

**Ω CDB-387**

**Ω Conductivity Meter**



**Operator's Manual**



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CDB-387

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# SECTION 1

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## Introduction

### Description

The OMEGA® CDB-387 Conductivity Meter is a precision microprocessor-controlled auto-ranging digital conductivity meter with the ability to measure Total Dissolved Solids (TDS), Resistivity and Temperature. The meter has a wide range of features, which include temperature compensation with an adjustable temperature coefficient.

### Unpacking

Remove the Packing List and verify that you have received all equipment. If you have any questions about the shipment, please call the OMEGA Customer Service Department at 1-800-622-2378 or (203) 359-1660.

When you receive the shipment, inspect the container and equipment for any signs of damage. Note any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

### *Note*

The carrier will not honor any claims unless all shipping material is saved for their examination. After examining and removing contents, save packing material in the event that re-shipment is necessary.

The following items are packed in the box:

- CDB-387 Conductivity Meter
- Conductivity Cell, K=1/cm
- Calibration Solution
- Power Adaptor
- 9V Battery
- Operator's Manual

## Setting Up

The instrument can be used on battery or AC power. It is not necessary to remove the battery before transferring to AC power.

### AC Operation

- Use only the approved power adaptor supplied .
- Check that the adaptor is the correct voltage for your power supply
- Plug the adaptor into the power socket on the back of the meter then connect to the AC supply.

### Battery Operation

- A battery should always be used to protect calibration data in the event of a power failure. Install the battery as shown in figure 1.
- The battery will afford the user 24 hours of continuous use. When the battery needs changing, the word BAT will appear on the display.

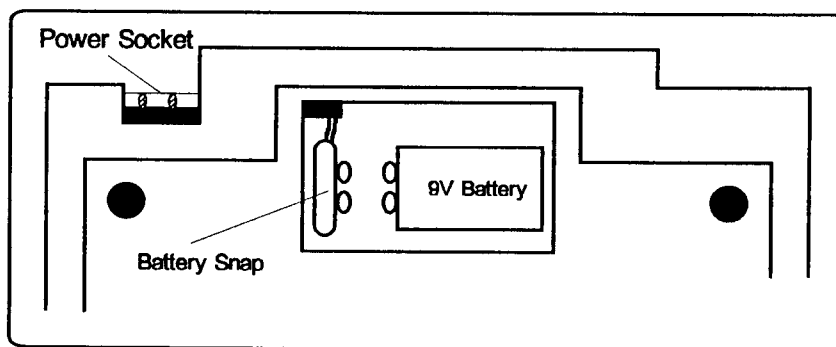


Figure 1. Bottom view of instrument showing power connections.

## Instrument Test Procedure

- Switch on and ensure the meter is in Conductivity mode and uncalibrated (Press Mode key to select Conductivity mode and press Clear key for 5 seconds to clear calibration data). With the conductivity cell disconnected the display will now read 0.00 $\mu$ S/cm (or 0.000 mS/m).
- Select TDS mode (press Mode key), 0.000 mg/L
- Select Resistivity mode (press Mode key); display should show over-range reading.
- Select °C mode (press Mode key); displayed value should be in the range 0.0 - 50.0°C. Adjust the displayed reading until it reads 25.0°C using the  $\downarrow$   $\uparrow$  keys
- Select %°C function (press %°C key). If the default value of 2.000% is not displayed, press Clear key for 5 seconds.
- The meter is now ready for calibration (refer to Section 2).

### *A Note on Conductivity Cells and Solutions*

#### **Platinum Plate Cells**

This type of cell uses two platinum cell plates coated with a platinum oxide layer. It is important not to touch the surfaces of these cell plates while in use or when cleaning, as any surface damage could result in the linearity of the cell being affected. Because of this it is not suitable for samples containing suspended solids. Cell plates are required to be re-coated periodically. (refer to Section 7).

#### **Epoxy Carbon Plate Cells**

This type of cell has carbon cell plates in an epoxy housing. With its rugged construction it is suitable for industrial and field applications. If the cell becomes dirty or contaminated, cleaning can be carried out easily using a bottle brush and a weak detergent solution.

#### **The Calibration Solution**

The standard is an accurately made up solution of KCl. It is easily contaminated and great care should be taken when transferring cells to prevent carry-over. (Refer to Appendix 2 for preparation details and temperature effects).

***Calibration solutions are available from OMEGA Engineering Inc.***

## Units of Measurement

With the CDB-387 Conductivity Meter it is possible to express conductivity and resistivity values with two different types of multiples. The coherent system of units adopted by ISO (IUPAC) known as the SI unit, defines conductivity and resistivity to be expressed as multiples of per meter rather than the older c.g.s. units which expressed values as a multiple of per centimeter.

The relationship between the two multiples is as follows:-

Conductivity -  $1 \text{ mS/cm} = 100 \text{ mS/m}$  and Resistivity -  $10 \text{ M}\Omega\cdot\text{cm} = 0.10 \text{ M}\Omega\cdot\text{m}$

### To change the multiple

- 1 Display cell constant by pressing 'K' key
- 2 Set preferred units by pressing the 'K' key to select either m or cm.
- 3 Exit with correct type of units set by pressing the 'Mode' key.

*This facility to change the units, can be used at any time.*

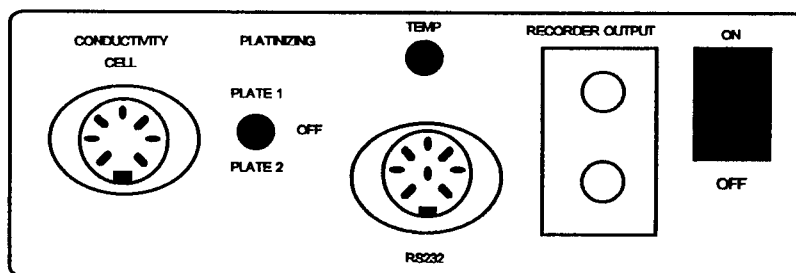


Figure 2. Rear view of CDB-387 Meter

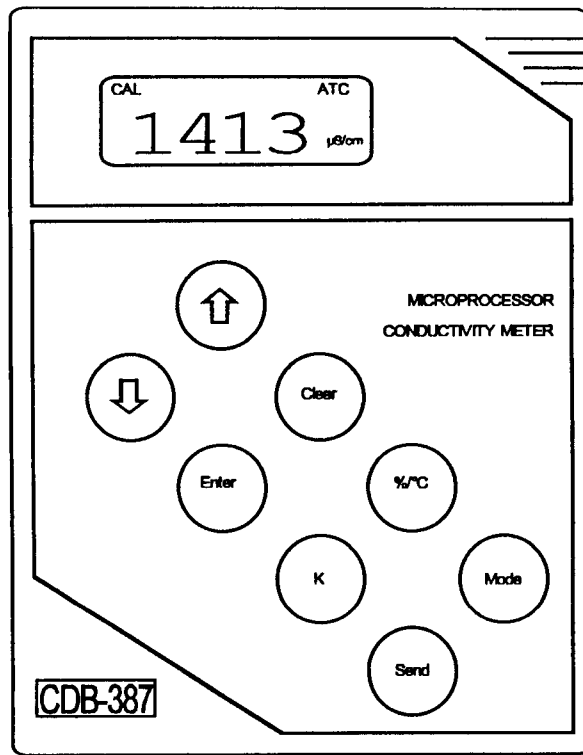










Figure 3: Front Panel

- 
 - Calibration Keys, alter displayed value
-  - Enters displayed value as calibration data
-  - Clears calibration data when pressed for 5 seconds
-  - Displays cell constant
-  - Displays temperature coefficient
-  - Transmits data to printer/computer. If not connected, freezes displayed value
-  - Selects measurement type -  $\mu\text{S}$ ;  $\text{M}\Omega$ ; TDS;  $^{\circ}\text{C}$



# SECTION 2

## Calibration and Measurement

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For accurate results, it is important to remember that when transferring from one solution to another, the cell should be rinsed using de-ionized water and blotted dry. This will prevent contamination of your sample due to carry-over. For the most accurate measurements, use a calibration solution as close as possible to the value of the sample.

---

REFER TO FIGURES 2 & 3.

### ○ Using a $K=1/cm$ ( $K=100/m$ ) conductivity cell

- ❶ Switch on the power ON/OFF switch on the back panel.
- ❷ Clear any previous calibration data (press Clear for 5 seconds, CAL flag should disappear).
- ❸ Connect conductivity cell to socket marked 'cell' and place in calibration solution. (Refer to Appendix 2 for details on calibration solutions).
- ❹ Select the required working units for Conductivity (Refer to Page 4 - Units of Measurement - for details).
- ❺ Select Conductivity mode or required function, (press Mode key until function is displayed) and wait for the reading to stabilize.
- ❻ Using the  $\downarrow$   $\uparrow$  keys (flashing CAL flag), adjust the reading so that the correct value for the standard is displayed. Press the 'Enter' key to store calibration data. The instrument and cell are now calibrated. Transfer cell to sample and record reading when stable.
- ❼ The cell constant of the calibrated cell can now be inspected by pressing the 'K' function key.
- ❽ The 'Mode' key can now be used to select the required measurement mode.

---

*Note: The cell constant  $K=1/cm$  ( $K=100.0/m$ ) may have a manufacturing tolerance of  $\pm 20\%$  and give values in the range 0.80 to 1.20/cm (80.0 to 120.0/m).*

---

***Note: All measurements are automatically temperature compensated by means of a thermistor device located in the conductivity cell head (See Section 3 page 8). This can also be used for temperature measurement by selecting °C mode.***

### **○ Using conductivity cells with other cell constants**

If the cell constant is already known or has been found by previously calibrating using the technique above, it may be entered directly.

- ❶ Select Conductivity mode and clear any existing calibration data (press Clear key for 5 seconds).
- ❷ Select Cell Constant function (press 'K' key) and set the preferred units of measurement (by carrying out a repeat pressing of the 'K' key until desired units are displayed). *Note: This facility to change the multiple for the displayed reading can be carried out at any time.*
- ❸ The default value of  $K=1.00/\text{cm}$  ( $K=100.0/\text{m}$ ) can now be adjusted to the known cell constant using the  $\downarrow \uparrow$  keys.
- ❹ The cell constant is now set and is held as calibration data.
- ❺ The 'Mode' key can now be used to select the required measurement function. (Cal flag should now be displayed in all modes).

# SECTION 3

## Temperature Compensation

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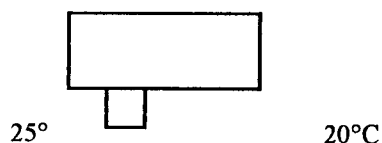
In order to make meaningful inter-sample comparisons of conductivity, the CDB-387 electronically compensates to a fixed temperature called the 'base' temperature. This is carried out automatically by means of a thermistor in the cell head, or manually by adjusting the displayed value in °C mode to the sample temperature.

The base temperature is factory set to the internationally accepted 'base' temperature of 25.0°C. This can be changed to the less frequently used 'base' temperature of 20.0°C by altering a switch setting inside the meter. The base temperature can be checked at any time by holding down the %/°C key when the meter is switched on.

---

### Adjustment of base temperature

SW1



#### ○ Using Automatic Temperature Compensation

- 1 Connect an ATC version conductivity cell (or plug in a separate temperature probe to replace the thermistor in the cell head).
- 2 Follow the calibration and measurement procedures in Section 2.

#### ○ Using Manual Temperature Compensation

- 1 Select °C function, with no thermistor connected a flashing °C flag should be displayed.
- 2 Adjust the displayed reading using the ↓ ↑ keys to the temperature of the sample or calibration solution being measured. This can be found by reconnecting the temperature probe or using a separate thermometer.
- 3 Follow the calibration and measurement procedures in Section 2.

## ○ Using No Temperature Compensation

- ❶ Select °C function and adjust the displayed value using the  $\downarrow$   $\uparrow$  keys to the base temperature being used.
- ❷ Press the %/°C key and adjust the temperature coefficient value to 0%/°C using the  $\downarrow$   $\uparrow$  and keys.
- ❸ Measure the temperature of the conductivity calibration solution by reconnecting the temperature probe or using a separate thermometer.
- ❹ Refer to the KCl values given in Appendix 2 and calibrate to the value given in the table for the temperature of the sample.
- ❺ Absolute conductivity measurements which are not temperature compensated can now be made by transferring the cell to the sample.

Absolute Conductivity = Value Displayed x Cell Constant

# SECTION 4

## Temperature Coefficients

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The conductivity of electrolytes changes with temperature. The rate of this change is termed the temperature coefficient and is different for all electrolytes. For most applications where the temperature is unlikely to fluctuate, the default value of 2%/°C is acceptable. This applies to most weak aqueous solutions in the range of 10 - 13,000 $\mu$ S/cm.

If more accurate temperature compensation is required then the exact temperature coefficient for the sample should be determined. This can be calculated automatically using the following procedure.

---

### ○ To Determine Sample Temperature Coefficient

- ❶ Place the cell in the sample with unknown temperature coefficient and calibrate.
- ❷ Select the %/°C function and store the above calibration data by pressing the 'Enter' key. The %/°C flag will now be flashing in all modes.
- ❸ Select the °C function using the 'Mode' key. Change the temperature of the sample by approximately 10.0°C either by cooling or heating.
- ❹ Select the %/°C function for a second time. Store the new temperature and conductivity data by pressing the 'Enter' key. (%/°C flag should become stable). The new calculated temperature coefficient value is now displayed.
- ❺ Before proceeding to make further measurements it is necessary to clear the above data (Enter Conductivity mode and press Clear for 5 seconds). Recalibrate to known value and enter new calculated %/°C value. See page 11.

### ○ Entering Known Temperature Coefficient Values

If the temperature coefficient value of the solution is already known either by previously using the above technique or by some other means, it may be entered as follows:-

- ❶ Select the %/°C function, clear any previous value (press the Clear key for 5 seconds).
- ❷ Adjust the displayed value to the desired reading using the ↓ ↑ keys.
- ❸ The temperature coefficient has now been set. Select measurement mode required.

***Note: The above value can be inspected at any time by using the %/°C key. If the instrument is calibrated, this data will be stored when the instrument is turned off.***

# SECTION 5

## Use of the Recorder Output

REFER TO THE RECORDER INSTRUCTIONS

- ① Connect the recorder, via the red and black 4mm recorder sockets on the back panel. (Red - POSITIVE and Black - NEGATIVE) (Figure 2).
- ② Ensure that the recorder is set for the appropriate range, i.e:

MODE	RANGE(mV)	DISPLAY	RECORDER
Cond	0 - 200	1000 $\mu$ S/cm	100mV
TDS	0 - 200	666mg/L	66.6mV
Res	0 - 200	10.0M $\Omega$ .cm	10.0mV
$^{\circ}$ C	$\pm$ 200	25.0 $^{\circ}$ C	25.0mV

### Range Hold

The auto-ranging facility on the CDB-387 automatically selects the most appropriate range for the current reading.

#### To disable the auto-ranging facility.

- ① Place the cell in the sample and select required mode.
- ② Press Send Key followed by Enter key. (Range hold will be indicated by a flashing HOLD flag).
- ③ To disable range hold press Clear key.
- ④ Exit Hold facility by pressing Send key

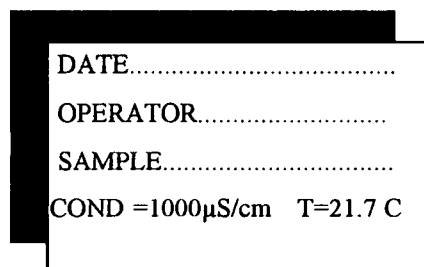
**NOTE:** Range hold is not accessible when the RS232 output is in use.

# SECTION 6

## Operation with a Printer or Computer

### Operation with a Printer

- Connect a printer (set at 1200 Baud) to the meter via the RS232C port on the back of the meter.
- Follow the calibration procedure given in SECTION 2
- To print out a sample reading, press the Send key. The first time the key is pressed the following printout is obtained.



```
DATE.....  
OPERATOR.....  
SAMPLE.....  
COND =1000µS/cm T=21.7 C
```

- Pressing and releasing the Send key subsequently, will result in a printout of the displayed reading and temperature only.
- To obtain a printout of other parameters for the same sample, press the Mode key and then the Send key.
- To print a new identifier, press and hold down the Send key.



## Operation with a computer

Connect a computer using 1200 Baud via the RS232C port on the back of the meter. A computer program is required to receive and send characters from the computer. The current readings can be sent to the computer manually by pressing the Send Key. Each line is terminated with a CR LF (Carriage return line feed). All characters are ASCII printable alpha-numeric.

TWO commands CA and RD can be sent from the computer.

### ○ CA - send calibration data

COMMAND CA

1 CR LF

COND = 1413 $\mu$ S/cm CR LF

T = 22.0° C CR LF

K = 0.997 /cm CR LF

Tb = 25.0°C CR LF

# SECTION 6

## Operation with a Printer or Computer

○RD - send current readings

### COMMAND RD

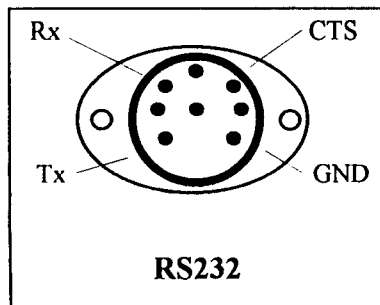
COND = 1413 $\mu$ S/cm CR LF

TDS = 944mg/L CR LF

RES = 0.001 MO.cm CR LF

T = 21.5 C CR LF

### Connection Details



### Port Specification

Baud Rate: 1200

Data Format: 1 start bit, 8 Data bits

2 stop bits, No parity bits

Voltage levels:  $\pm$ 5V

# SECTION 7

## Platinizing

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When using platinum plate conductivity cells, it is important to keep the plates covered with a platinum oxide film (i.e. fine black deposits over the entire plate surface). Should the platinum oxide film deteriorate, the following procedure should be carried out to restore a well deposited black film.

---

### Cleaning

- ① De-grease in a dilute solution of liquid detergent. Wash in chromic acid if using glass-platinum cells.
- ② Rinse in de-ionized water.
- ③ Rinse with 1 Molar nitric acid.
- ④ Wash well with de-ionized water.
- ⑤ Proceed with platinizing.

### Re-platinizing

*Note: Re-platinizing can only be carried out if an external power adaptor is connected.*

**(⚠ Care should be taken as the chemicals are hazardous)**

- ① Prepare platinizing solution by dissolving 1.0 g of chloroplatinic acid and 0.015g of lead acetate in 50mL distilled water.
- ② With the cell connected to the meter, immerse in the platinizing solution, ensuring that both plates are completely immersed.
- ③ Select 'Plate 1' with platinizing switch on the back panel ('Plat' should be displayed). After 30 seconds, select 'Plate 2' with the platinizing switch, reversing the polarity every 30 seconds. Continue to do this for 10 minutes.
- ④ The plates should have an even layer after 2 minutes - if not, clean and repeat the process.
- ⑤ Wash in de-ionized water.
- ⑥ Repeat ③ using a solution of sulfuric acid for the same period (10 minutes) to obtain a more adherent coating.
- ⑦ Soak the cell in distilled water for 48 hours before use. Re-check the cell constant before re-using the cell.

# SECTION 8

## TROUBLESHOOTING

### Symptom

No Display

"BAT" flag displayed

Display reads zero

Display shows -- on left hand side

Drifting Readings

Poor linearity

Flashing °C flag when temperature probe connected

### Probable Cause(s)

- Power supply disconnected

- Battery is flat or not installed

- Battery is low

- Cell disconnected

- Cell not immersed in solution

- Cell is open circuit

- Select correct range

- Solution outside the range of the instrument

- Cell Contaminated

- Conductivity cell needs re-platinizing

- Faulty temperature probe

## **Error Codes**

<b>PRO</b>	- Temperature probe malfunctioning
<b>E8</b>	- Serial Code malfunction

**In the event of a malfunction, it is important to pinpoint the problem to either the instrument or the cell. If a spare cell is available, substitute it for the one in use.**

**There are no user serviceable parts in this instrument. Please ensure that the meter together with all accessories is returned to OMEGA Engineering Inc. with a full description of the symptoms of the problem. No attempt should be made to repair the meter.**

# SECTION 9

## Accessories

### Available From OMEGA Engineering Inc

All cells listed have automatic temperature compensation (ATC). Standard lead length is 1 meter. Other lead lengths can be made to order.

Part No	Description	Measurement	Cell	Application
<b>Dip Type Cells</b>				
CDE-5001-GD1	Glass Dip K=1/cm	100 $\mu$ S-100mS	platinum plates	general
CDE-5002-ED1	Polymer Dip K=1/cm	100 $\mu$ S-100mS	platinum plates	general
CDE-5004-ED10	Epoxy Dip K=10/cm	100mS-2000mS	graphite plates	industrial &field
CDE-5010-ED1	Epoxy Dip K=1/cm	100 $\mu$ S-100mS	graphite plates	industrial &field
CDE-5011-ED01	Epoxy Dip K=0.1/cm	0.01 $\mu$ S-200mS	graphite plates	industrial &field
CDE-5014-GD01	Glass Dip K=0.1/cm	0.01 $\mu$ S-100 $\mu$ S	platinum plates	pure water
CDE-5019-ED1	Epoxy Dip K=1/cm	100 $\mu$ S-100mS	graphite plates	industrial &field
<b>Sample Cells</b>				
CDE-5015-GS01	Glass sample K=0.1/cm	0.01 $\mu$ S-100 $\mu$ S	platinum plates	pure water
<b>Flow Cells</b>				
CDE-5005-GF1	Glass Flow K=1/cm	100 $\mu$ S-100mS	platinum plates	lab use
CDE-5008-EF10	Epoxy Flow K=10/cm	100mS-2000mS	graphite plates	industrial flow line
CDE-5012-EF1	Epoxy Flow K=1/cm	100 $\mu$ S-100mS	graphite plates	industrial flow line
CDE-5013-ED01	Epoxy Flow K=0.1/cm	0.01 $\mu$ S-200mS	graphite plates	industrial flow line

# SECTION 10

## Specifications

<b>Conductivity:</b>	<b>Ranges and resolution:</b>	0 - 20.00 $\mu$ S/cm or 2.000mS/m 0 - 200.0 $\mu$ S/cm or 20.00 mS/m 0 - 2000 $\mu$ S/cm or 200.0mS/m 0 - 20.0 mS/cm or 2000mS/m 0 - 200mS/cm or 20.00S/m
	<b>Accuracy:</b>	$\pm 0.3\%$ of reading
<b>TDS:</b>	<b>Ranges and resolution:</b>	0 - 13.20 mg/L 0 - 132.0 mg/L 0 - 1320 mg/L 0 - 13.2g/L
	<b>Accuracy:</b>	$\pm 0.3\%$ of reading
<b>Resistivity:</b>	<b>Ranges and resolution:</b>	0 - 2.000 M $\Omega$ .cm or 0.020M $\Omega$ .m 0 - 20.00 M $\Omega$ .cm or 0.200 M $\Omega$ .m
	<b>Accuracy:</b>	$\pm 0.3\%$ of reading
<b>Temperature:</b>	<b>Range:</b>	-30 to +130 $^{\circ}$ C
	<b>Resolution:</b>	0.1 $^{\circ}$ C
	<b>Accuracy:</b>	$\pm 0.3^{\circ}$ C
<b>Temperature Compensation:</b>		0 - 50 $^{\circ}$ C
<b>Reference Temperature:</b>		25 $^{\circ}$ C (Selectable to 20.0 $^{\circ}$ C)
<b>Temperature Coefficient:</b>		Default 2%/ $^{\circ}$ C. User adjustable 0 - 5%/ $^{\circ}$ C
<b>Recorder Output:</b>		$\pm 200$ mV, 2x 4mm sockets
<b>Platinizing Output:</b>		25mA, @ 3V
<b>RS232:</b>		See Section 6
<b>Power:</b>		9V battery or power adaptor via 2.1mm female socket
<b>Instrument size:</b>		8.27" x 5.9" x 3.47"
<b>Instrument weight:</b>		1.2lb

# Appendix 1

## Cell Constants

Conductivity cells with different cell constants can be used to achieve greater accuracy, or used to make difficult measurements easier. Selection of the correct cell constant is dependent on the conductivity range of your sample. Conductivities of various waters and common solutions, together with the most suitable cell constants are given below.

### **K = 0.1/cm (K = 10.0/m)**

For measurements of solutions with very low conductivity. e.g. pure water, de-mineralized water, distilled water, boiler feed water.

### **K = 1.0/cm (K= 100/m)**

For measurements of solutions with medium conductivity, e.g. surface water, waste water, diluted salt solutions, fertilizers, electroplating rinses.

### **K = 10/cm (K=1000/m)**

For measurements of solutions with high conductivity, e.g. strong acid, strong alkali, strong salt solutions, sea water.

In order to obtain the absolute conductivity value, multiply the displayed reading by the cell constant.

### Cell Conversion Table

<b>c.g.s units</b>	<b>SI units</b>
<b>K =1.0/cm</b>	<b>K = 100.0/m</b>
<b>K = 0.1/cm</b>	<b>K = 10.0/m</b>
<b>K = 10.0/cm</b>	<b>K =1000/m</b>



# Appendix 2

## Calibration Solutions

1413 $\mu$ S/cm @ 25°C 0.01M KCl

°C	$\mu$ S/cm	mS/m	°C	$\mu$ S/cm	mS/m
5	896	89.6	25	1413	141.3
10	1020	102.0	26	1441	144.1
15	1147	114.7	27	1468	146.8
16	1173	117.3	28	1496	149.6
17	1199	119.9	29	1524	152.4
18	1225	122.5	30	1552	155.2
19	1251	125.1	31	1581	158.1
20	1278	127.8	32	1609	160.9
21	1305	130.5	33	1638	163.8
22	1332	133.2	34	1667	166.7
23	1359	135.9	35	-	-

12.88mS/cm @ 25°C 0.1M KCl

°C	$\mu$ S/cm	mS/m	°C	$\mu$ S/cm	mS/m
5	896	89.6	25	1413	141.3
10	1020	102.0	26	1441	144.1
15	1147	114.7	27	1468	146.8
16	1173	117.3	28	1496	149.6
17	1199	119.9	29	1524	152.4
18	1225	122.5	30	1552	155.2
19	1251	125.1	31	1581	158.1
20	1278	127.8	32	1609	160.9
21	1305	130.5	33	1638	163.8
22	1332	133.2	34	1667	166.7
23	1359	135.9	35	-	-
24	1386	138.6	36	-	-

## Calibration Solutions

2.765 mS/cm @ 25°C 0.02M KCl

°C	mS/cm	mS/m	°C	mS/cm	mS/m
5	1.752	175.2	25	2.765	276.5
10	1.994	199.4	26	2.819	281.9
15	2.243	224.3	27	2.873	287.3
16	2.294	229.4	28	2.927	292.7
17	2.345	234.5	29	2.981	298.1
18	2.397	239.7	30	3.036	303.6
19	2.449	244.9	31	3.091	309.1
20	2.501	250.1	32	3.146	314.6
21	2.553	255.3	33	3.201	320.1
22	2.606	260.6	34	3.256	325.6
23	2.659	265.9	35	3.312	331.2

111.8mS/cm @ 25°C 1.0 M KCl

°C	mS/cm	S/m	°C	mS/cm	S/m
5	74.14	7.414	25	111.80	11.180
10	83.19	8.319	26	113.77	11.377
15	92.52	9.252	27	115.74	11.574
16	94.41	9.441	28	-	-
17	96.31	9.631	29	-	-
18	98.22	9.822	30	-	-
19	100.01	10.014	31	-	-
20	102.07	10.207	32	-	-
21	104.00	10.400	33	-	-
22	105.54	10.554	34	-	-
23	107.89	10.789	35	-	-
24	109.84	10.984	36	-	-

## WARRANTY

OMEGA warrants this unit to be free of defects in materials and workmanship and to give satisfactory service for a period of **13 months** from date of purchase. OMEGA Warranty adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that our customers receive maximum coverage on each product. If the unit should malfunction, it must be returned to the factory for evaluation. Our Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective it will be repaired or replaced at no charge. However, this WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear or which are damaged by misuse are not warranted. These include contact points, fuses, and triacs.

**We are glad to offer suggestions on the use of our various products. Nevertheless, OMEGA only warrants that the parts manufactured by it will be as specified and free of defects.**

**OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED.**

**LIMITATION OF LIABILITY: The remedies of buyer set forth herein are exclusive and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.**

Every precaution for accuracy has been taken in the preparation of this manual; however, OMEGA ENGINEERING, INC. neither assumes responsibility for any omissions or errors that may appear nor assumes liability for any damages that result from the use of the products in accordance with the information contained in the manual.

SPECIAL CONDITION: Should this equipment be used in or with any nuclear installation or activity, buyer will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the equipment in such a manner.

## RETURN REQUESTS / INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA ENGINEERING Customer Service Department. Call toll free in the USA and Canada: 1-800-622-2378, FAX: 203-359-7811; International: 203-359-1660, FAX: 203-359-7807.

BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, YOU MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OUR CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. P.O. number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems you are having with the product.

FOR **NON-WARRANTY** REPAIRS OR **CALIBRATION**, consult OMEGA for current repair/calibration charges. Have the following information available BEFORE contacting OMEGA:

1. P.O. number to cover the COST of the repair/ calibration,
2. Model and serial number of product, and
3. Repair instructions and/or specific problems you are having with the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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- Wire: Thermocouple, RTD & Thermistor
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- Recorders, Controllers & Process Monitors
- Infrared Pyrometers

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- Load Cells & Pressure Gauges
- Displacement Transducers
- Instrumentation & Accessories

## FLOW/LEVEL

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- Air Velocity Indicators
- Turbine/Paddlewheel Systems
- Totalizers & Batch Controllers

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- pH Electrodes, Testers & Accessories
- Benchtop/Laboratory Meters
- Controllers, Calibrators, Simulators & Pumps
- Industrial pH & Conductivity Equipment

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- Cartridge & Strip Heaters
- Immersion & Band Heaters
- Flexible Heaters
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- Metering & Control Instrumentation
- Refractometers
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- Air, Soil & Water Monitors
- Industrial Water & Wastewater Treatment
- pH, Conductivity & Dissolved Oxygen Instruments

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