles obtained during the cruise.

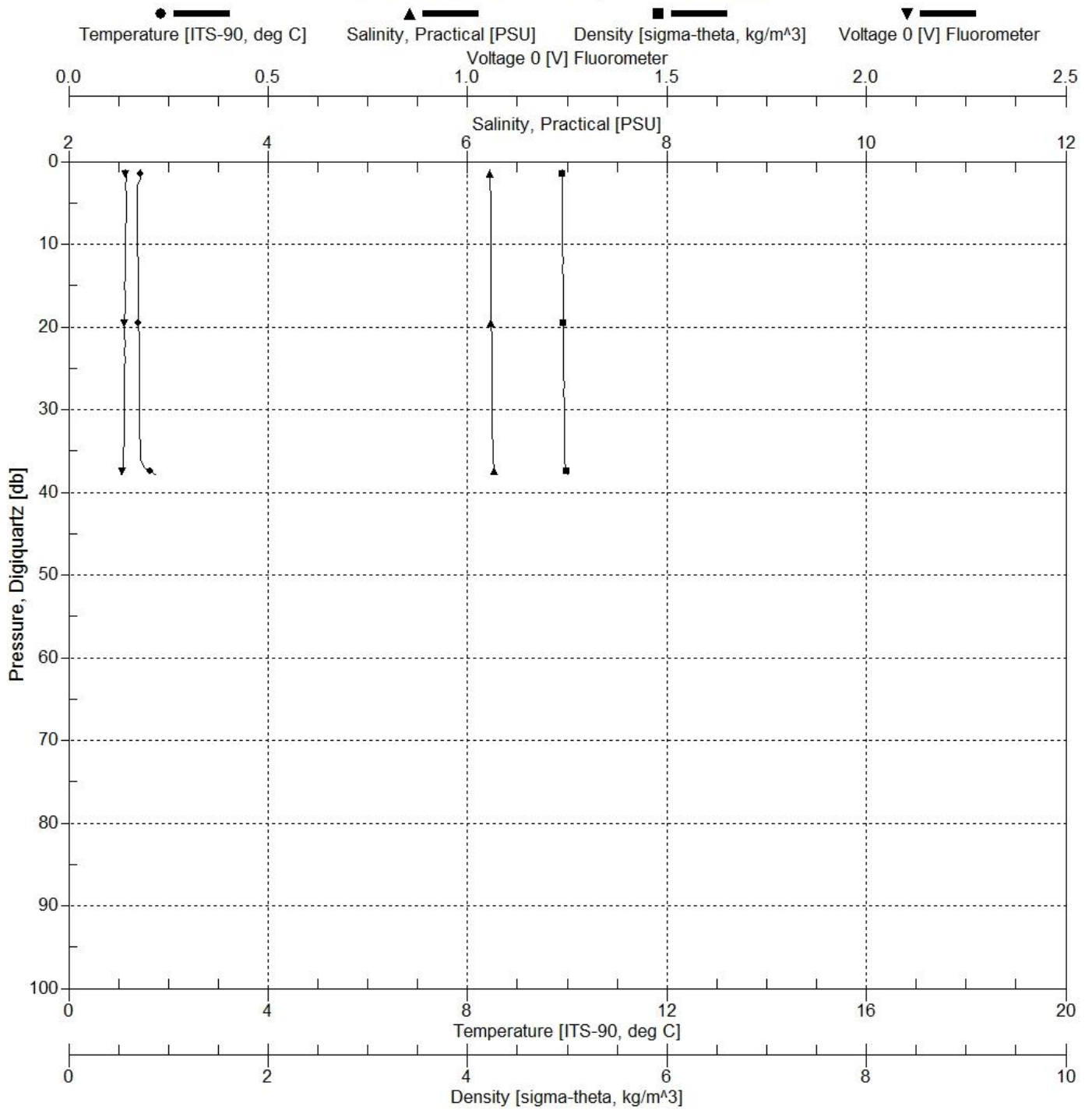
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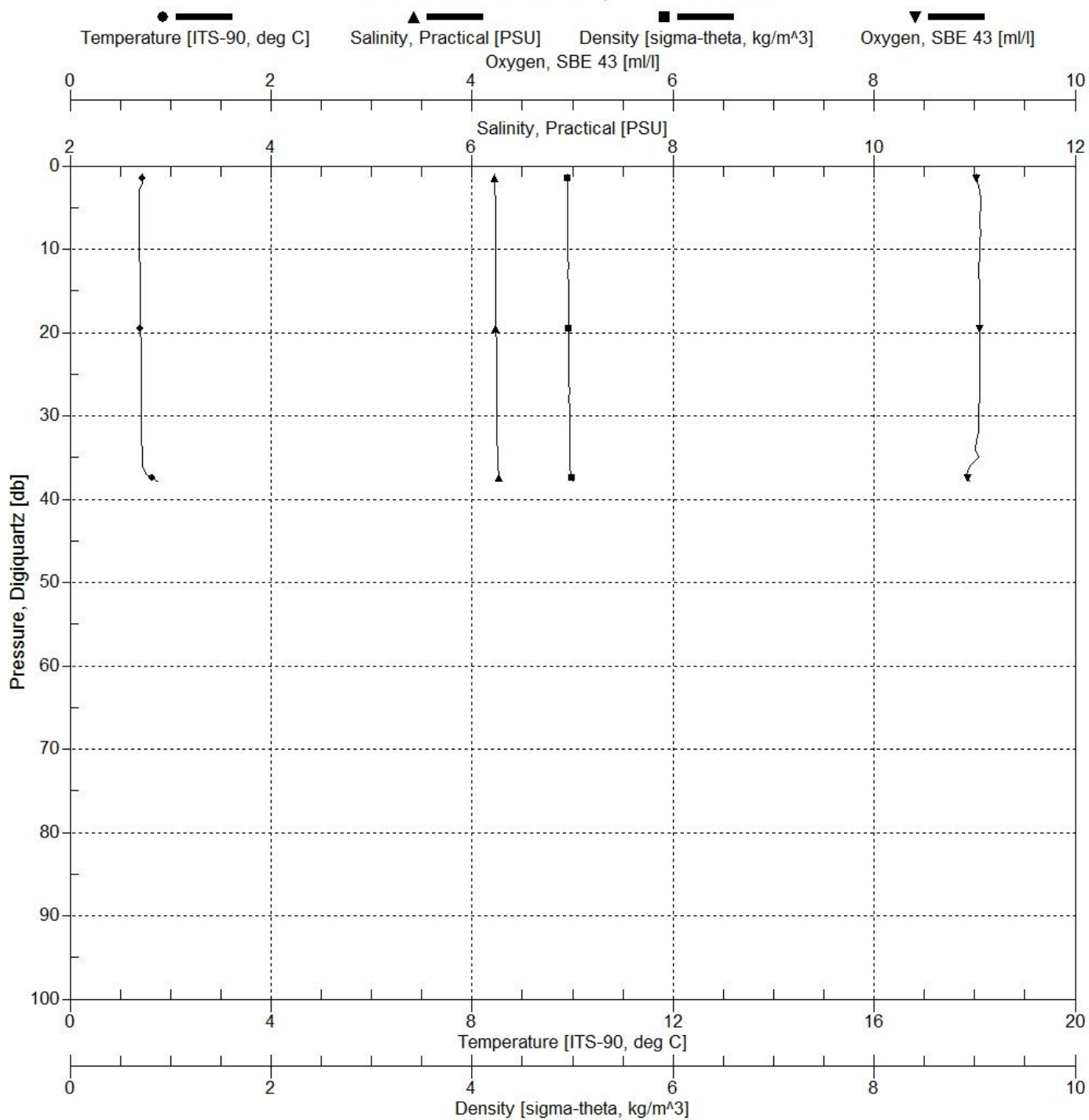
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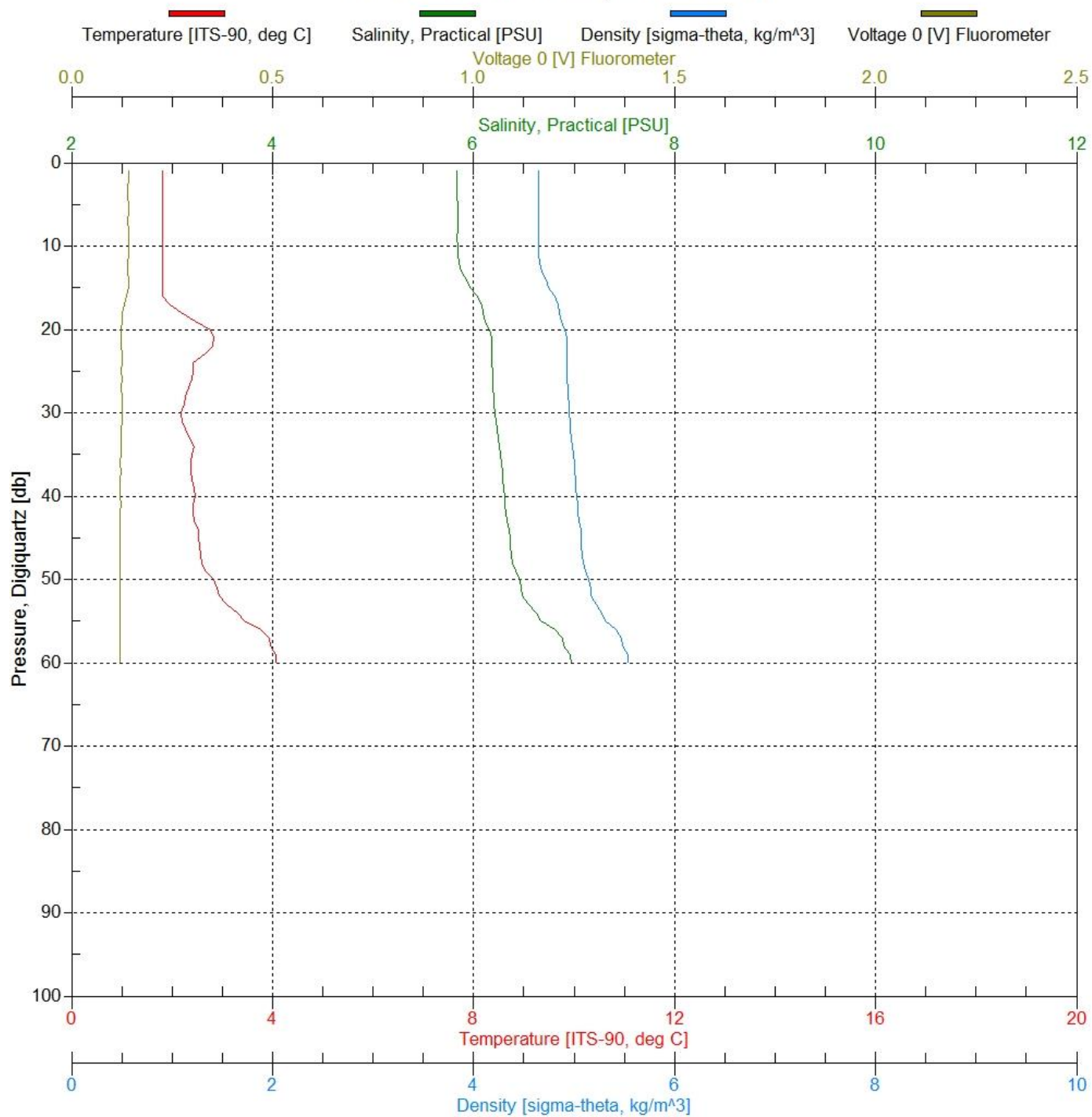
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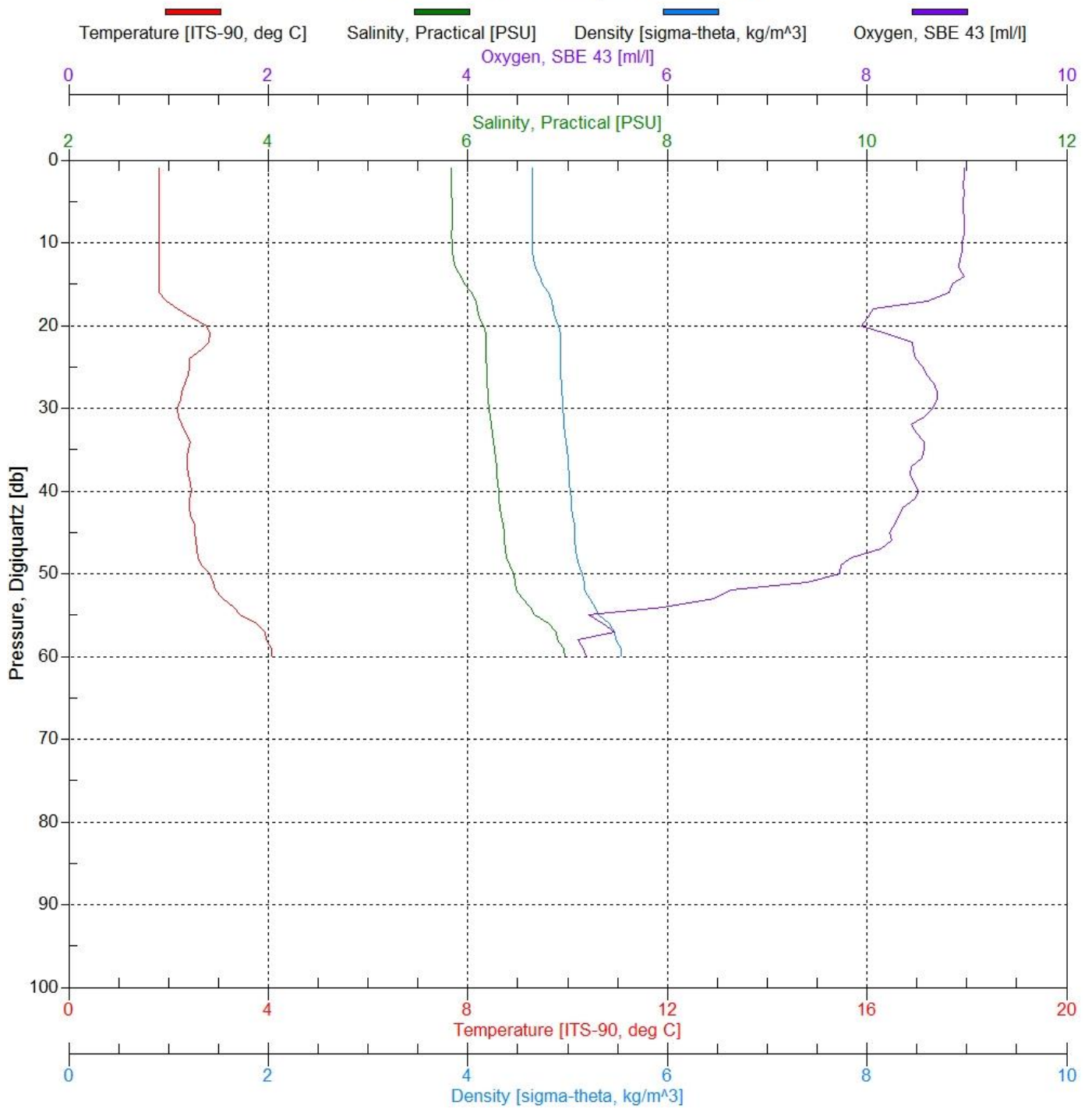
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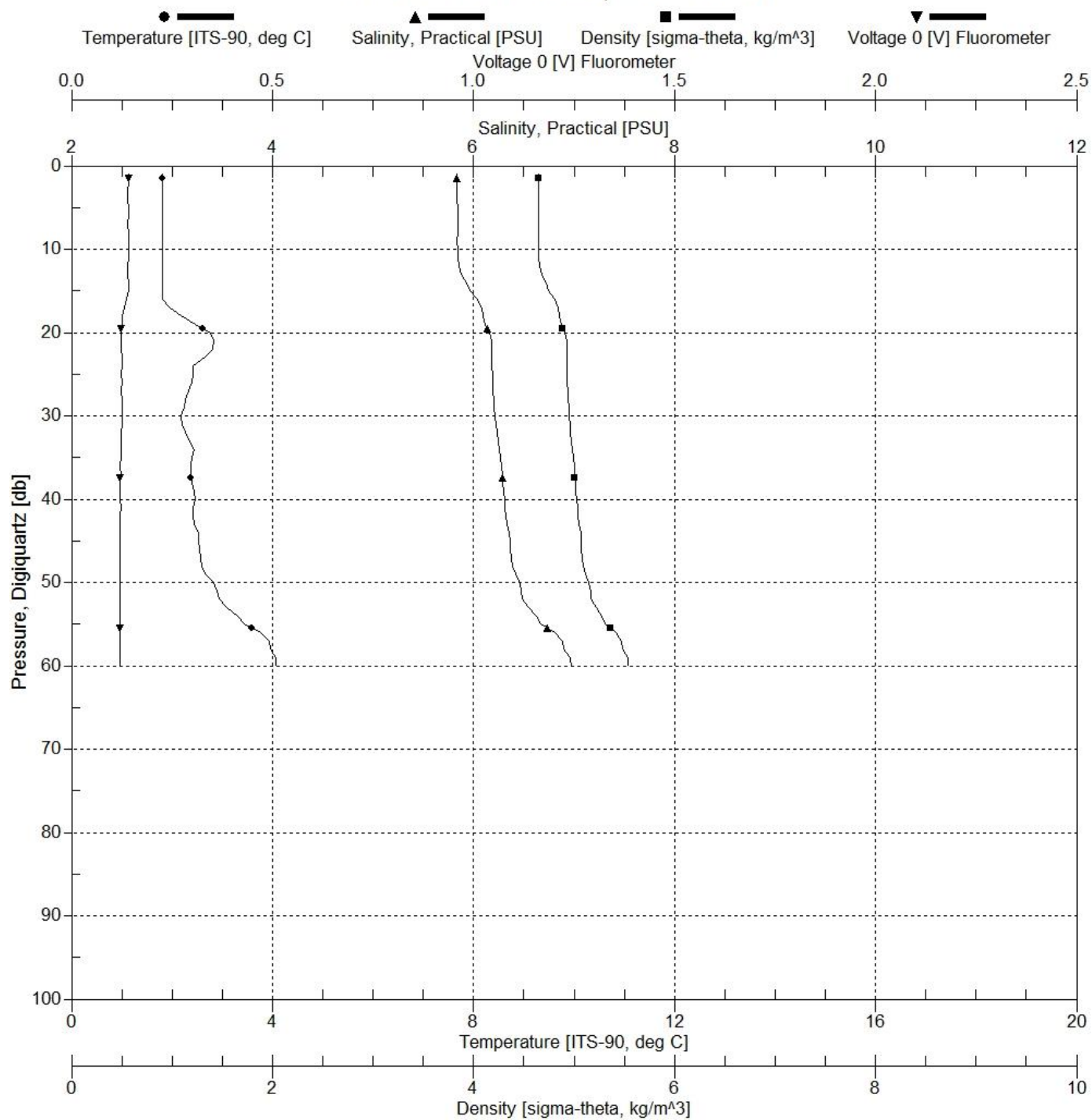
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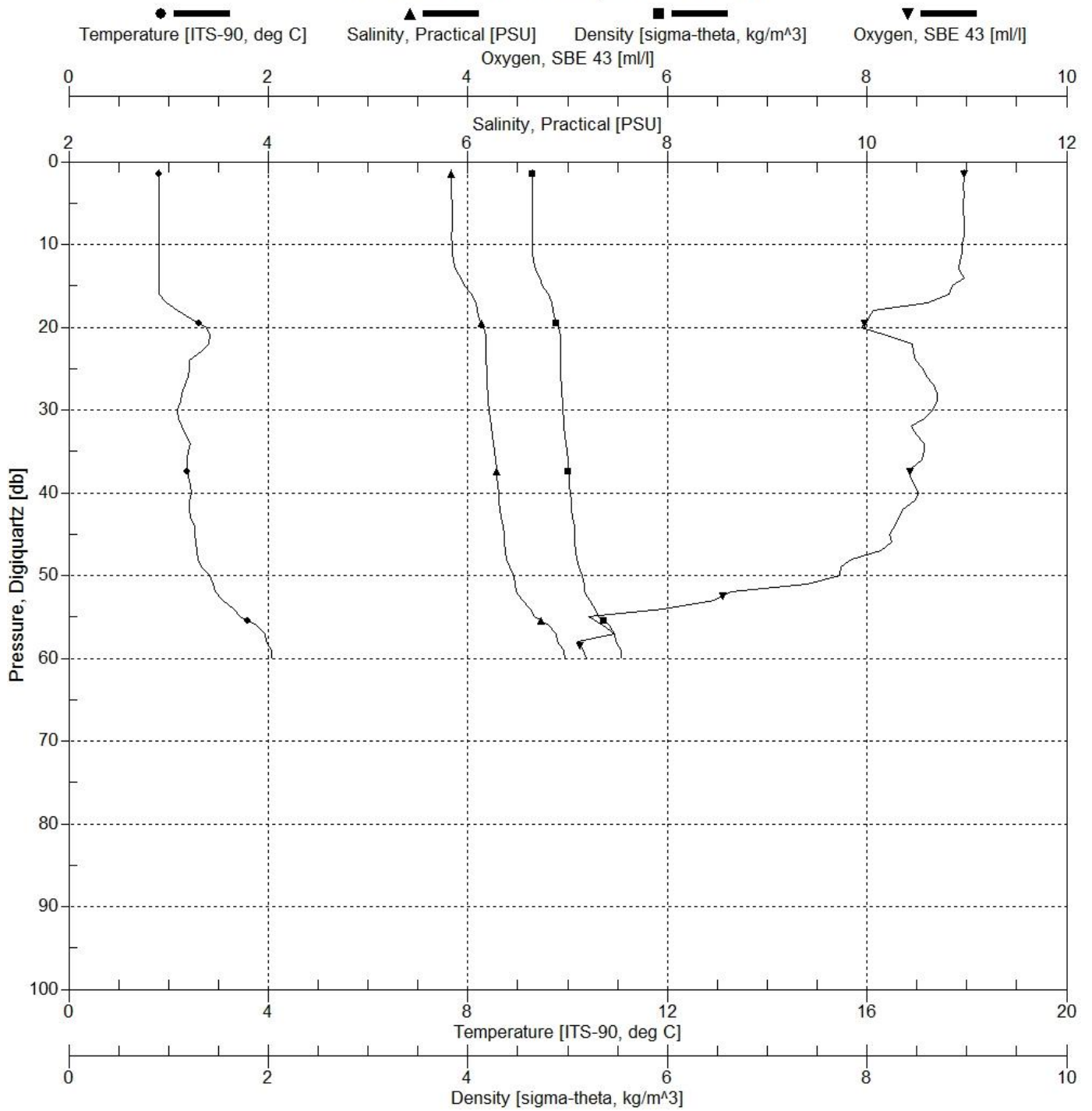
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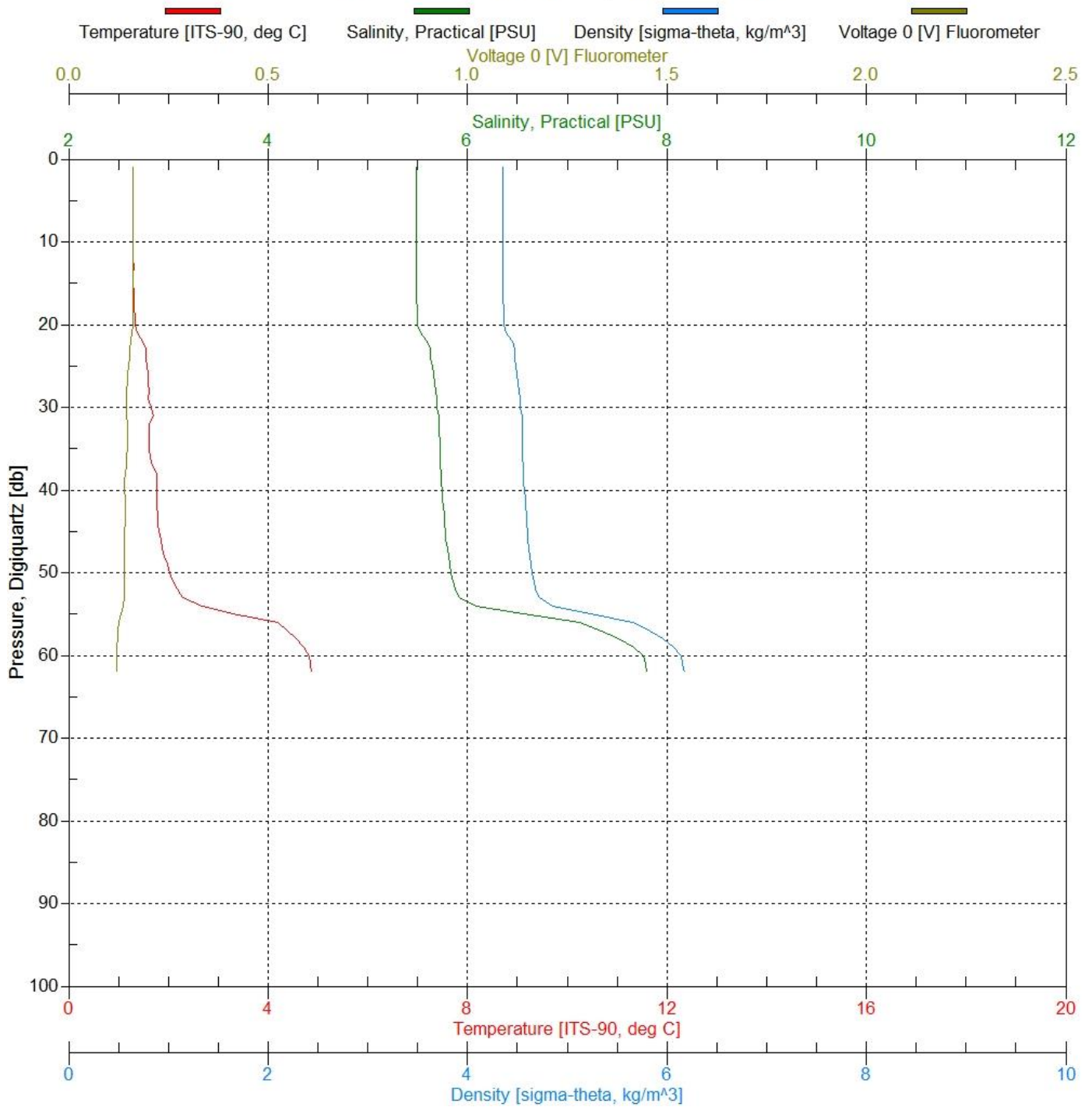
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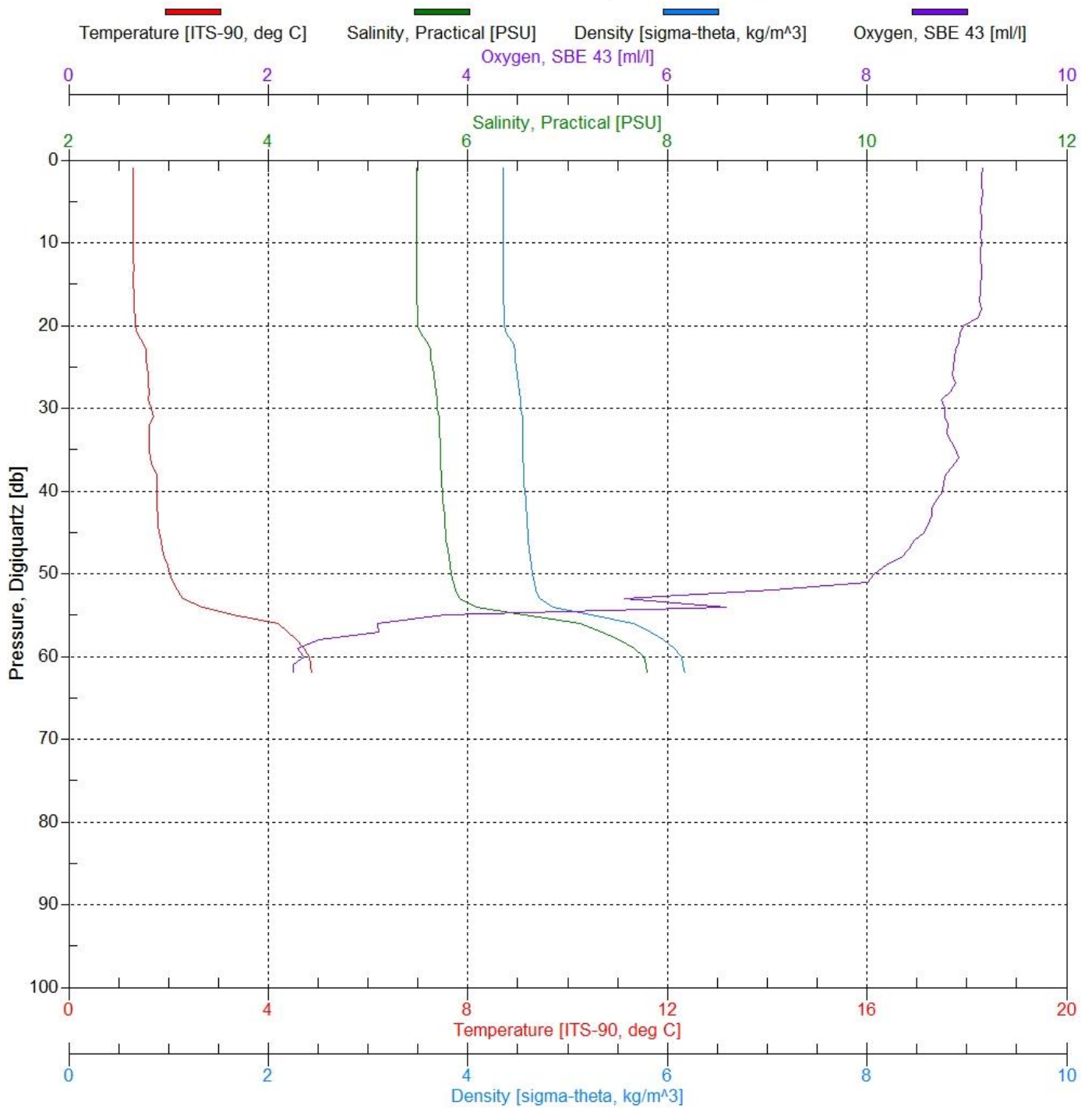
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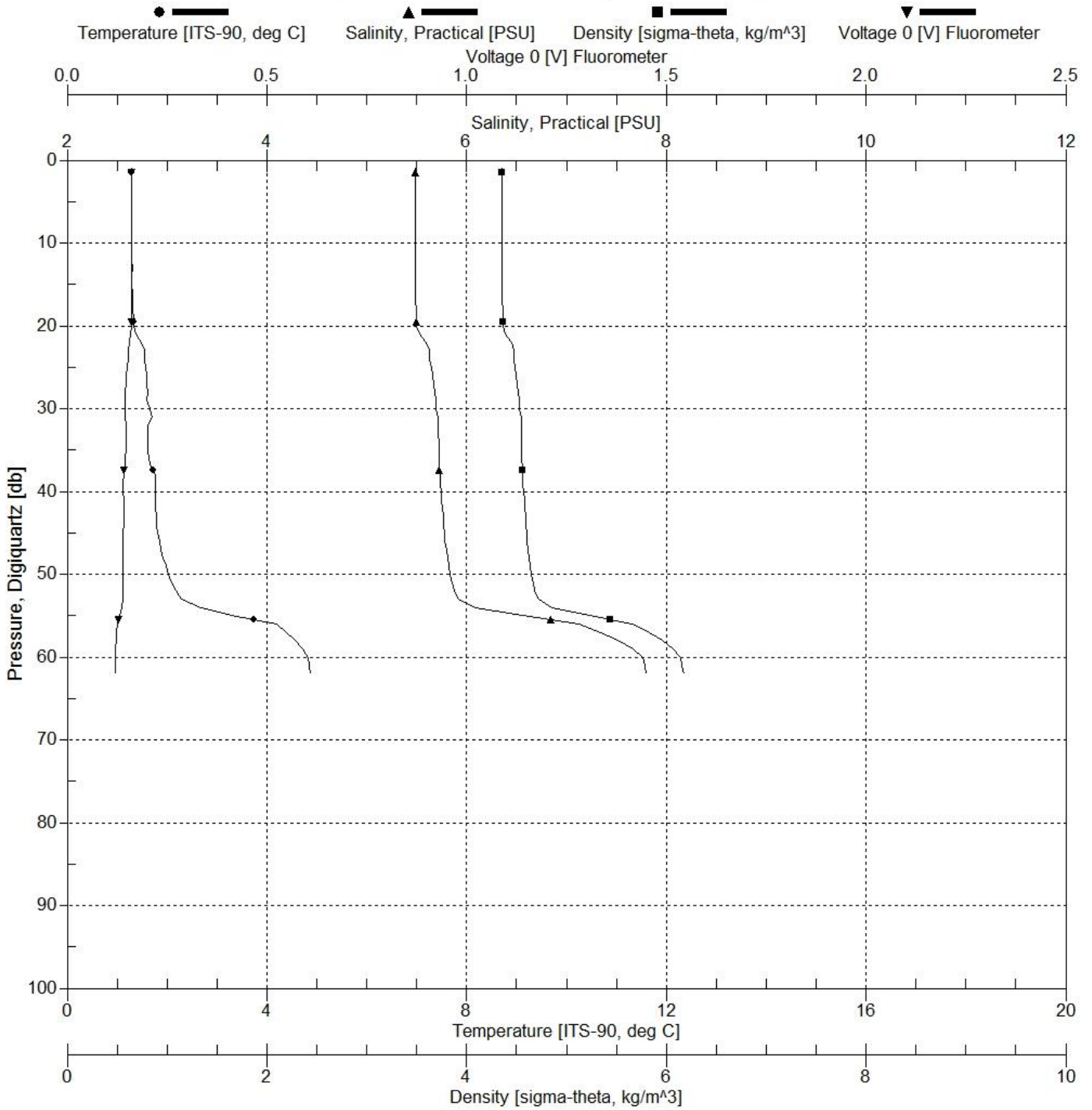
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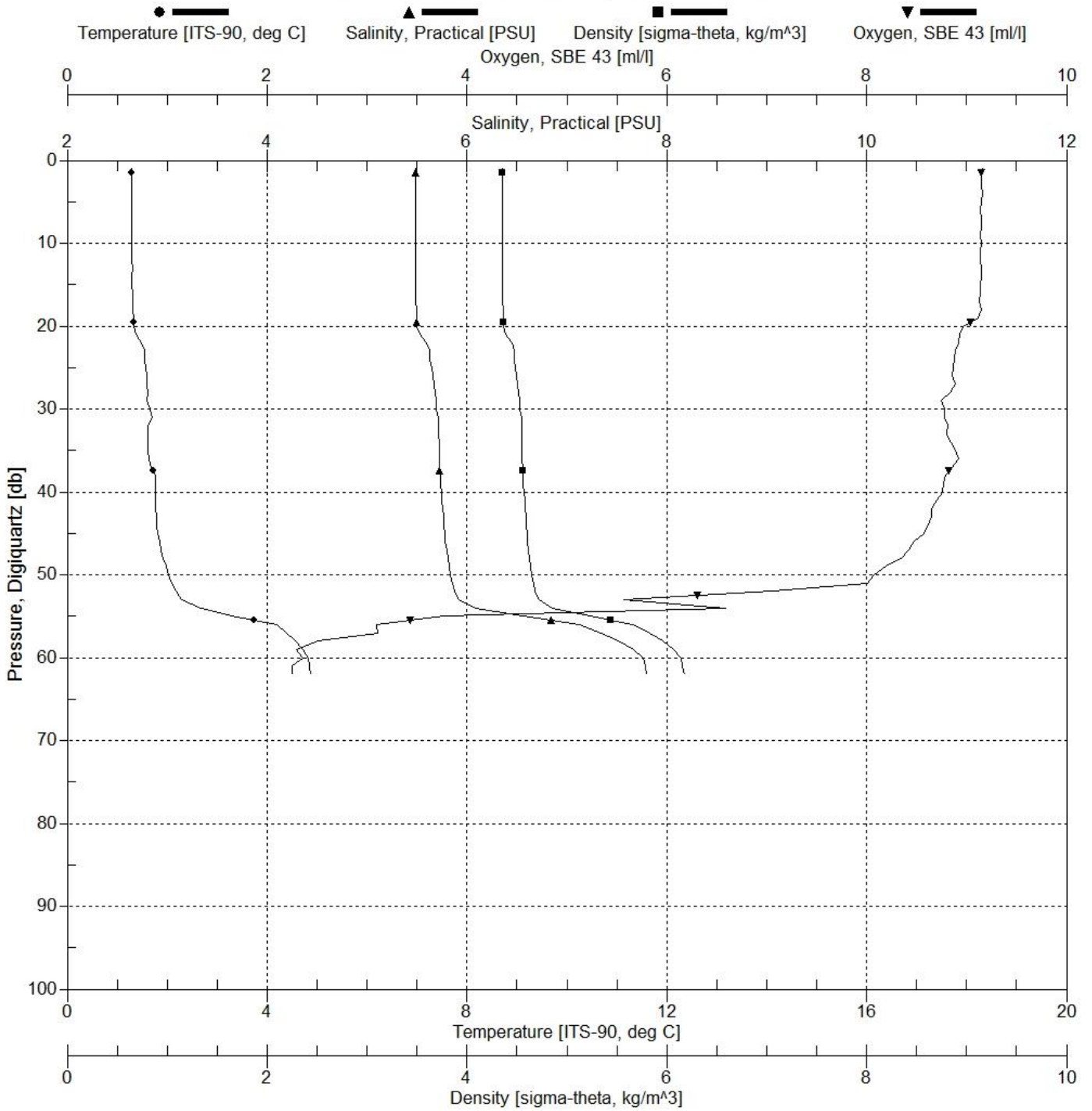
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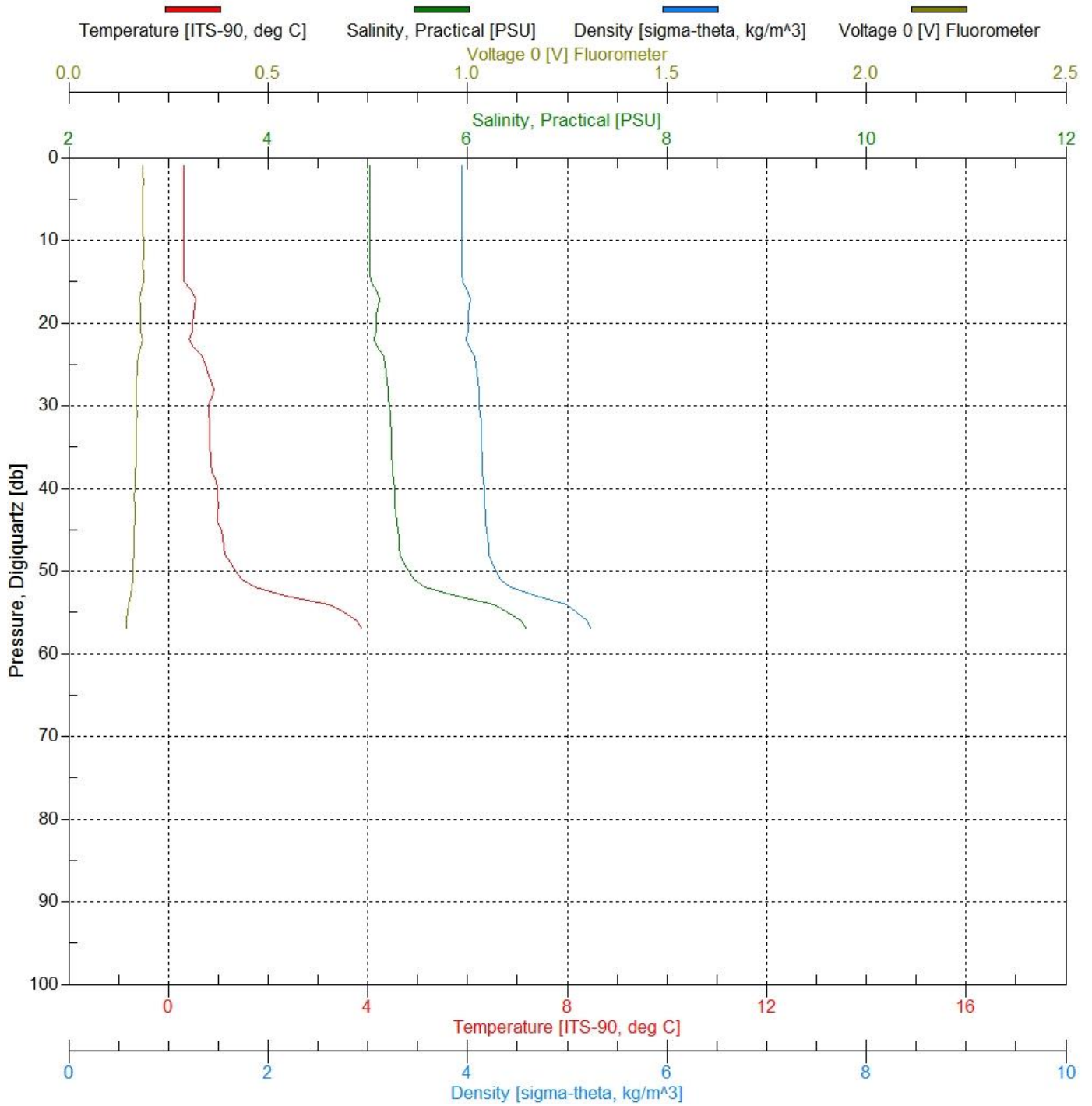
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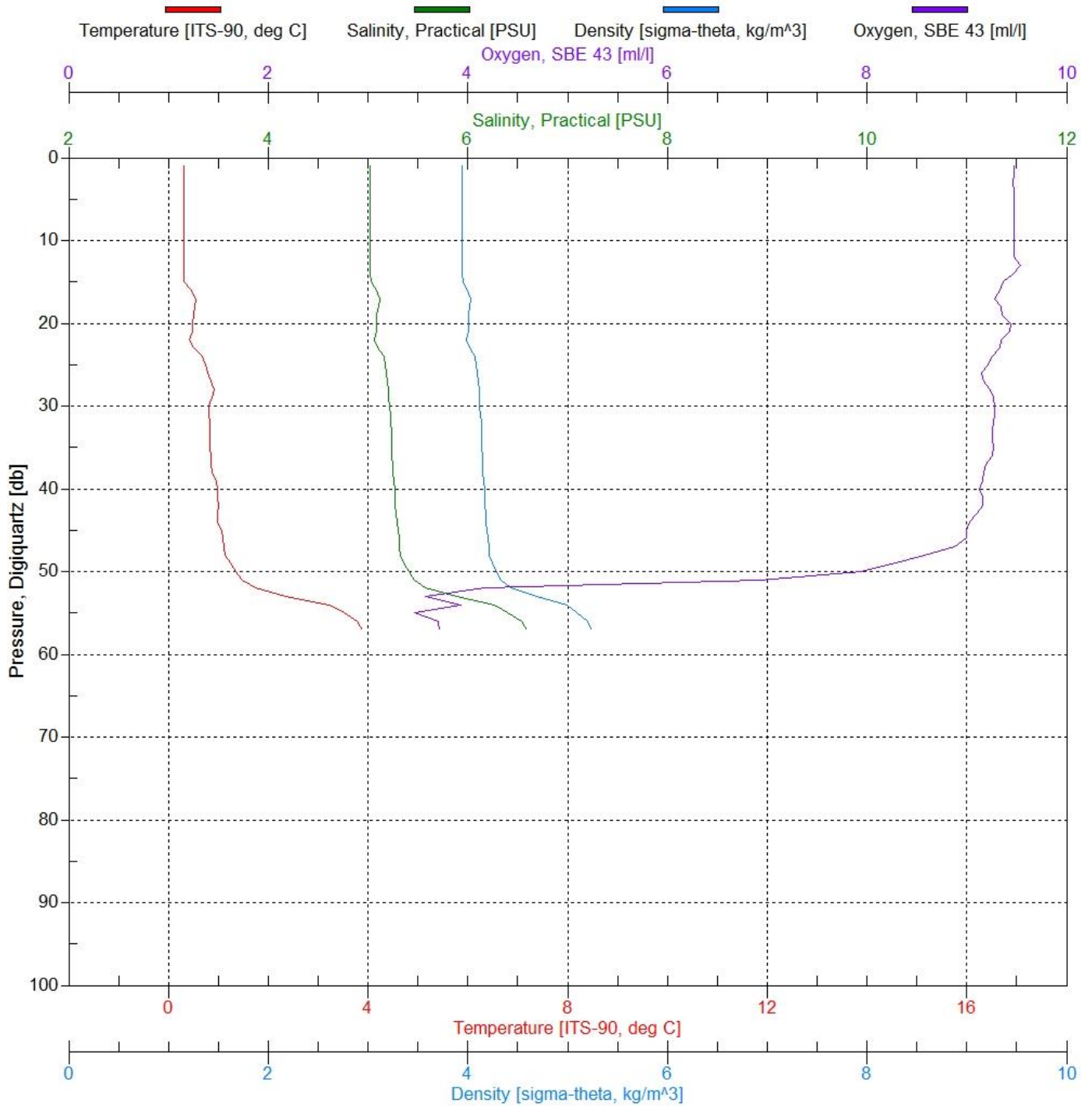
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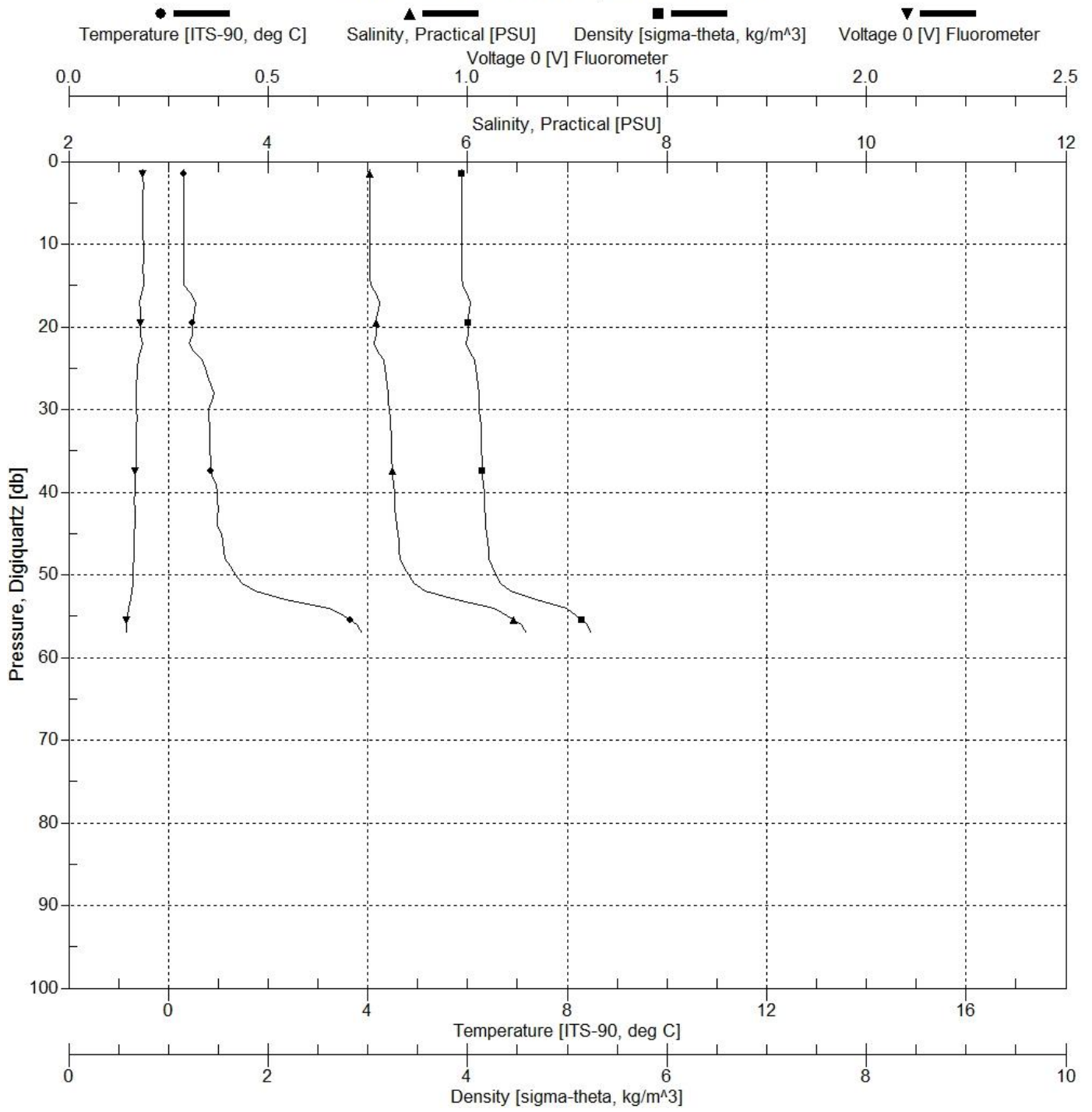
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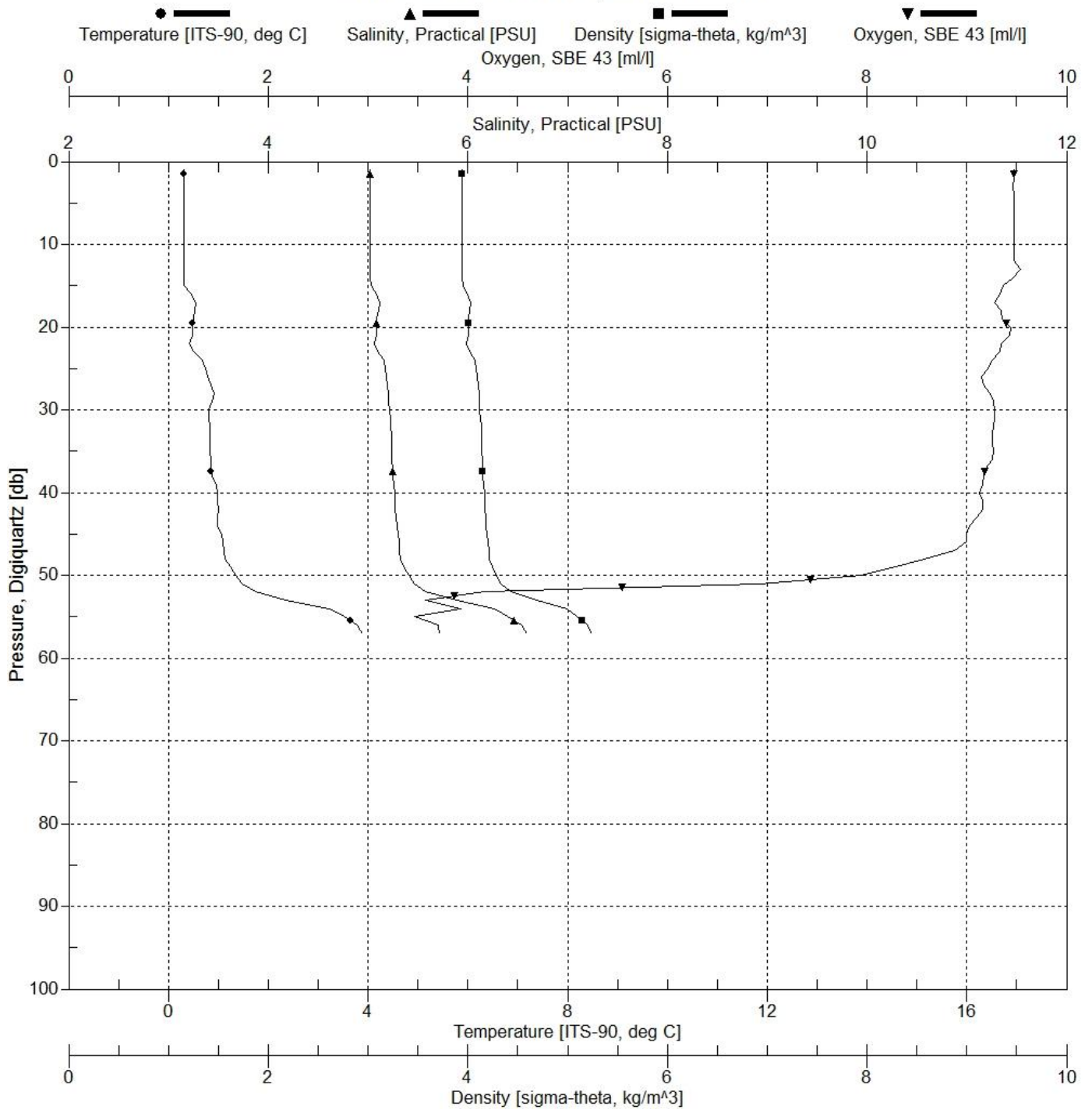
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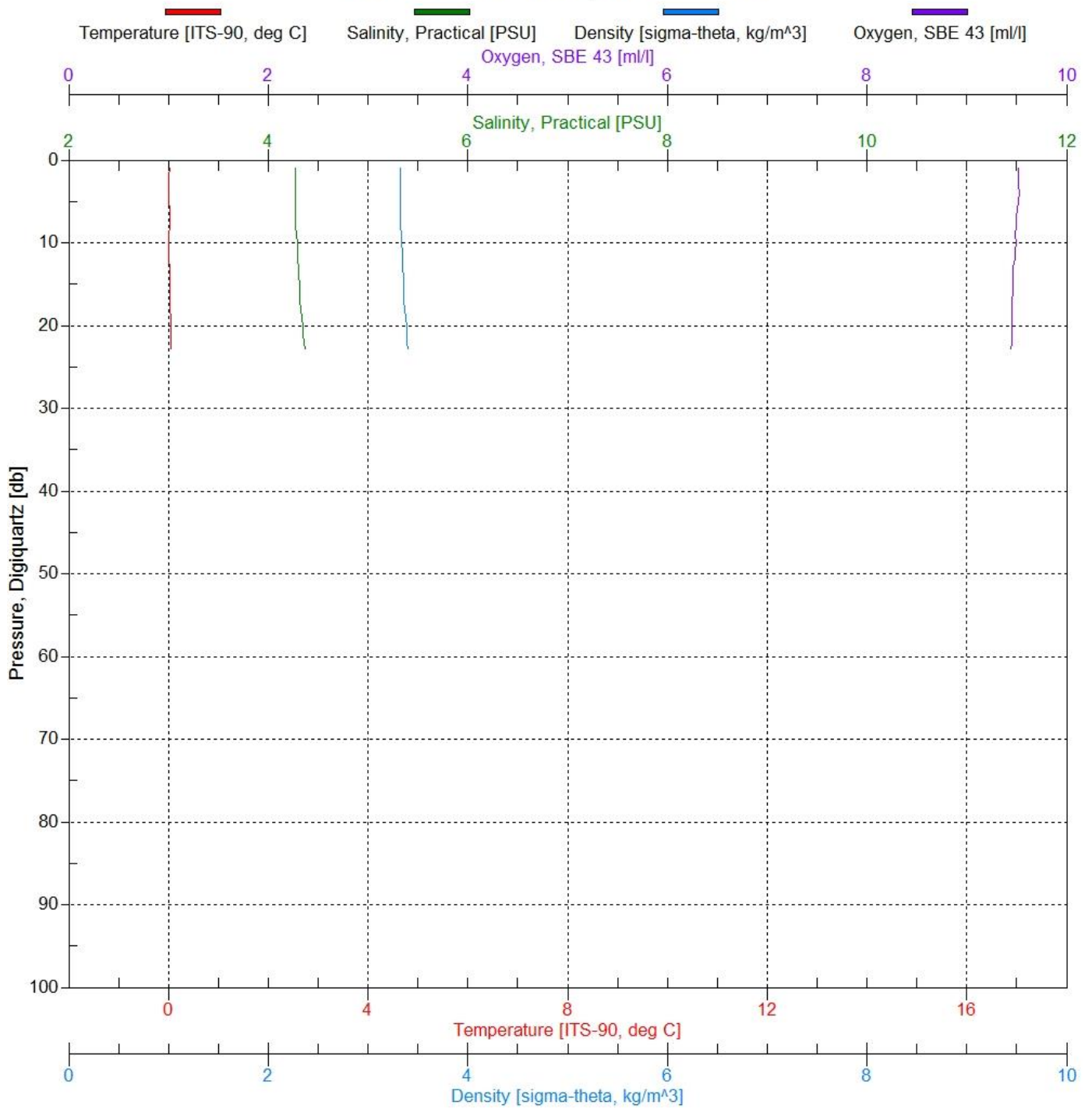
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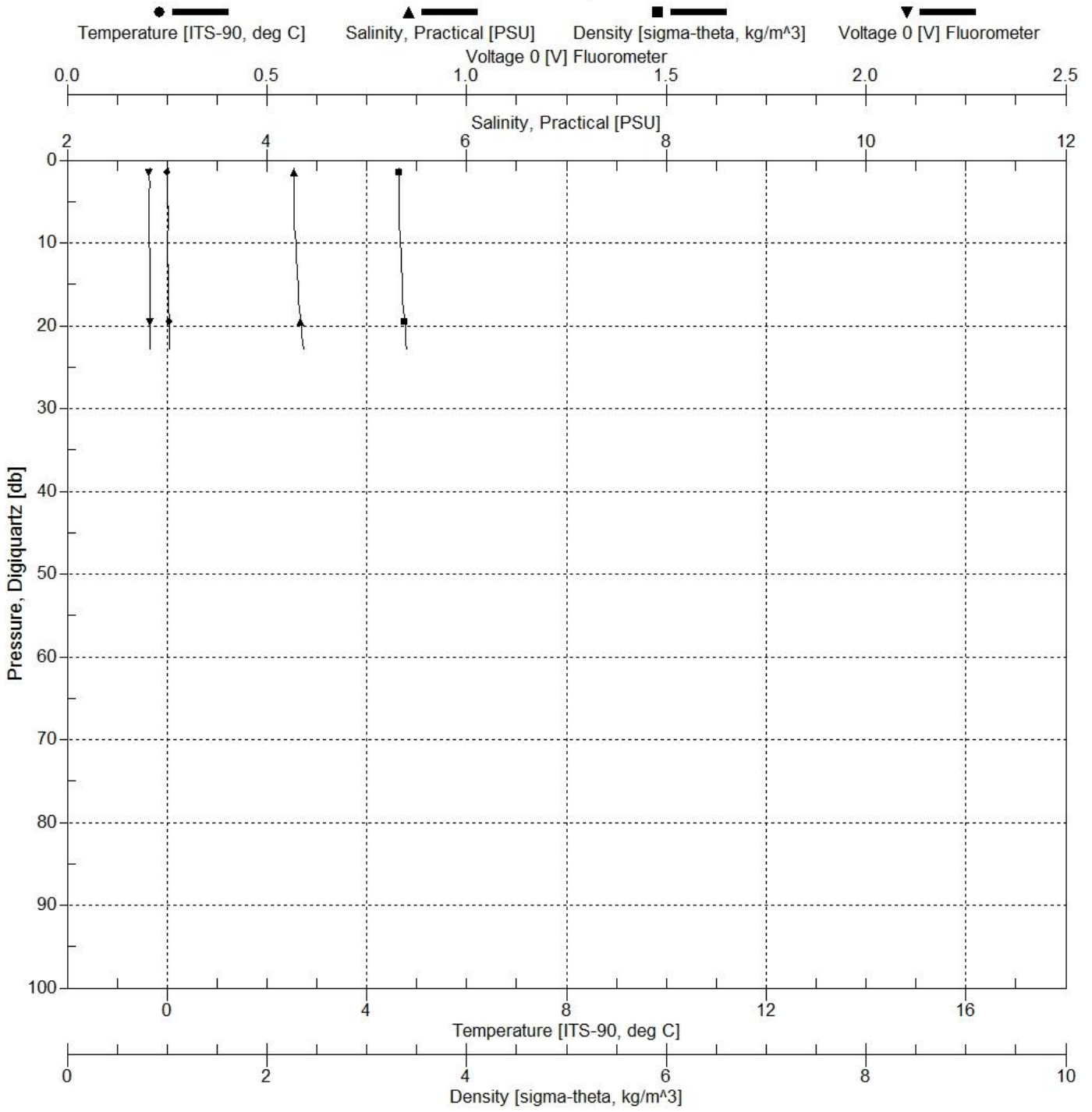
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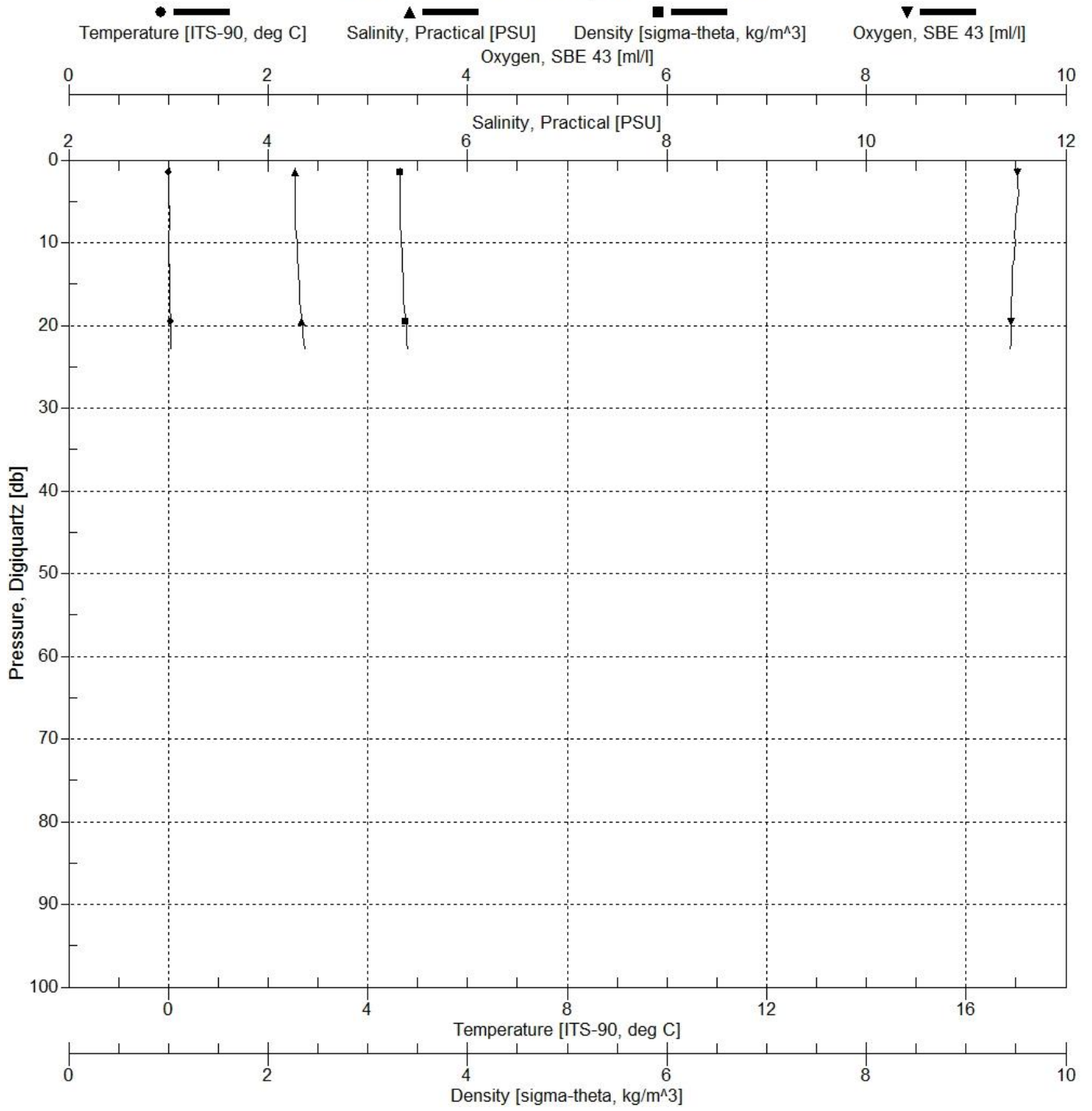
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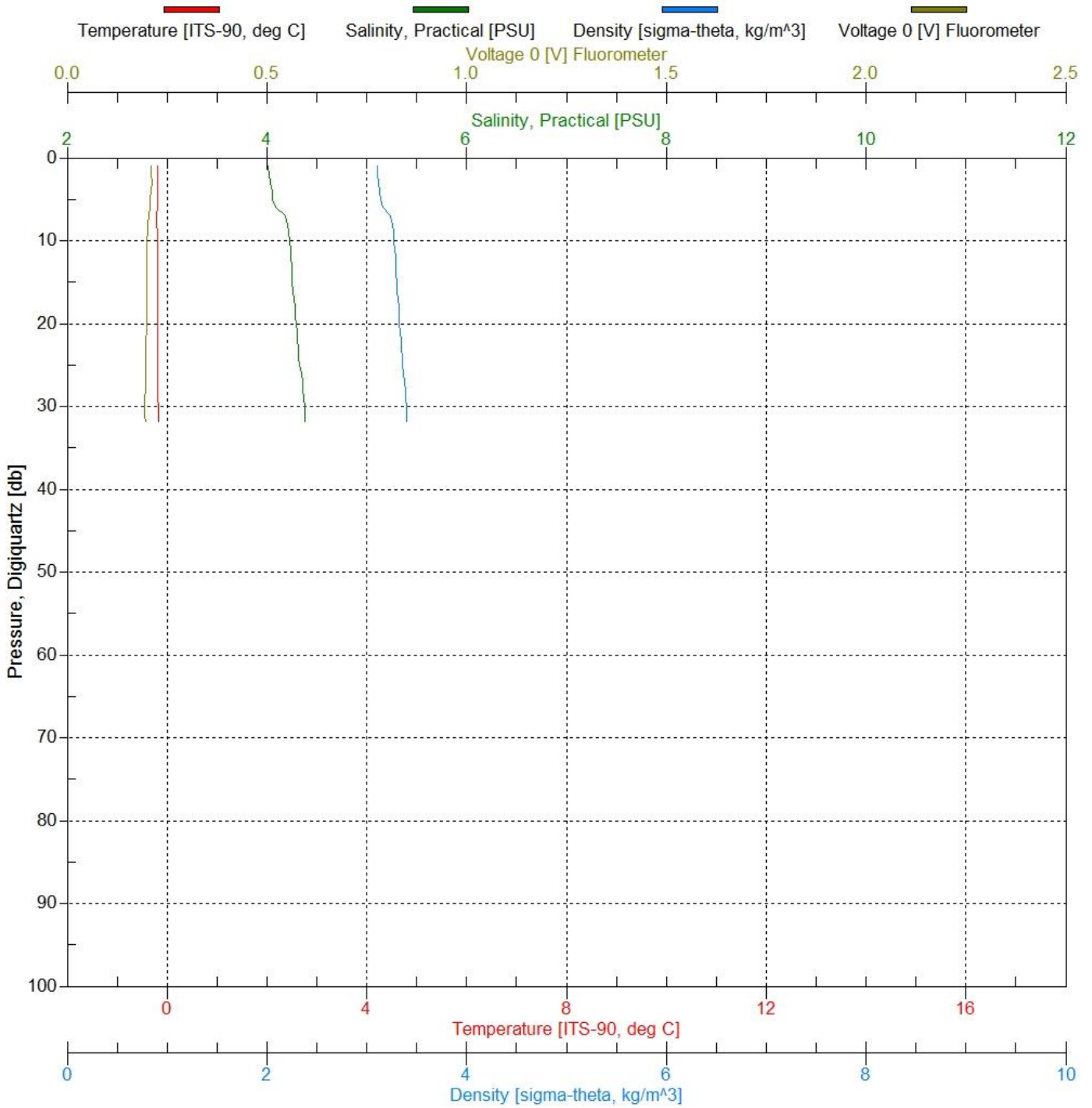
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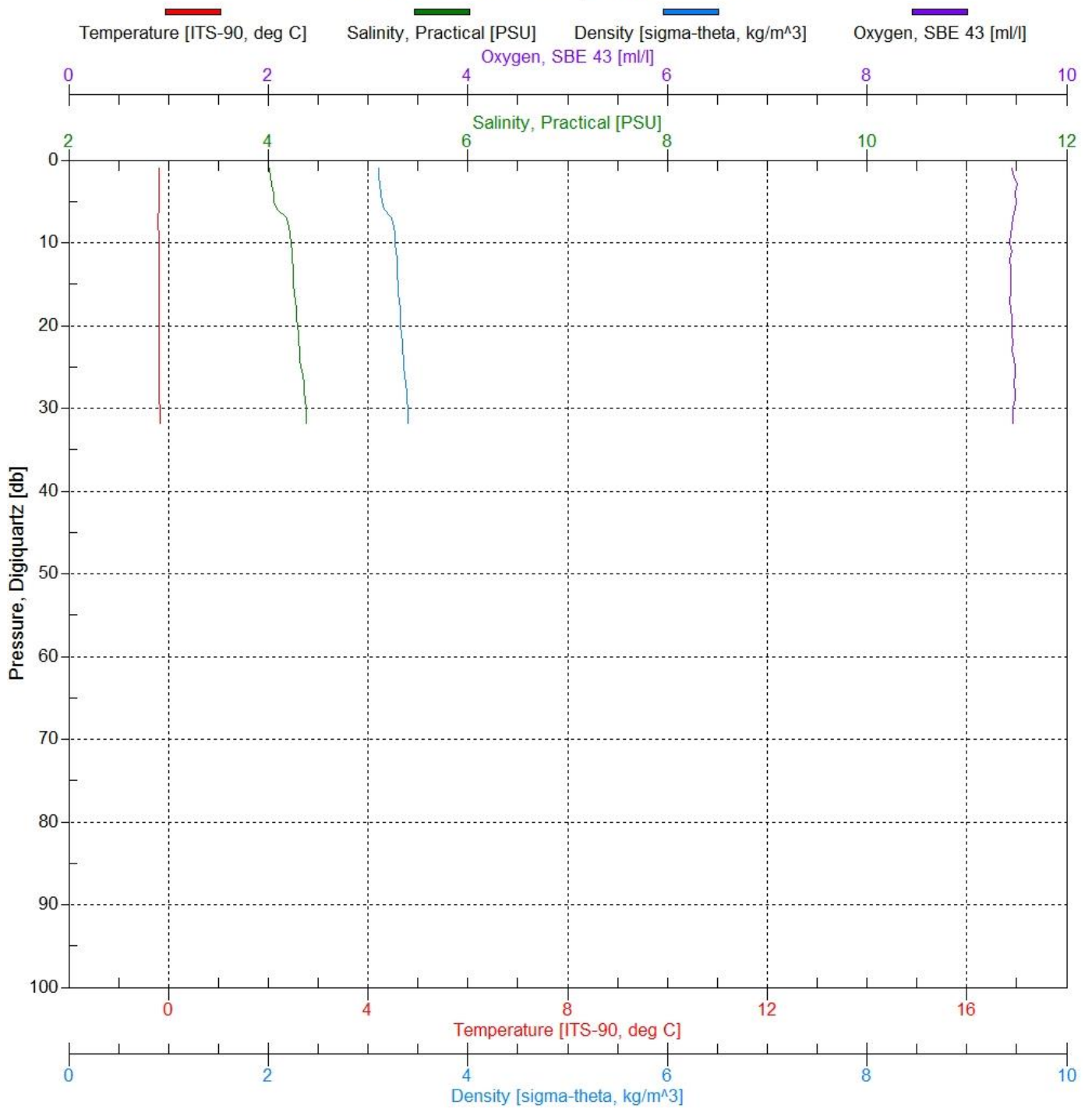
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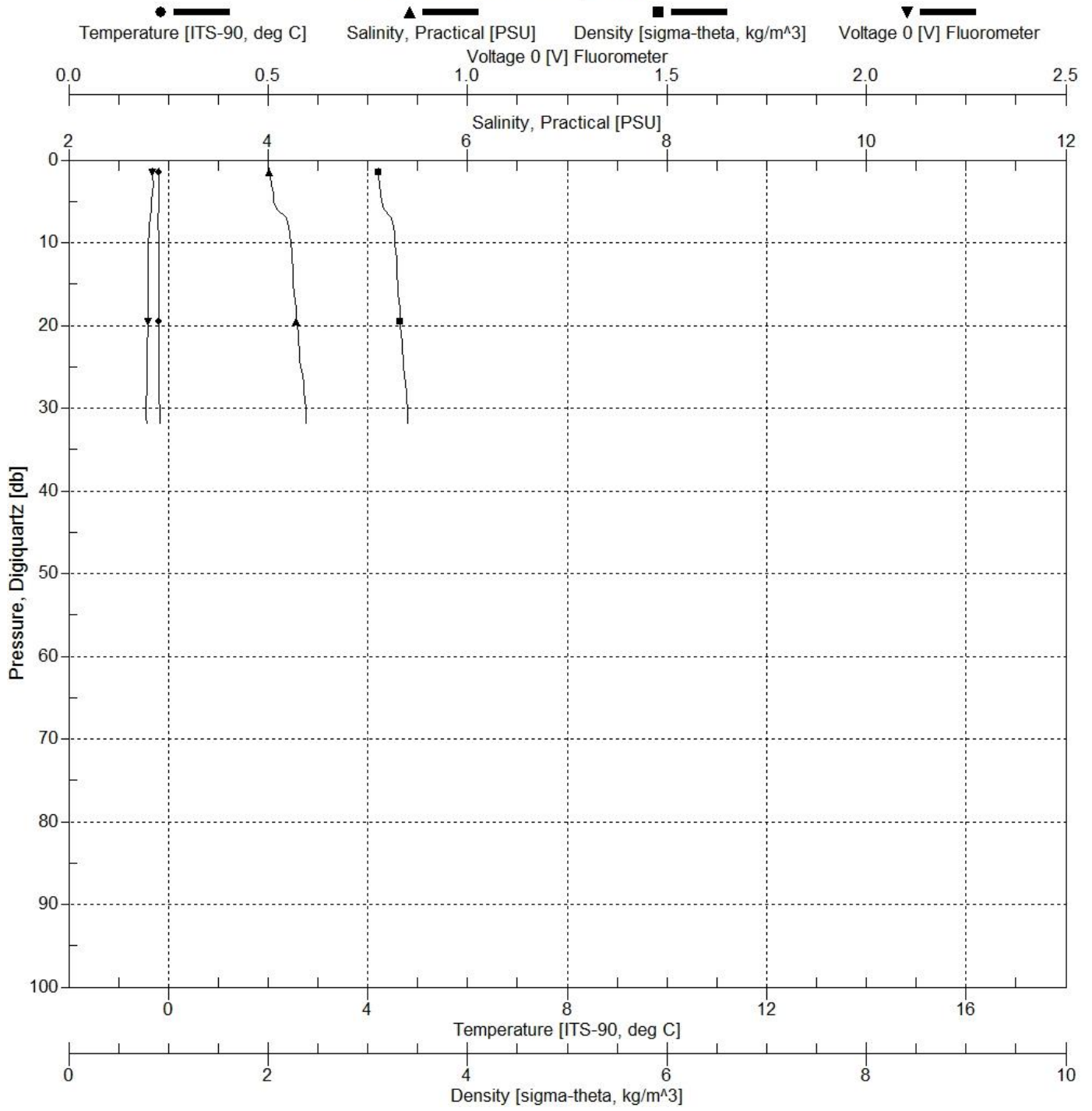
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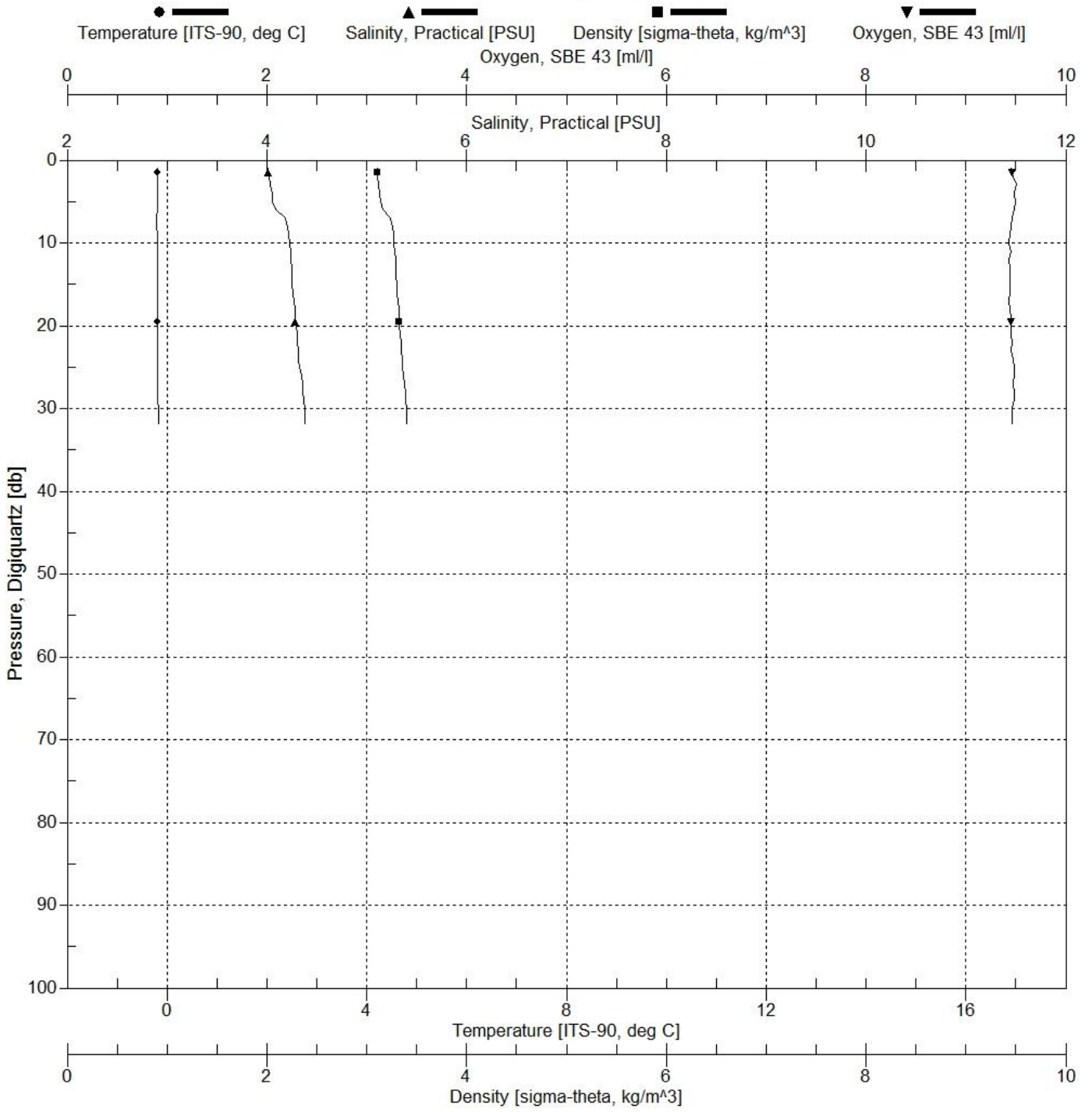
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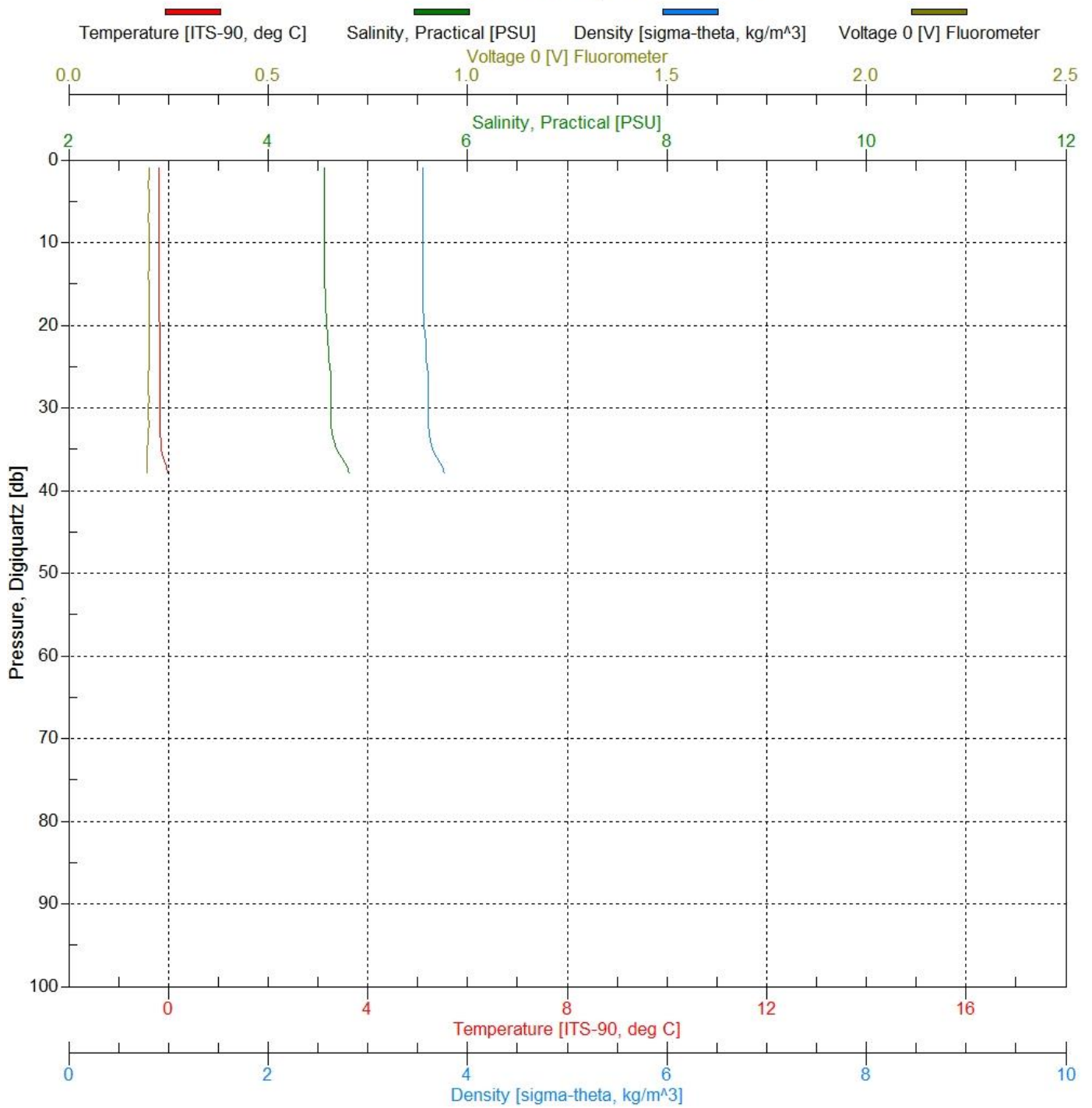
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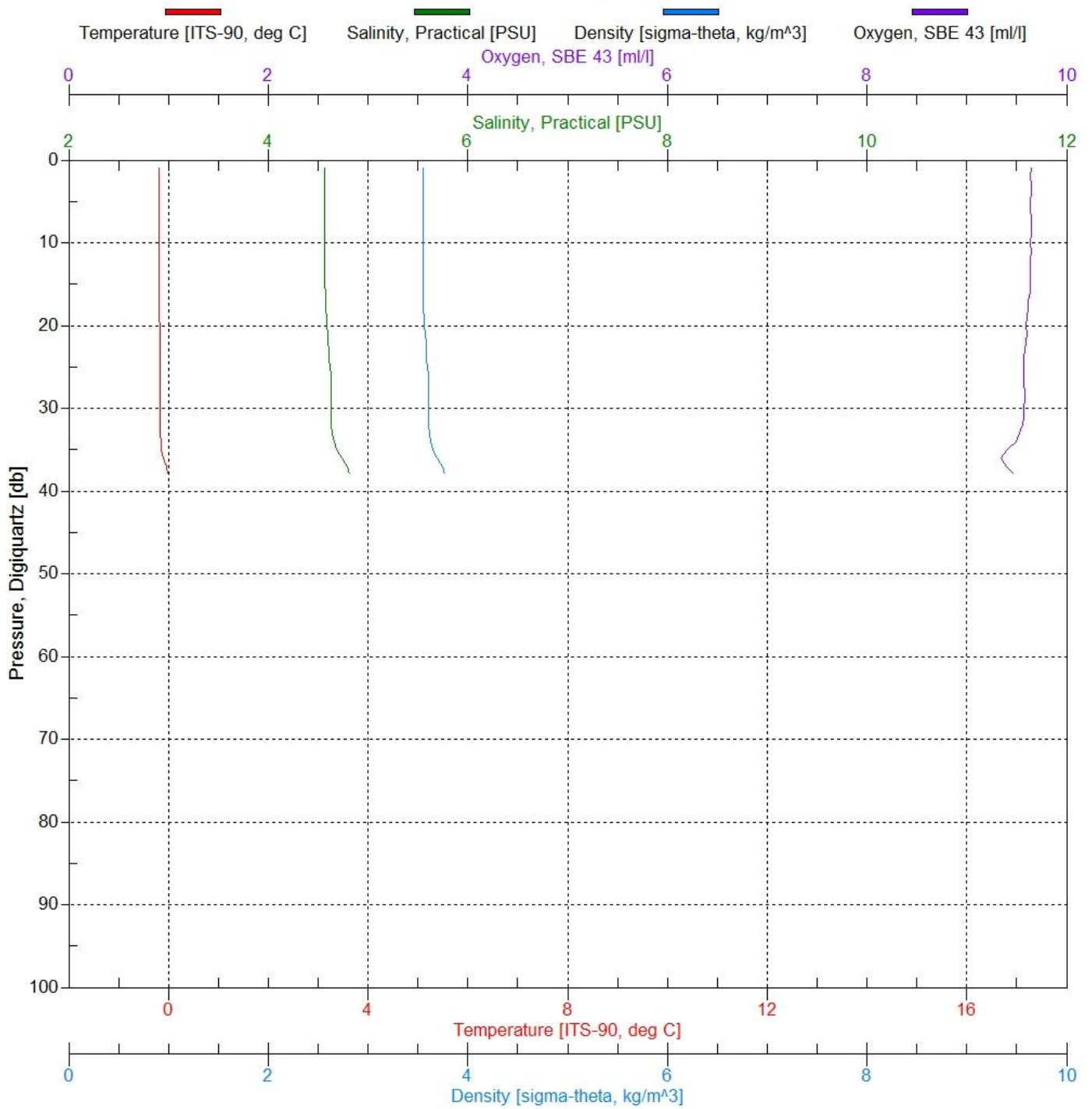
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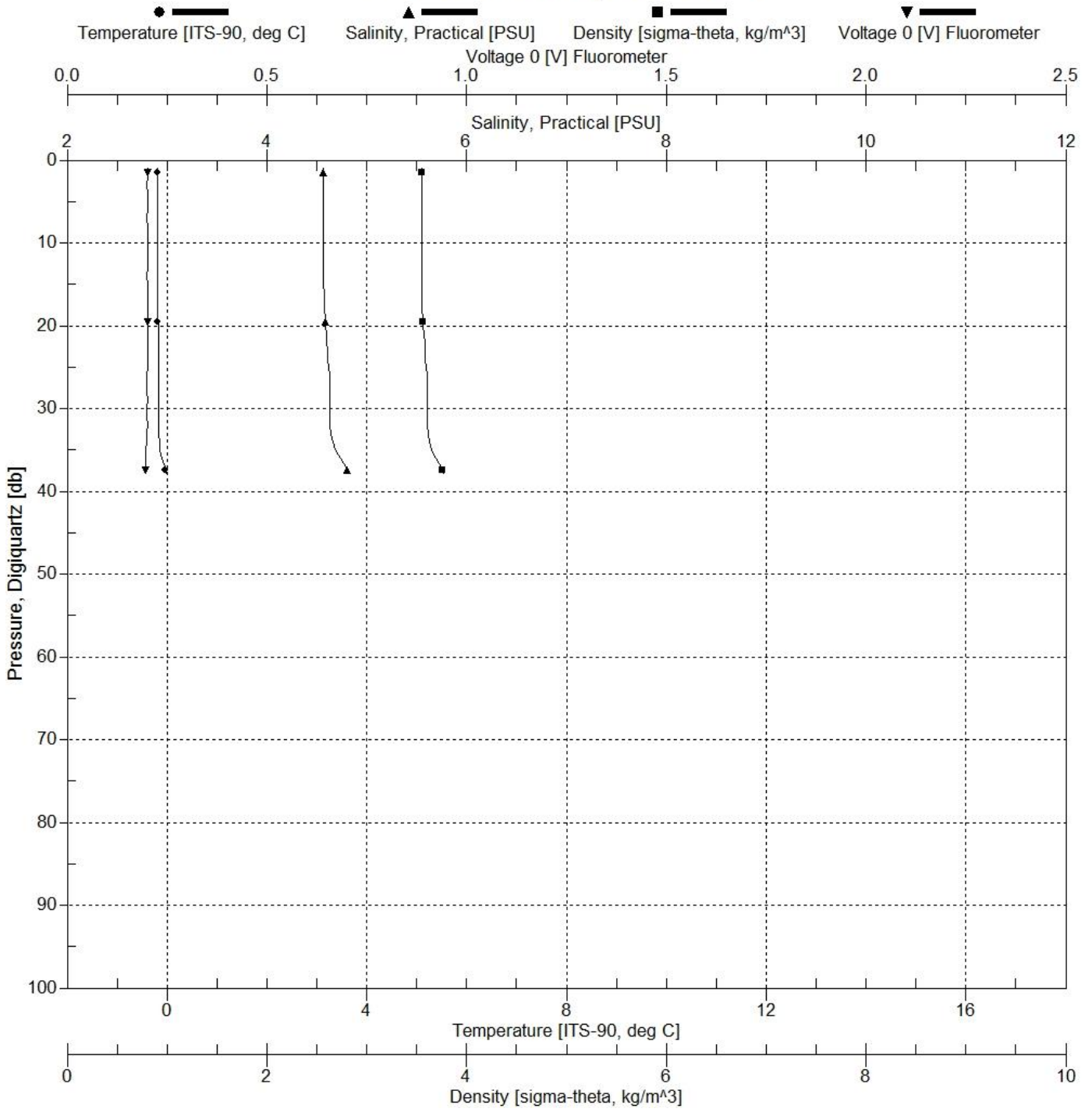
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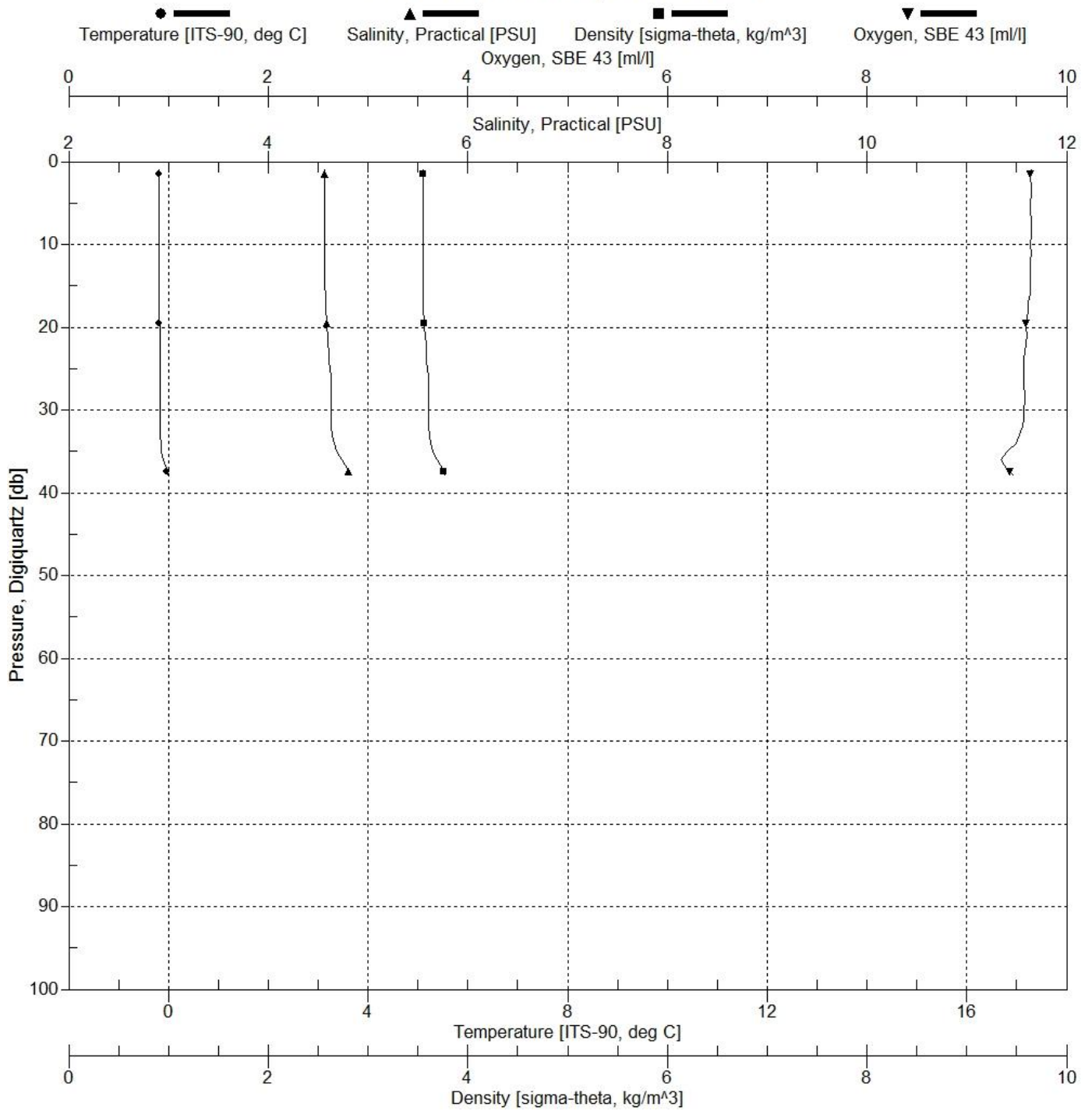
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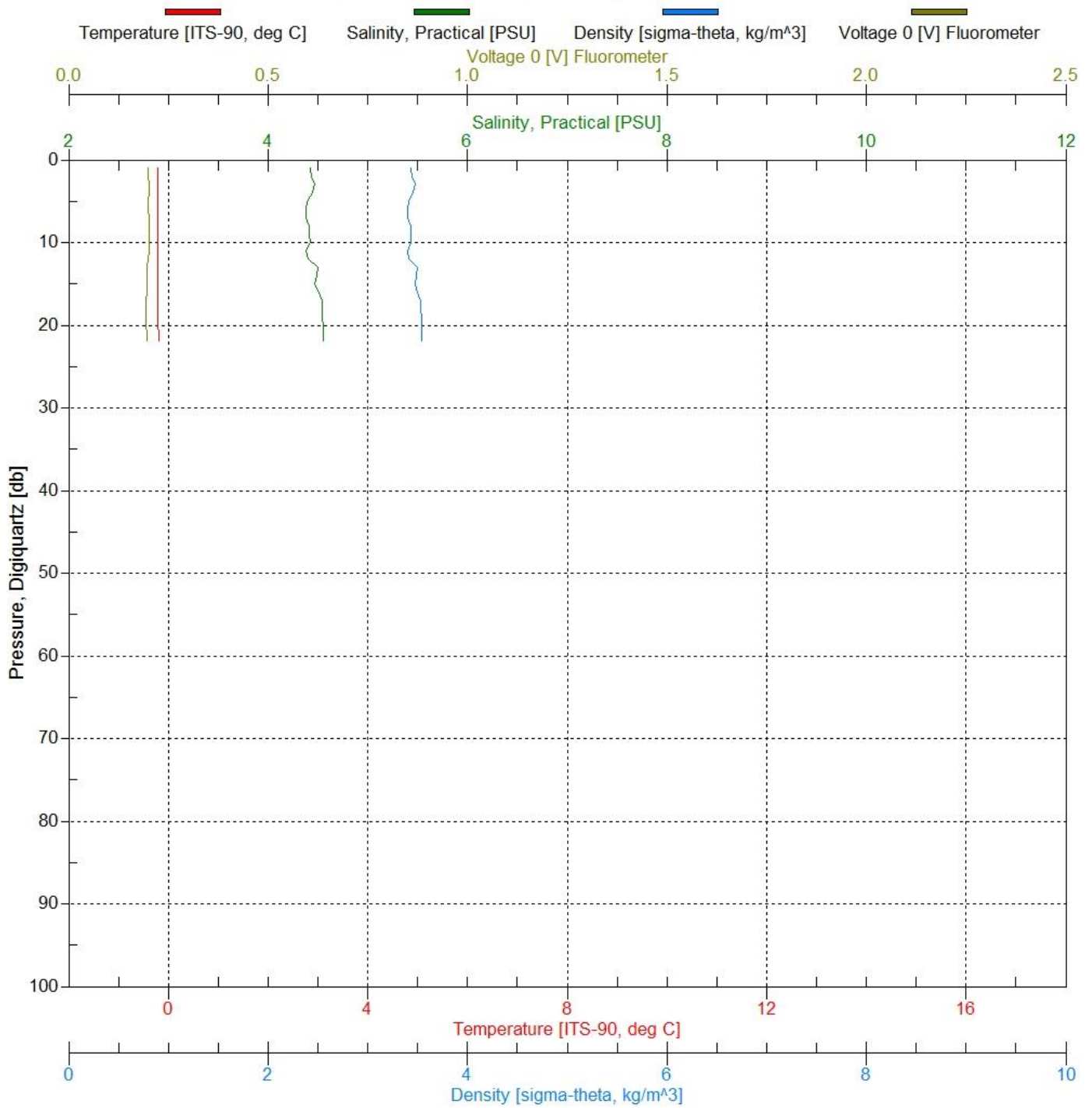
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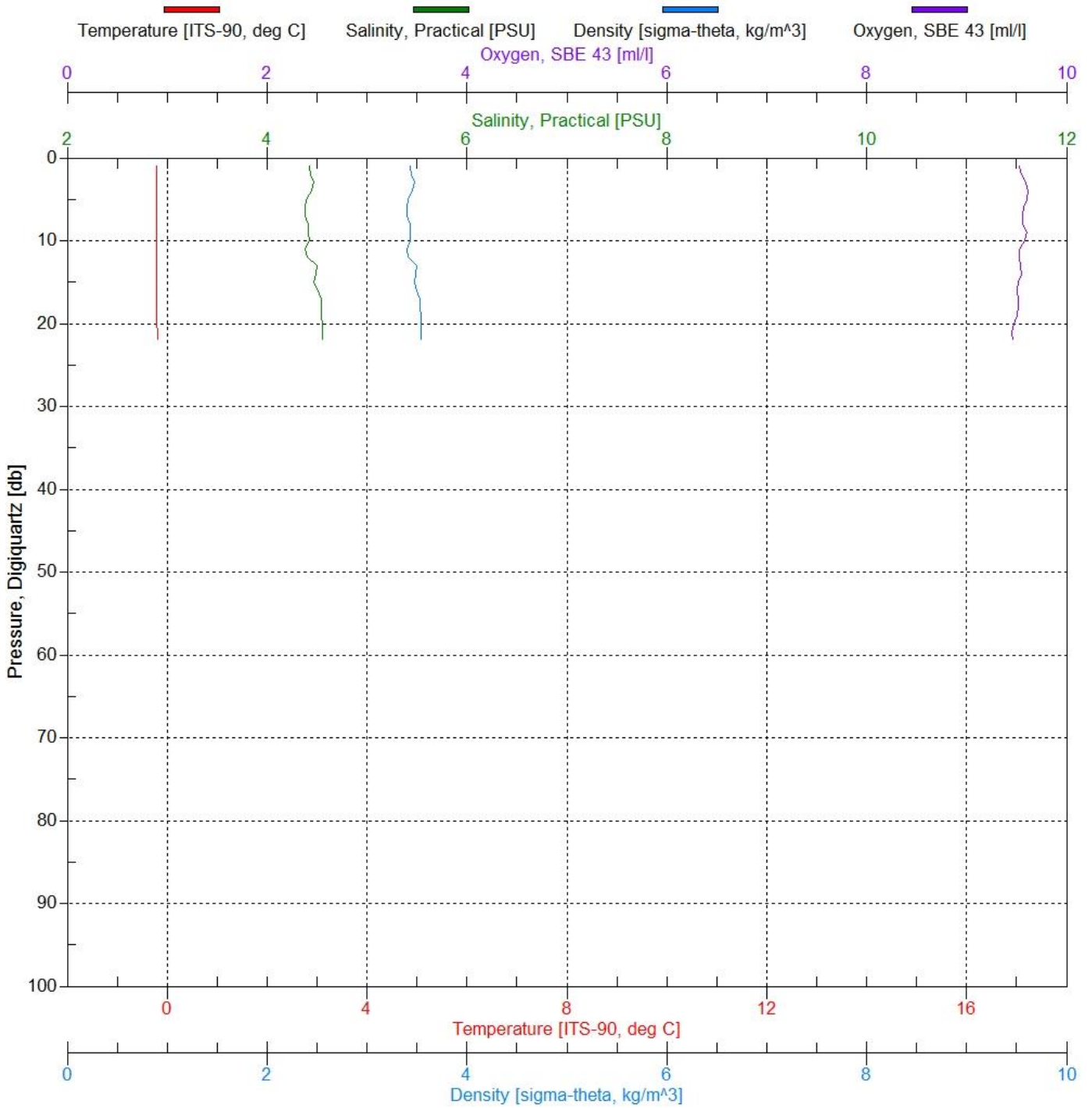
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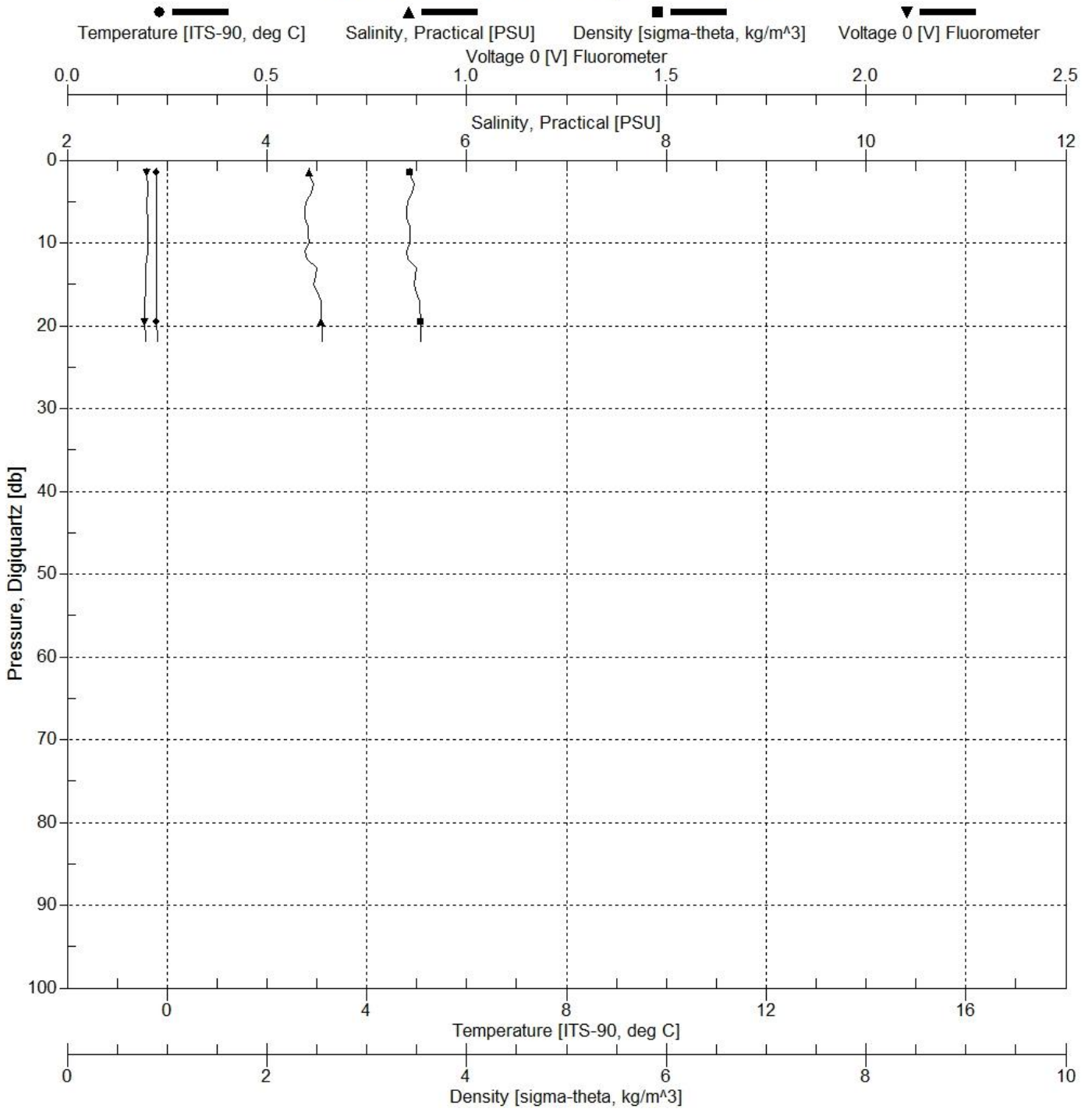
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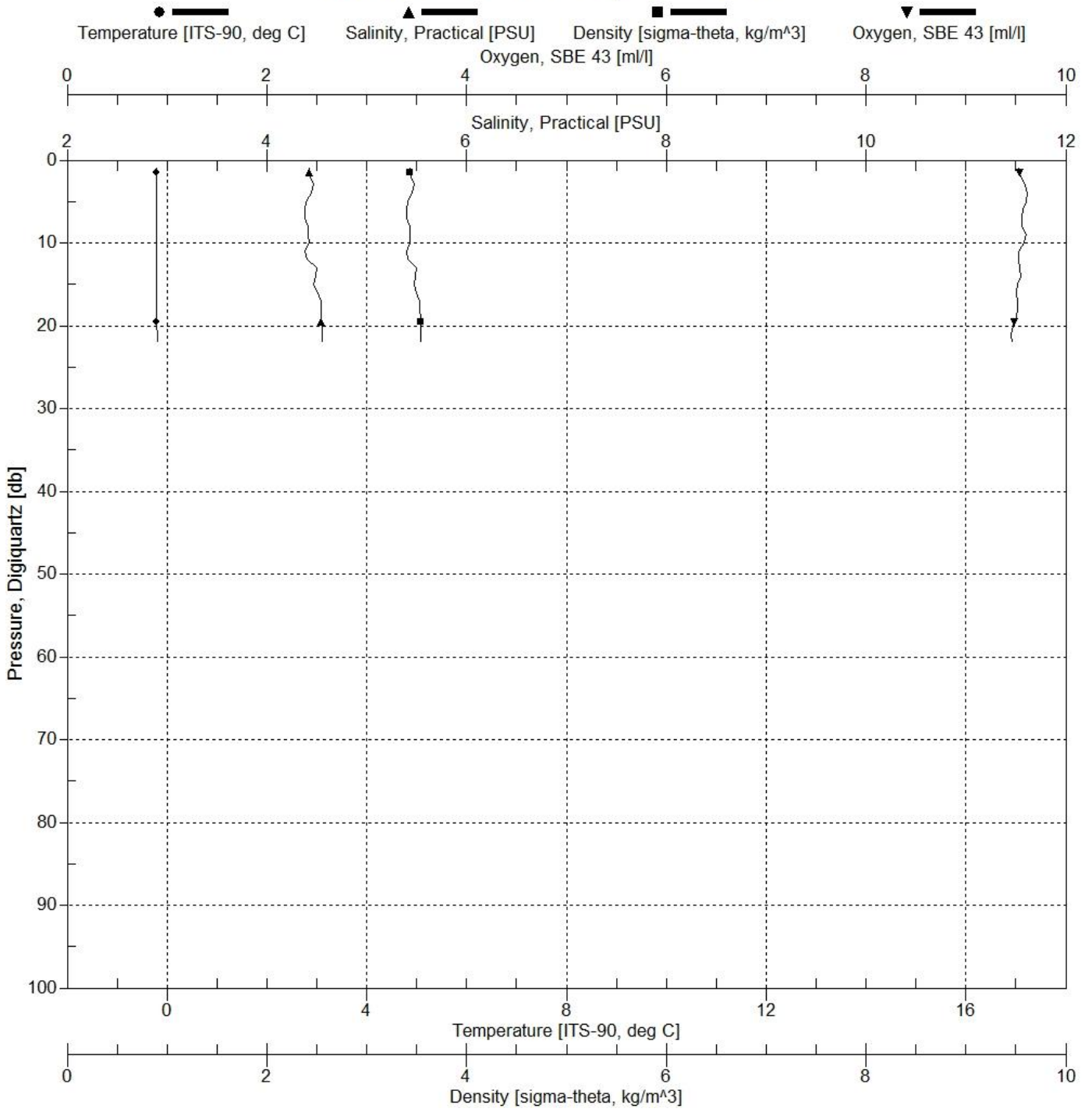
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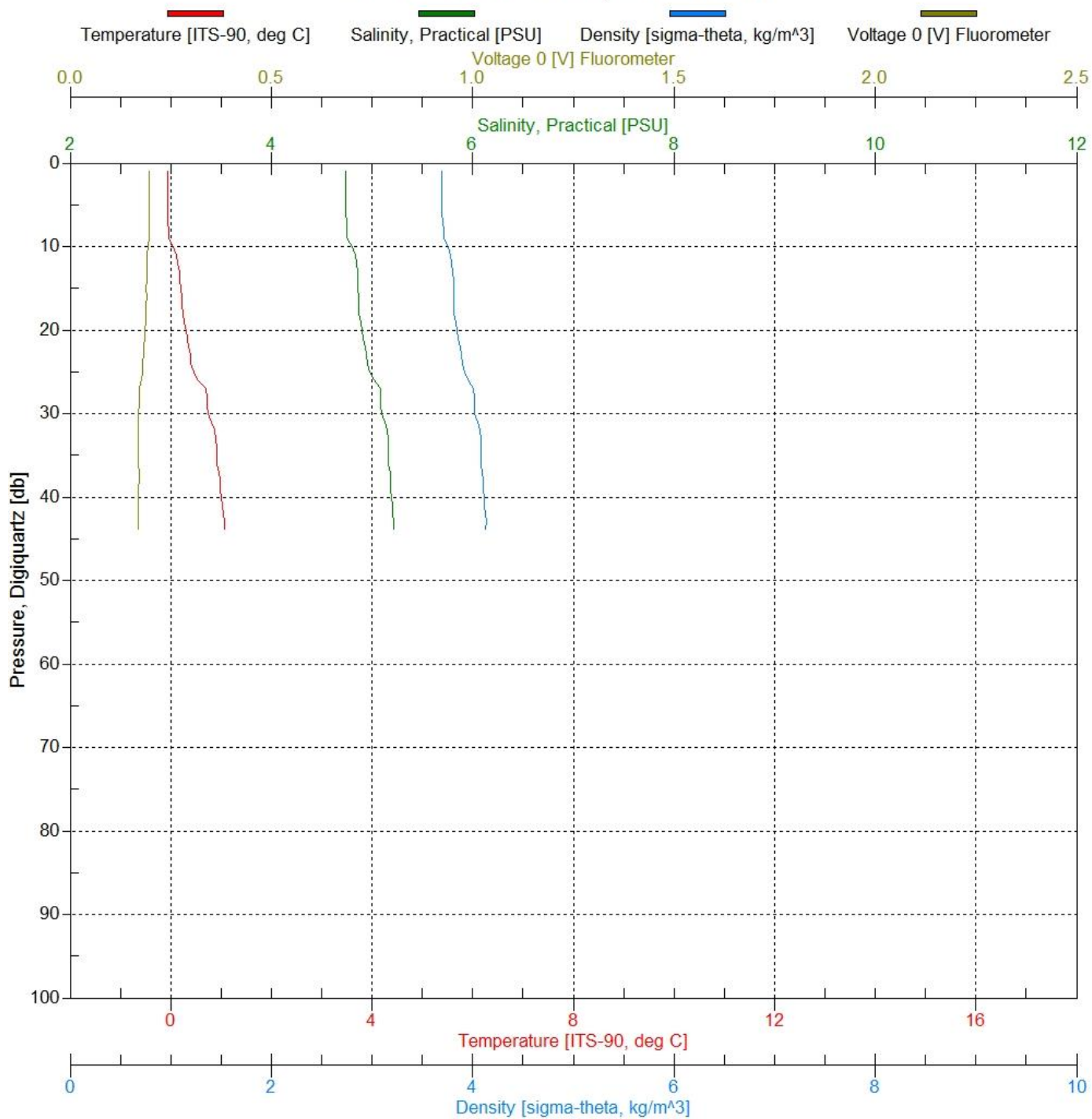
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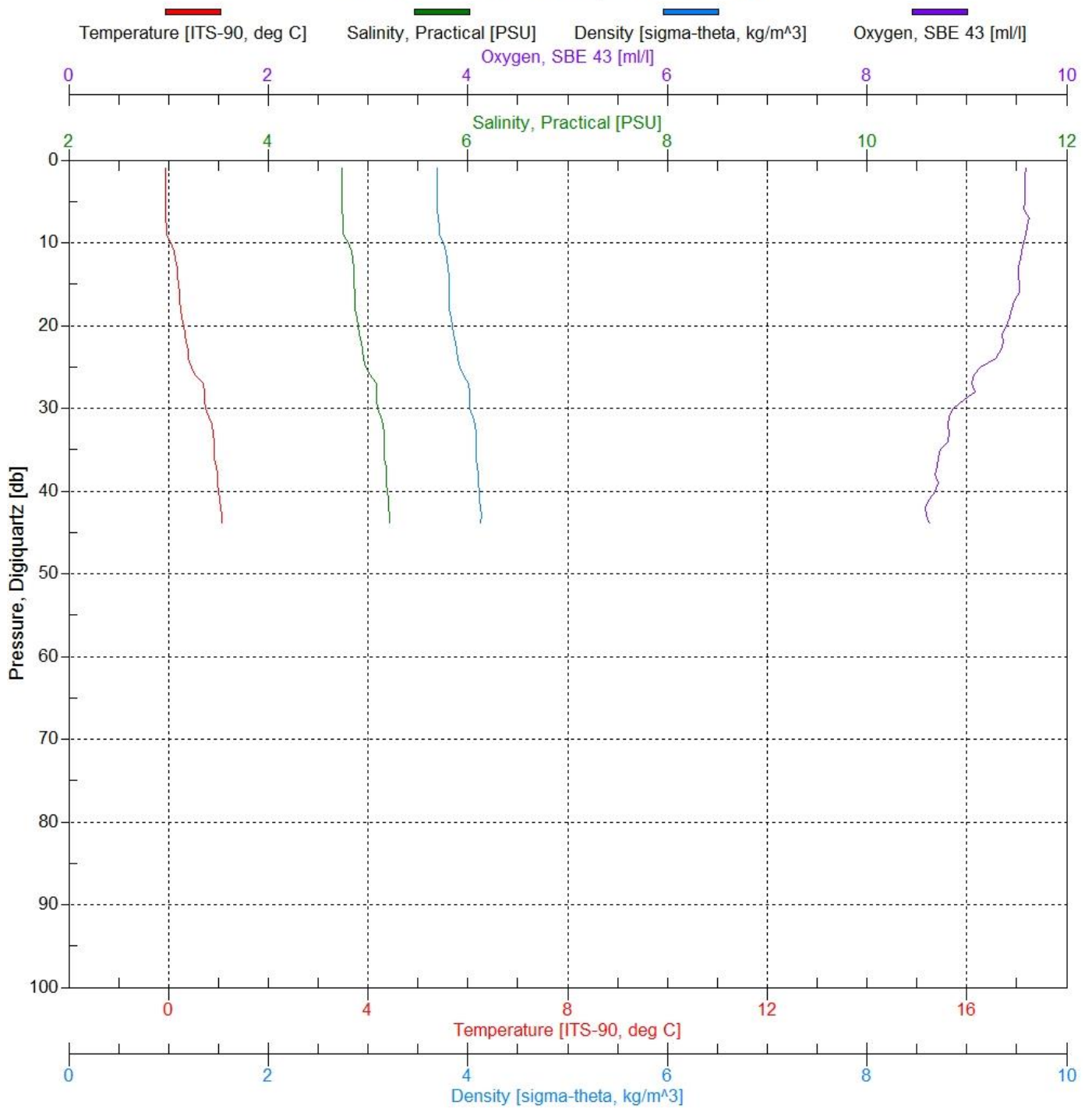
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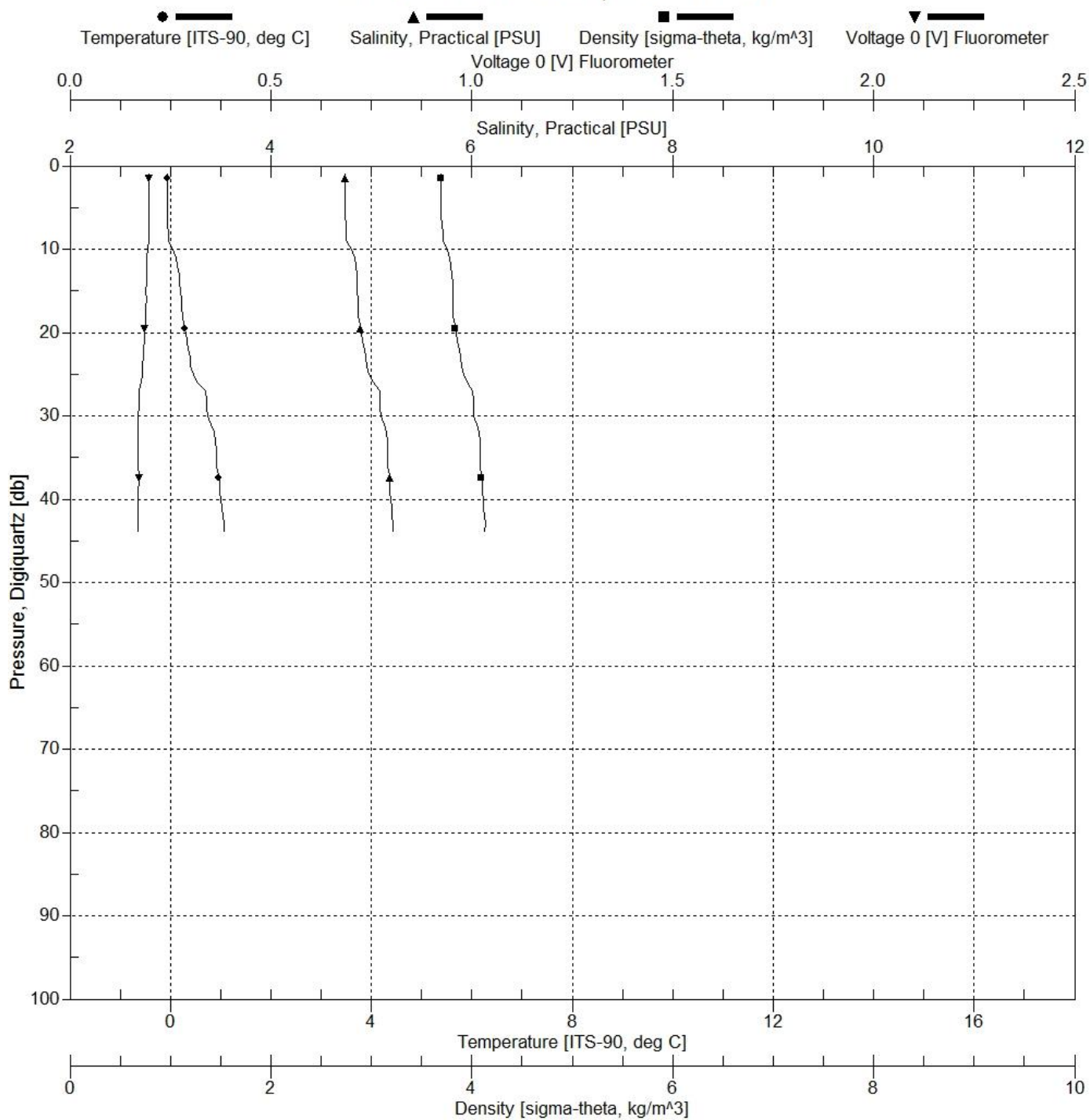


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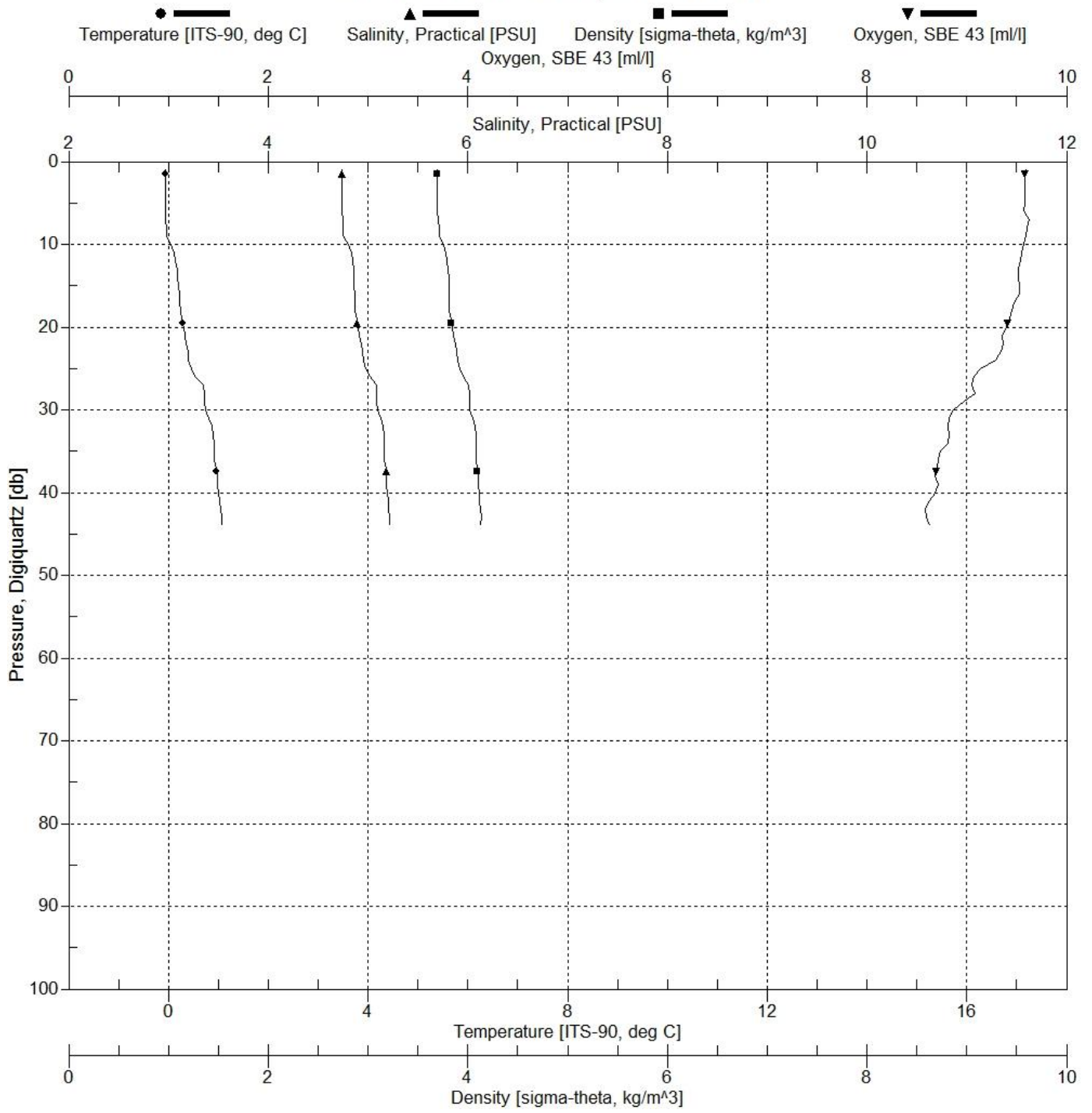


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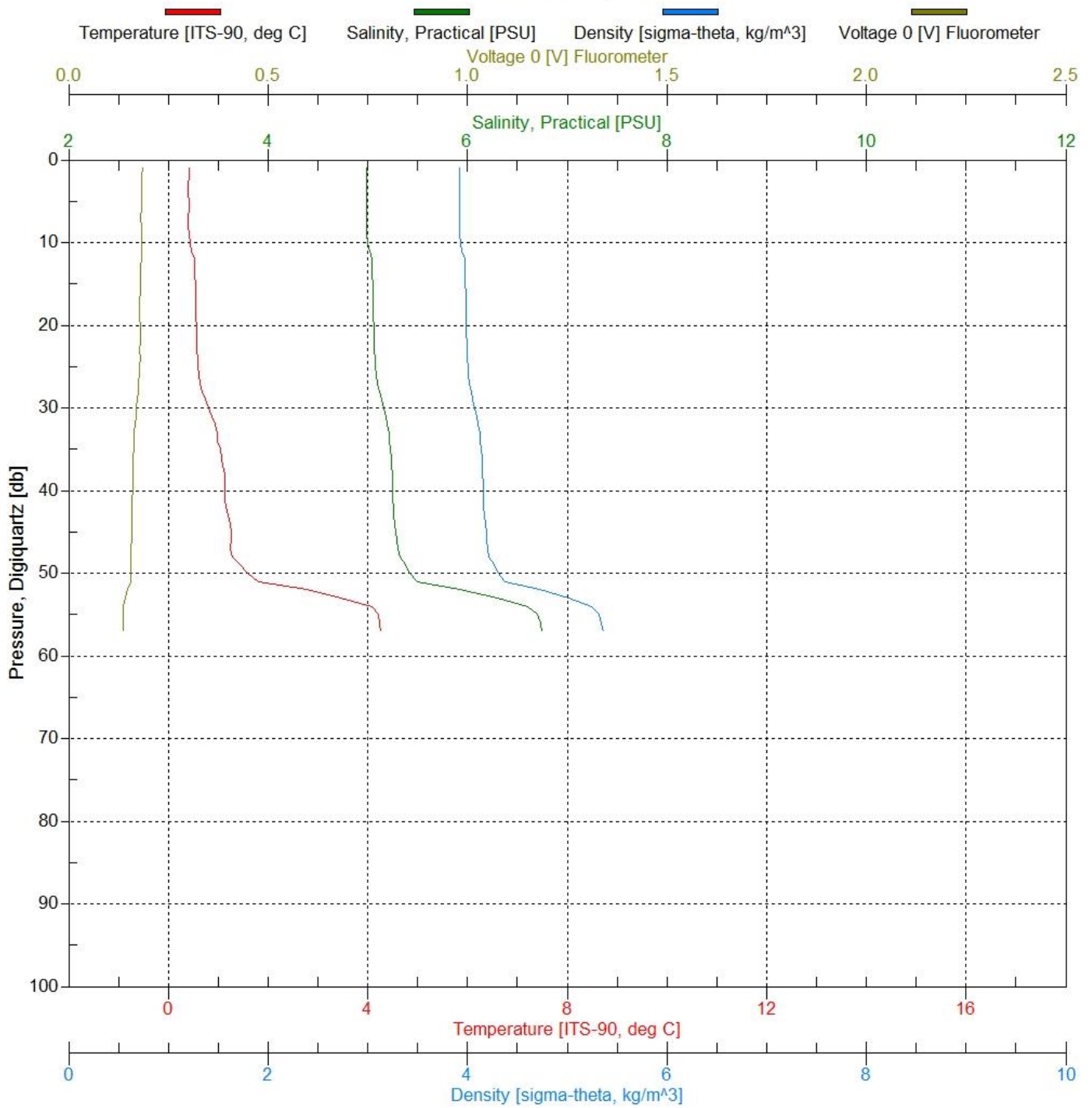




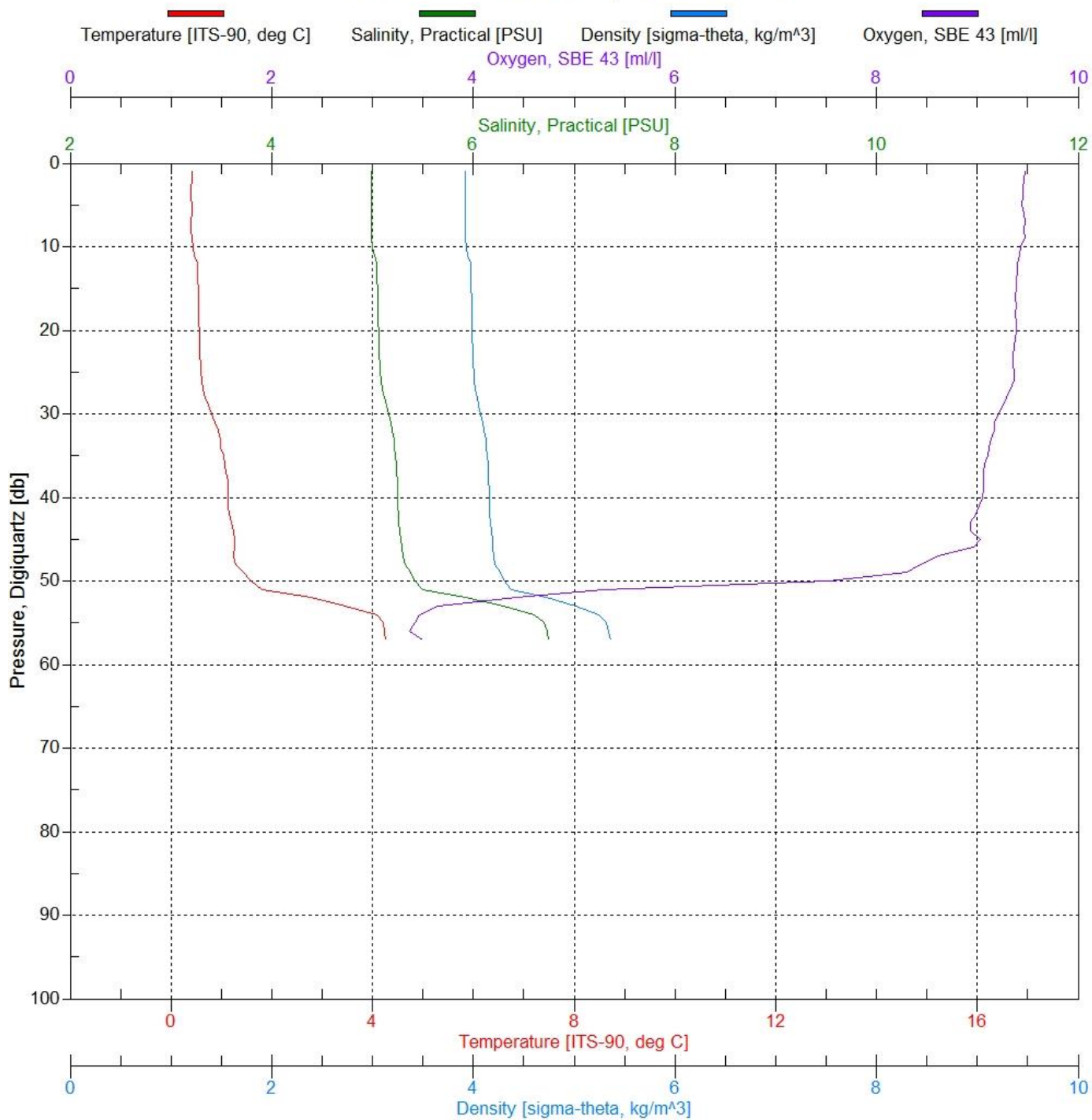
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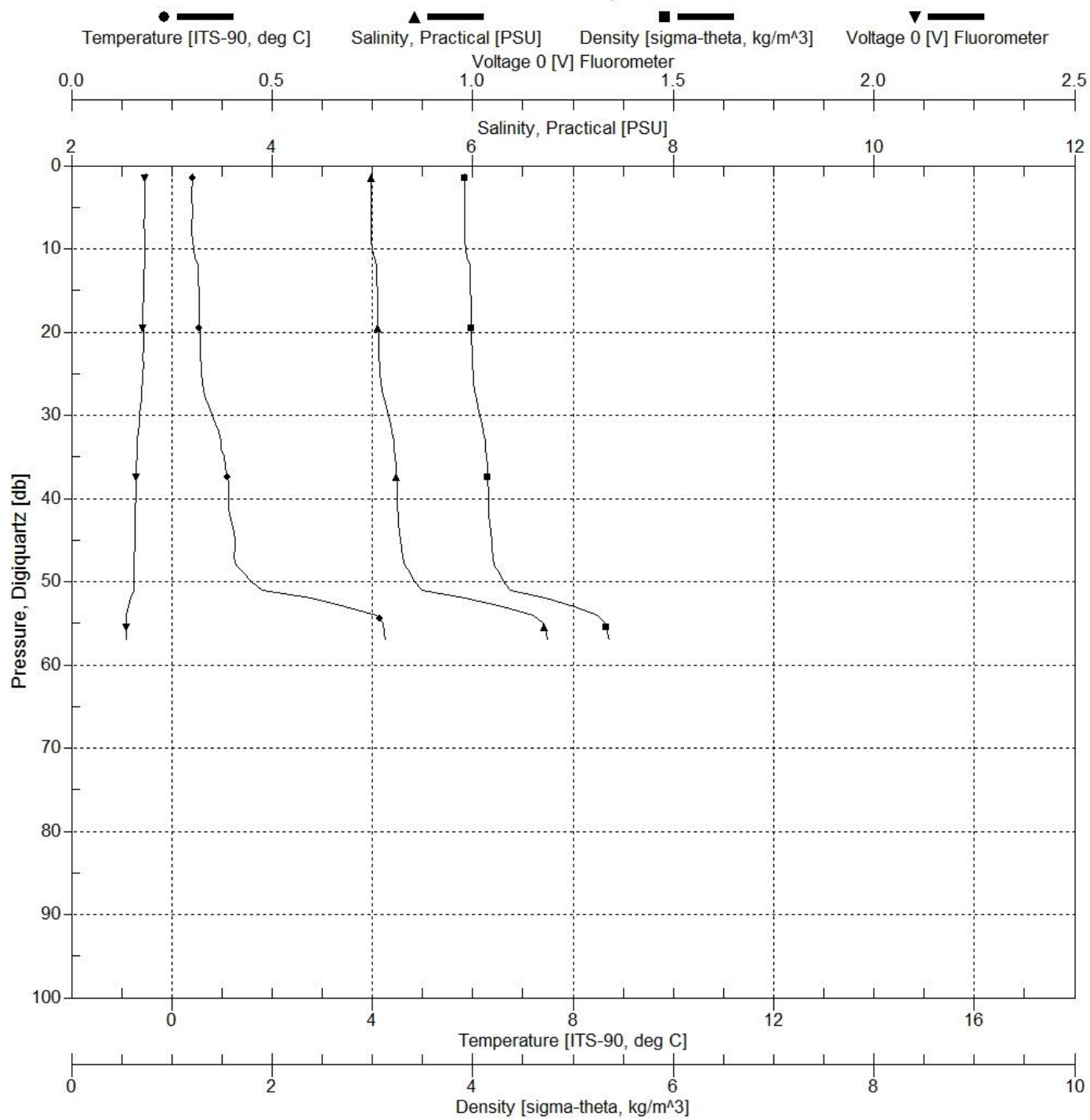


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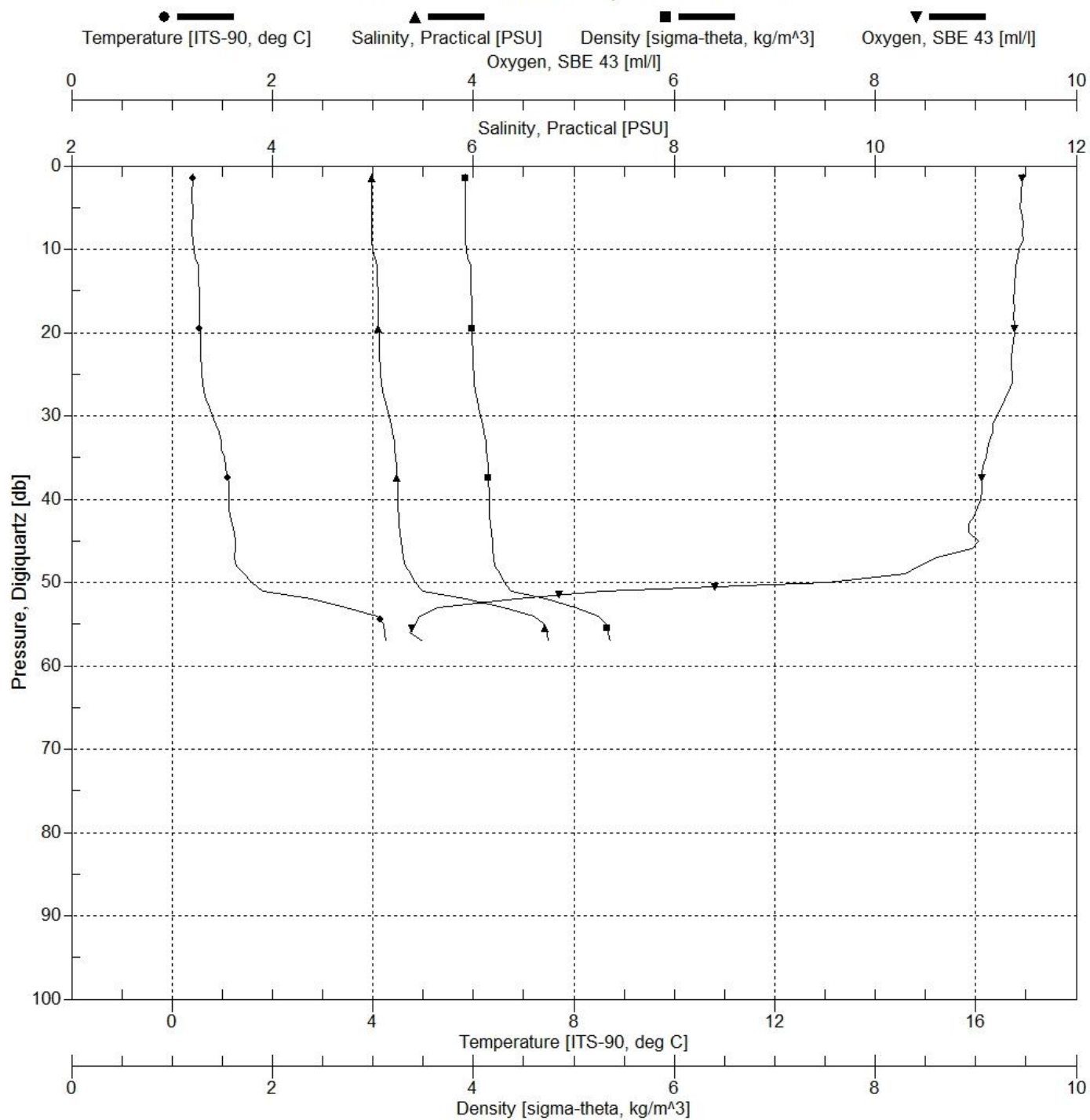


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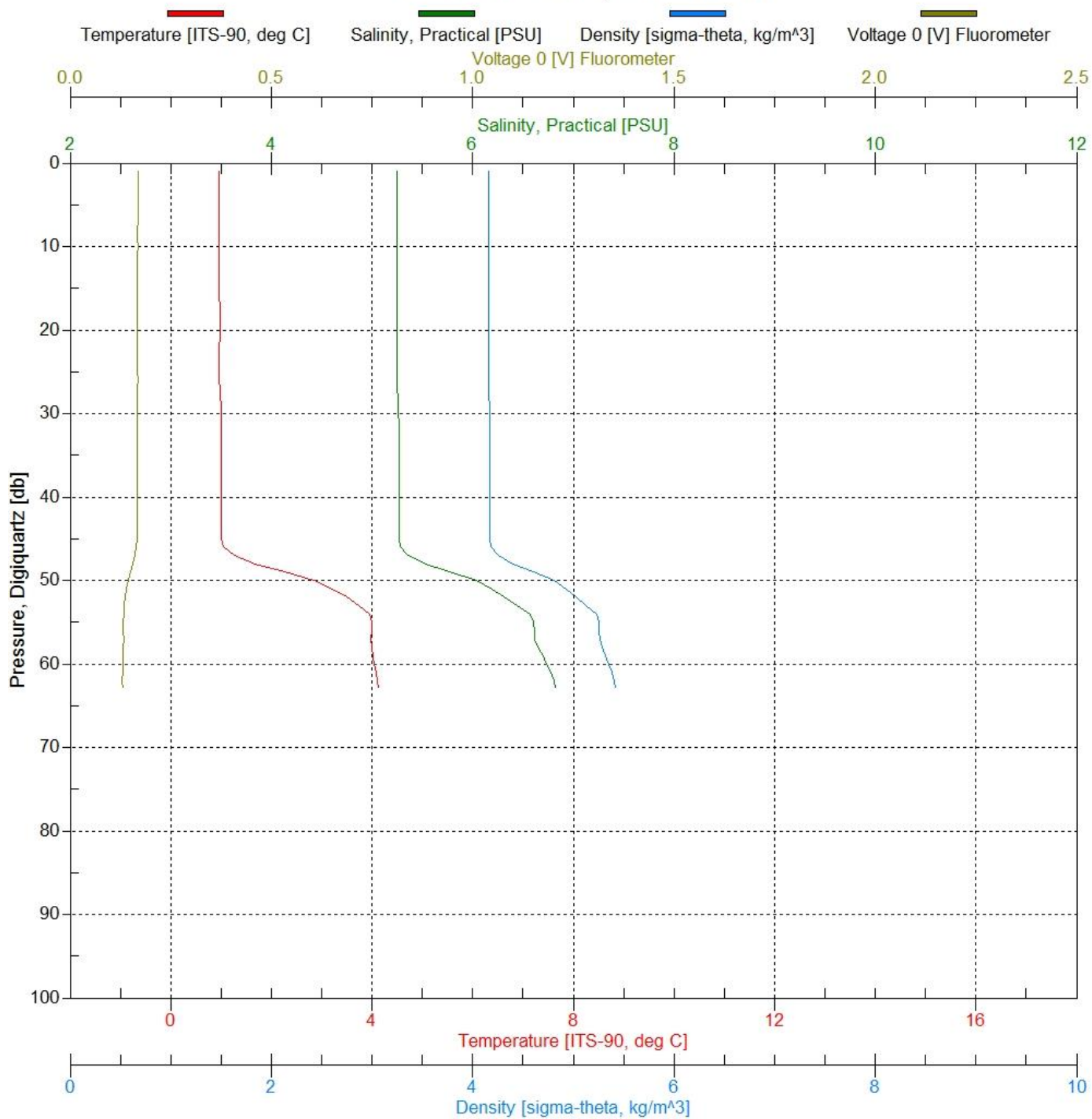




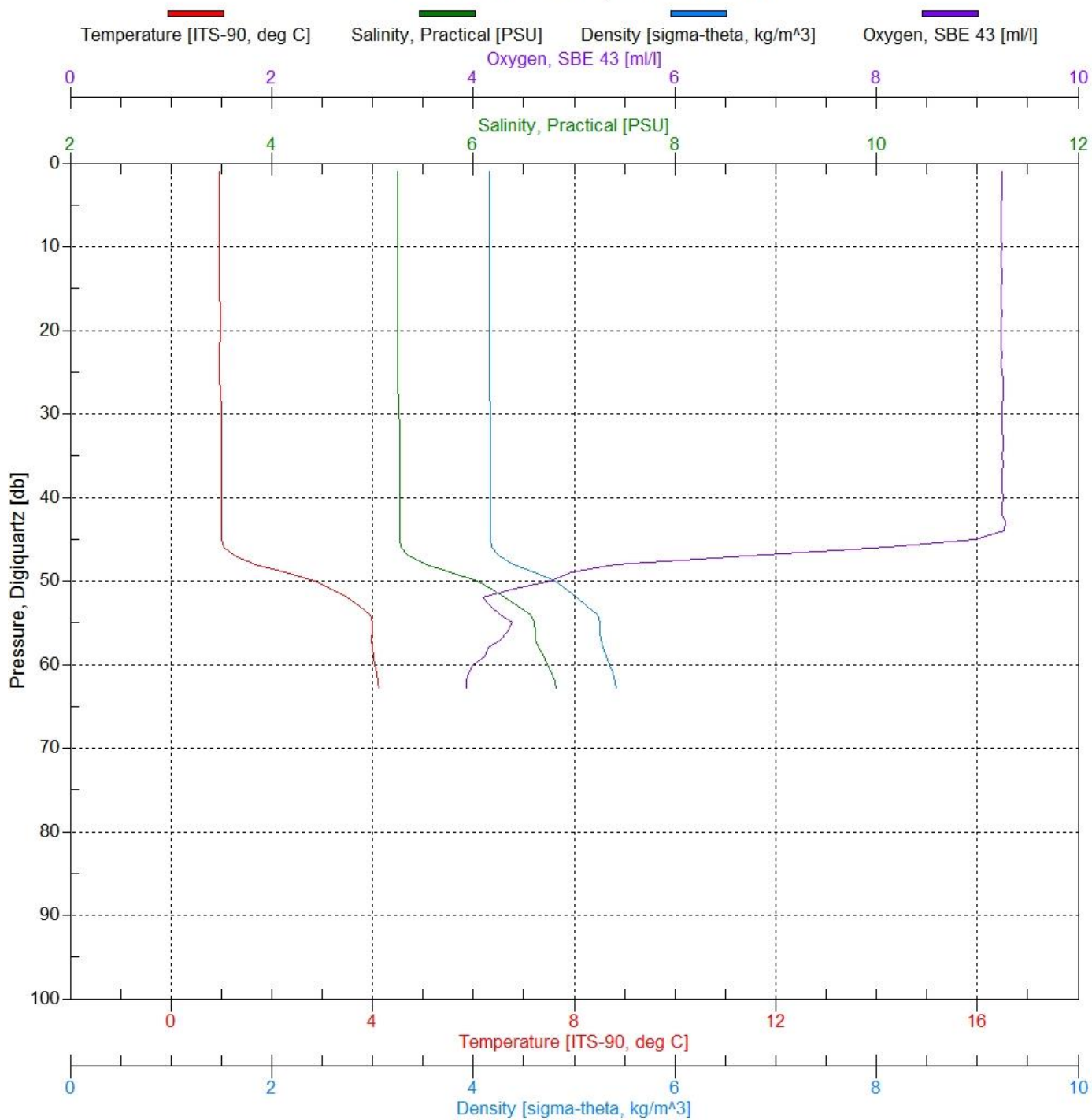
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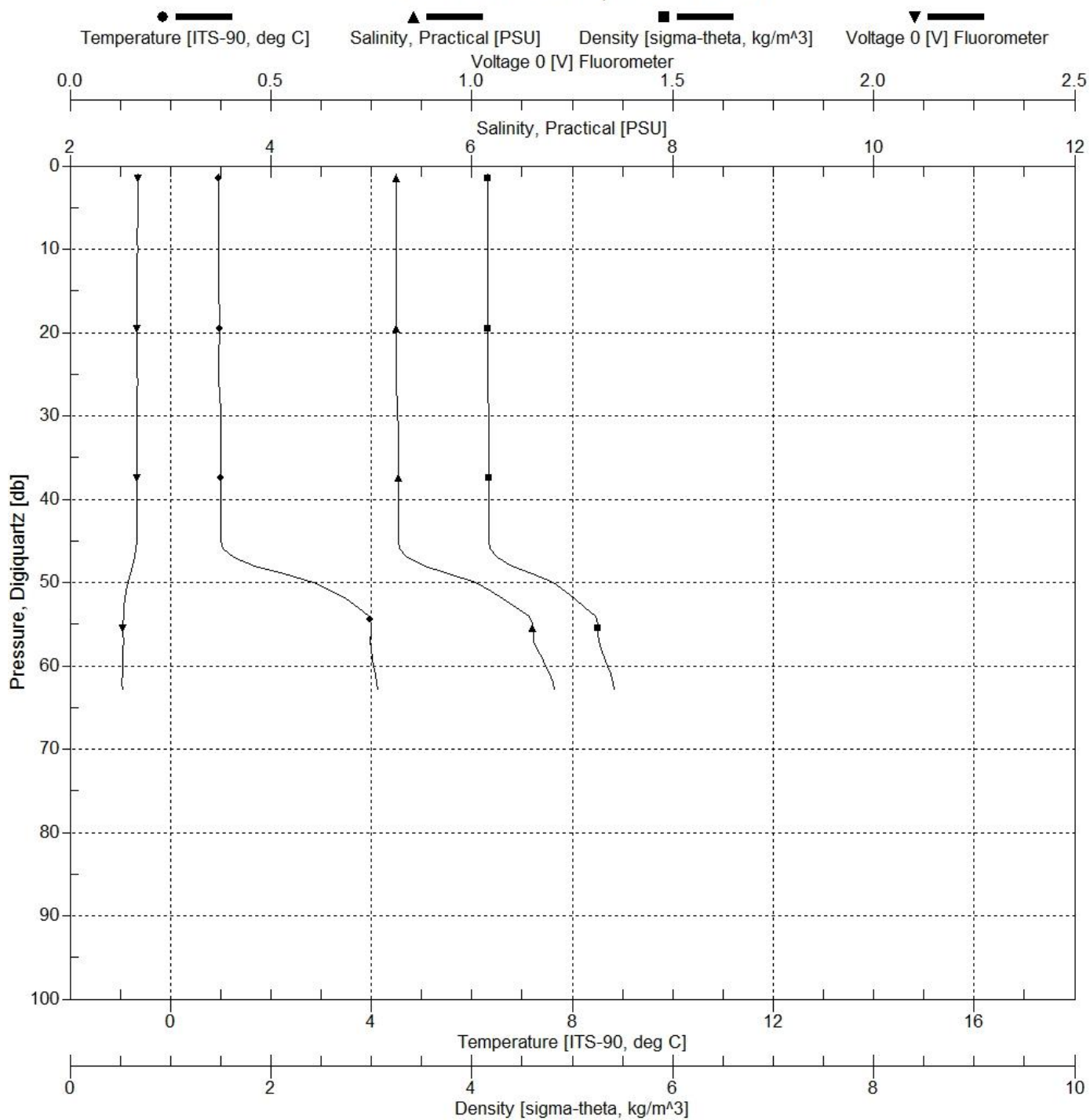


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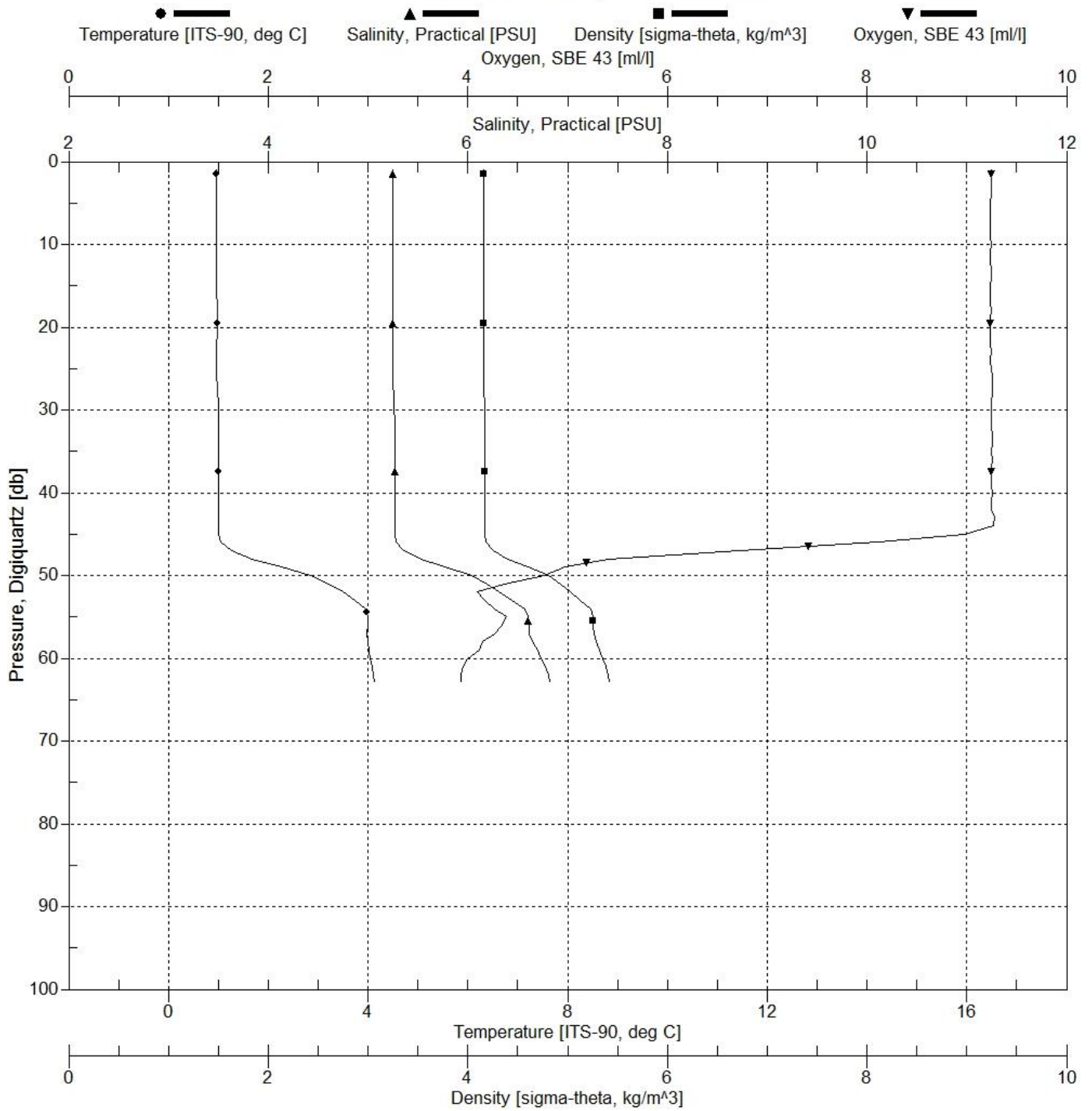


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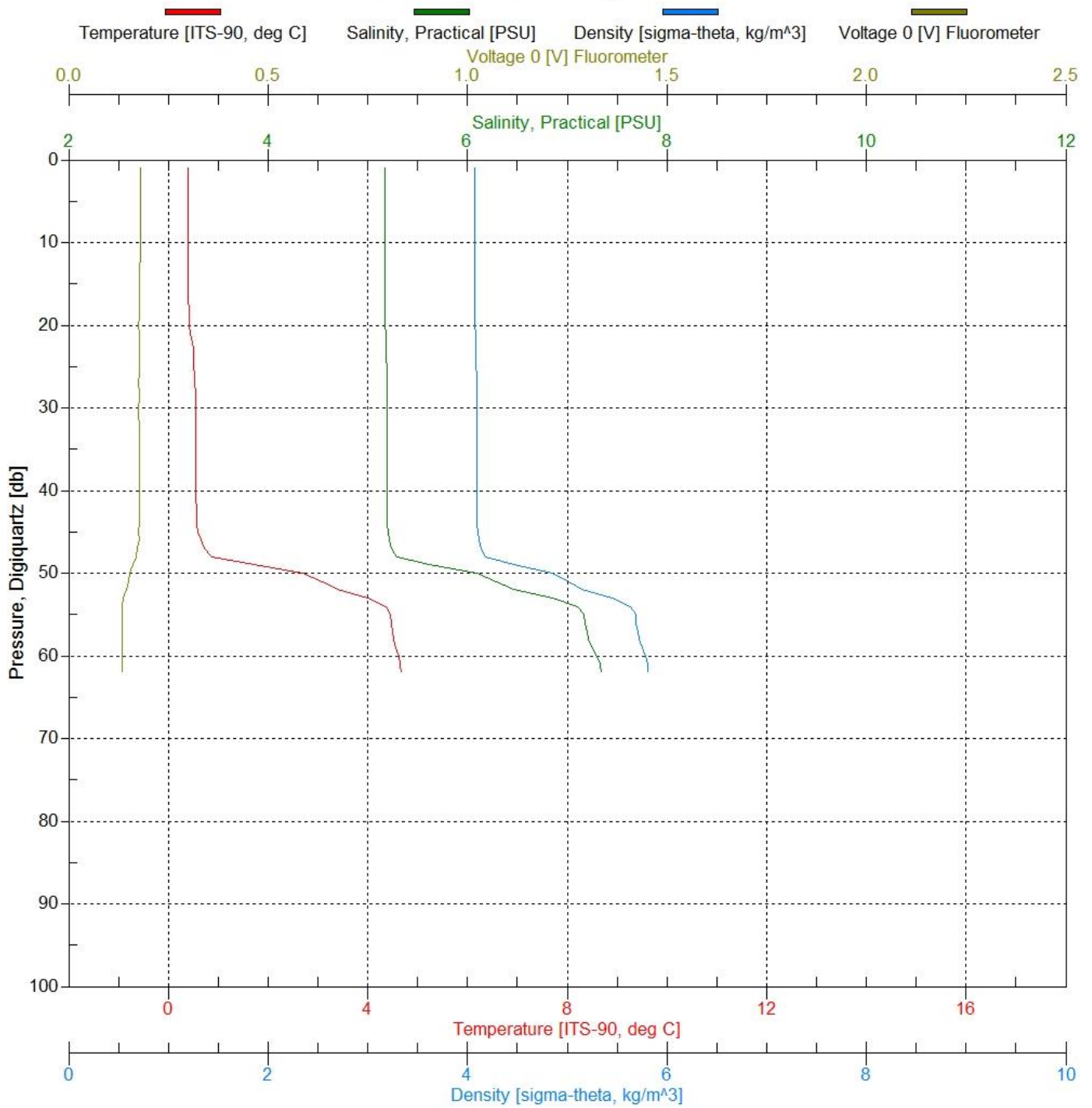




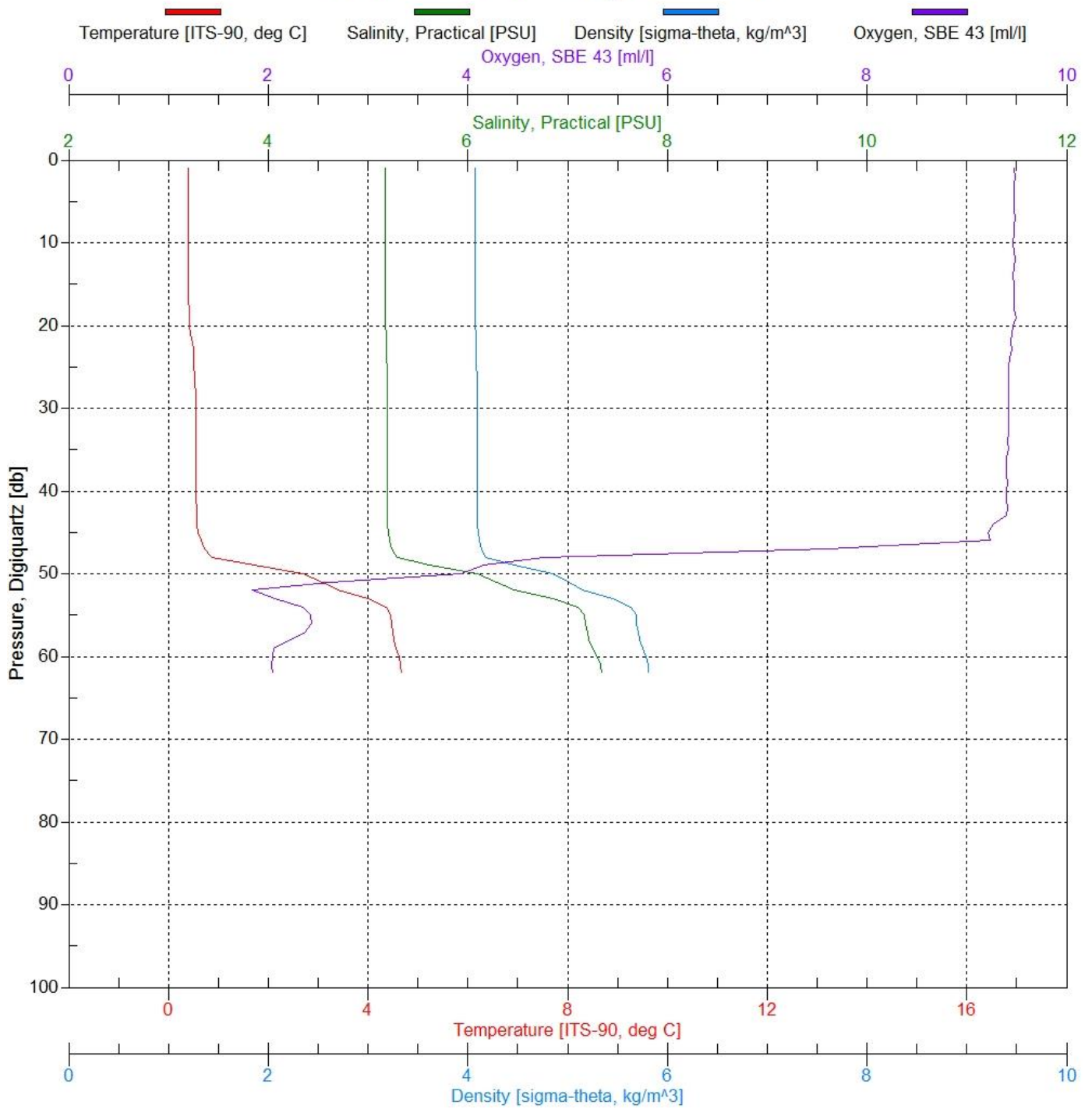
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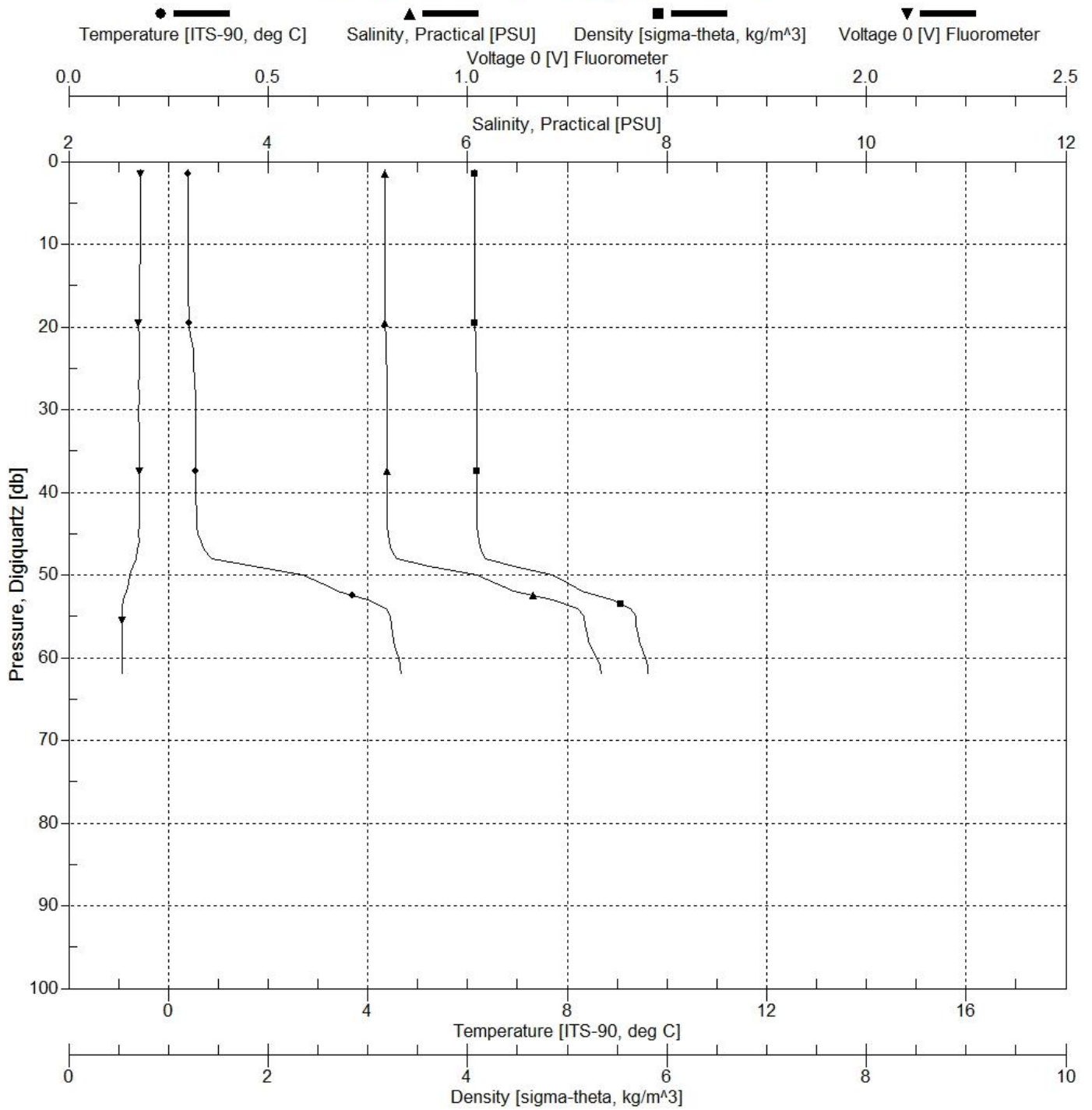
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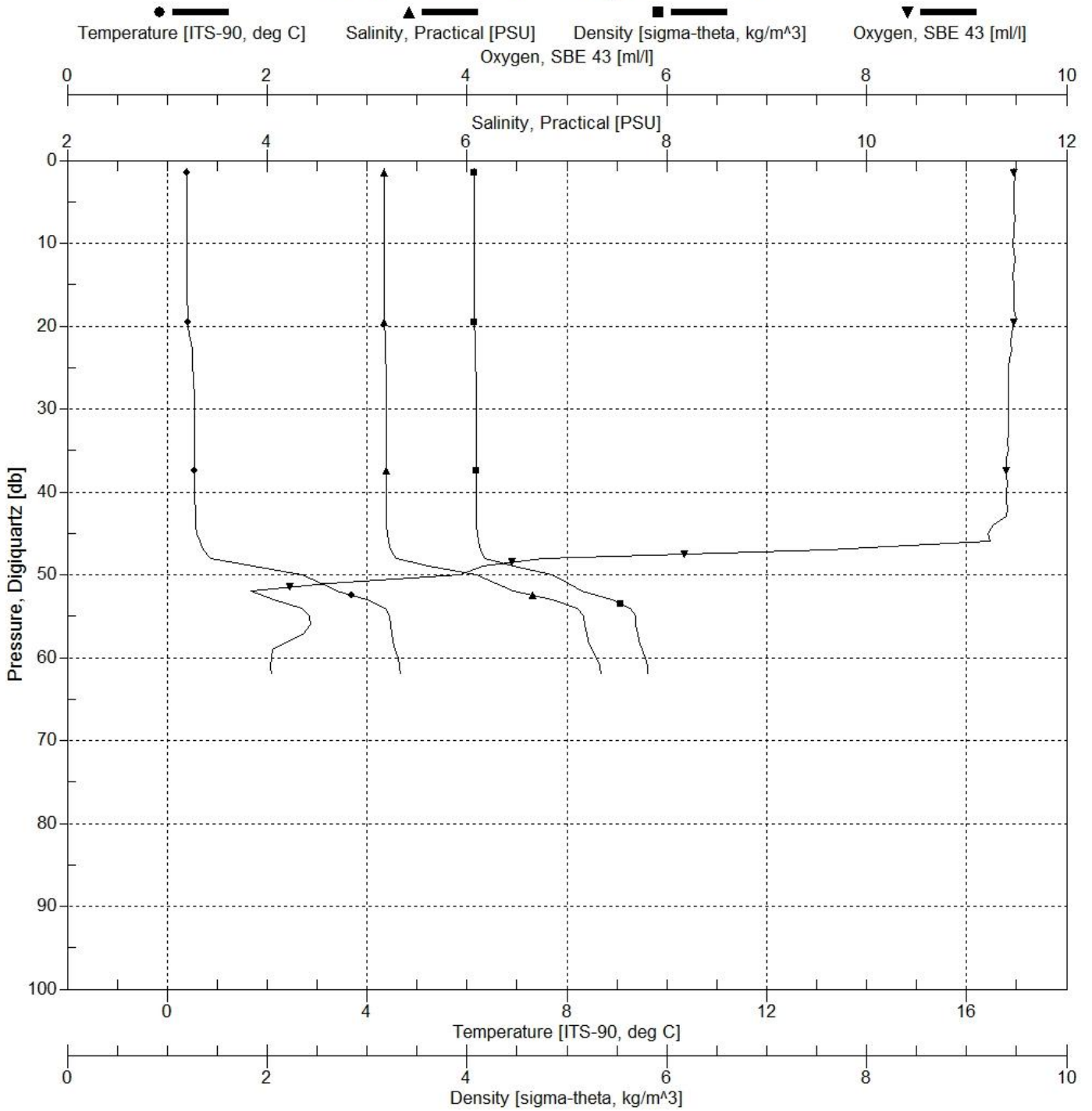
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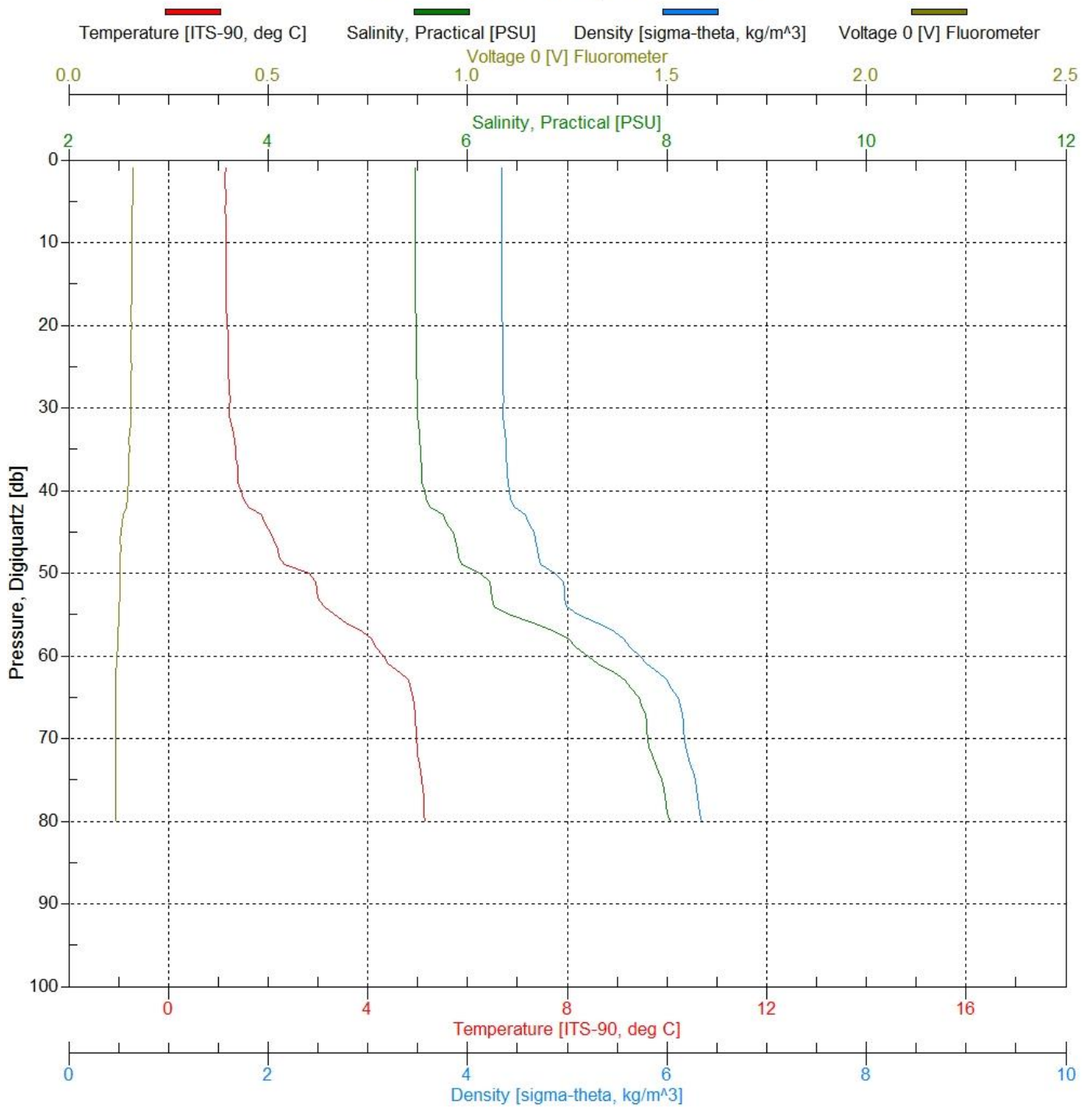
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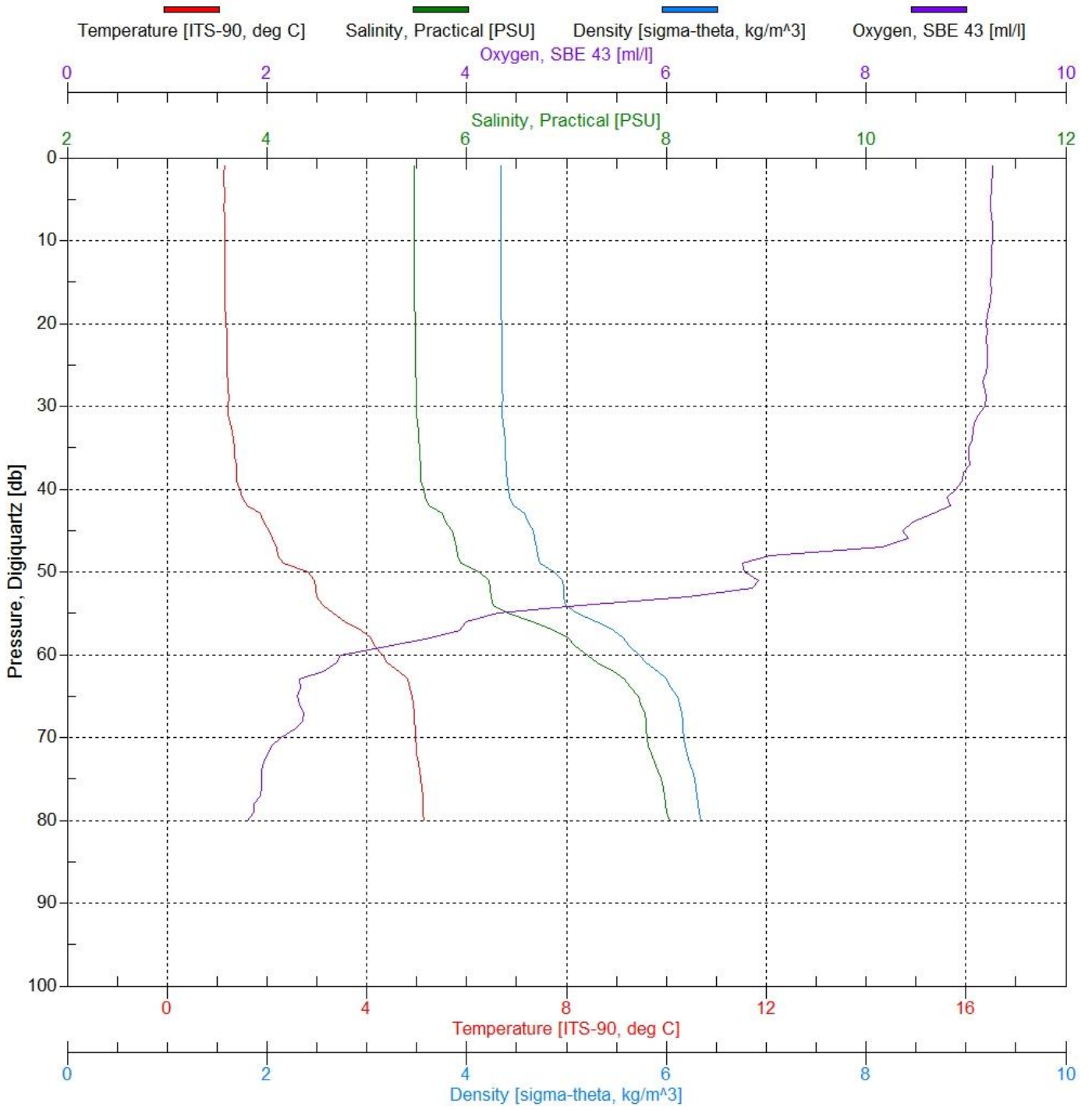
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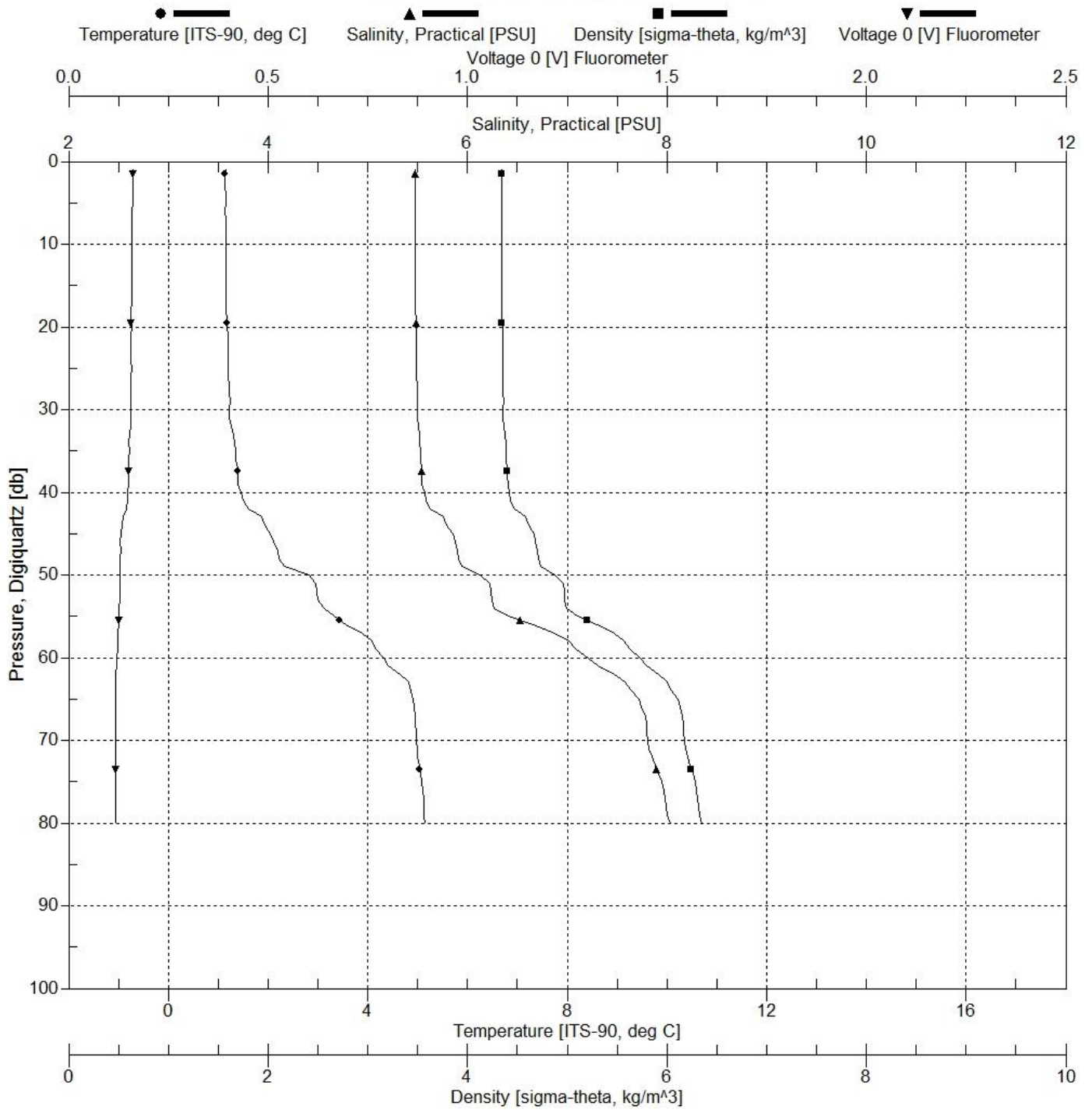
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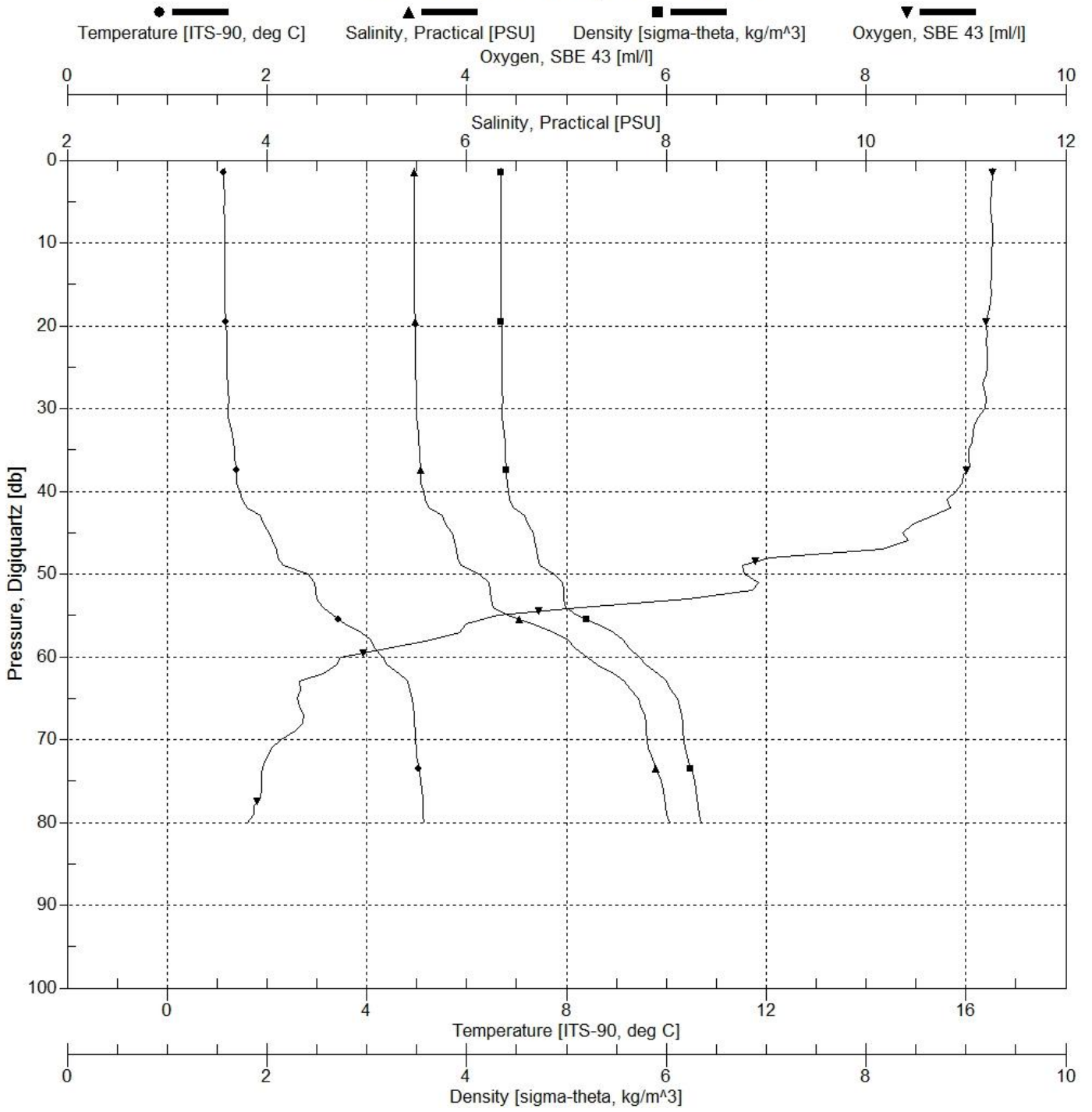
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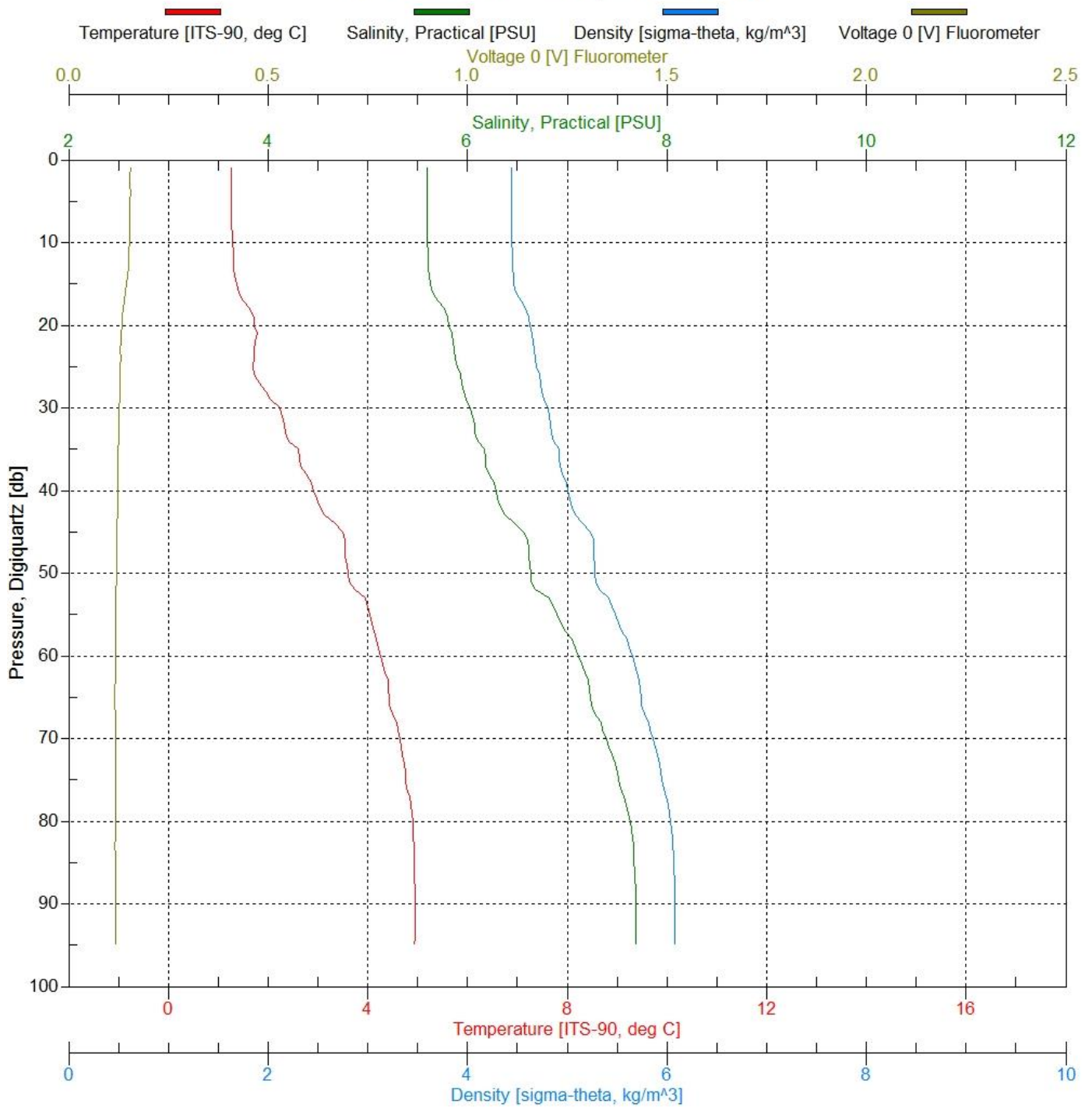
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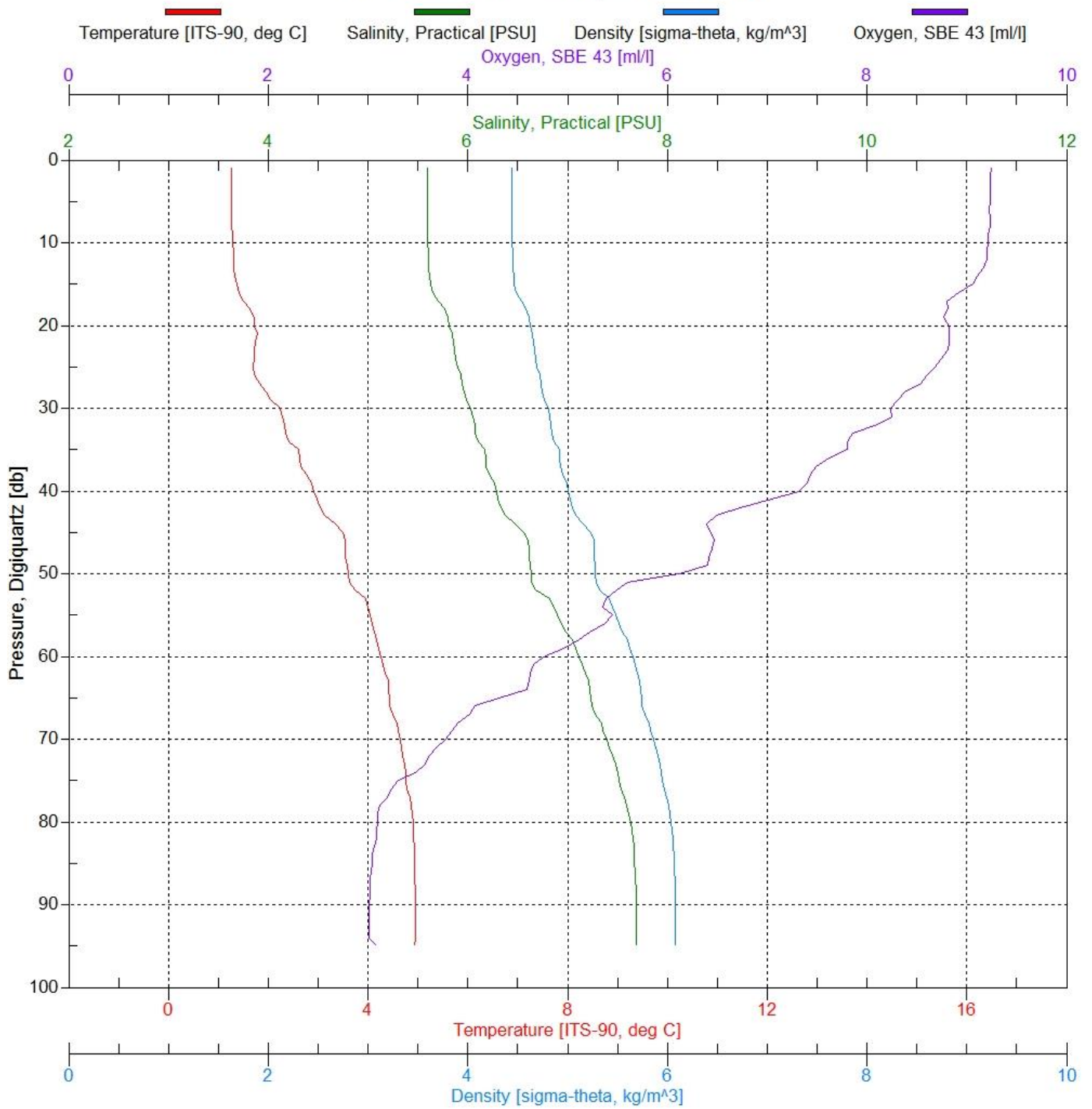
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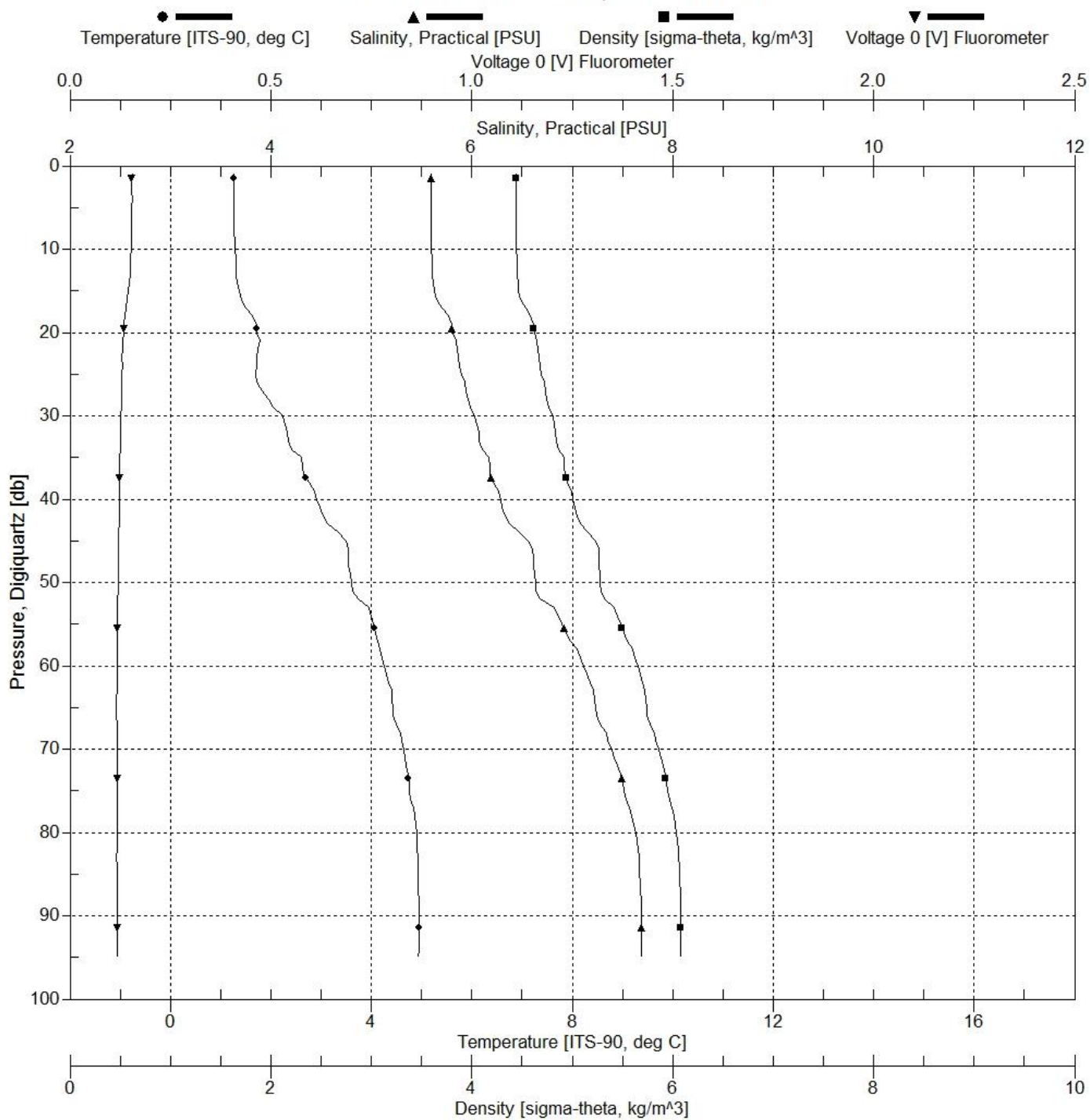


LL7 21.1.2017 14.25, a170047.cnv

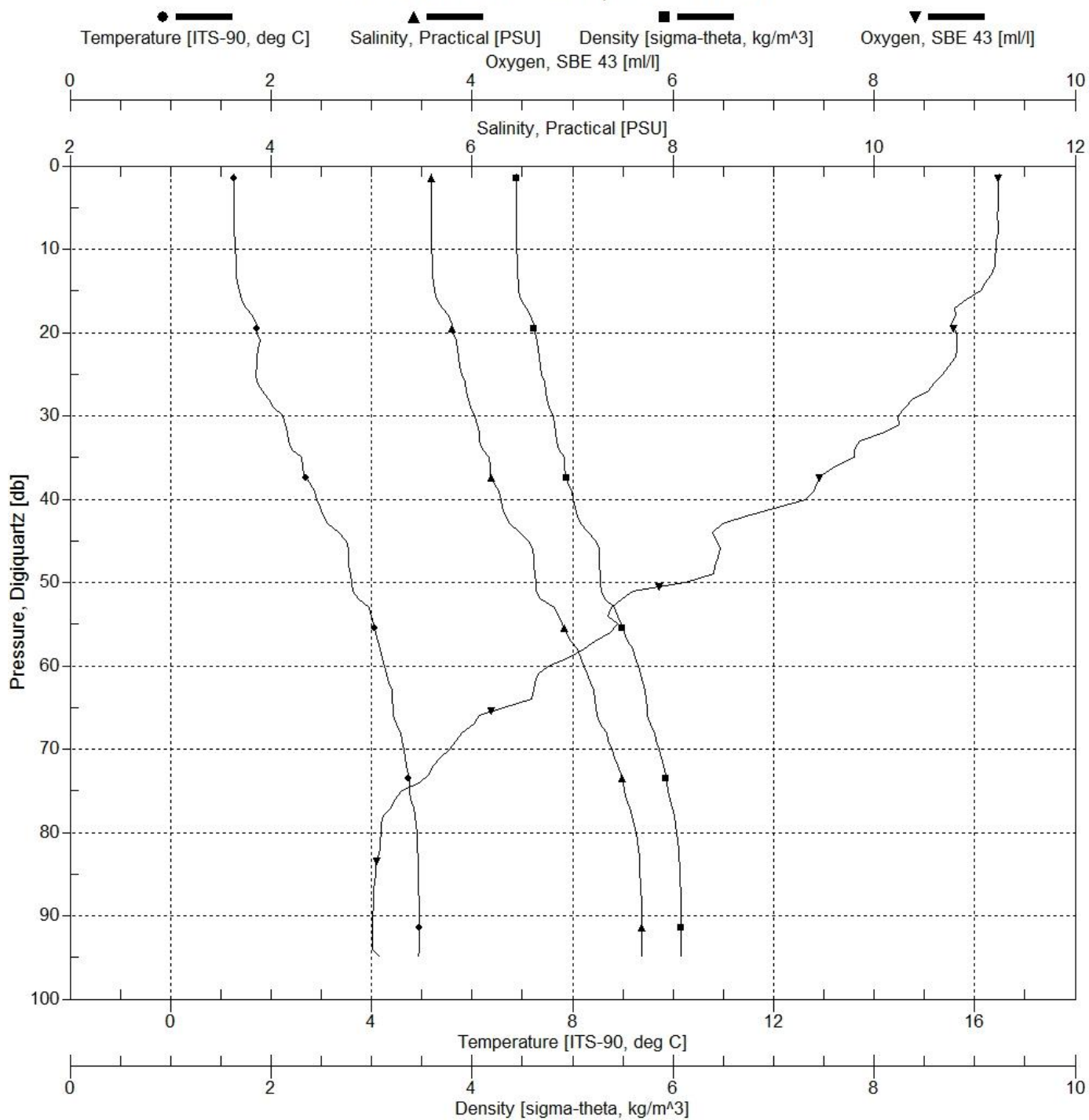


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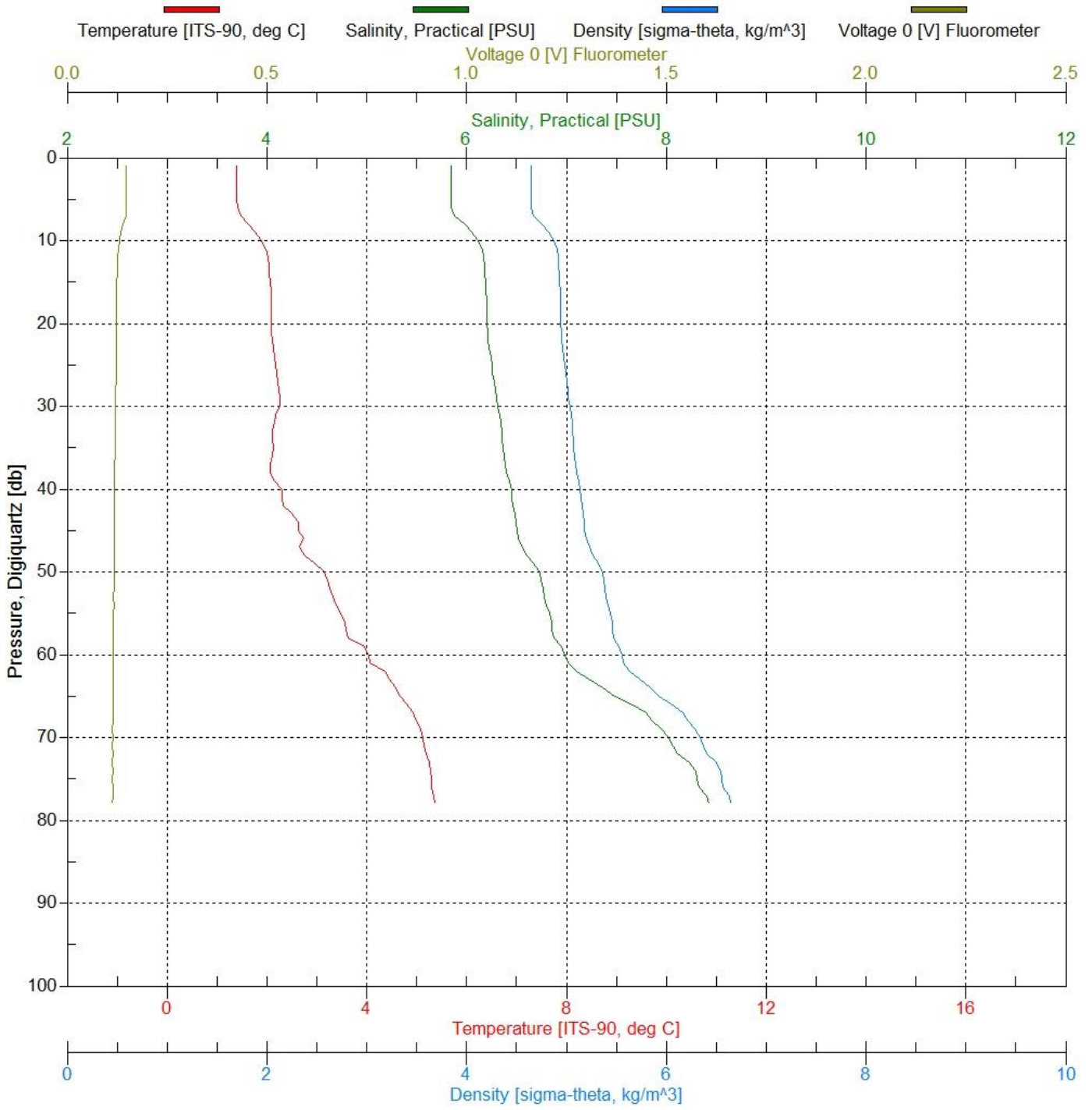




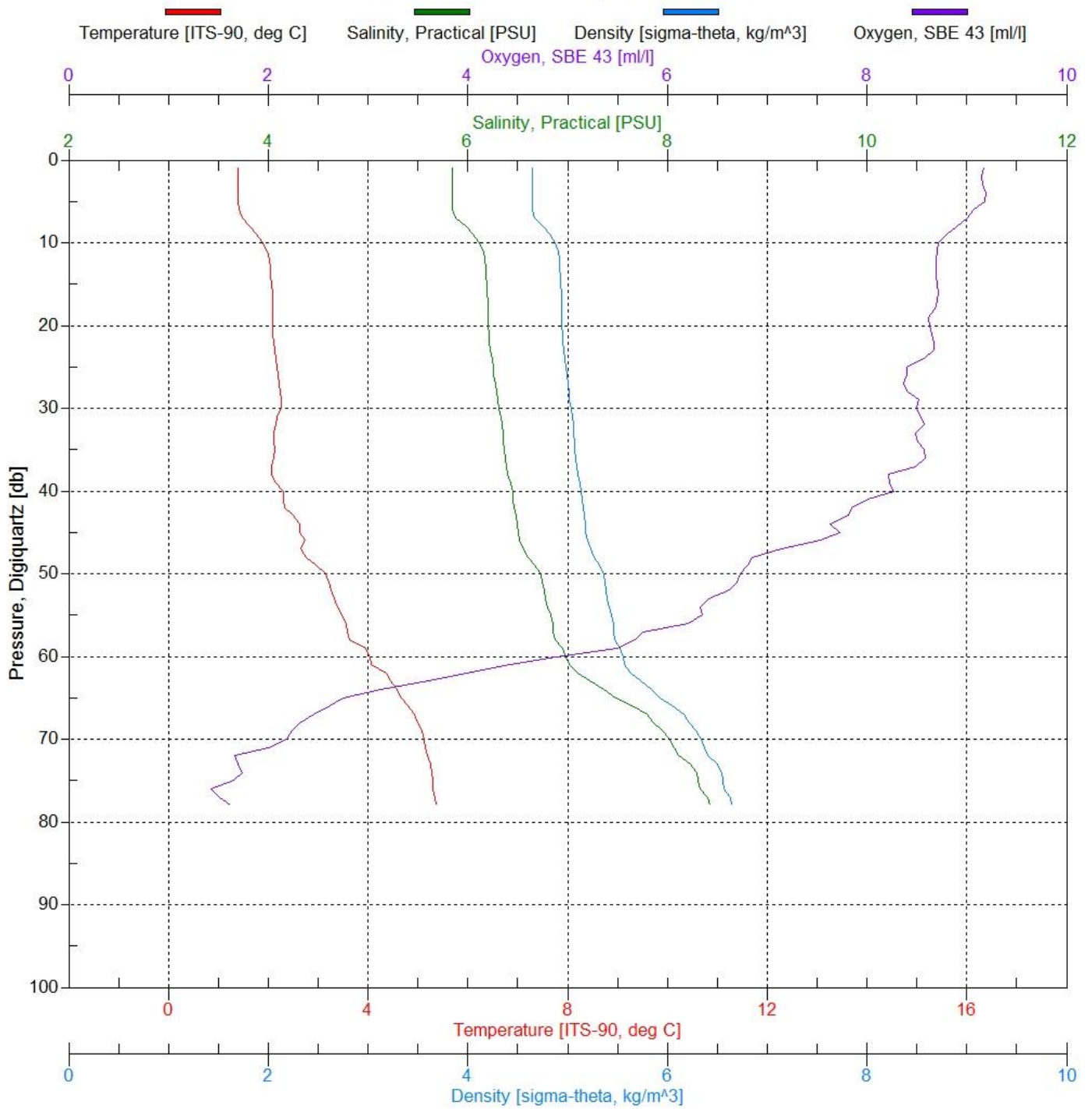
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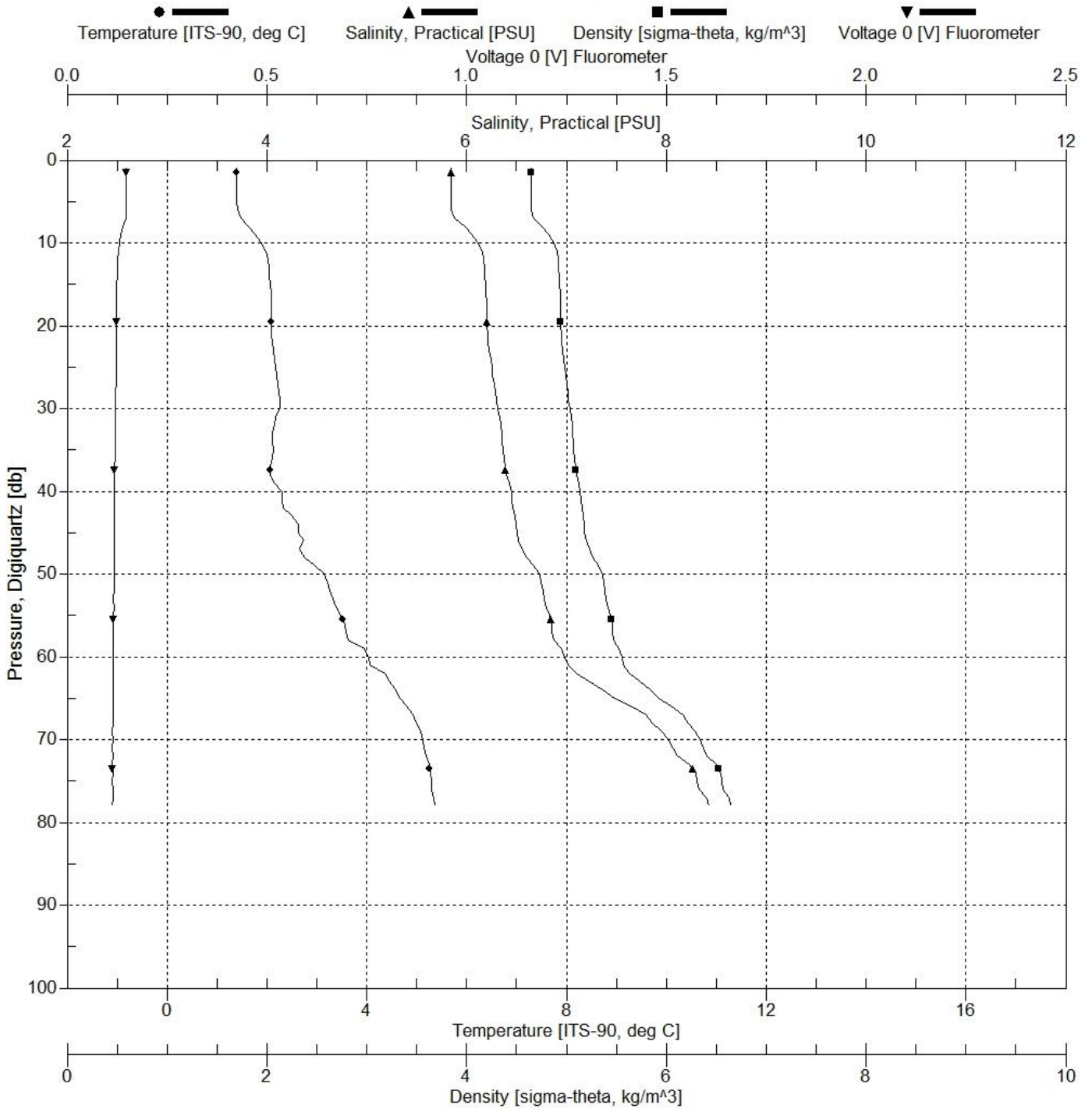
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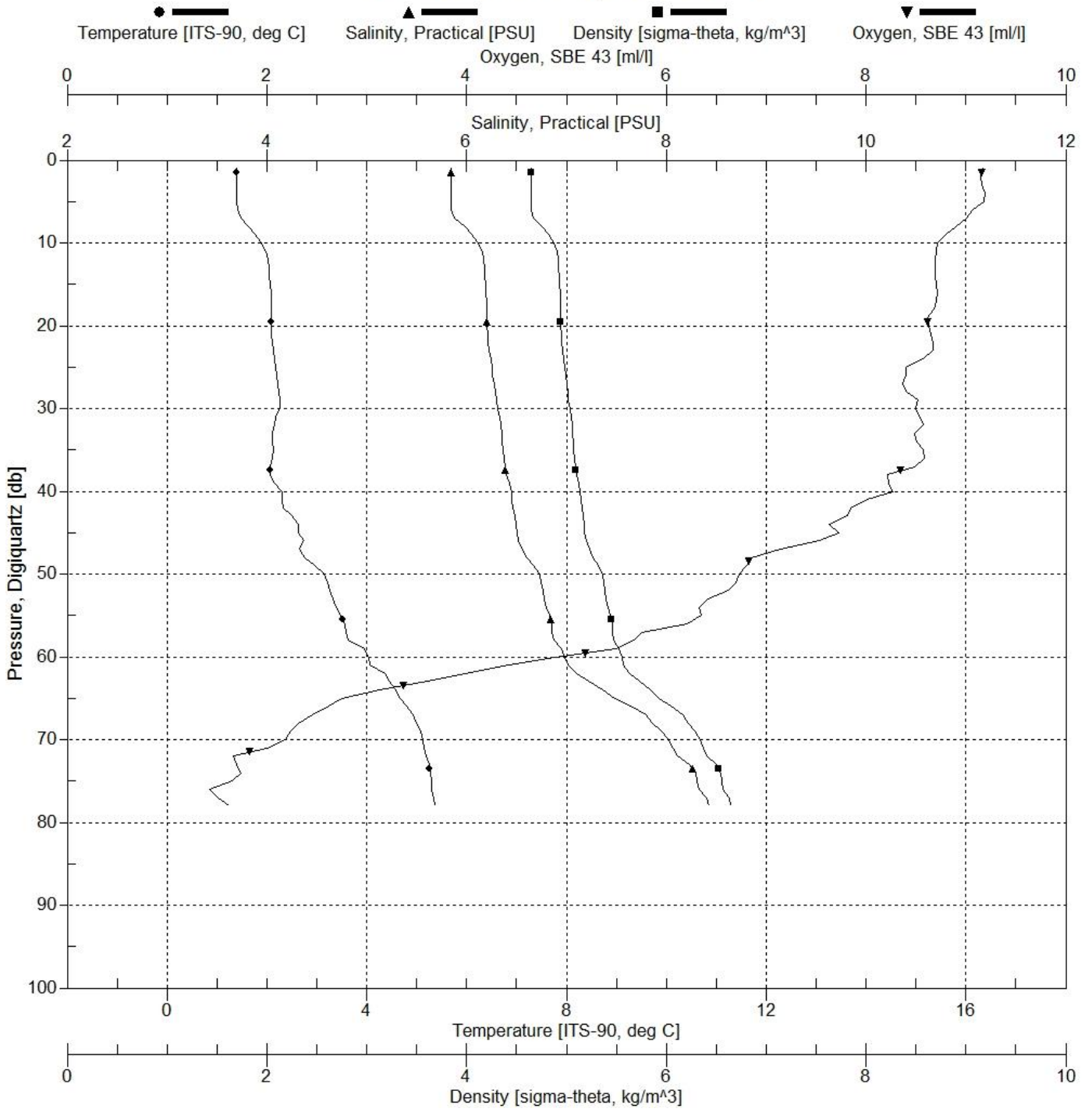
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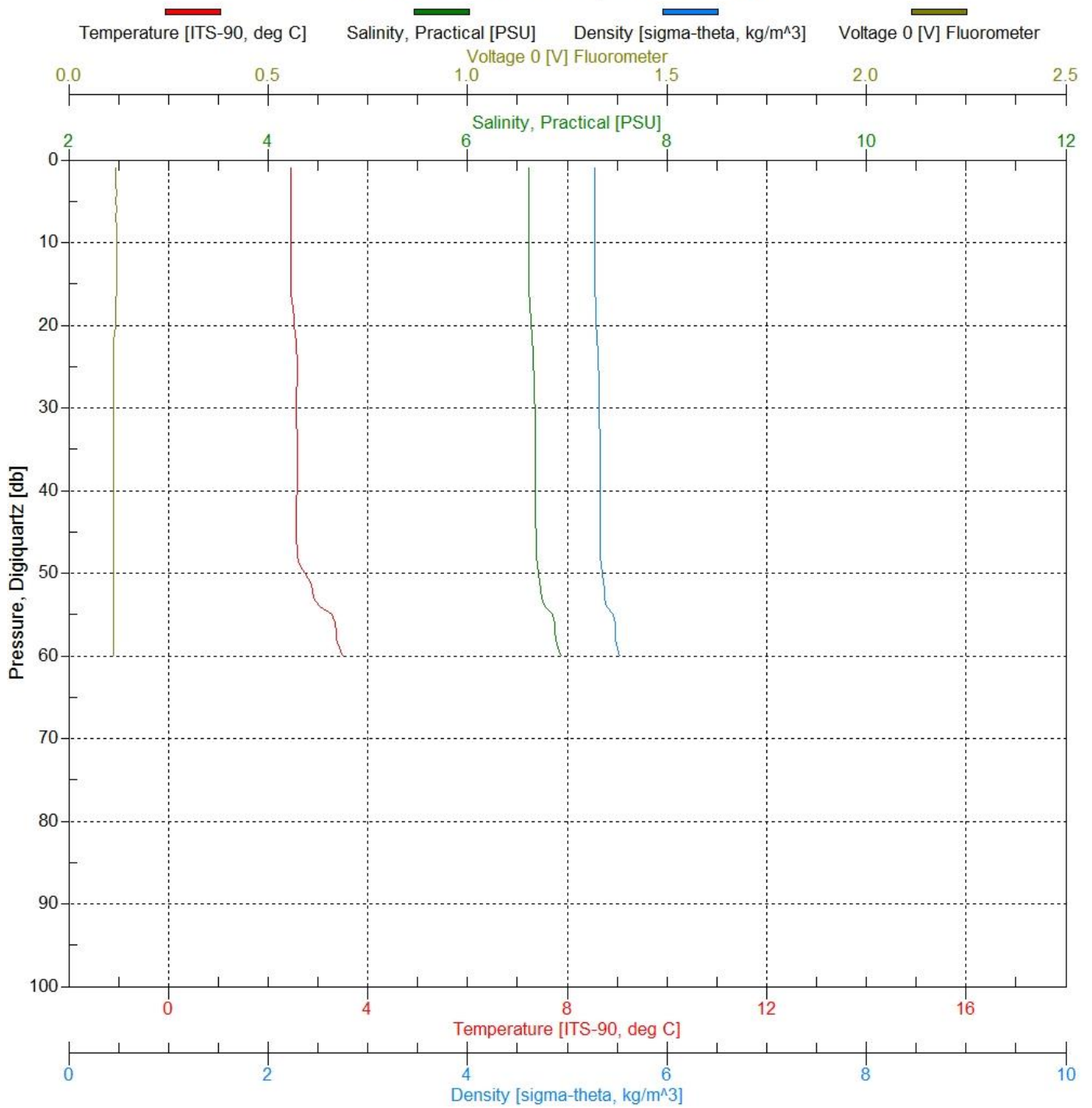
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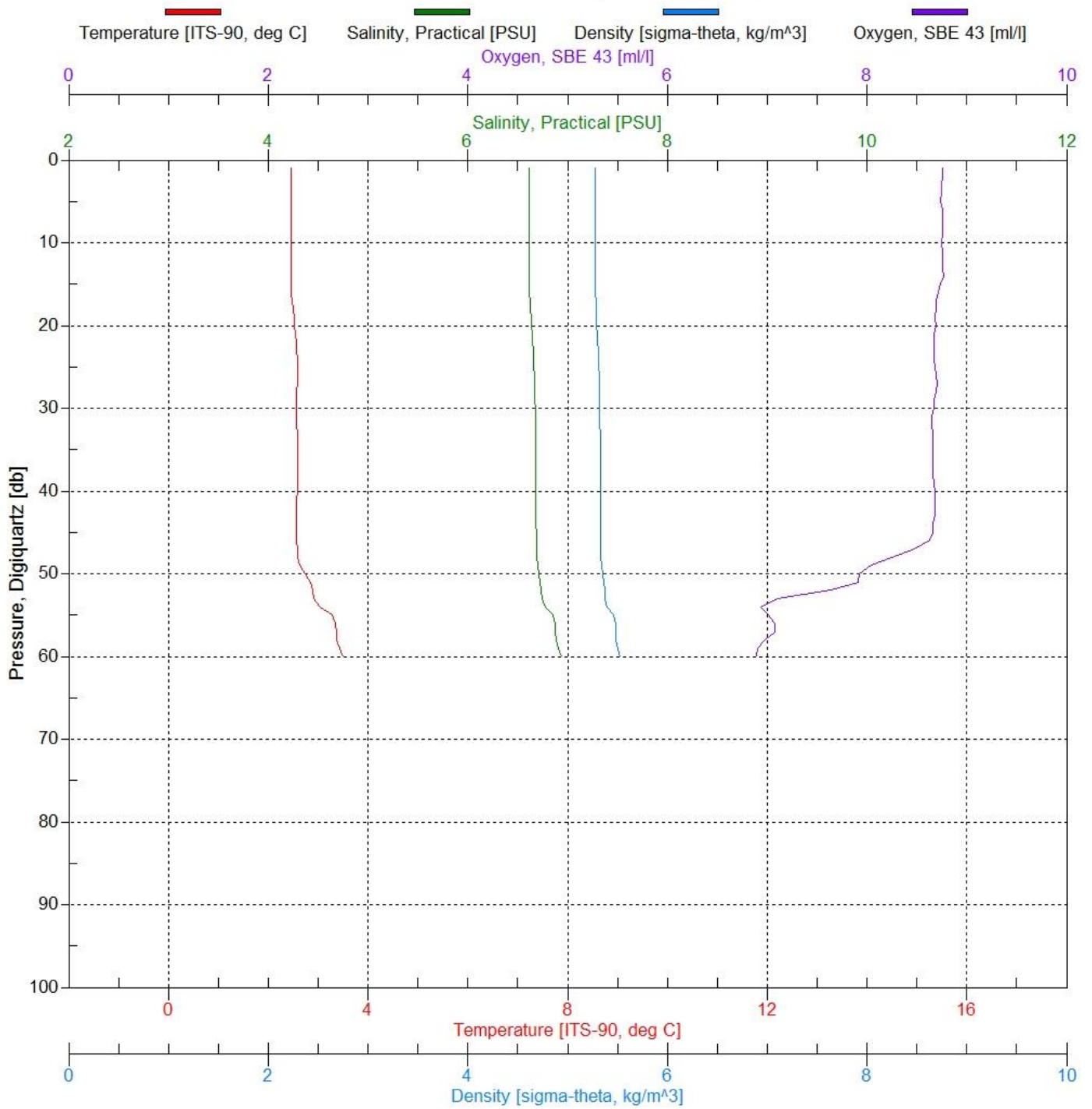
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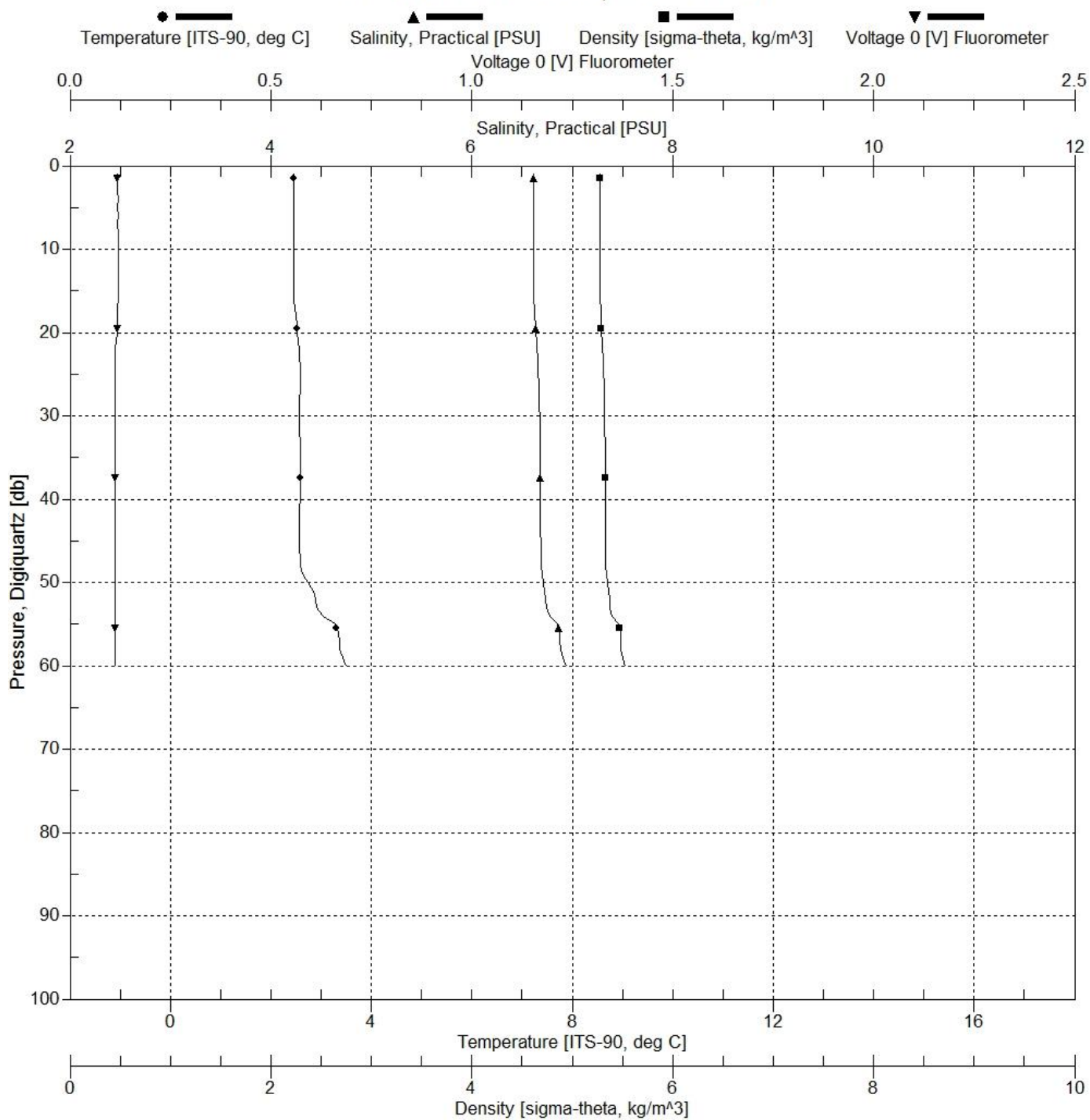


LL9 21.1.2017 23.10, a170050.cnv

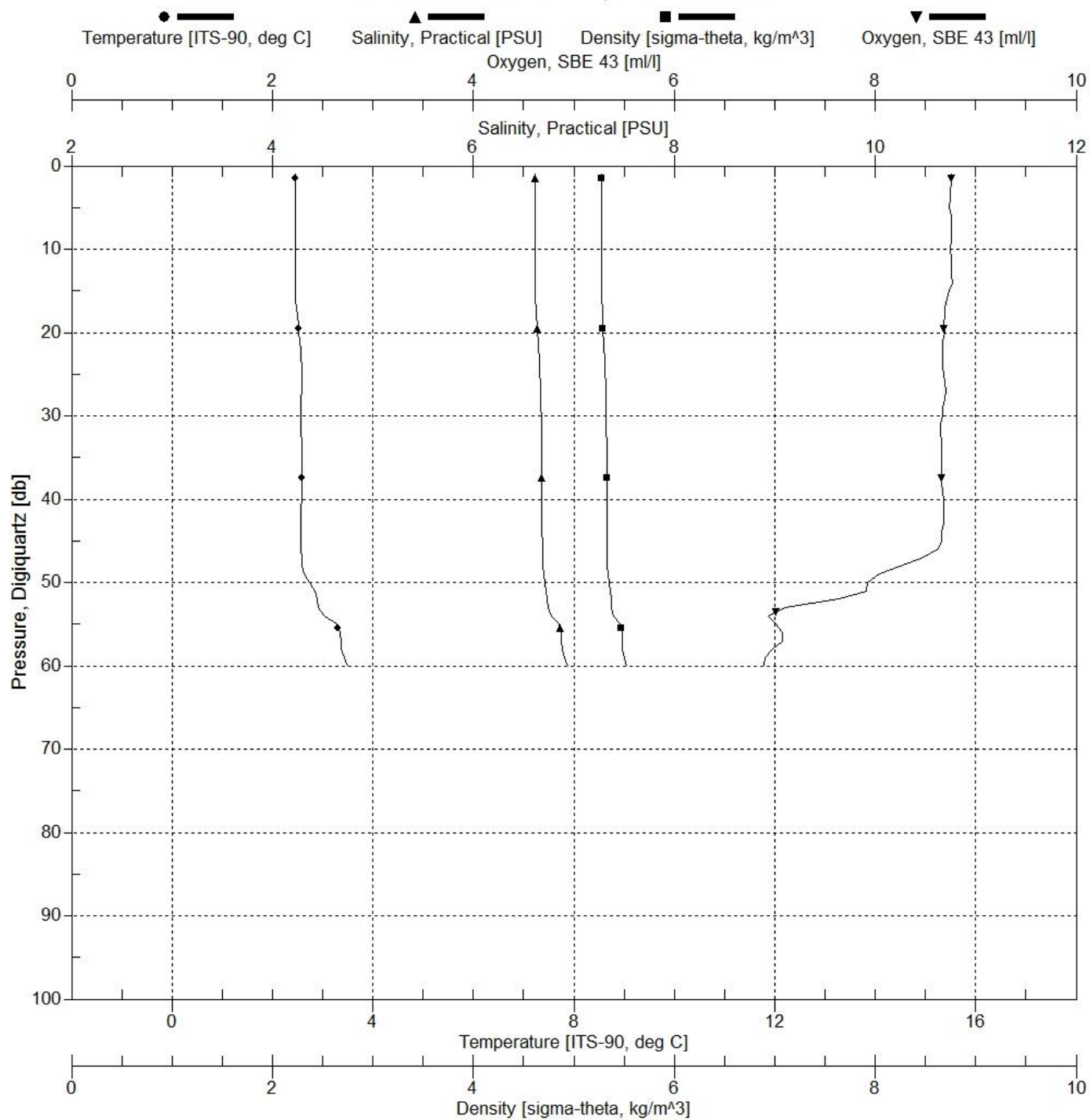


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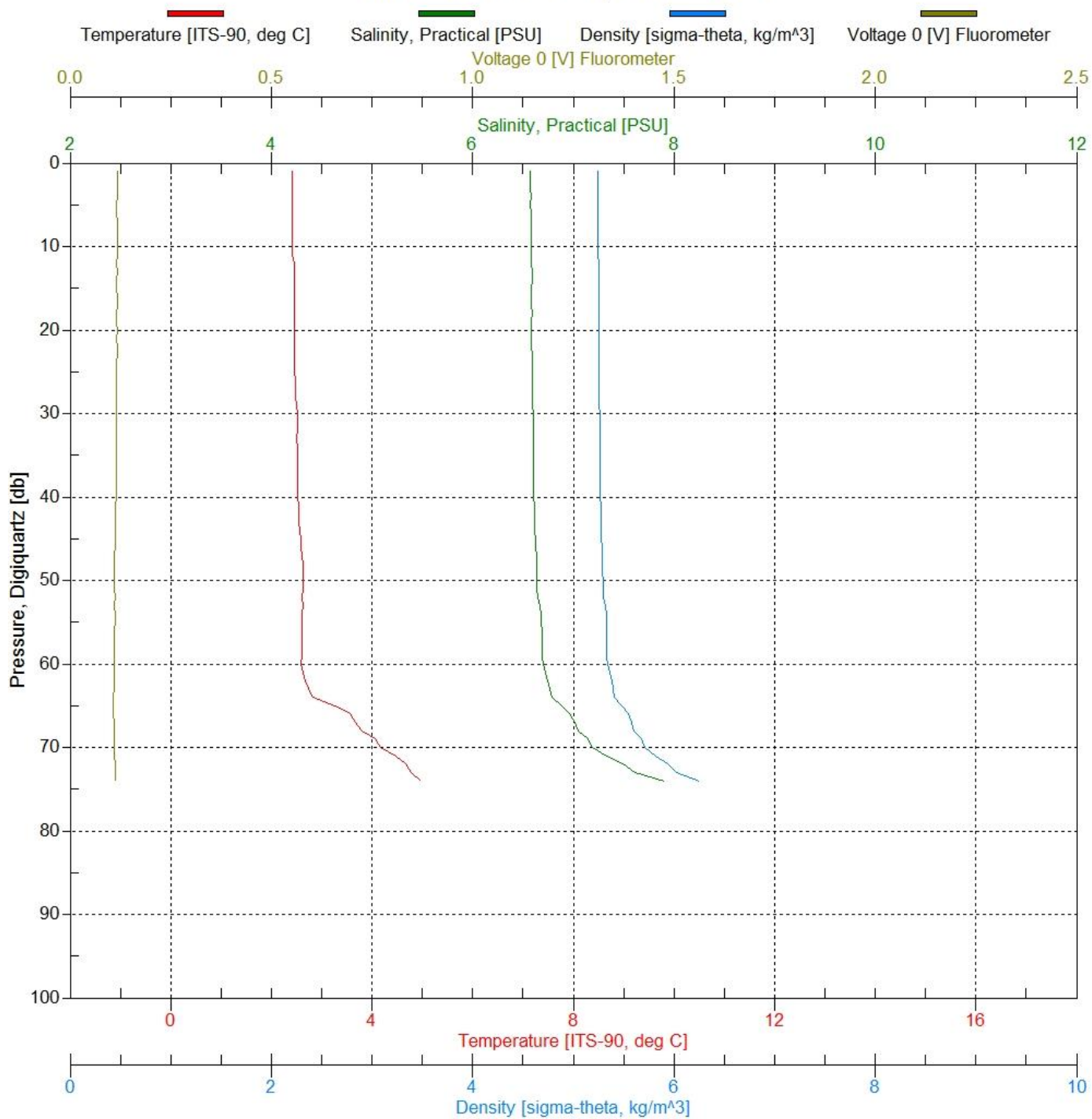




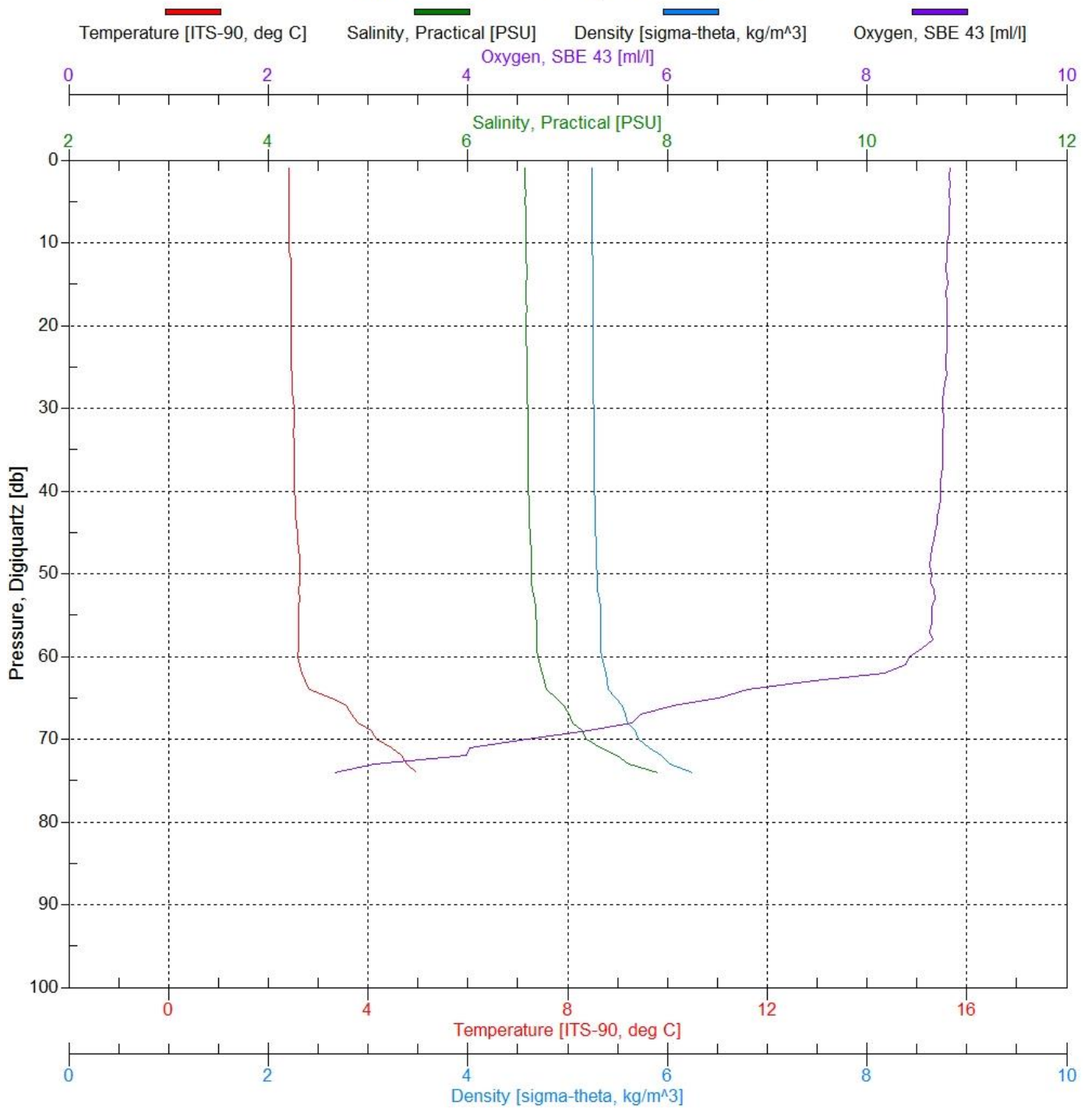
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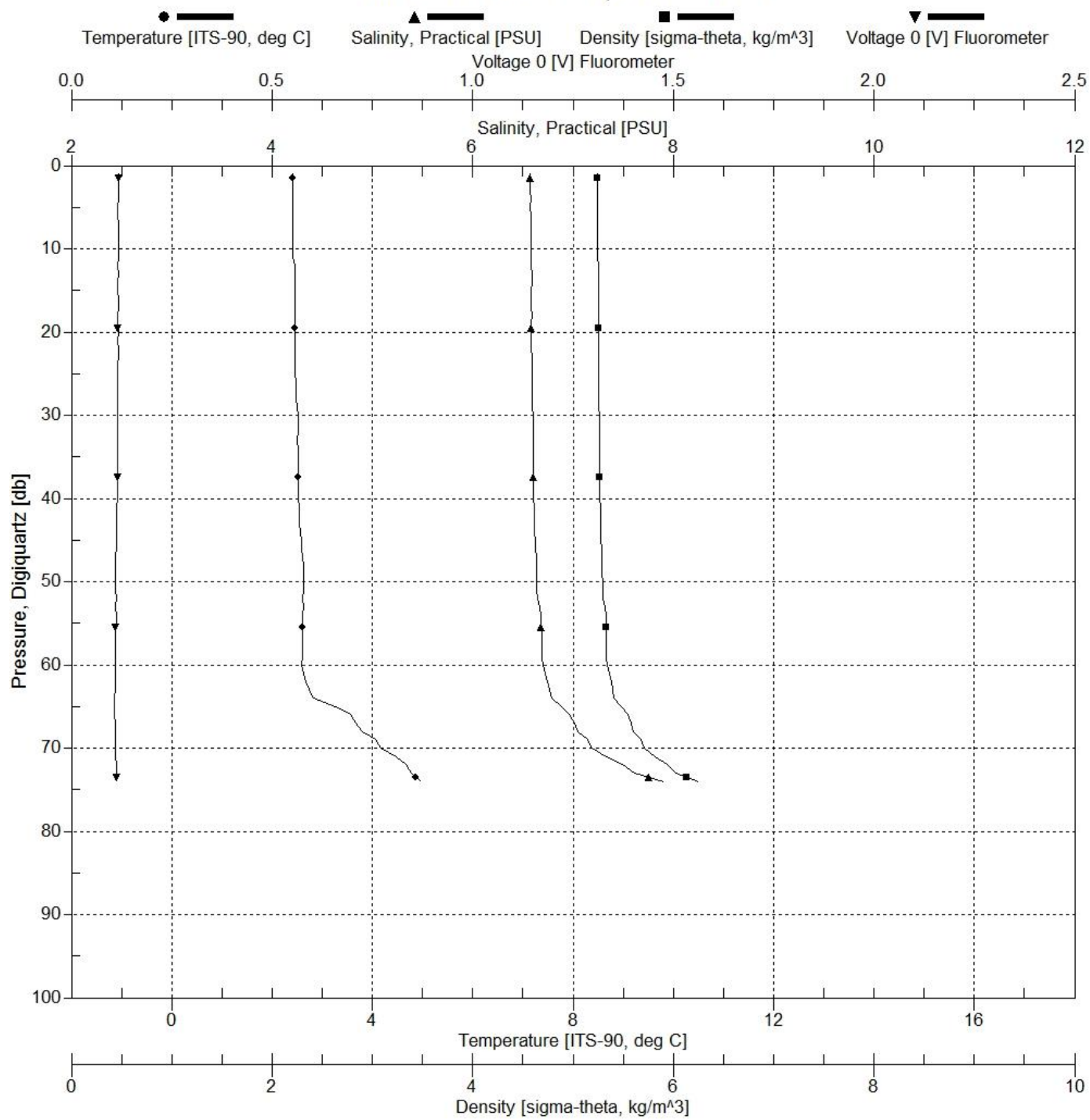


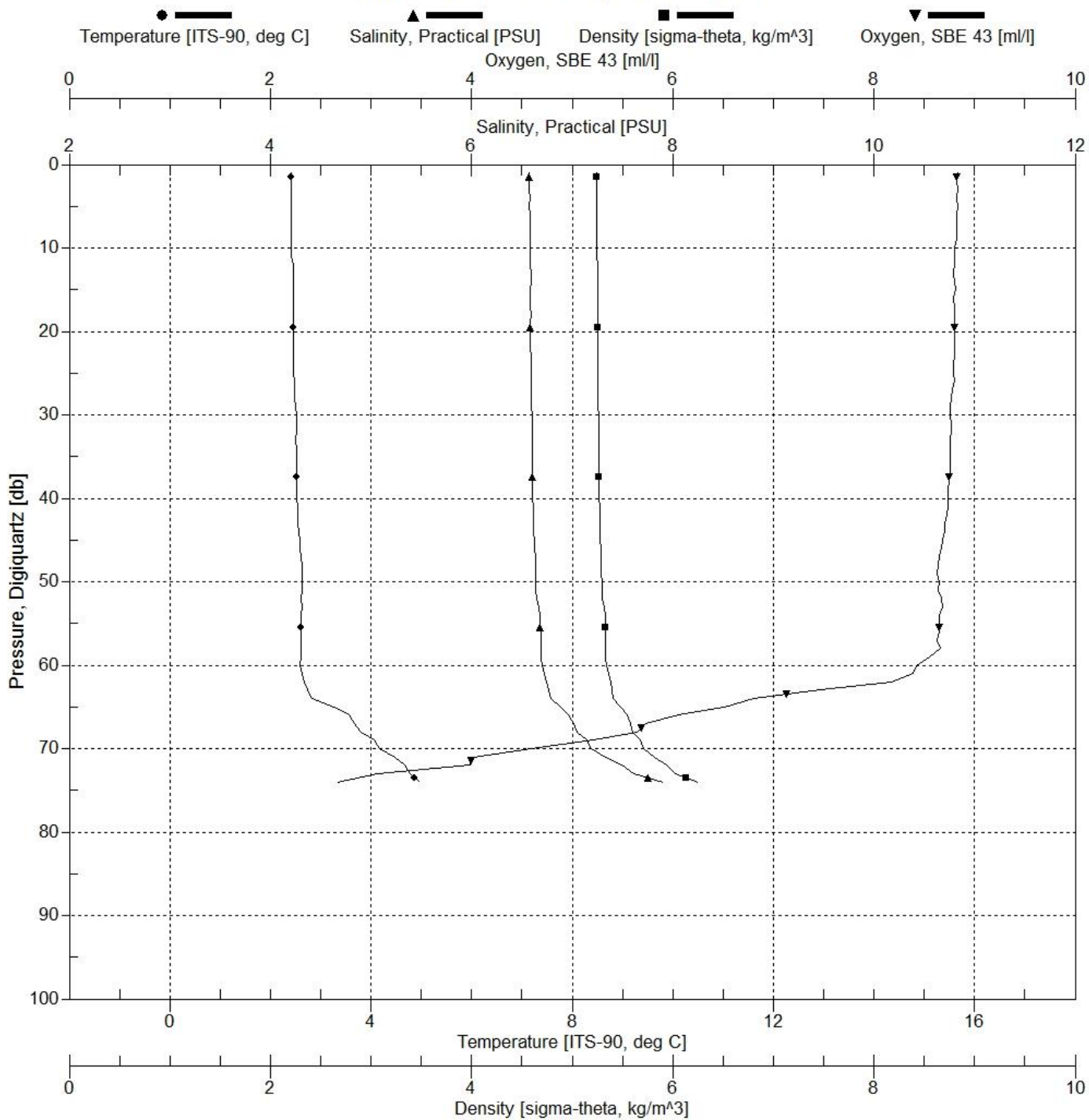
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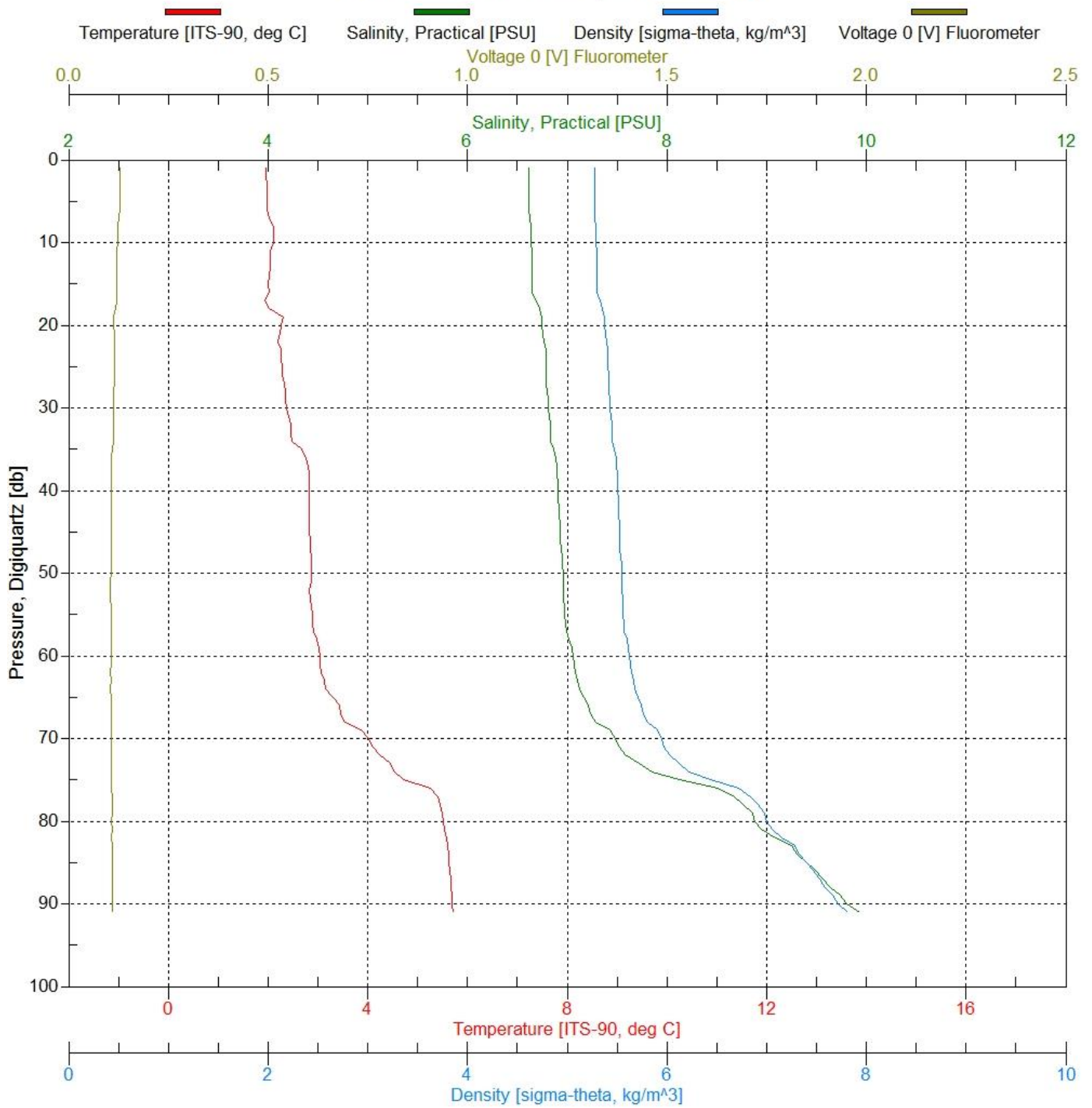
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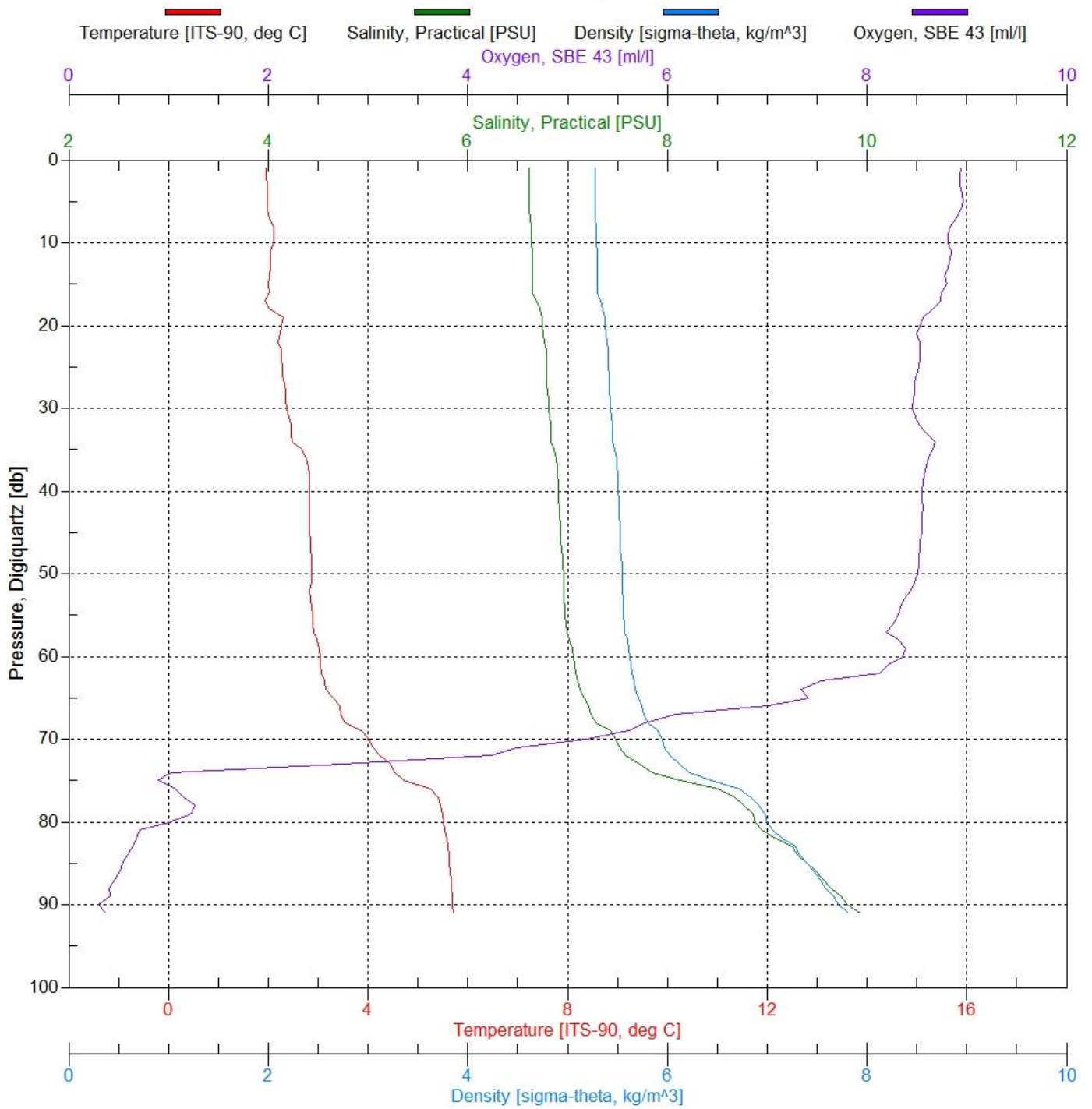




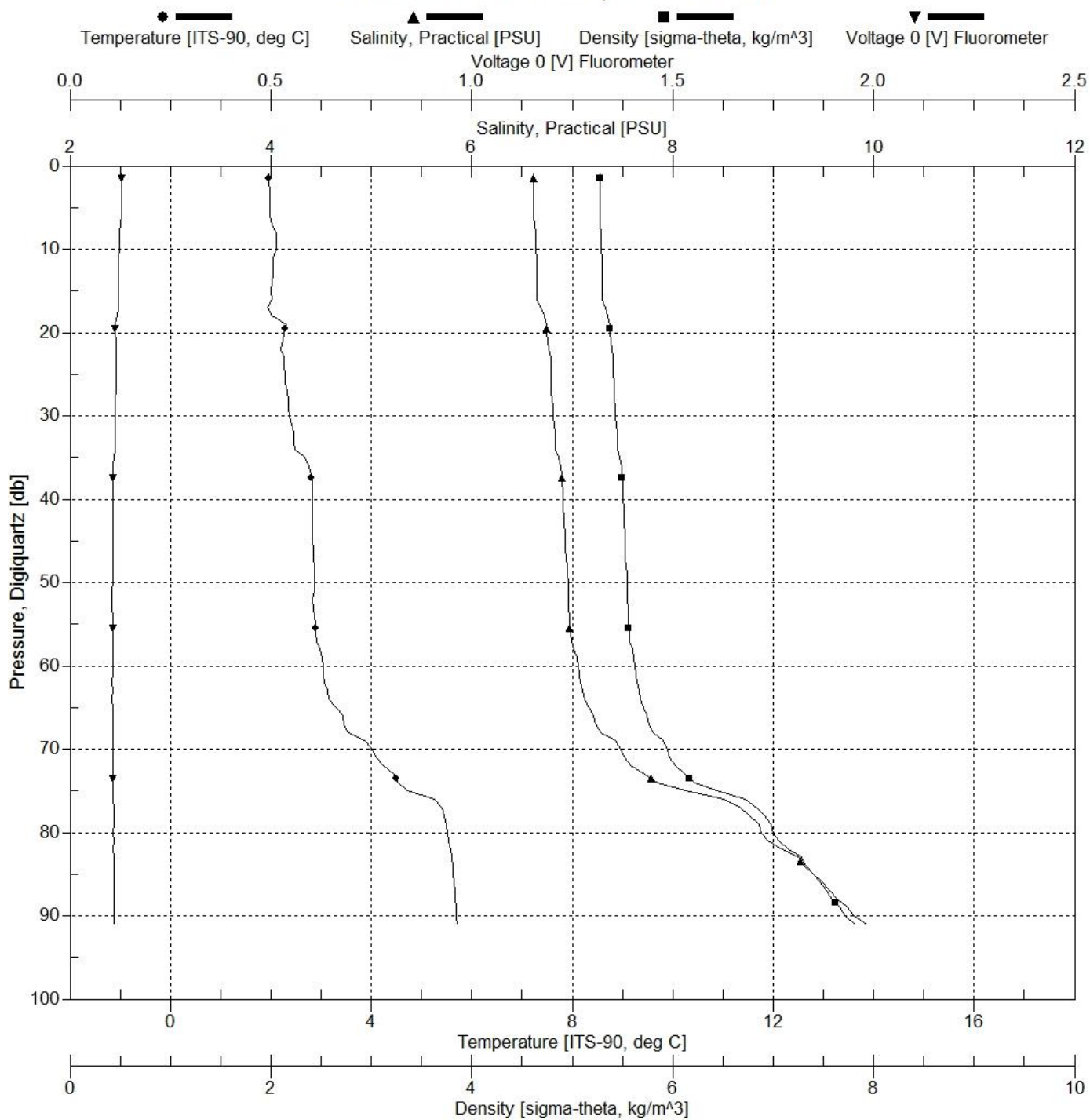
F62 22.1.2017 06.00, a170052.cnv



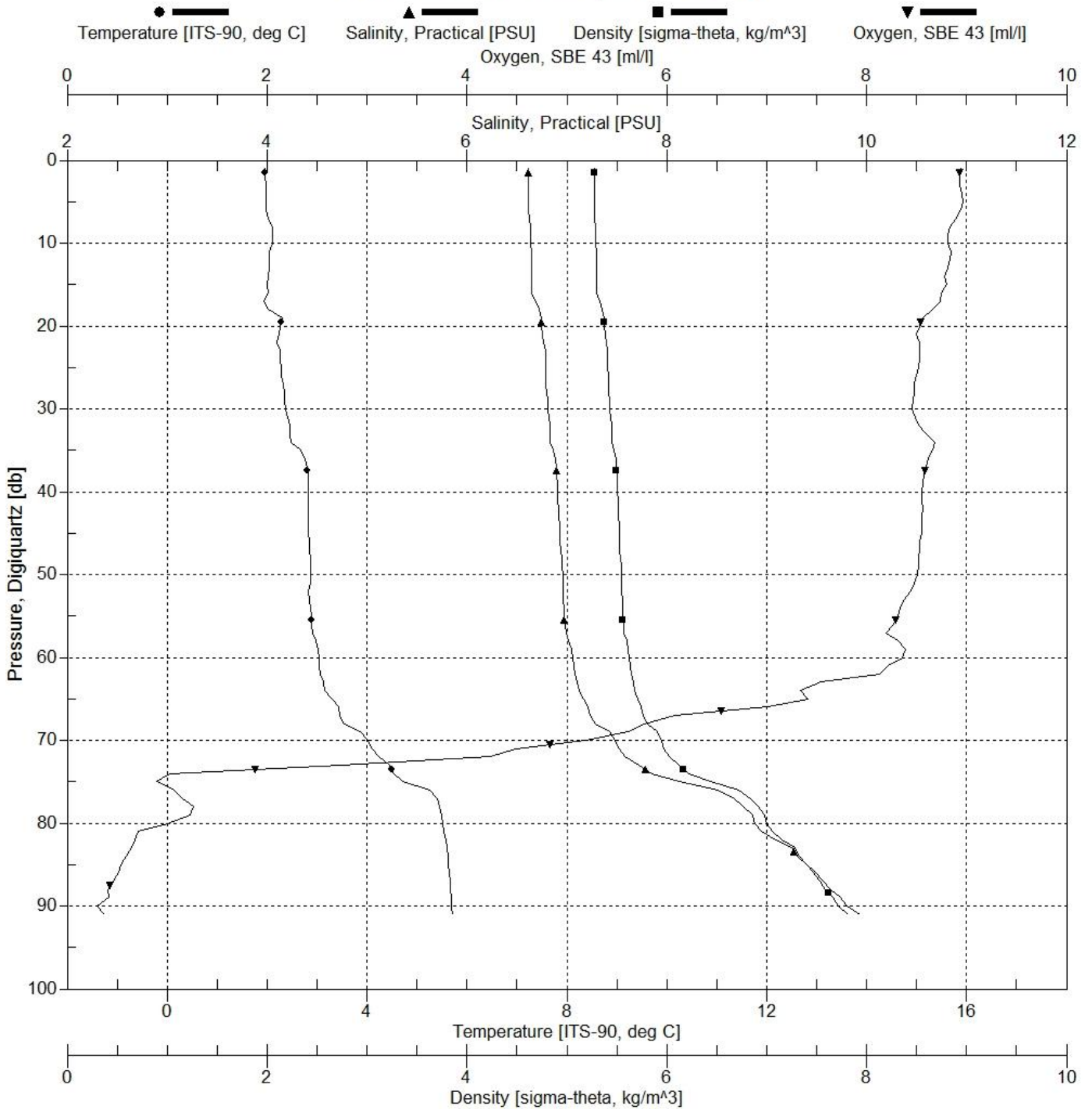
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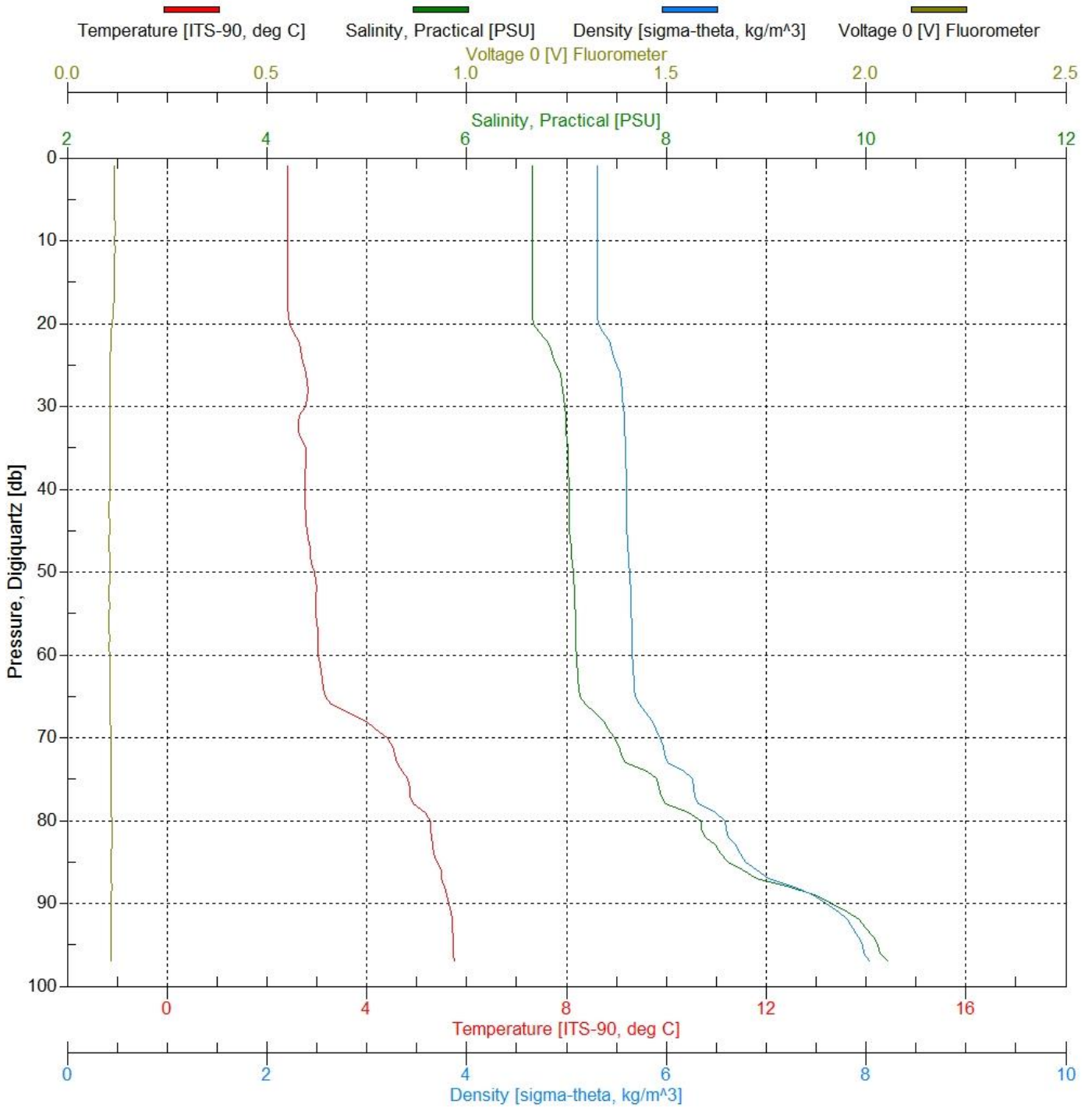
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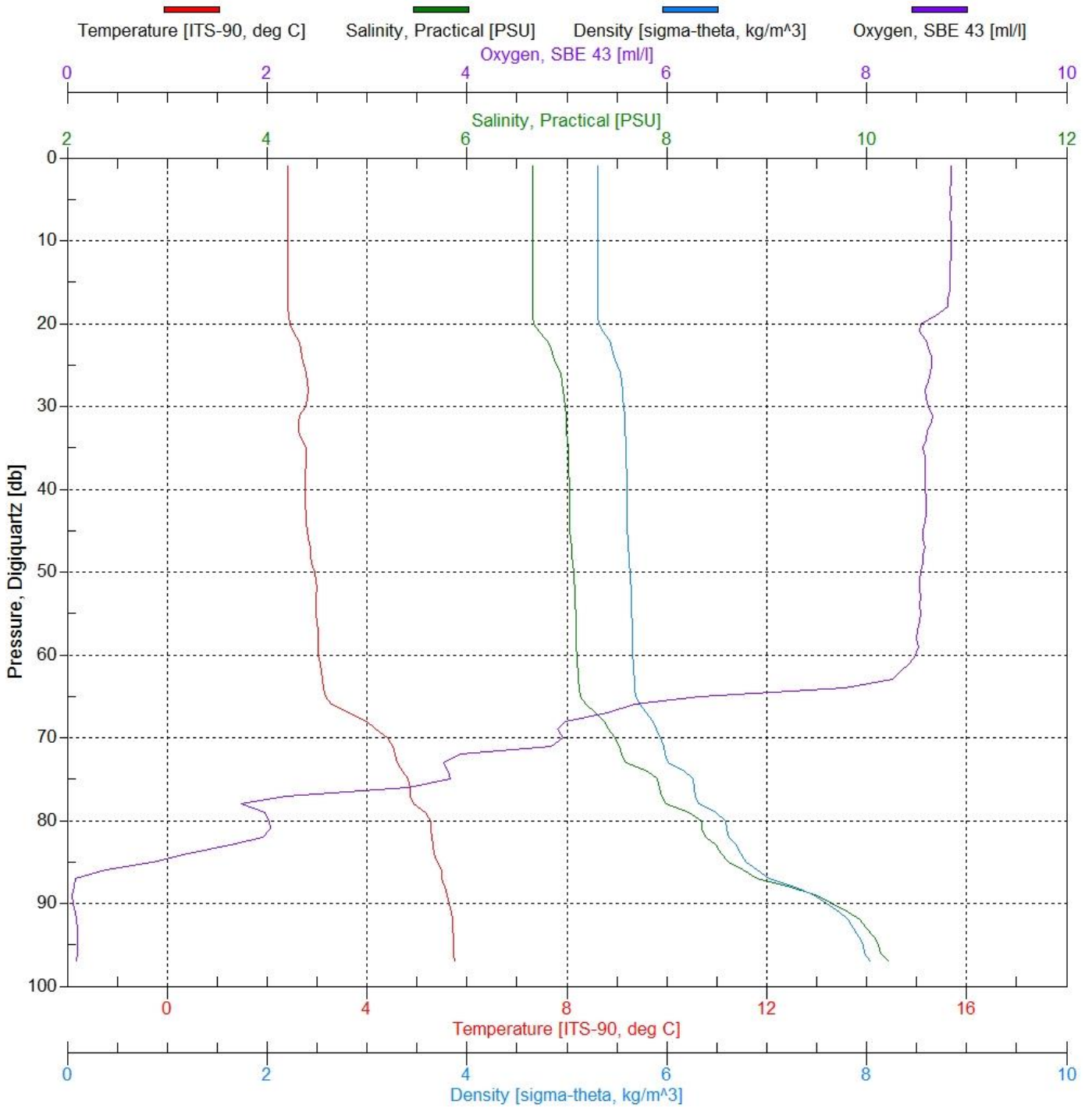
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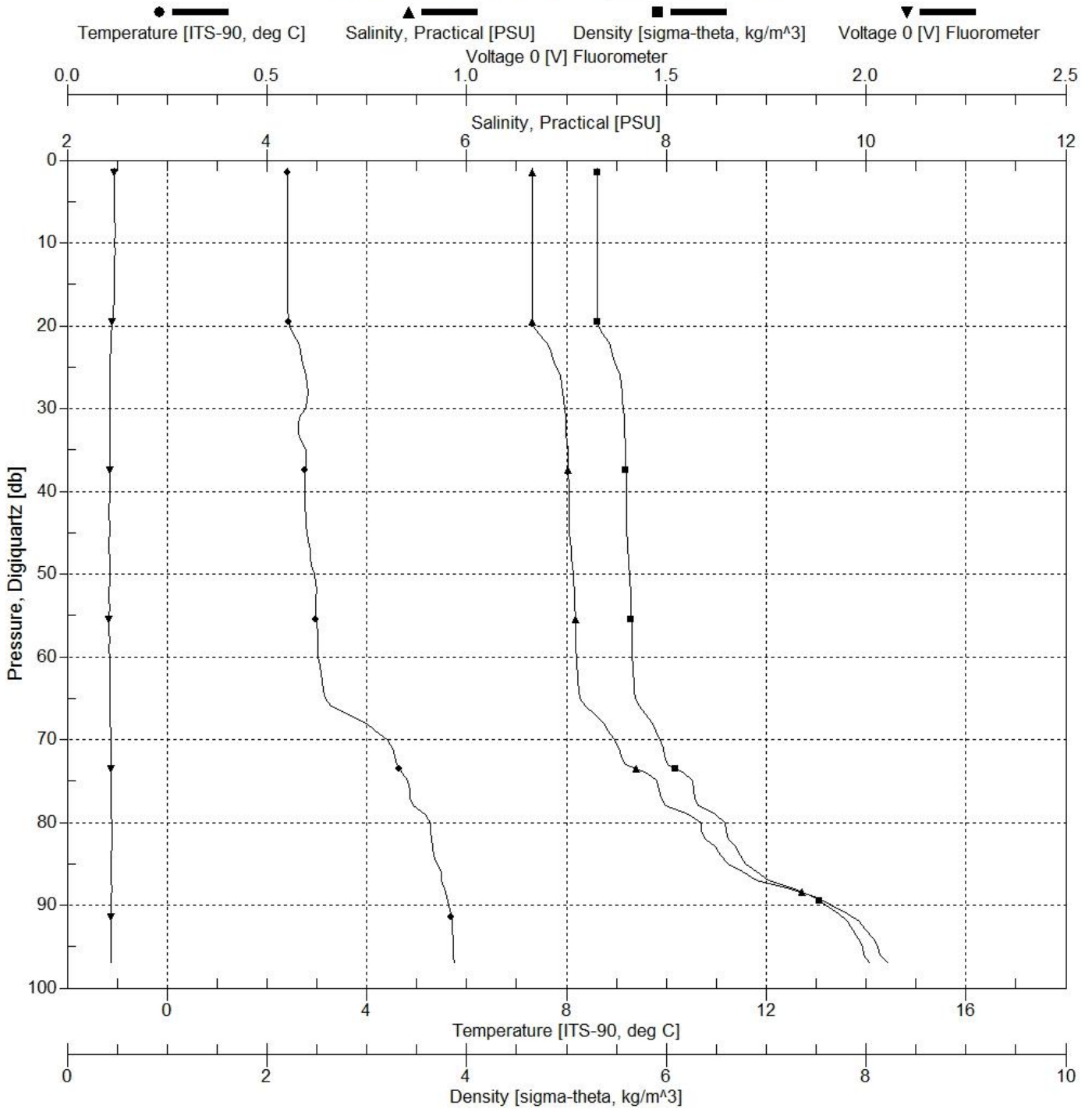
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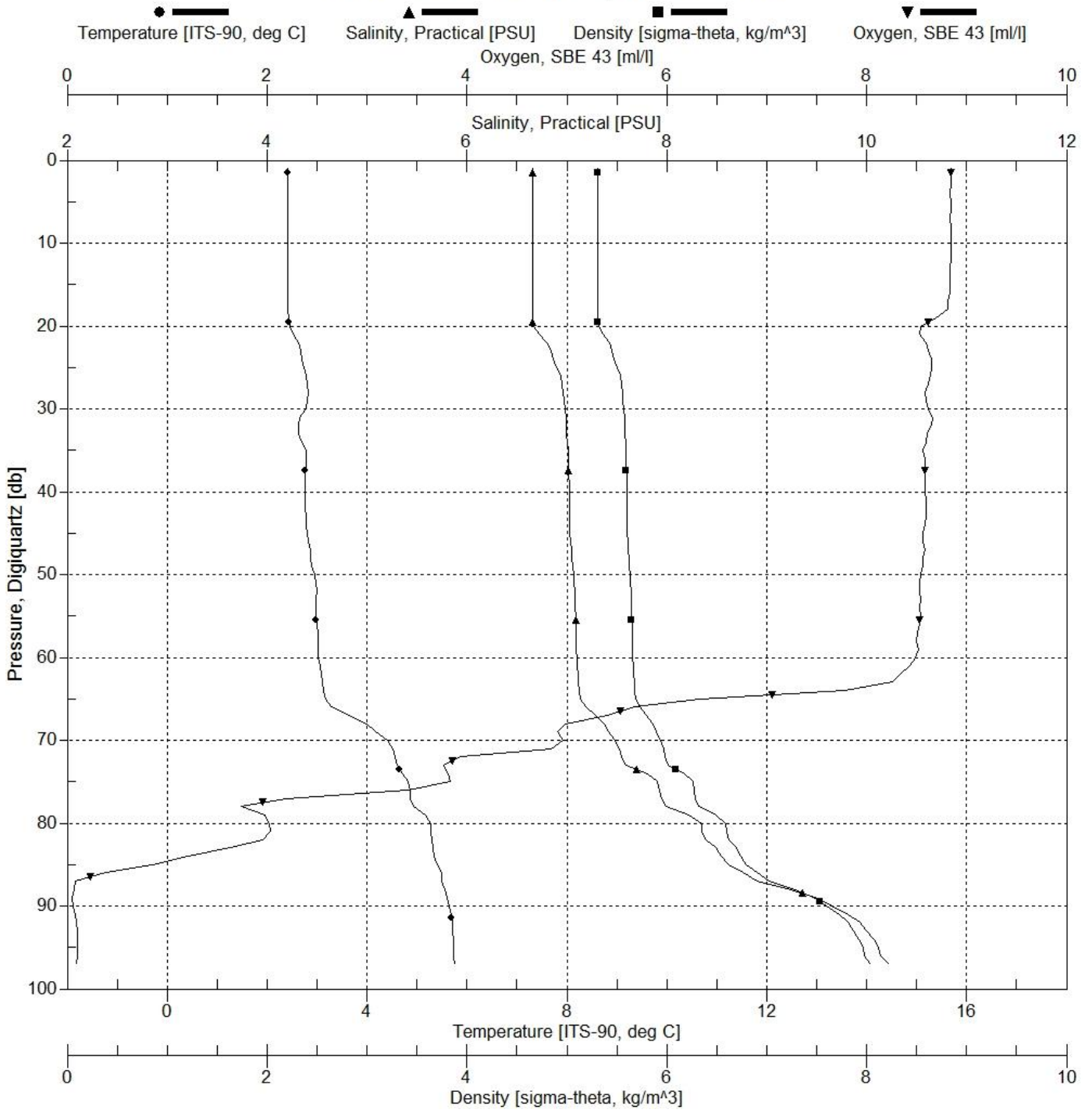
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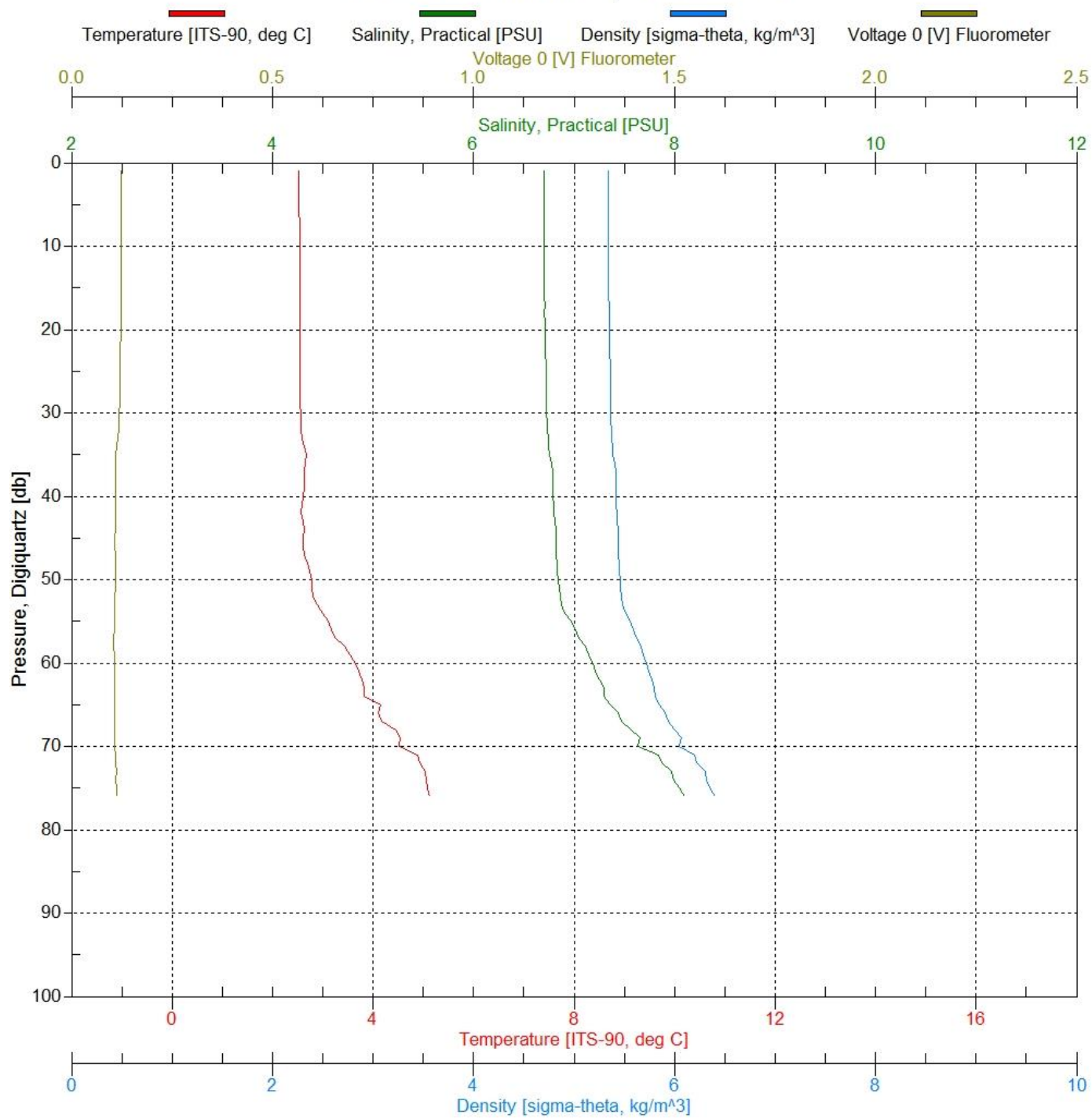
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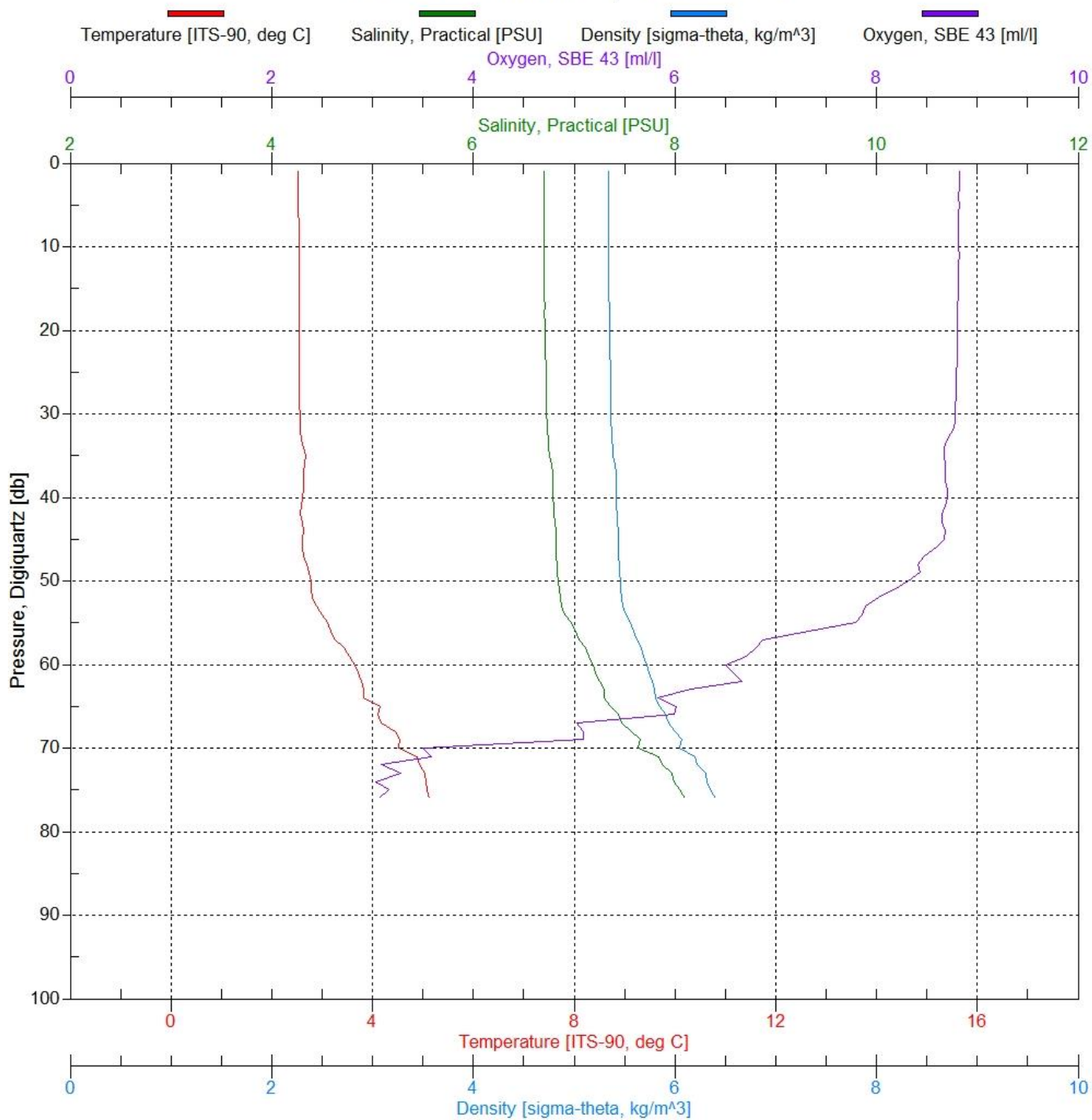
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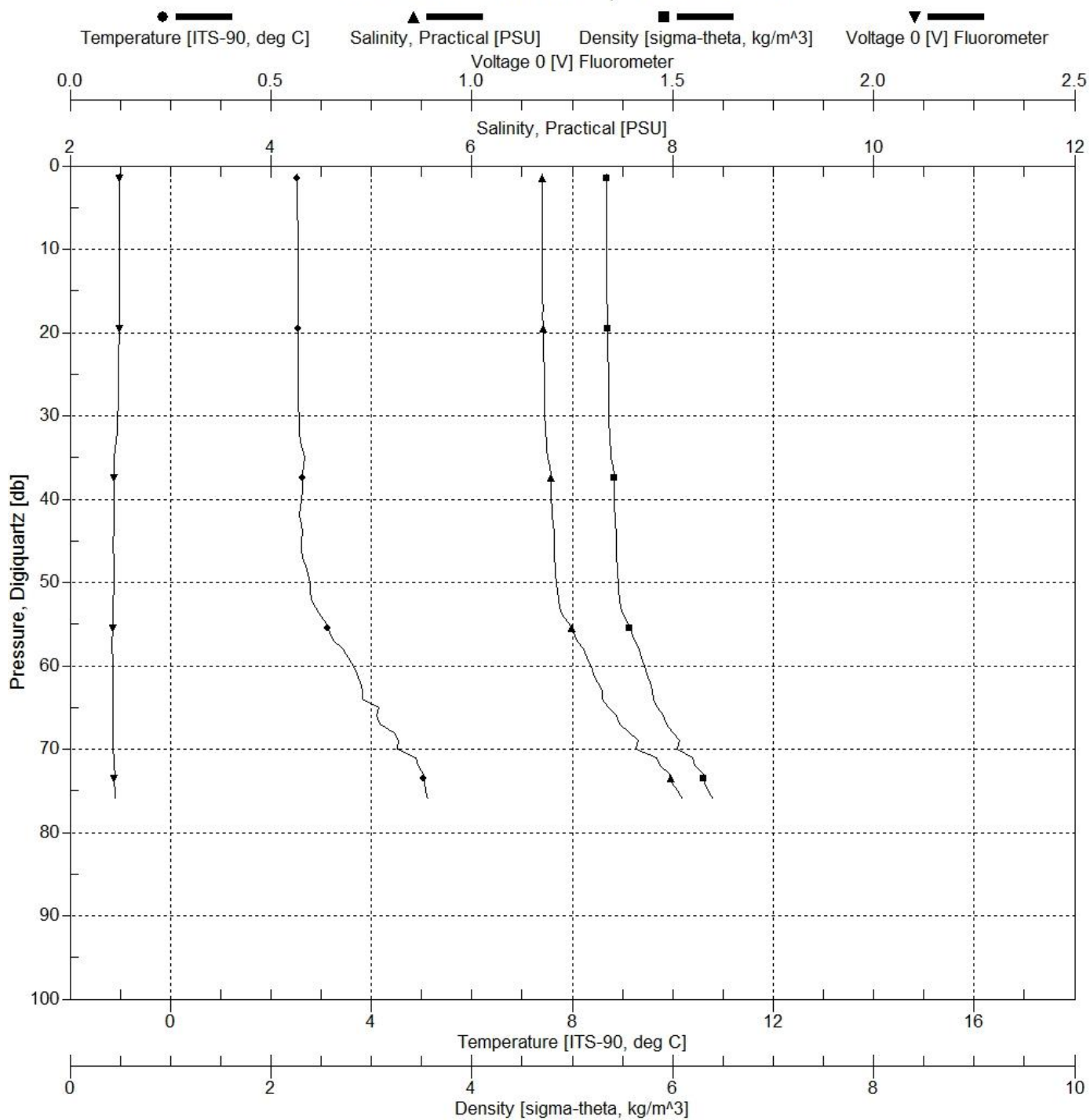


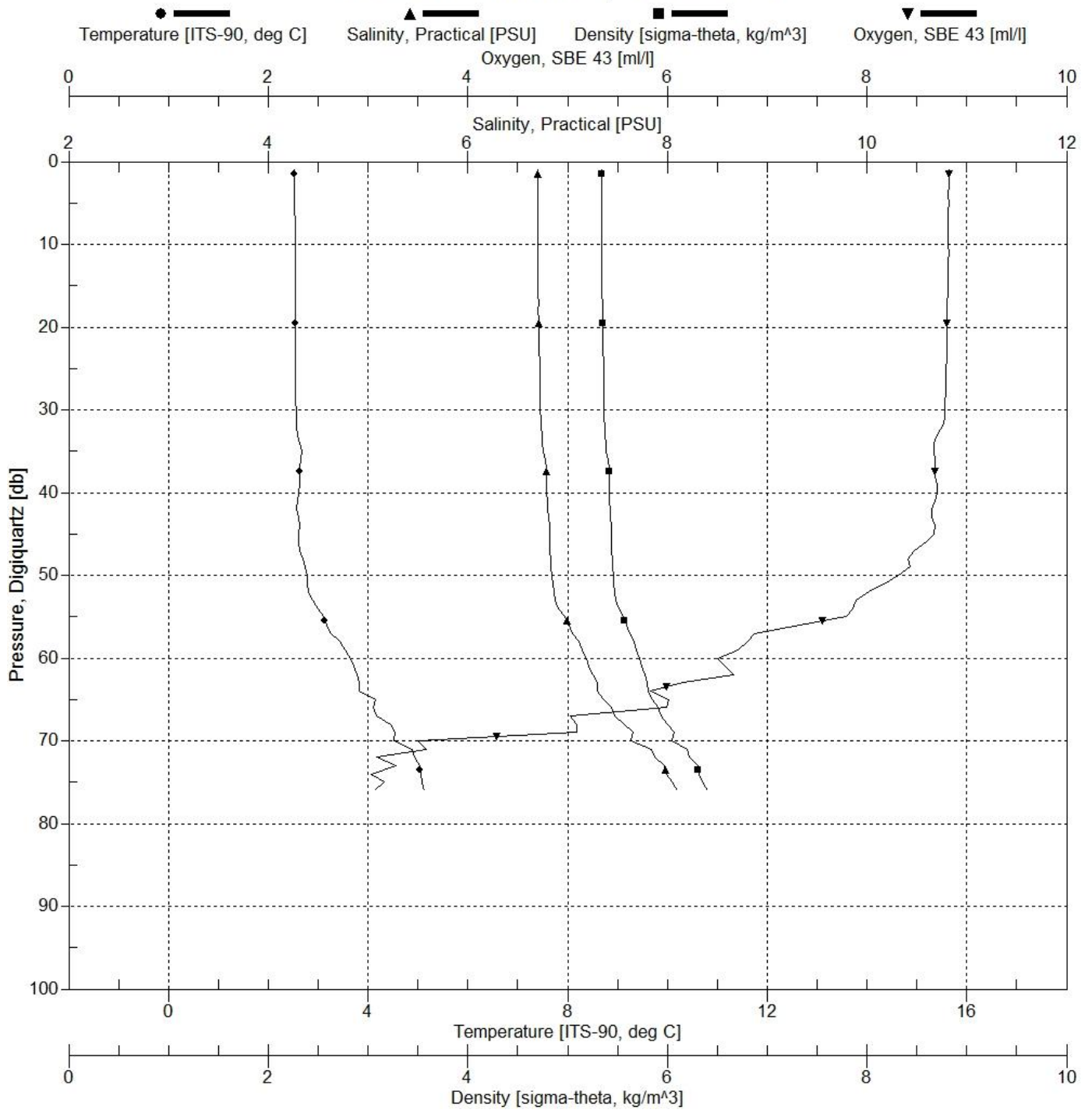
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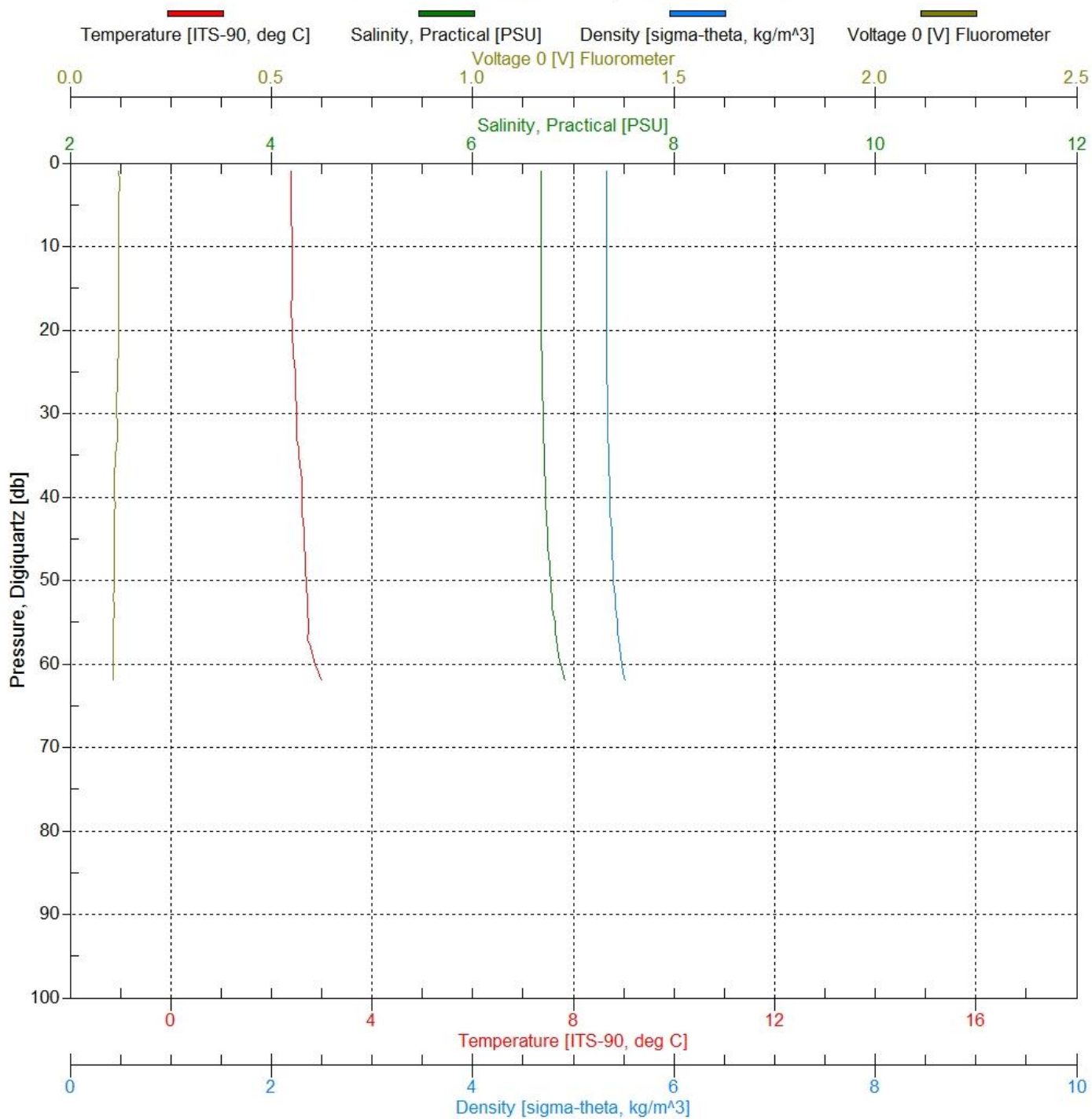
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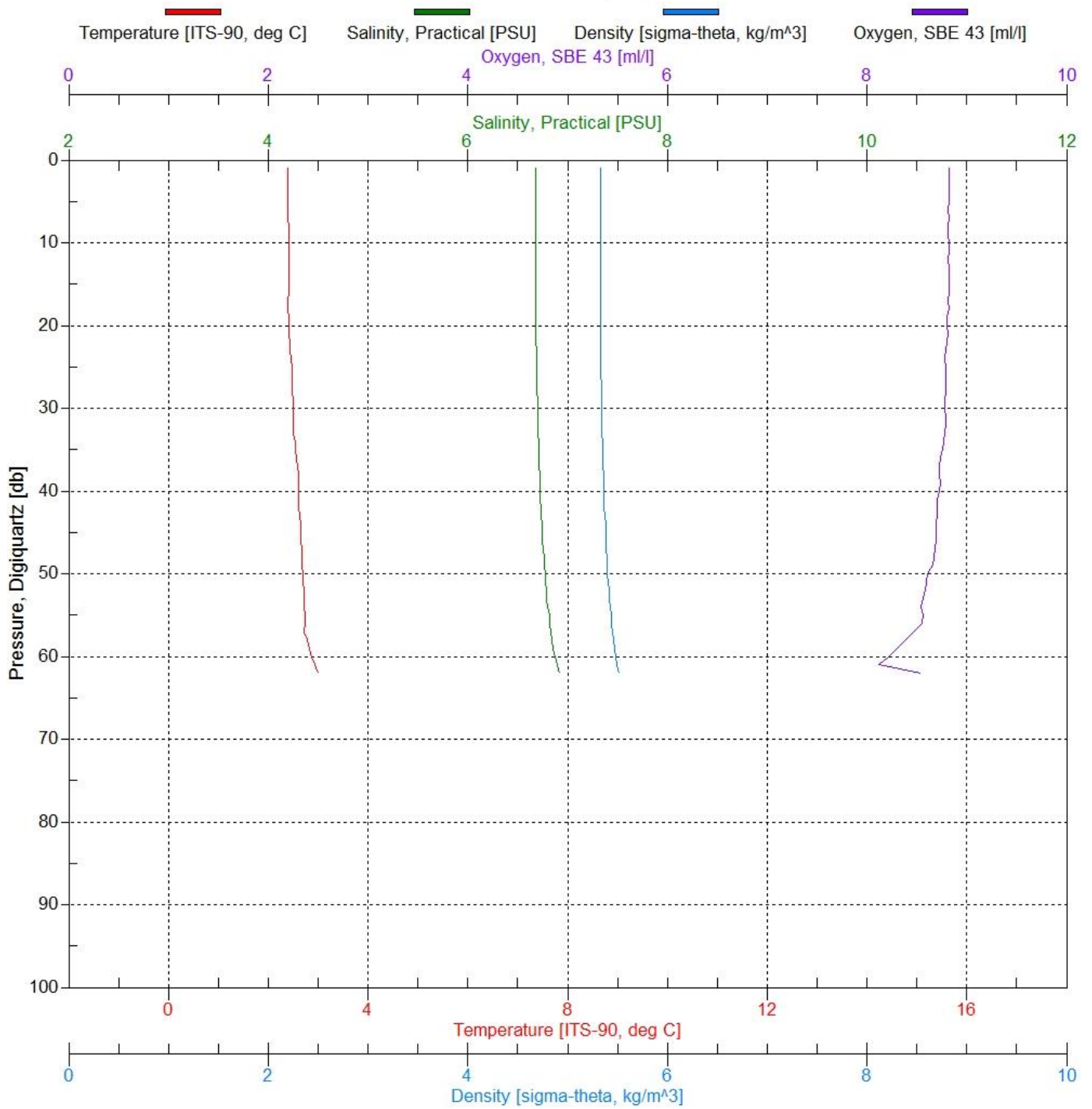


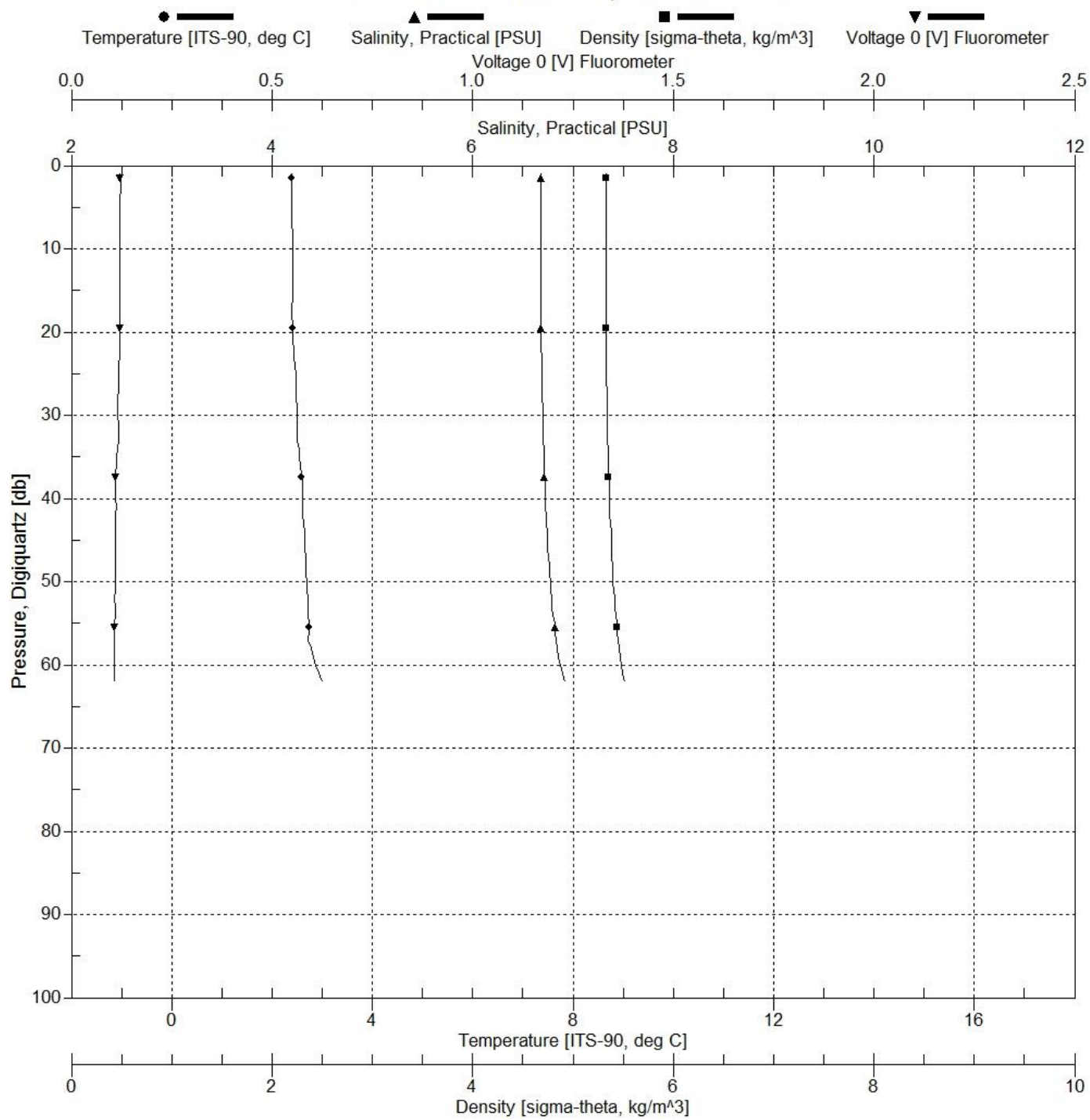


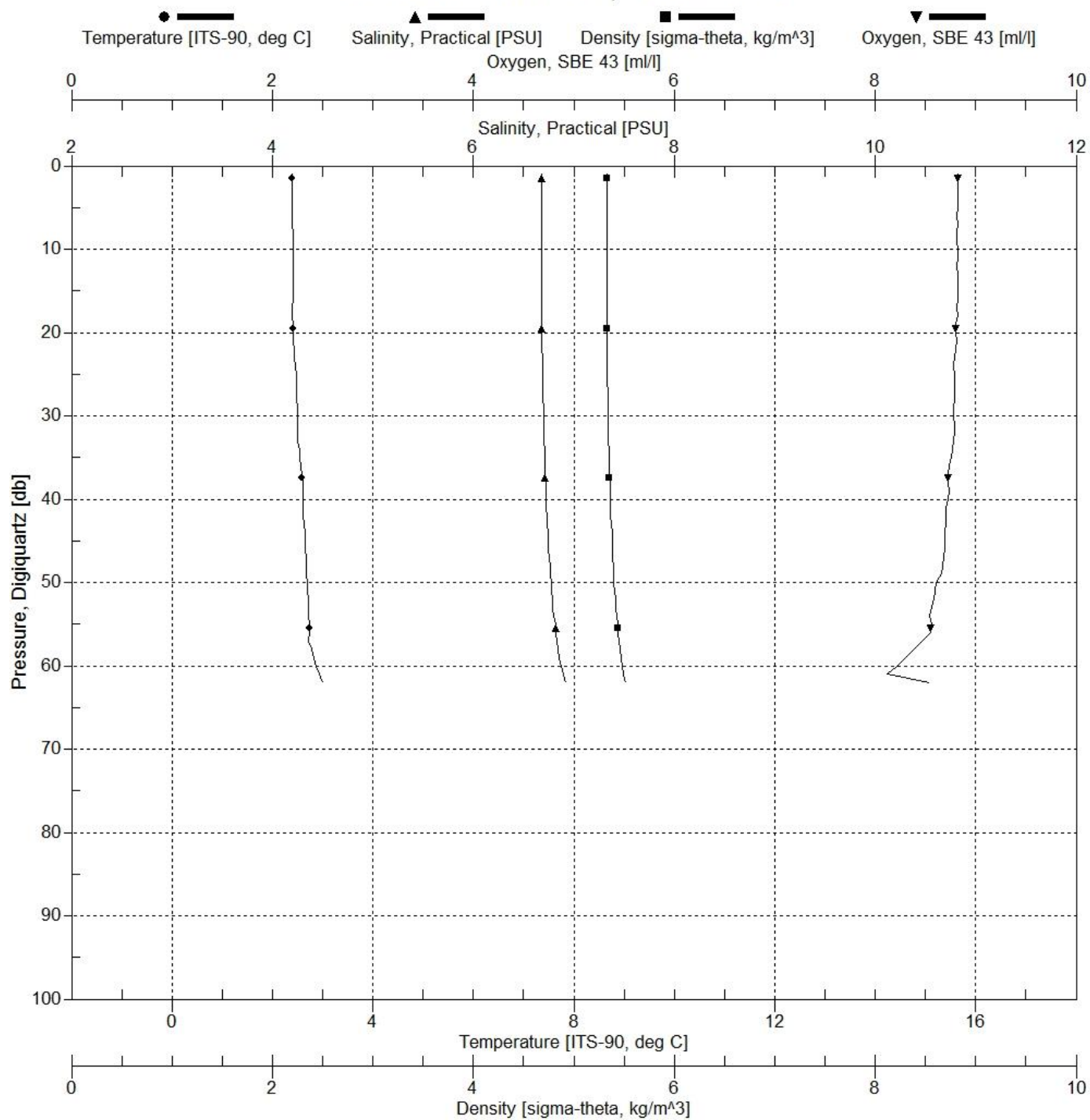
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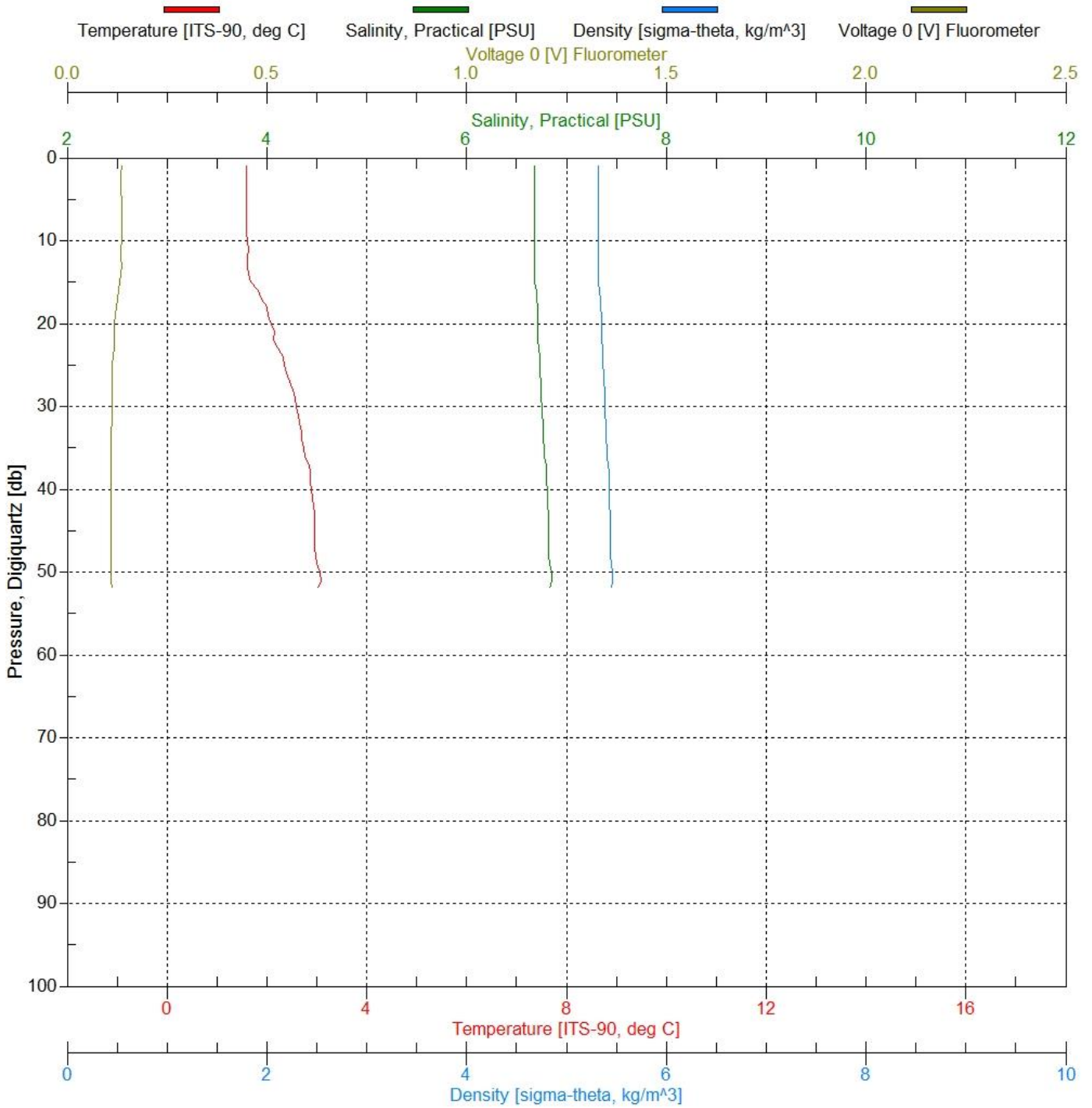
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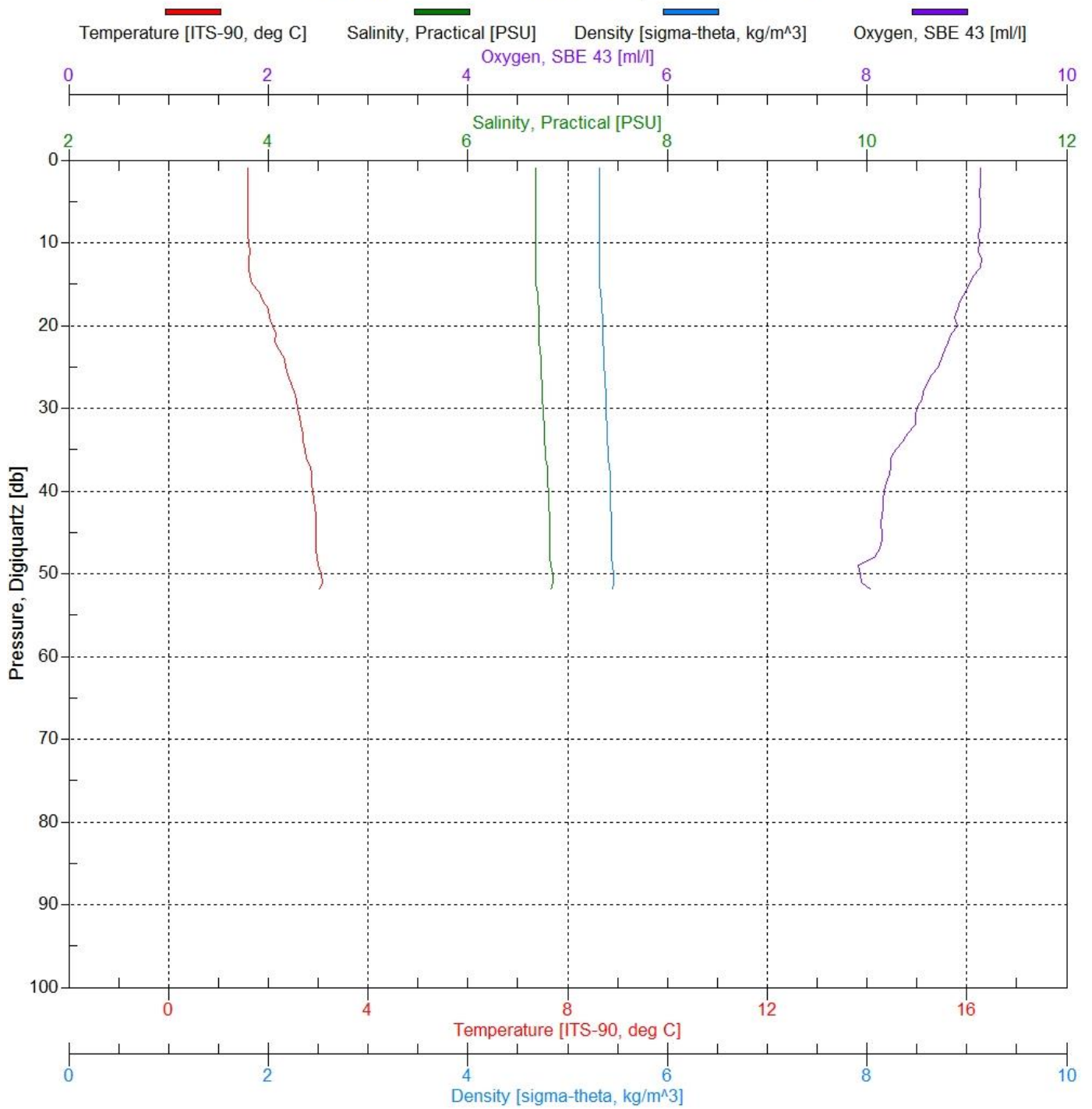




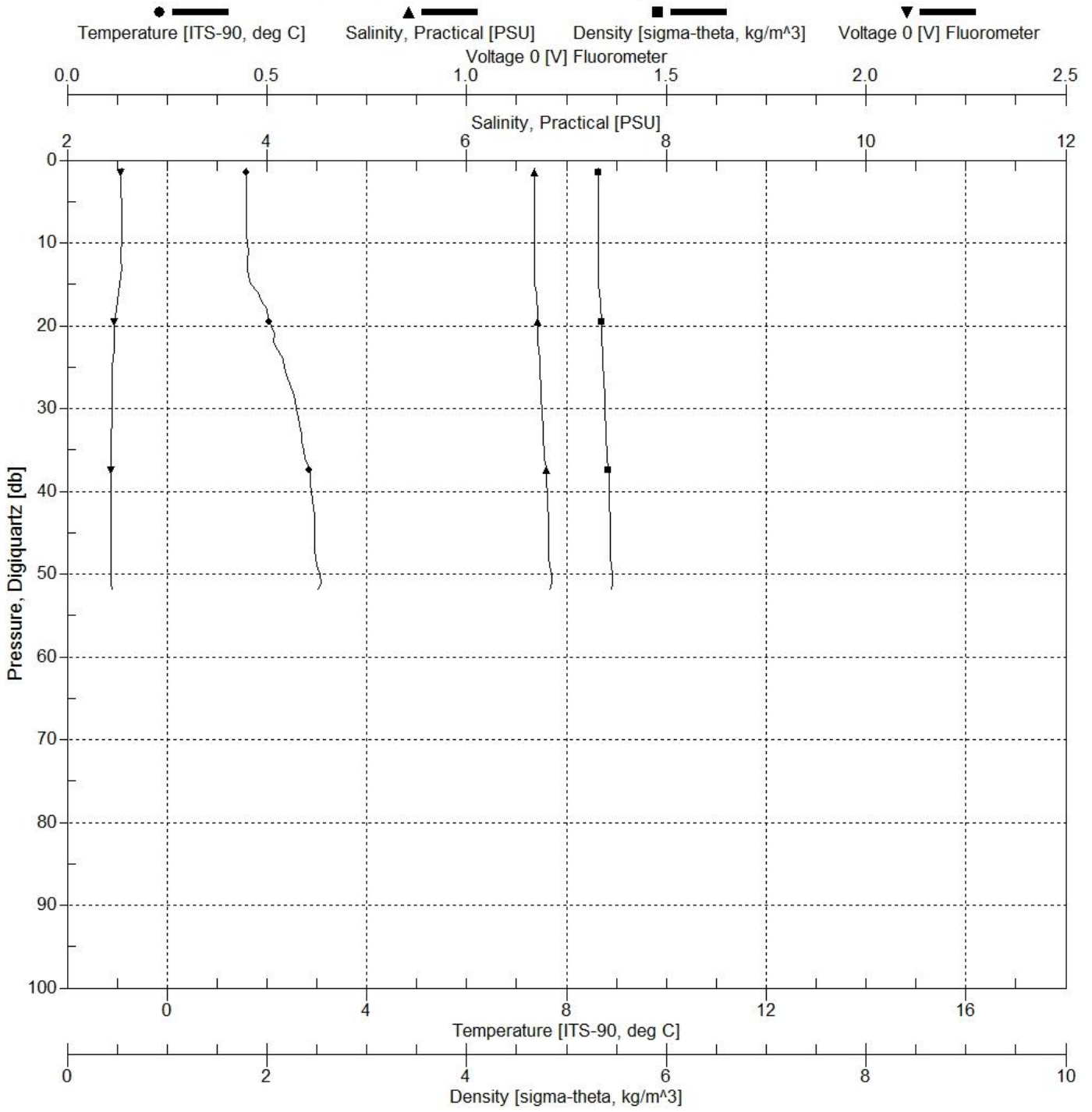
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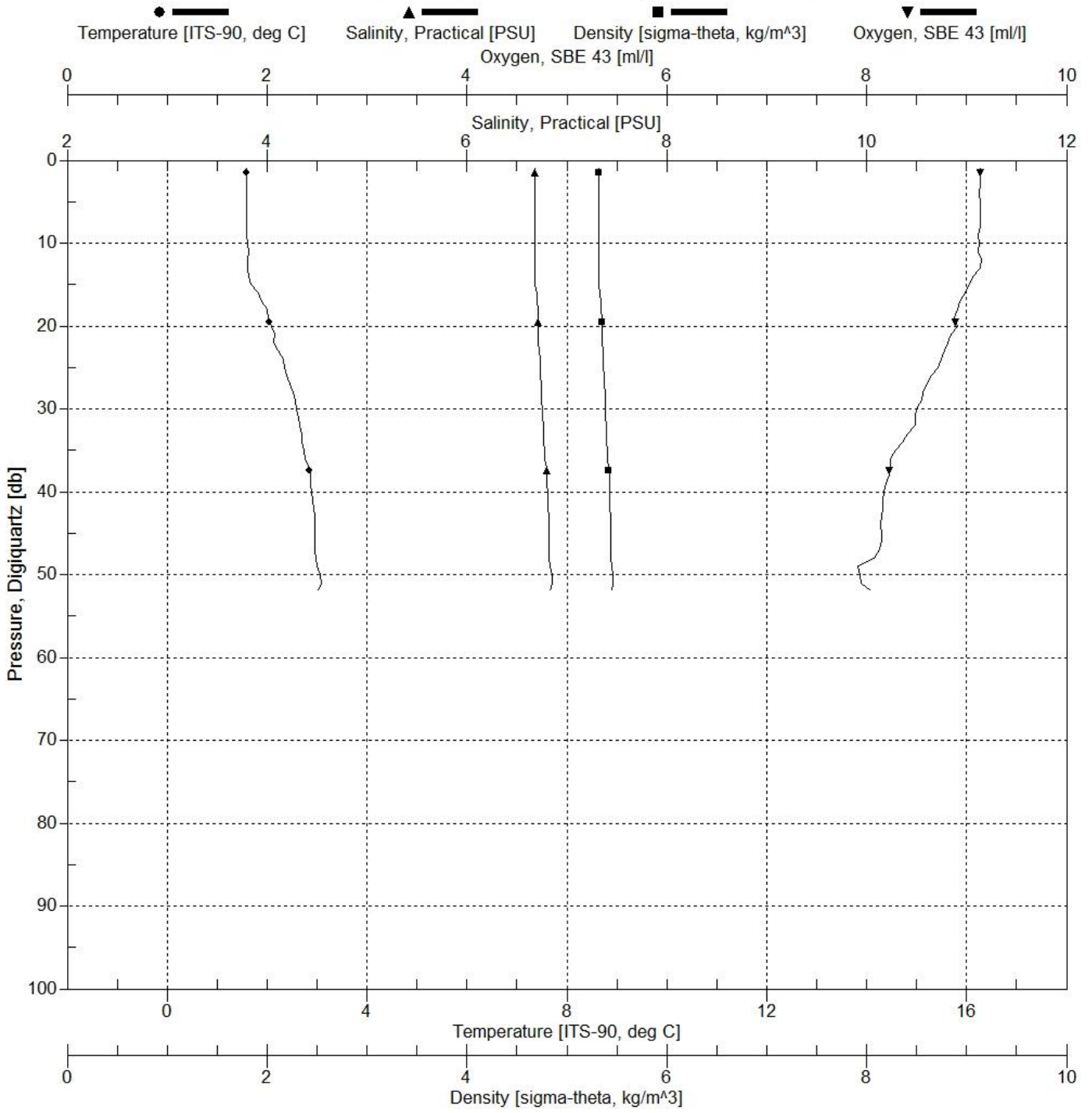
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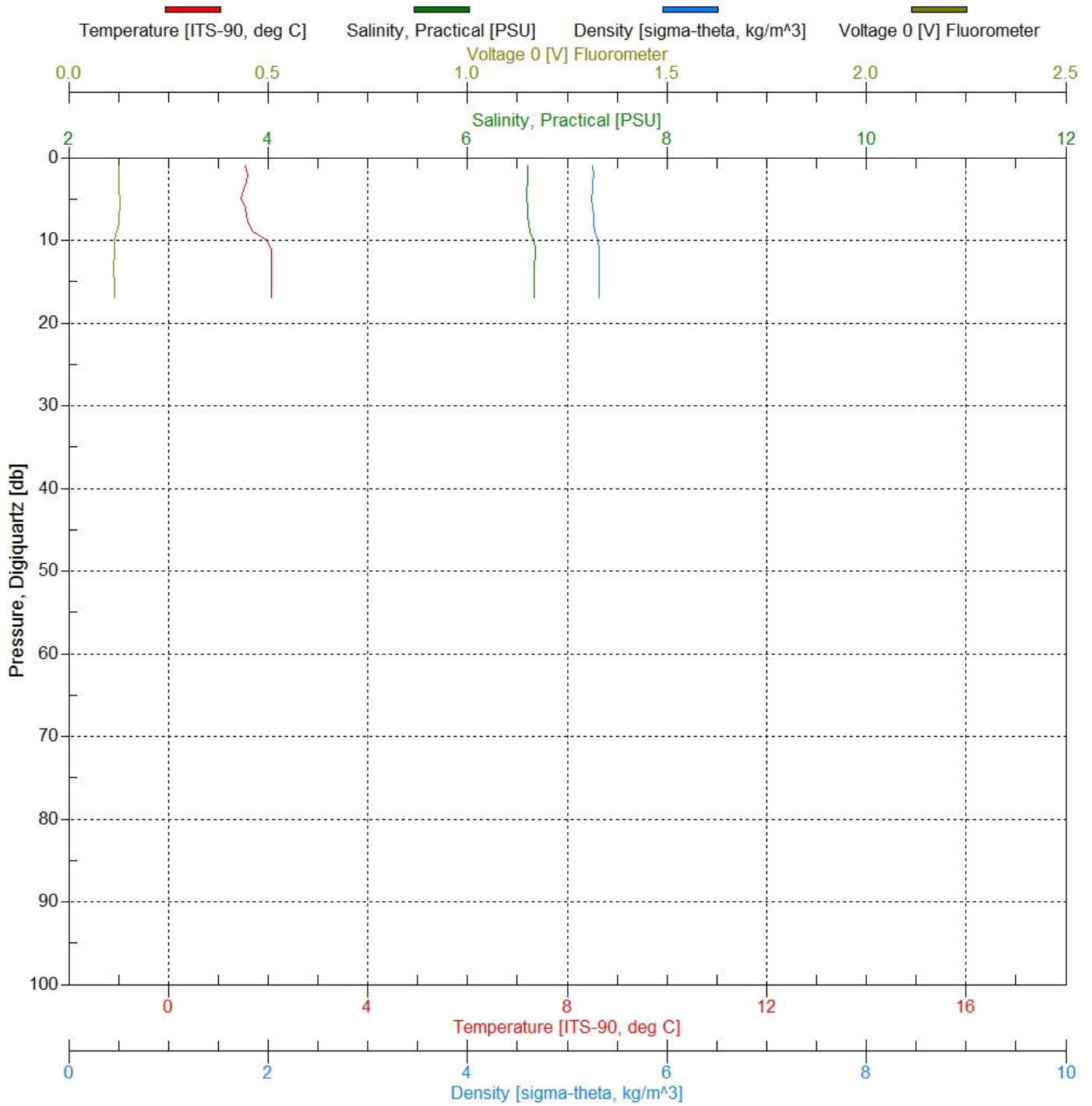
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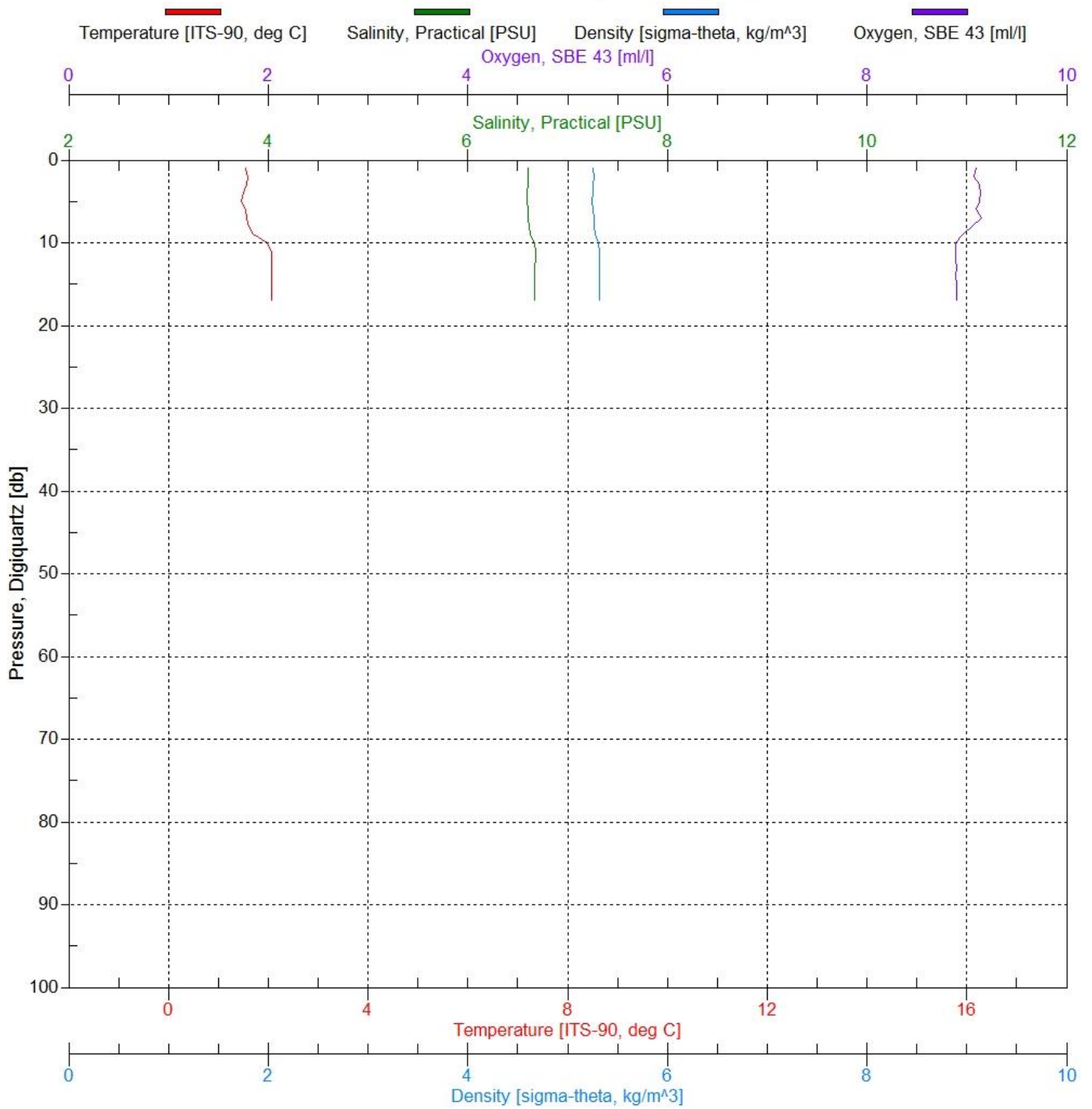
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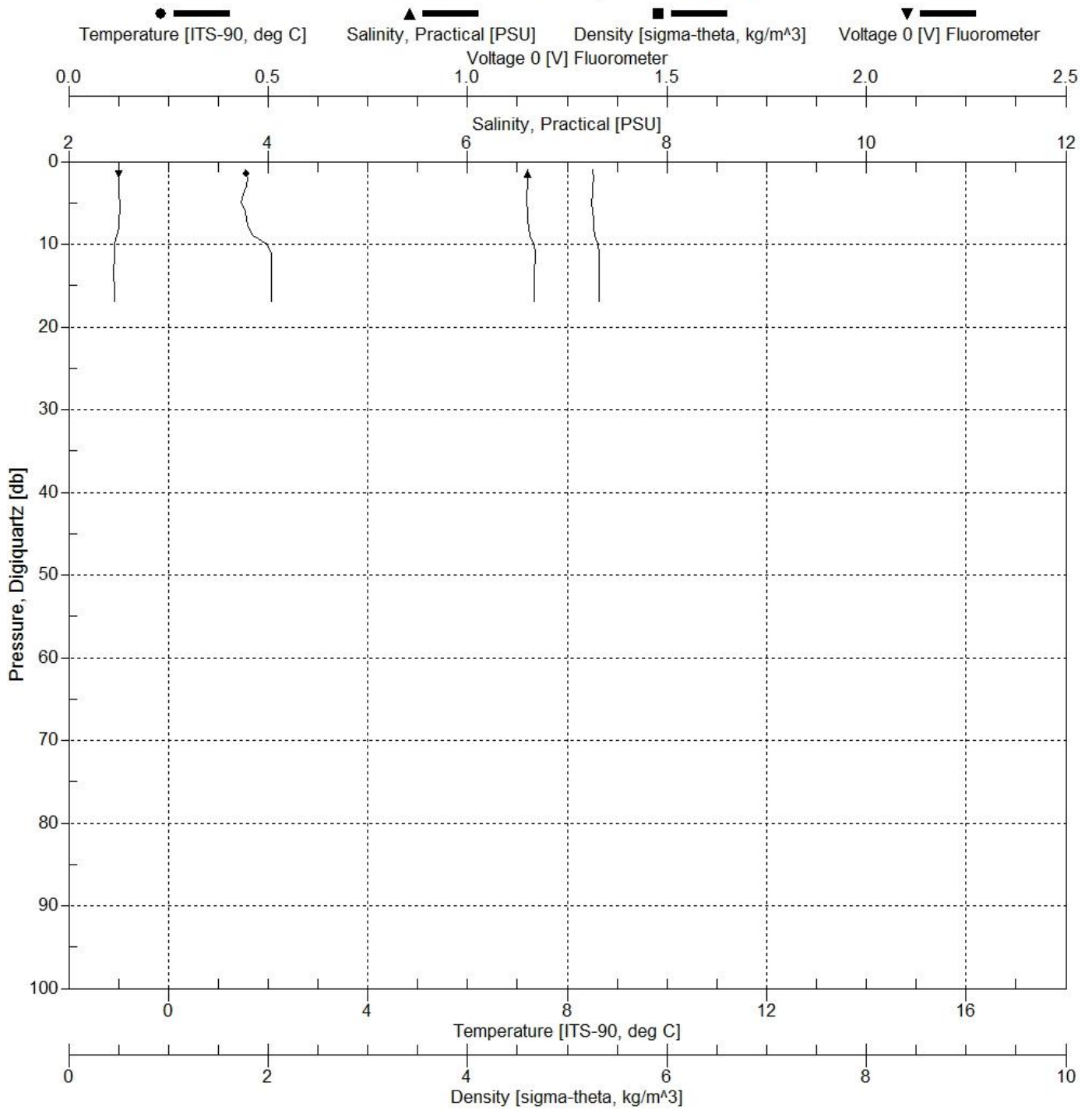
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XII3 23.1.2017 02.25, a170057.cnv



XII3 23.1.2017 02.25, a170057.cnv



XII3 23.1.2017 02.25, a170057.cnv

