SX716 Portable Dissolved Oxygen Meter

User Manual

IP57 WATERPROOF

APERA INSTRUMENTS, LLC

aperainst.com

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Scan the QR code below to watch the tutorial video on Youtube.

1 Brief Instruction

Thanks for purchasing Apera Instruments SX716 Portable DO Meter (will be called “the meter” in short in the following content).

Before using the meter, please read this instruction manual carefully in order to help you properly use and maintain it.

The meter can measure the parameters of DO and temperature of water solutions with high accuracy. It is the most cost-effective choice of a high-quality portable DO meter. It is suitable for applications in aquaculture, mining industry, power plants, environmental monitoring, etc., especially suitable for in-field use.

The meter has the following features:

1.1. Built-in microprocessor chip with the intelligent functions of auto. DO calibration, auto. temperature compensation, auto. salinity compensation, manual baromatric pressure compensation, data storage, function settings, auto. power off, and low voltage display etc.

1.2. Adopts digital filter technology to intelligently improve meter’s response speed and accuracy. The smiley face icon will appear when the reading is stable.

1.3. Built with a polaragraphic DO electrode with temperature and salinity sensors, which enables auto. temperature and auto. salinity compensation.

1.4. The polarographic DO electrode has a special electrode calibration sleeve. The electrode polarization only takes 5 minutes. Electrode adopts a combo-style membrane cap, which is very convenient to use. Each DO electrode comes with three backup membrane caps.

1.6. Meter’s LCD screen has clear and bright backlit display.

1.7. Built-tough. IP57 waterproof and dust-proof.

2 Technical Specifications

2.1 Dissolved Oxygen

Measuring range	(0 to 19.99) mg/L (ppm); (0 to 200.0) %
Resolution	0.1/0.01 mg/L (ppm) 1/0.1%
Accuracy	±0.30 mg/L (ppm), including electrode error
Response time	≤30s (25˚C, 90% response)
Temp. compensation range	(0 to 45) ˚C (automatic)
Salinity compensation range	(0 to 45) ppt (automatic)
Barometric pressure cocompensation range	(66 to 200) kPa (manual)
Automatic calibration	Air saturated by water; water saturated by air
Electrode type	Polarographic

2.2 Other Technical Parameters

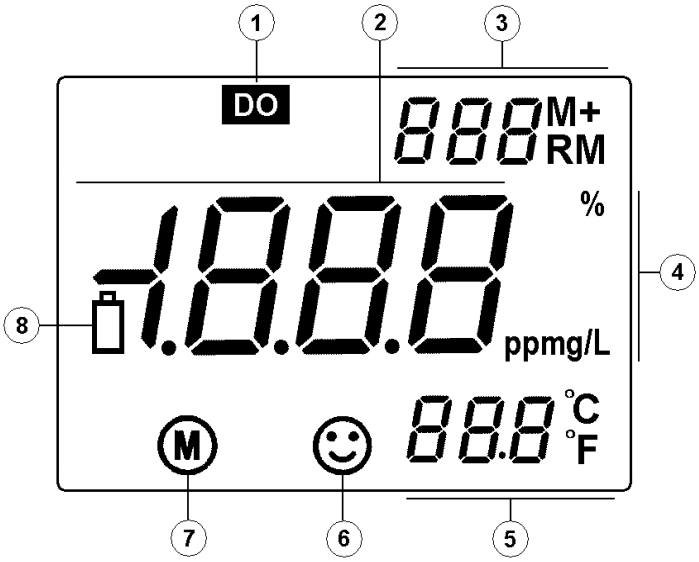
Data storage	100 sets
Data content	Serial number, measuring value, measuring unit, and temperature
Power Supply	Two AA alkaline batteries (1.5V x2)
Dimensions and weight	Meter: (65×120×31) mm/180g Carrying case: (255 x 210x 50) mm/790g
Quality and safety certification	CE, ISO 9001:2015

2.3 Working Condition

Working temperature	5 to 35˚C
Working humidity	≤85%
IP rating	IP57 water-resistant

3 About the Meter

3.1 Screen Display



① —— Parameter icon

② —— Measuring value

③ —— Serial number and icon as measuring value to be stored and recalled and indication icon for special states.

M+ — measuring value to be stored; RM — Stored value to be recalled;

④ —— Measurement unit

⑤ —— Temperature measuring value and unit

⑥ —— Measurement stabilization icon

⑦ —— Electrode calibration indication icon

⑧ —— Indication icon of low battery power; appears when the voltage is less than 2.6V, calling attention to replace the batteries.

3.2 Keypad

The meter has 5 operation keys in total.

Short press: press time <1 seconds; Long press: press time >2 seconds

3.2.1. ON/OFF – Power on/off

3.2.2. CAL – Calibration key.

(a) When in measurement mode, press this key to enter calibration mode.

(b) When in parameter setting mode, press this key to make changes.

3.2.3. MODE – Function key

Press the key to enter the parameter setting mode P1, P2, P3…

3.2.4. ☼ ENTER – Backlight and confirmation key

(a) When in measurement mode, short press (less than 1.5s) to turn on/off the back light display.

(b) When in calibration mode or the parameter setting mode, press this key to confirm, and then the meter enters measurement mode;

(c) When in measurement mode, hold the key to change units in turn: mg/L→ppm→%, when the desired unit appears, release the key to select it.

3.2.5. M+ RM – The combination key of data logging and recalling

(a) Short press to save the readings, long press to recall the saved readings when in the measurement mode.

(b) When in the parameter setting mode, press this key to change the number or ON/OFF state.

3.3 Data Log, Recall and Delete

3.3.1. Save the measurement:

In measurement mode, when the reading is stable and smiley face icon stays on screen, short-time press M+ RM key to save the measurement data. **M+** icon and the data serial number will show up on the upper right corner. The meter can store up to 100 sets of data.

3.3.2. Recall saved data:

(a) In measurement mode, long press the M+ RM key, the meter will recall the last saved data and the serial number. **RM** icon will appear in the upper right corner of the screen. Short press CAL or M+ RM key again, the meter will recall all the data in turn, hold CAL or M+ RM key to quickly review the data.

(b) In data recalling mode (**RM** and serial number in the lower right corner of the screen), press ☼ ENTER key to return to measurement mode.

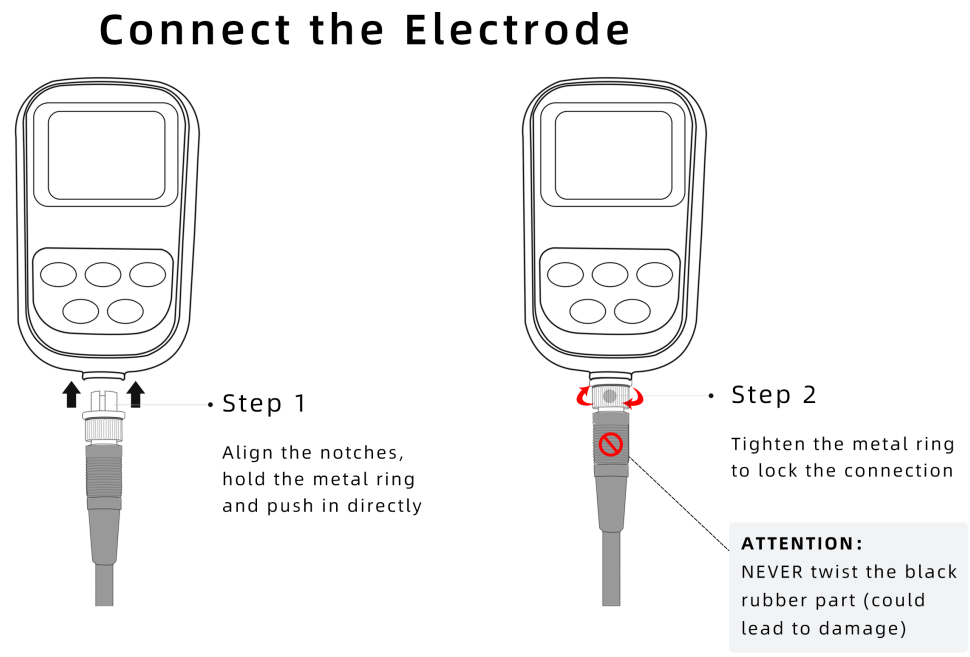
3.3.3. Delete the saved data:

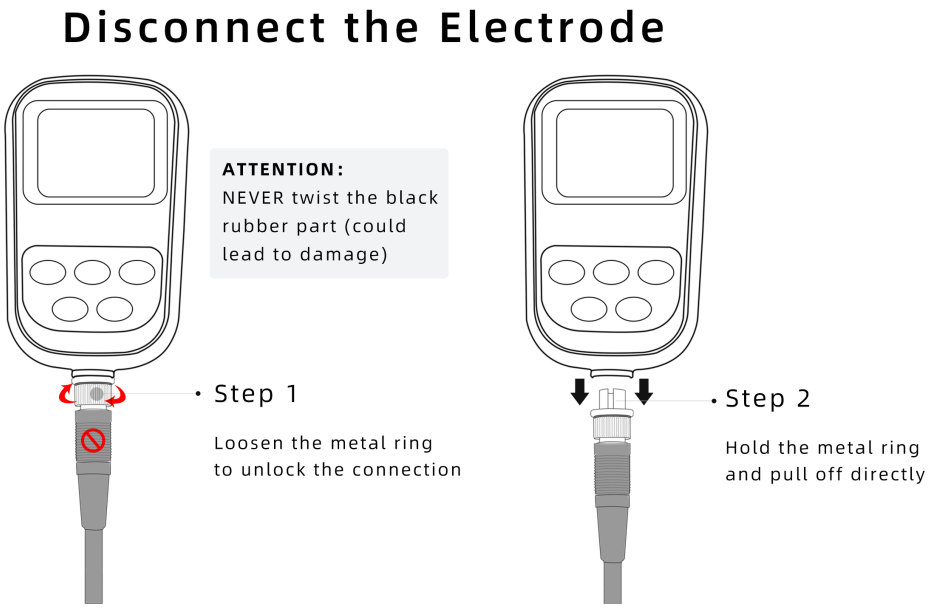
In data recalling mode, hold ☼ ENTER key for 5 seconds, **CLr** will show up for 2 seconds, meaning that all the saved data have been eliminated. Then the meter will return to measurement mode.

4 Dissolved Oxygen

4.1 Preparation before use

4.1.1. Electrode connection





4.1.2. Connect the DO electrode. Then Press ON/OFF key to power on the meter.

4.1.3. Choose DO unit: Hold ENTER to switch among mg/L, ppm and %. When the desired unit shows up, release the button to confirm the unit selection.

4.1.4. Check the sponge

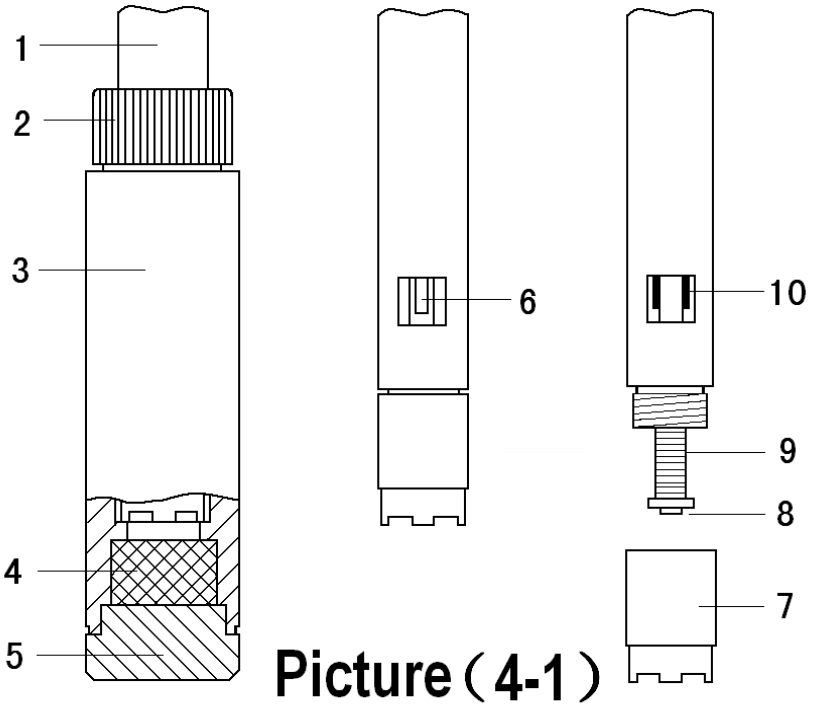
Check on the DO500 DO electrode: see picture (4-1). Screw off the bottom lid of electrode calibration sleeve, inspect whether the sponge inside is moist. If it is dried out, add in several drops of distilled water to the sponge to maintain the satured air inside the calibration sleeve (Do NOT add too much water so it won't be dripping).

4.1.1 Electrode polarization

After each power on, the DO electrode must be polarized for 5 minutes before measuring or calibration. So do not to turn off the meter in the middle of your DO measurement. Otherwise, you need to polarize the DO electrode again after next power on (The auto. power off function in DO mode has been turned off by default).

How to polarize the DO electrode — Just connect the DO electrode to the powered-on meter without measuring or calibrating.

Electrode polarization is to consume the remaining oxygen inside the inner solution of the membrane cap so as to ensure fast response and high accuracy. If a new membrane cap is replaced, or new inner solution is added, the polarization time should be 30 minutes instead of 5 minutes.



Picture (4-1)

1 — DO500 DO electrode

2 — Calibration sleeve cap

3 — Calibration sleeve

4 — Water stored sponge

5 — Calibration sleeve bottom lid

6 — Temperature electrode

7 — Membrane cap

8 — Cathode (gold)

9 — Anode (silver)

10 — Salinity electrode

4.2 DO Calibration (Saturated Oxygen)

Power on the meter, press CAL key, the meter enters calibration mode, **CAL** will be flashing at the upper-right corner. Insert the DO electrode to the calibration sleeve, and tighten the sleeve cap. Let the electrode sit for 3 to 5 minutes.

When the reading is fully stabilized, press CAL key again to finish the calibration. A flashing **100%** will show up, and the calibration will be finished in several seconds and the meter will return to measurement mode. If the reading is unstable, please wait for several more minutes. Do NOT press CAL key until the reading is fully stabilized.

4.3 DO Measurement

4.3.1. Measuring DO in flowing water

Power on the meter. Place the DO electrode into the flowing water. The water surface level should be higher than the location of the temperature electrode. The angle for the electrode and water surface should be 45° to 75°. Hold the electrode in the flowing water and wait for a stable reading, then press M+/RM to record the measurement. If the reading cannot be stabilized, keep swirling the electrode slowly in water to help you get a stable reading (typically takes 1-5 minutes).

4.3.2. Measuring DO in static water

Power on the meter. Place the DO electrode into water. The water surface level should be higher than the location of the temperature electrode. The angle for the electrode and water should be 45° to 75°. Keep swirling the electrode in water slowly (>5cm/s) for 1 to 5 minutes. When the reading is fully stabilized, record the measurement (do NOT stop the swirling while recording the measurement).

Never stop the DO electrode swirling in static water while measuring. Otherwise the dissvolved oxygen will be consumed by the DO electrode and the reading will keep dropping.

4.4 Notes about DO Measurement

a) When calibrating, the environment temperature and water temperature should be close to each other (≤10˚C). If the difference is large, please dip the electrode into the sample water for about 10 minutes, then calibrate the electrode according to Section 4.2.

b) Temperature has a large impact on DO measurement. When the electrode temperature and water temperature have larger difference, the reading time must be greater than 3 minutes. Otherwise, there could be some large errors.

c) Salinity and barometric pressure also affect DO measurement. The meter has automatic salinity compensation and manual barometric pressure compensation. For details, refer to Section 4.7 and 4.8.

d) When the meter is performing abnormally, please set the mode P7 to be **"**On**"** to restore meter to factory default setting, and then do the calibration again before measuring.

4.5 DO Electrode Maintenance

4.5.1 Always maintain a moist sponge

Screw off the bottom lid of electrode calibration sleeve (see picture 4-1), inspect whether the sponge inside is moist. If it is dried out, please add in several drops of distilled water to the sponge to maintain the satured air inside the calibration sleeve (Do NOT add too much water so it won't be dripping).

4.5.2 Remove air bubbles

Inspect the inner solution within the electrode membrane cap. Make sure it doesn't have air bubbles. If there are air bubbles, please screw off the membrane cap and add in new inner solution to remove the bubbles. Then screw the cap back on.

4.5.3 Clean the gold cathode

When the gold cathode is contaminated, use the polishing paper (DO504) to lightly wipe the gold cathode (along the arc of the gold surface); clean the gold surface with a clean tissue

or kimwipe afterwards; rinse off the electrode with distilled water, then shake off excess water; Add some new inner solution into the membrane cap; screw on the cap. Then perform the saturated oxygen calibation according to 4.2 before measuring again.

4.5.4 Replace the membrane cap

When the DO electrode's response time becomes slower, obvious errors occur in measurement, or when the sensitive membrane of DO electrode is wrinkled, cracked or damaged at any extent (the well-functioning membrane surface should look perfectly smooth), it's time to replace a new membrane cap (DO503) according to the following steps.

a) Screw off the membrane cap;
b) Rinse off the electrode without membrane cap with distilled water and shake off excess water.
c) Clean on the cathode surface (gold slice) with a clean tissue or kimwipe;
d) Add new inner solution (DO502) into a new membrane cap (DO503) slowly and do not let any air bubbles appear. If you found any air bubbles in the cap, carefully flick on the membrane cap to eliminate them.
e) Place the membrane cap on the table and put in the electrode vertically, slowly twist in, and then screw on the cap tightly. The excess inner solution will be squeezed out. Please wipe it off with tissue and rinse off the electrode in distilled water.
f) Check if there are any air bubbles in electrolyte (except for the smaller air bubbles), If so, re-assembly is needed.
g) Do not touch the sensitive membrane with fingers directly because the sweat and grease will affect the quality of the membrane.

4.6 Zero Oxygen Calibration

Usually there is no need to do zero oxygen calibration unless you have a high requirement for accuracy in low oxygen level (<1.0 ppm). To do zero oxygen calibration, follow the steps below:

Prepare 100mL of zero-oxygen water: In a 100 mL beaker, add in 5.0 g anhydrous sodium sulfite (Na_2SO_3); add 100 mL distilled water; mix well to dissolve. Not that the zero-oxygen water is only effective within 24 hours.

1) Polarize the meter for 15 minutes, and then perform the saturated oxygen calibration according to the 4.2.
2) Place the electrode into zero-oxygen water, press CAL key to enter calibration mode. When the stabilized reading is 0.02 ppm to 0.15 ppm after 5 minutes, press CAL key again to finish the calibration, then flashing **0.0%** will show up, the calibration will be finished in several seconds and **0.00 ppm** will show up. Rinse off the electrode with distilled water afterwards.
3) If the reading is less than 0.02 ppm after 5 minutes, it means the electrode is in good condition and there is no need to perform zero oxygen calibration. Just press ENTER key to return to measurement mode.
4) If the reading is greater than 0.15 ppm after 5 minutes, it's time to replace the membrane cap according to section 4.5.4 or remove the membrane cap and use the polishing paper (DO504) to lightly polish the gold cathode according to section 4.5.3. Then perform the saturated air calibration and zero oxygen calibration before measuring.

4.7 Salinity Calibration

Dissolved oxygen is also affected by salinity in water. The meter has automatic salinity compensation, and the salinity electrode is pre-calibrated before leaving the factory. In general, there is no need to perform salinity calibration. Salinity calibration is only needed when replacing a new electrode. For the procedure of salinity calibration, please refer to 4.9.3 in P2.

For the salinity electrode installed in DO electrode (see picture 4-1), its surface is plated with a layer of platinum black to reduce electrode polarization. When cleaning salinity electrode, never brush it otherwise the coating will be peeled off. Just rinse it off by swirling in pure water to remove contaminants. For organic contaminants, rinse off with warm water containing detergent or alcohol.

4.8 Barometric pressure manual compensation

Dissolved oxygen is also affected by barometric pressure. The meter has the function

of manual Barometric pressure compensation. We suggest to reset the value according to the standard barometric pressure table when there is a big change in barometric pressure to ensure the accuracy of barometric pressure compensation (Please see Appendix 2 and Appendix 3). For the procedure of Barometric pressure calibration, refer to 4.9.4.

4.9 Parameter Setting

4.9.1 DO parameter settings (Chart 4-1)

Prompt Mark	Parameter Setting Items	Code	Parameter
P1	Resolution selection		0.01/0.1(mg/L and ppm) 0.1/1(%)
P2	Salinity calibration		
P3	Barometric pressure setting		
P4	Temperature unit setting		˚F/˚C
P5	Back light display time setting	bL	0-1-3-6 min
P6	Auto power off time setting	AC	0-10-20 min
P7	Restore to producer setting		OFF-On (shut-set)

4.9.2 Resolution selection (P1)

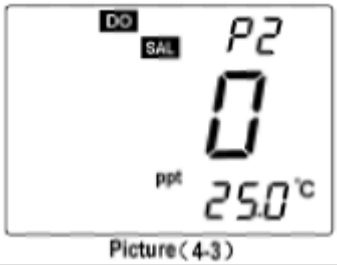
(a) Press MODE key and enter P1 mode, see picture (4-2);

(b) Press CAL key to choose resolution: 0.01→0.1;

(c) Press MODE key to enter the next parameter setting or press ☼ ENTER to return to the measurement mode.

Picture(4-2)

4.9.3 ***Salinity calibration setting (P2)***



Picture(4-3)

(a) In P1 mode, press MODE key to enter P2 mode, see picture (4-3).

(b) Immerse the DO electrode into 12.88mS/cm calibration solution (sold separately), solution level should exceed salinity electrode; let it stand still after stirring; then press the CAL key when the value is stable and smiley face icon appears. **12.9** will show up on the screen. The calibration will be finished after several seconds, and the meter will display a stable salinity value.

(c) Press MODE key to enter the next parameter setting or press ENTER key to return to measurement mode.

4.9.4 ***Barometric pressure setting (P3)***

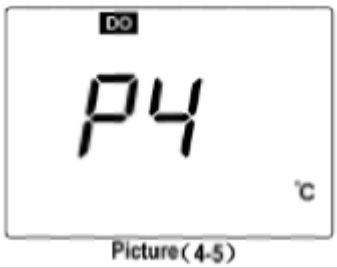
Picture(4-4)

(a) Under mode P2, press MODE key to enter P3 mode, the screen displays a barometric pressure measuring value set earlier (unit is kPa), such as 101.3 kPa, shown as picture (4-4).

(b) Press CAL or M+/RM to adjust according to standard barometric pressure value, and long press them to quickly change the value.

(c) Press MODE key to enter next parameter setting or press ENTER key to confirm and return to measurement mode.

4.9.5 ***Temperature unit ˚C/˚F setting (P4)***



Picture(4-5)

(a) Short press MODE key in mode P3 to enter mode P4, see picture (4-5).

(b) Press CAL or M+/RM key to choose temperature unit: ˚C or ˚F.

(c) Press MODE key to enter next parameter setting or press ENTER key to return to measurement mode.

4.9.6 ***Backlight display time setting (P5)***

Picture (4-6)

(a) Short press MODE key in mode P4 to enter mode P5, see picture (4-6).

(b) Press CAL or M+/RM key to choose the auto-off time of backlight: 0 min, 1 min, 3 min or 6 min. The backlight display function will be closed if choosing 0 min.

(c) Press MODE key to enter next parameter setting or press ☼/ENTER key to return to measurement mode.

(d) The default setting for P5 is 1 min.

4.9.7 ***Auto power-off time setting (P6)***

Picture (4-7)

(a) Short press MODE key in mode P5 to enter mode P6, see picture (4-7).

(b) Press CAL or M+/RM key to choose the time: 0min, 10min or 20min. The auto power off function will be closed if choosing 0min.

(c) Press MODE key to enter next parameter setting or press ☼/ENTER key to confirm and return to measurement mode.

(d) The default setting for P6 is 0 min (see item4.4.2).

4.9.8 ***Restore to factory default setting (P7)***

Picture (4-8)

(a) Short press MODE key in mode P6 to enter mode P7, see picture (4-8).

(b) Press CAL or M+/RM key to choose **"On**", meaning that parameters have been restored to the factory default setting mode, and the meter returns to measurement mode after 2 seconds.

5 What's in the kit

5.1. SX716 DO meter *1

5.2. DO500 DO electrode *1

5.3. DO502 DO electrode inner solution (30mL) *1

5.4. DO503 membrane cap (DO electrode use) *3

5.5. DO504 Cathode polishing paper *2

5.6. Screwdriver *1

5.7. Spare AA batteries *2

5.8. Operation manual *1

5.9. Carrying case *1

6 Limited Warranty

We warrant this instrument to be free from defects in material and workmanship and agree to repair or replace free of charge, at option of APERA INSTRUMENTS, LLC, any malfunctioned or damaged product attributable to responsibility of APERA INSTRUMENTS, LLC for a period of THREE YEARS (SIX MONTHS for the electrode) from the delivery.

This limited warranty does not cover any damages due to:
Transportation, storage, improper use, failure to follow the product instructions or to perform any preventive maintenance, modifications, combination or use with any products, materials, processes, systems or other matter not provided or authorized in writing by us, unauthorized repair, normal wear and tear, or external causes such as accidents, abuse, or other actions or events beyond our reasonable control.

7 Appendix

7.1 Appendix 1 Content of Saturated Oxygen in Water at Different Temperature

Temperature ˚C	DO mg/L	Temperature ˚C	DO mg/L	Temperature ˚C	DO mg/L
0	14.64	16	9.86	32	7.30
1	14.22	17	9.66	33	7.18
2	13.82	18	9.46	34	7.07
3	13.44	19	9.27	35	6.95
4	13.09	20	9.08	36	6.84
5	12.74	21	8.90	37	6.73
6	12.42	22	8.73	38	6.63
7	12.11	23	8.57	39	6.53
8	11.81	24	8.41	40	6.43
9	11.53	25	8.25	41	6.34
10	11.26	26	8.11	42	6.25
11	11.01	27	7.96	43	6.17
12	10.77	28	7.82	44	6.09
13	10.53	29	7.69	45	6.01
14	10.30	30	7.56		
15	10.08	31	7.43		

7.2 Appendix 2 Content of Saturated Oxygen at Different Barometric pressure

Barometric pressure		Dissovled Oxygen Concentration (mg/L)		
mmHg	kPa	15˚C	25˚C	35˚C
750	100.00	9.94	8.14	6.85
751	100.13	9.96	8.15	6.86
752	100.26	9.97	8.16	6.87
753	100.40	9.98	8.17	6.88
754	100.53	9.99	8.18	6.89
755	100.66	10.00	8.20	6.90
756	100.80	10.01	8.21	6.91
757	100.93	10.03	8.22	6.92
758	101.06	10.04	8.23	6.93
759	101.20	10.07	8.24	6.94
760	101.33	10.08	8.25	6.95
761	101.46	10.09	8.26	6.96
762	101.60	10.11	8.27	6.97
763	101.73	10.12	8.28	6.98
764	101.86	10.14	8.30	6.99
765	102.00	10.15	8.31	7.00
766	102.13	10.16	8.32	7.01
767	102.26	10.18	8.33	7.02
768	102.40	10.19	8.34	7.02
769	102.53	10.21	8.35	7.03
770	102.66	10.22	8.36	7.04
771	102.80	10.23	8.37	7.05
772	102.93	10.25	8.39	7.06
773	103.06	10.26	8.40	7.07
774	103.19	10.28	8.41	7.08
775	103.33	10.29	8.42	7.09

Conversion between mmHg and kPa:

mmHg×0.13333=kPa

$DO_{pt} = P \times DO_t \div 760$

Note:

DO_{pt} — DO concentration under temperature t, Barometric pressure P, mg/L;

P — Barometric pressure, mmHg;

DO_t — DO concentration under temperature t, Barometric pressure 760mmHg, mg/L; 760 — Barometric pressure, mmHg.

7.3 Appendix 3 Content of Oxygen at Different Altitude

Altitude		Barometric pressure		DO	Altitude		Barometric pressure		DO
Foot	meter	kPa	mmHg	mg/l	Foot	meter	kPa	mmHg	mg/l
0	0	101.3	760	8.25	7500	2287	77.1	579	6.28
500	152	99.34	746	8.09	8000	2439	75.63	568	6.16
1000	305	97.6	733	7.95	8500	2591	74.44	559	6.06
1500	457	95.87	720	7.81	9000	2744	72.97	548	5.94
2000	610	94.28	708	7.68	9500	2896	71.64	538	5.83
2500	762	92.54	695	7.54	10000	3049	70.17	527	5.71
3000	915	90.95	683	7.41	10500	3201	68.84	517	5.61
3500	1067	89.35	671	7.28	11000	3354	67.38	506	5.49
4000	1220	87.75	659	7.15	12000	3659	66.58	500	5.42
4500	1372	86.15	647	7.02	13000	3963	65.78	494	5.36
5000	1524	84.56	635	6.89	14000	4268	64.98	488	5.29
5500	1677	83.09	624	6.77	15000	4573	64.18	482	5.23
6000	1829	81.63	613	6.65	16000	4878	63.38	476	5.16
6500	1982	80.03	601	6.52	17000	5183	62.58	470	5.10
7000	2134	78.56	590	6.40	18000	5488	61.79	464	5.03

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