

Portable Digital DO/O₂/TEMP. Meter
UC-12

Operator's Manual
No. 0101-01

CENTRAL KAGAKU CO., LTD.

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Preface

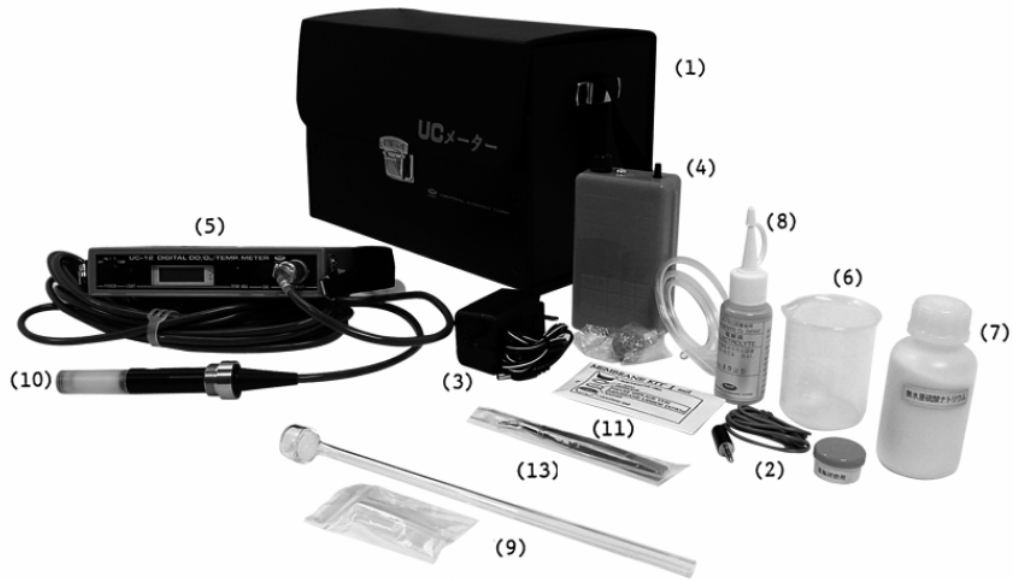
The model UC-12 meter utilizes a polarographic DO sensor to determine dissolved oxygen (DO) and atmospheric oxygen (O₂). Further, the sensor incorporates a thermo-sensitive resistance element which provides measurements of water and air (atmospheric) temperatures.

The UC-12 meter is compact, slim and very easy to carry around. It is equipped with a splash-proof molded plastic enclosure which provides protection against adverse weather conditions and seawater. The enclosure material is also highly resistant to high humidity and acid or alkali corrosion, thereby enabling the meter to be used under any field conditions.

The display window is provided with a light which enables nighttime outdoor measurements.

To ensure efficient use of the UC -12 meter, it is highly recommended that this operator's manual be carefully read prior to placing the meter in service.

1. Meter Unit and Accessories



- | | |
|------------------------------|--------------------------------|
| 1) UC meter carrying case | 2) Recorder transmission cable |
| 3) Exclusive battery charger | 4) Air pump |
| 5) Meter unit | 6) Poly beaker |
| 7) Anhydrous sodium sulfite | 8) Electrolyte |
| 9) Electrode abrasive | 10) Syringe |
| 11) Membrane | 12) Operator's Manual |
| 13) Tweezers | 14) Sensor |

Meter Unit	Model UC-12, with shoulder strap	1
Sensor	Model UC-203 (standard throw-1in type with 5m long lead wire)	1
Standard Accessories	Membrane (membrane filter)	5 pcs
	Electrolyte (50 Ml)	1 btl
	Poly beaker	1
	Tweezers	1 pr
	Syringe	1
	Electrode abrasive	1 btl
	Air pump (with ball filter)	1 set
	Anhydrous sodium sulfite	1 btl
	Exclusive battery changer	1
	Recorder transmission cable	1
UC meter carrying case	1	
Operator's manual	1	
Optional	Bench-top rack CSS-1/MQR-2 exclusive recorders AD-1010 microcomputer-based multi UC printer	

2. Performance and Specifications

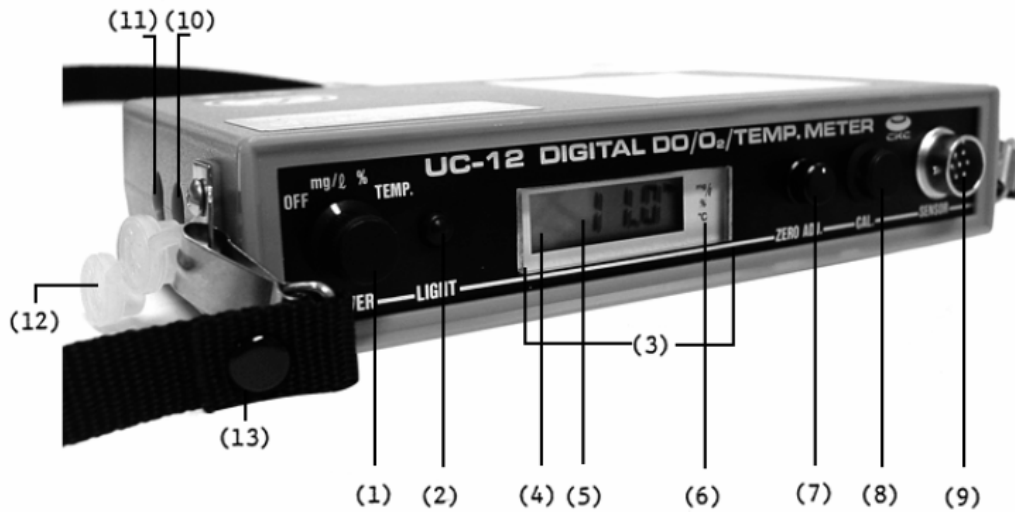


Measuring method	Polarographic DO electrode and thermo-sensitive resistant element		
Measurement parameter	DO	O ₂	Water/air temp.
Measuring range	0 ~ 20.0 mg /	0 ~ 25.0%	0 ~ 50.0
Temp. compensation range	0 ~ 40	0 ~ 40	-
Reproducibility	±0.1 mg / ±1digit (at constant temp)	±0.1%± 1digit (at constant temp)	±0.5
Resolution	0.1 mg /	0.1%	0.1
Display	3-digit digital (liquid crystal)		
Low battery alarm	Flickers if batt. Voltage drops below 4.5 V		
Temp. compensation method	Automatic thermistor compensation		
Recorder output signal	0 ~ 10mV		
Display illumination	Pushbutton-operated nighttime light		

Power Supply	Either AC or DC (Four unit-3 Ni-Cd, with AC adaptor/charger)	
Batt. Operating time	Approx. 20hours (when used continuously under max. display condition)	
Electrode	Model UC-203	
	DO/O ₂	Cathode: platinum Anode: silver Membrane: 1 mil (0.025mm) in FEP thickness
	Temp. (thermo-sensitive resistance element): platinum	
Dimensions & weight	Meter unit:	190(W) × 110(H) × 37(D)(mm) approx. 640g
	Electrode:	17Ø × 122(L) (mm) approx. 360g (with protective cylinder) 250Ø × 134(L) (mm) approx. 470g (with protective cylinder)
Lead wire	5m long (standard throw-in type) 10m length available	

3. Parts Identification and Function

3-1 Meter Unit



- | | |
|--------------------------------|--|
| 1) Select switch | 2) Light ON/OFF push-button |
| 3) Display | 4) Battery flicker alarm |
| 5) Display panel | 6) Measuring unit indicator |
| 7) Zero adjust Knob | 8) Sensitivity adjust dial |
| 9) Sensor connector receptacle | 10) Charger connecting jack |
| 11) Recorder output terminal | 12) Protective cap (a) Protective cap(b) |
| 13) Shoulder | |

1) “POWER” select switch

Turns the power ON/OFF and selects one of the following ranges:

mg/ : DO range Dissolved oxygen measurement

%: O₂ range Atmospheric oxygen measurement

Temp.: Temperature range Water or air temperature measurement

2) “LIGHT” on/off pushbutton

Depressing this button will turn on the light in the display.

This function is useful in nighttime outdoor measurements.

3) Display

Battery flicker alarm, Display panel, Measuring unit indicator

4) Battery flicker alarm

Flickers when battery voltage drops below a specified level, indicating that the batteries are in need of recharging.

5) Display panel

Measured values are digitally indicated on the 3-digit liquid crystal display (LCD).

6) Measuring unit indicator

The adequate measuring unit is marked with an arrowhead (“ ”) when the “power” select switch is set to the parameter to be measured.

7) “ZERO ADJ” knob

Used for the monthly zero adjustment of the Do sensor.
see Sec. 5-1

8) “CAL” sensitivity adjust dial

Used to calibrate the DO sensor. See Secs. 5-2 and 5-3.

9) “SENSOR” connector receptacle

The DO sensor is connected to this receptacle. See Sec. 4-3.

10) “CHG” charger connecting jack

The exclusive battery charger is connected to the jack when the batteries are to be recharged or when the meter is to be operated on AC power. See Secs. 4-2 and 7-1

11) “REC” recorder output terminal

A recorder is connected to this terminal. See Sec. 8-1.

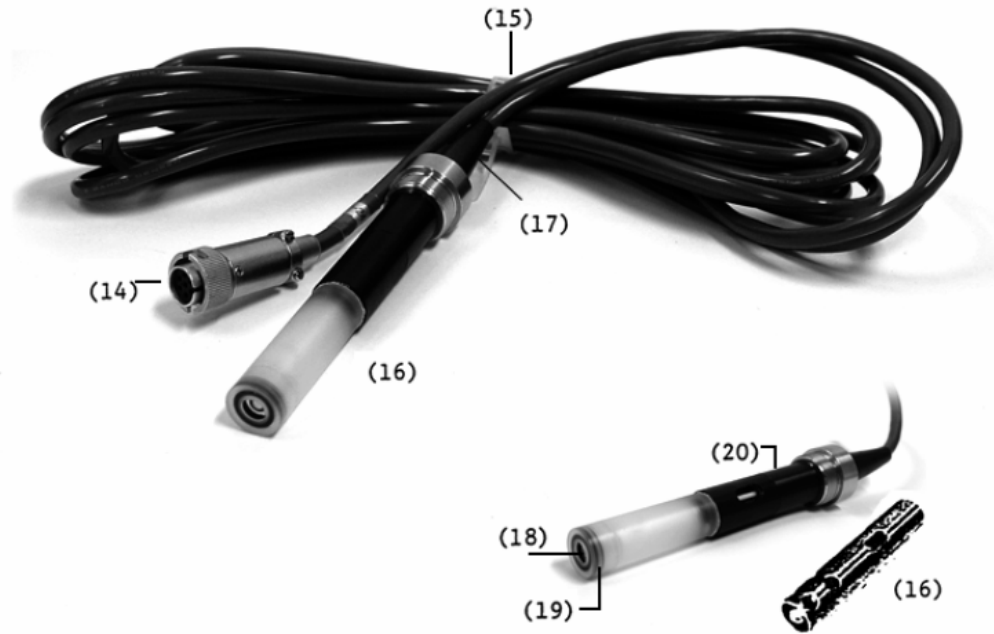
12) Protective caps (a) and (b)

Always leave these caps attached when the meter is not in use.

13) Shoulder strap

Resistant to water and provided with an adjusting buckle.

3-2 DO sensor unit



- 14) Cable connector
- 15) Lead wire
- 16) Stainless steel protective
- 17) Threaded protective cylinder mount
- 18) Electrode
- 19) Membrane
- 20) Thermo-sensitive resistance element

14) Cable connector

To connect the DO sensor to the meter unit, insert this connector into the receptacle on the meter by aligning its groove with the slide rail on the receptacle, then lock the connector by turning the outer ring. Clockwise while pushing.

15) Lead wire

The DO sensor is connected via this cable to the meter unit.

This throw-in type cable is composed of strong lead wire.

(30m or longer lengths are provided with a support rope.)

16) Stainless steel protective

Serves not only as a protector for the sensor unit but also as a weight.

The cylinder material is corrosion-free SUS.

17) Threaded protective cylinder mount

When the sensor unit is subjected to the maintenance procedures or if the protective cylinder is an obstacle to the measurement, remove the cylinder by turning it counterclockwise.

18) Electrode

This is the most important part for the measurement. When it is necessary to leave the electrode exposed for the measurement, utmost care should be taken not to damage the membrane at the tip.

See Sec. 7-2

19) Membrane

This semipermeable membrane is pervious only to oxygen molecules(O₂) in water and atmosphere.

See Sec.7-2

20) Thermo-sensitive resistance element

This thermo-sensitive element provides measurements of water and air(atmospheric) temperatures.

During water temperature measurements, this element should be fully immersed in water(90%

response time: within 60 seconds). See Step(3) of Sec. 5 "Water & air temperature".

4. Preparation for Use and Precautions



Use of AC Power Supply

Because of the danger of overcharging, AC power supply should not be used for more than 24 hours continuously.

4-1 Checking the battery condition

Turn the “power” select switch to the “*mg / l*”, “%” or “TEMP.” position. This also turns the power ON. If the battery flicker alarm turns on and off, the battery voltage is below 4.5V. In this case, recharge the batteries (See Sec. 7-1) or operate the meter on AC power (See Sec. 4-2).

4-2 Operating the meter on AC power



To operate the meter on AC power, connect the exclusive charger to the meter. This charger can be used for AC operation in the following situations:

- 1- The meter cannot be battery-operated due to low battery voltage.
- 2- The batteries are being charged.
- 3- The meter is to be operated continuously for an extended period of time.

To recharge the batteries, turn the “power” select switch to “OFF” with the meter in the AC operation mode. See Sec. 7-1.

4-3 Connecting the DO sensor to the meter



Remove the protective cap from the sensor connector receptacle on the meter unit. Insert the DO sensor connector into the receptacle by aligning its groove with the slide rail on the receptacle then lock the connector by pushing the outer ring and turning it clockwise while pushing until it comes to a stop.

Cautions:

- 1- Keep the connector pins free from water droplets.
- 2- If the pins are rusty or dusty, clean them, as rust or dust on the pins may cause contact failure.
- 3- Prior to inserting the connector into the receptacle, make certain that both are in alignment. Do not force the misaligned connector into the receptacle.

4-4 Positioning the DO sensor in water

Measurements should be made with the DO sensor placed vertically or slightly tilted in water to be analyzed.

Create an approx. 10cm/sec flow of water around the sensor membrane by slowly moving the sensor. Use a magnetic stirrer when the DO sensor is placed in a sample bottle.

5. Measuring Procedures

Measurement's should be made with the DO sensor placed vertically or slightly tilted in water to be analyzed. Create an approx. 10-cm/sec flow of water around the sensor membrane by slowly moving the sensor. Use a magnetic stirrer when the DO sensor is placed in a sample bottle.

Dissolved Oxygen(DO)

- | | | | |
|----|---|---|---|
| 1. | <u>Sensor connection</u>
Battery check | { | Perform these steps as directed in Sec.4 "Preparation for Use". |
| 2. | Zero adjustment | { | Perform this step once a month as directed in Sec. 5-1. |
| 3. | Calibration | { | Can be used as a routine calibration method, particularly suitable for field measurements. However, the difference between ambient and sample temperatures should be within 5 . |
| | { Air | | |
| | { O2 Saturated water | { | Used when additional measuring accuracy is needed. See Secs. 5-2, 5-3 and 7-3. |
| 4. | Measurement | { | Suited for field or deep-part measurements. |
| | { Throw-in | | |
| | { Sample | { | Suited for laboratory measurements or when the sampling site is inaccessible. |
| 5. | Power OFF | { | Rinse the DO sensor with pure water and return the select switch to "OFF" |
| | | | * The display can be easily read even in the nighttime or in the dark when the "LIGHT" on/off button is depressed. |

5-1 Zero adjustment



* Always perform the zero adjustment once a month.

- 1) Turn the select switch to the “*mg / l*” position.
- 2) Place the DO sensor in an approx. 5% sodium sulfite solution (Dissolve 5g anhydrous sodium sulfite in 100ml water.)
- 3) After the reading has been stabilized, turn the “ZERO ADJ” knob until the reading “00.0” is displayed.
- 4) Then, thoroughly rinse the DO sensor with pure water.

5-2 Calibration with air



- 1) Suspend the DO sensor vertically in the air.
- 2) Turn the select switch to the “TEMP” position and measure the atmospheric temperature.
- 3) Determine the air calibration value at the above temperature from the calibration table given at the end of this manual.
- 4) Turn the select switch to the “*mg / l*” position, then turn the “CAL” dial until the air calibration value determined is indicated on the display.

5-3 Calibration with O₂-saturated water



- 1) Fill the poly beaker with distilled or tap water (up to the level which allows one-third of the sensor to be immersed in water). Remove the stainless steel protective cylinder from the DO sensor and place the exposed sensor in water.
- 2) Turn the select switch to the “TEMP” position and measure the water temperature.
- 3) Determine the value (mg / l) of saturated dissolved oxygen at the water temperature measured by using the calibration table given at the end of this manual.
- 4) Place the ball filter of the air pump, in the beaker and feed air into the water for 5 minutes.
- 5) After the reading is stabilized while feeding air into the water, turn the “CAL” dial until the saturated DO value determined is displayed.
- 6) After the completion of the above steps, proceed to the measuring procedure. (Replace the protective cylinder when the sensor is to be thrown in the water.)

5.4 Dissolved oxygen in organic solvents (DO)

- 1) Turn the select switch to the *mg / l* position.
- 2) Place the DO sensor in an approx. 5% sodium sulfite solution.
- 3) After the reading has been stabilized,
turn the "ZERO ADJ" knob until the reading 00.0 is displayed.
- 4) Then, thoroughly rinse the DO sensor with distilled water.
- 5) Fill the beaker with organic solvent up to the level
which allows one-third of the DO sensor to be immersed.
- 6) Place the ball-filter of the air pump in the beaker
and feed air into the organic solvent for 5 minutes.
- 7) After the reading is stabilized while air into the organic solvent,
turn the "CAL" knob until the reading 100 (Saturated DO 100% value).
- 8) After the completion of the above steps, proceed to the measuring procedure.

Atmospheric Oxygen (O₂)

* The display can be easily read even in the nighttime or in the dark when the “LIGHT” on/off button is depressed.

1.	<u>Sensor connection</u> Battery check	Perform these steps as directed in Sec. 4 “Preparation for use”.
2.	Setting to “%”	Turn the select switch to the “%” position.
3.	Calibration	Leave the DO sensor in the air. After the reading has been stabilized, adjust the “CAL” dial for a reading of 21.0%
4.	Measurement	Leave the DO sensor in the location to be analyzed and read the %O ₂ value from the display.
5.	Power OFF	After the completion of the measurement, always return the select switch to “OFF”.

Water and Air Temperatures.

* The display can be easily read even in the nighttime or in the dark when the “LIGHT” on/off button is depressed.

1.	<u>Sensor connection</u> Battery check	Perform these steps as directed in Sec. 4 “Preparation for use”.
2.	Setting to “TEMP”	Turn the select switch to the “TEMP” position.
3.	Measurement	Place the DO sensor in the water or atmospheric air to be analyzed, read the value from the display.
4.	Power OFF	After the completion of the measurement, always return the select switch to “OFF”. IF the sensor has been placed in water, thoroughly rinse it with pure water.

Note! : The temperature sensor utilizes a thermosensitive resistance element with a 90% response of 1 minute or less.

6. Unusual Measuring Conditions

6-1 Measurements at depth or under high water pressure



Measuring errors may occur when the measuring point is deep below the water surface or under high water pressure, as encountered in treatment plants. To eliminate such errors, open the pressure equalization hole by sliding the rubber cover. In normal measurements, however, leave the hole closed.

(Pressure equalization hole and rubber cover is attached only to electrode with 10m or longer lengths leadwire.)

6-2 Measurements with samples containing high C concentrations

If the water sample contains 5000 mg / l or more of chloride ions, correct for the effect of the ions on the measured value. Correct the measured value according to the table below.

Correction formula: (Measured value) \times (correction factor obtained from table) = Correct value

C ion conc. (mg / l)	Water temp. ($^{\circ}C$)	Correction factor
5000	0 ~ 30	0.95
10000	0 ~ 5	0.89
	5.1 ~ 30	0.90
15000	0 ~ 11	0.84
	11.1 ~ 30	0.85
20000	0 ~ 2	0.78
	2.5 ~ 11	0.79
	11.1 ~ 30	0.80

7. Maintenance

7-1 Recharging the batteries



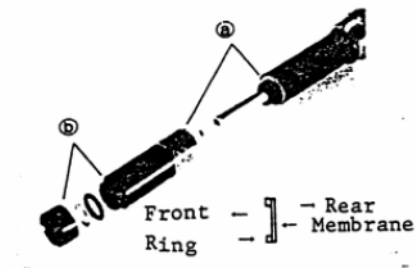
When the battery flicker alarm is activated or if the battery seems to be low as a result of continuous operation for an extended period of time (approx. 20hour continuous operation possible), recharge the batteries as follows:

- 1) Insert the exclusive charger cord plug into the “CHG” jack on the side panel of the meter unit.
- 2) Insert the charger power plug into a 200-VAC outlet.
- 3) The batteries will be recharged when the “power” select switch is in the “OFF” position (charging time required: approx. 8 hrs).

Note! :

- 1) Ensure that only the attached battery charger is used. The used of battery chargers designed for other equipment can be the cause of trouble.**
- 2) Ensure that charging time does not exceed 24 hours.**
- 3) During charging, the instrument can be used directly from AC current. It should be not be used for more than 24 hours continuously as this can be the cause of overcharging.**

7-2 Replacing the membrane and electrolyte



Note! :

* As shown in the above figure, place O-ring before the membrane.

* The tweezers supplied is helpful for this step.

If the membrane is damaged or soiled, replace the membrane and electrolyte as follows:

- 1) Unscrew the protective cylinder from the DO sensor unit.
- 2) With the sensor in an upright position, loosen the screw located at portion (See photo) and pull out the electrode from the lower membrane assembly.
- 3) Discard the electrolyte in the cylinder of the membrane assembly.
- 4) Loosen the screw at portion and remove the membrane and O-ring from membrane protective cylinder.
- 5) Replace the membrane with a new one and fit together the membrane assembly (Do not install the membrane inside out. Be sure to reinstall the O-ring.).
- 6) With the membrane protective cylinder upright, pour about 2.5ml of electrolyte into the cylinder using the syringe provided.
- 7) Insert the upper electrode unit vertically into while turning to and fro. Allow excess electrolyte to overflow from the membrane protective cylinder.
- 8) The sensor assembling step is now completed. Perform zero adjustment before proceeding to measurement. See Sec. 5-1.

7-3 Re-Generating the DO sensor



If it is impossible to calibrate the sensor and meter for dissolved oxygen(DO) measurement (with either air or O₂-saturated water), or if the saturation value determined from the calibration table cannot be indicated on the display even by turning the “CAL” dial fully clockwise, the DO sensor should be regenerated as follows:

- 1) Pull out the electrode unit from the membrane assembly as directed in Sec. 7- , step (1) and (2)
- 2) Apply the electrode abrasive to a soft cloth or paper and carefully polish the anode and cathode with the cloth or paper until they restores luster again.
- 3) Wipe off the abrasive from the electrode and reassemble the sensor.

7-4 Cleaning the meter unit

Clean the meter surface with a soft cloth and a dilute solution of a neutral detergent.

7-5 Troubleshooting guide

Trouble	Cause	Action	Procedure
① No reading displayed	Low battery	→ Recharge/operate on AC	Sec. 4-1 Sec. 4-2 Sec. 7-1
② One or two digits missing	Electric Circuit failure	→ Repair	Contact your distributor
③ Battery flicker alarm activated	Zero fluid	→ Zero adjust again	Sec. 5-1
④ Display panel not lit up	Membrand/ electrolyte	→ Replace membrane electrolyte	Sec. 7-2
⑤ Zero adjustment impossible	Reduced sensor performance	→ Regenerate sensor	Sec. 7-3
⑥ Cal. adjustment impossible	Broken lead wire connector contact failure	→ Repair	Contact your distributor
⑦ Reading unstable			
⑧ Minum (-) sign displayed			

* If the above actions fail to restore the meter to normal or if the cause of the trouble is not clear, contact your distributor or our company immediately. Do not tamper with the meter as it is equipped with a special splash-proof enclosure.

8. Optional Products

The following optional products are available to enhance the use fullness of the UC-12 meter. For details contact your distributor or our company.

8-1 Model CSS-1/MQR-2 exclusive recorders

The UC-12 meter is equipped with a recorder output terminal (0~10mV for DO/O₂/TEMP). An exclusive recorder, when connected to the terminal, provides an additional data recording function.

8-2 Model AD-1010 Microcomputer-based multi UC printer

This multi-functional, four-channel printer is equipped with a built-in micro-computer which offers advanced operation capabilities. The multi-purpose printer provides records of multi-parameter data, graphic printouts of time-related parameter changes, etc.

8-3 Other UC-series meters

The UC-12 meter can be converted to a total analytical system when combined with the following other UV meters:

Portable Digital UC-23 pH/ORP meter

Portable Digital UC-33 conductivity meter

Portable Digital UC-4 chlorine-ion meter

Portable Digital UC-5 residual chlorine meter

Portable Digital UC-6 turbidity meter

8-4 Bench-top rack

The UC-12 can be used as laboratory bench-top unit when mounted on the rack.

8-5 Calibration Table

Temp. ()	Air cal. value	Saturated DO(<i>mg</i> /)	Temp. ()	Air cal. value	Saturated DO(<i>mg</i> /)
0	15.06	14.15	18	9.69	9.18
1	14.66	13.77	19	9.51	9.01
2	14.26	13.40	20	9.33	8.84
3	13.88	13.04	21	9.15	8.68
4	13.50	12.70	22	9.98	8.53
5	13.14	12.37	23	8.82	8.39
6	12.81	12.06	24	8.67	8.25
7	12.48	11.75	25	8.52	8.11
8	12.17	11.47	26	8.38	7.99
9	11.77	11.19	27	8.24	7.87
10	11.58	10.92	28	8.11	7.75
11	11.30	10.67	29	7.99	7.64
12	11.05	10.43	30	7.87	7.53
13	10.80	10.20	31	7.68	7.43
14	10.54	9.97	32	7.83	7.32
15	10.32	9.76	33	7.51	7.23
16	10.09	9.56	34	7.41	7.13
17	9.90	9.37	35	7.31	7.04

Warranty

Should the instrument described in this manual be found defective within the warranty period when used under normal operating conditions, return it to your distributor or our company, together with the warranty card. We will repair or adjust the defective instrument at no charge to the customer according to the warranty conditions (described in the warranty card).