EDT directION
ELECTROCHEMISTRY PRODUCTS

Model RE388TX Conductivity Meter

Instruction manual

Table of Contents

SECTION 1
Introduction

Description

The RE388Tx is a precision auto-ranging, bench-top conductivity meter. The meter can be used to measure: Conductivity; TDS; Re-sistivity; Salinity; Concentration and Temperature. Automatic tem-perature compensation is standard in all modes. The meter features a built-in platinizing unit as well as an RS232 output.

Unpacking

Verify that you have received all equipment. If you have any ques-tions about the shipment, please call EDT Direct ION. or your agent.
When you receive the shipment, inspect the container for any signs of damage. Note any evidence of rough handling in transit. Imme-diately report any damage to the agent.

Note
The carrier will not honour any claims unless all shipping material is saved for their examination. After examining and removing con-tents, save packing material in the event that re-shipment be neces-sary.
The following items are packed in the box:

- RE388Tx
- Glass Cell K=1/cm
- Cell Holder
- Power Adaptor
- Calibration Solution
- 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

- Only use the approved power adaptor supplied
- Check that the adaptor is the correct voltage for your power supply
- Plug the adaptor into the power socket at the back of the meter, then connect to the AC supply.

Battery Installation

- Approximately 24 hours of continuous use is afforded by the 9V battery.
- The BAT flag appears on the display to indicate a low battery.
- To install or replace the battery, slide off the back cover
- Remove the old battery and insert a new one ensuring that the polarity is correct
- Replace back cover.

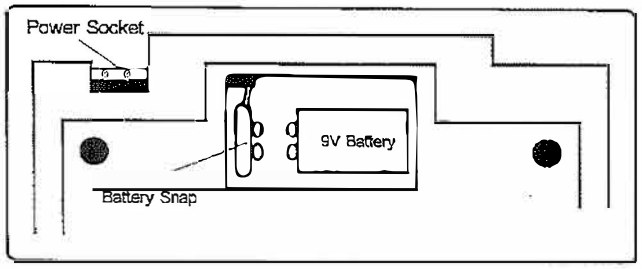


Figure 1. Bottom view of instrument showing power connections

Instrument Test Procedure

Refer to Figure 2

- Switch the instrument on using the black switch on the back panel. The meter should start up in conductivity mode.
- Clear any calibration data by first pressing the Clear key and then holding the Enter key down for 5 seconds
- Display the cell constant by pressing K. The units should be /cm. If units are /m, press K again. Adjust the K value (if necessary) to 1.000/cm using the ⇧⇩keys.
- Press the Mode key to display each mode sequentially. With no cell connected, the values displayed should be as follows:

Conductivity	**0.00µS/cm**	**±1 digit**
TDS	**0.00mg/L**	**±1 digit**
Resistivity	**- - -MΩ.cm**	**(Over-range)**
Salinity	**-L**	**(Under-range)**
Concentration	**1000c**	
°C	**OC**	**Open Circuit**

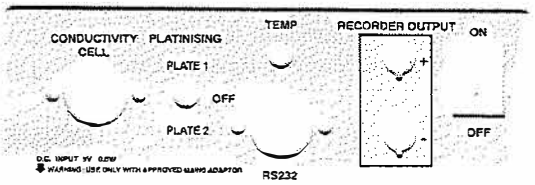


Figure 2: Rear View of RE388Tx

Figure 3. Front Panel

Calibration Keys—Alter displayed reading

Enters displayed value as calibration data

Clears Calibration data when Enter pressed for 5 s

Displays cell constant

Displays temperature coefficient

Transmits data to printer. Acts as Hold facility.

Selects measurement type—µS; MΩ; TDS; Salinity Conc °C

Units of Measurement

When using the RE388Tx Conductivity or Resistivity may be expressed in one of two units:
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.
The C.G.S Units expressed values as multiples of per centimetre.

The relationship between the two units is as follows:
Conductivity 1mS/cm = 100mS/m
Resistivity 10MΩ.cm = 0.1MΩ.m

Changing the multiple

❶ Press the K key to display the multiple
❷ Set the preferred units by pressing the K key to select either m or cm
❸ Exit with the correct units set by pressing the mode key

A Note on Conductivity Cells

Platinum Plate Cells.

These cells use two platinum cell plates coated with a thin layer of platinum oxide. It is important not to touch the surface of the plates (while in use or when cleaning) since any surface damage could result in the linearity of the cell being affected. For this reason, these cells are not suitable for samples containing suspended solids. If damage does occur, the cells can be re-coated (see Section 10).

Graphite Plate Cells

These cells have graphite cell plates in an epoxy housing. The rugged construction of the cells means they are suitable for both industrial and field applications. Cleaning the cells is easy, using a bottle brush and weak detergent solution.

Setting the Cell Constant

Before making any measurement, the cell constant must be entered. The constant may be entered in units of/cm or /m

- Connect the cell and power up by pressing the black switch on the back
- The instrument will automatically start up in conductivity mode

Entering a Known Cell Constant

1. Press K. Units are shown in the top right corner of the display. To change the units press K again.
2. Using the ⇩⇧ keys, scroll up or down until the correct value is reached. The cell constant is now set. Return to the function you required by using the mode key.

Often the exact cell constant is unknown. A nominal value of, say, 1.00/cm is quoted and the cell and instrument must be calibrated against a standard solution to obtain the exact value.

Determining an Unknown Cell Constant

1. Use a standard solution. E.g. 0.01M KCl has a conductivity of 1413µS/cm @25°C
2. Press the MODE key to display conductivity
3. Place the cell in the standard. When the reading is stable, use the ⇧⇩ keys to adjust the displayed value to that of the standard. (The CAL flag will flash).
4. Press K. The cell constant is now set and displayed. Return to the function you require by pressing the mode key.

NOTE: DO NOT PRESS THE Enter KEY WHEN SETTING THE CELL CONSTANT

Setting the Temperature Coefficient

The conductivity of electrolytes changes with temperature. The rate of this change is termed the temperature coefficient and differs 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 solutions in the range 10 to 13,000µS/cm. If more accurate temperature compensation is required, then the exact temperature coefficient for the sample should be determined.

Determining an Unknown Temperature Coefficient

1. Place the cell in the sample.
2. Press %/°C key, then press Enter. (the %/°C will flash).
3. Change the temperature of the sample by 10 degrees.
4. Select %/°C. Press Enter. The new Coefficient is now displayed. Make a note of this value.
5. Press the Mode key to display conductivity mode, then clear the data by pressing the Clear key for 5 seconds.
6. Recalibrate to a known value and enter the calculated coefficient. (see below).

To Enter a Known Temperature Coefficient

If the temperature coefficient value is already known or has been determined as above it may be entered as follows:

1. Select the %/°C key and clear any previous calibration data. (Press Clear for 5 seconds)
2. Adjust the displayed value to the correct value using the ⇩ ⇧ keys
3. The temperature coefficient has now been set. Select measurement mode.

General Information

Read this section before proceeding with Sections 2,3,4,5 and 6

Before calibrating, or making a measurement on any mode, it is important to note the :

- The cell constant is correct
- The temperature coefficient is correct
- Any unnecessary calibration data is cleared.
- Calibration data is indicated by the presence of the word CAL on the display. To inspect the data, press the Chk key. Calibration points are shown in sequence. To clear the data, remain in CHK mode and press and hold down the Enter key for 5 seconds.
- The cell constant is not considered to be calibration data but a physical constant. The value *will not* be erased by the Clear procedure.
- The temperature coefficient *will* be eased by the clear procedure so always make a note of it and re-enter if necessary.
- All measurements are automatically temperature compensated to a base temperature of 25°C.
- To make un-compensated measurements then the temperature coefficient should be set to zero.

Section 2

Conductivity

Please refer to page 9 before proceeding.

The following can only be carried out if the instrument has not been calibrated in Concentration Mode.

Most conductivity cells are linear over a wide range. Since the cell constant has already been set (see p 7) , measure conductivity as follows:

❶ Connect cell and select conductivity mode
❷ Place cell in sample
❸ Wait for a stable reading and record result noting the units.

For very accurate results any non-linearity arising from polarisation effects, may be calibrated out as follows:

❶ Prepare up to four calibration solutions, each with a known conductivity
❷ Connect cell and select conductivity mode
❸ Place cell in first standard and wait for a stable reading. Using the ⇩ ⇧ keys, adjust the reading to the correct value (CAL flag will flash). Press Enter. (CAL flag will stop flashing).
❹ Repeat ❸ for each standard.
❺ Place cell in sample and record value noting units.

The calibration points may be inspected at any time as follows:

① Press Clear
② First a number identifier is displayed and then the standard value.
③ This is repeated for each standard.
④ Return to the function you require by pressing the Mode key.

Section 3

Total Dissolved Solids (TDS)

TDS Measurement

Please refer to page 9 before proceeding

1. Connect Cell
2. Select TDS mode by pressing the mode key until the correct units are displayed
3. Place cell in the sample. (The correct range will be selected automatically).
4. Wait for a stable reading and record result noting units.

Section 4

Resistivity

Resistivity Measurement

Please refer to page 9 before proceeding

1. Connect Cell
2. Select TDS mode by pressing the mode key until the correct units are displayed
3. Place cell in the sample. (The correct range will be selected automatically).
4. Wait for a stable reading and record result noting units.

Section 5

Salinity

Salinity Measurement

Please refer to page 9 before proceeding

1. Connect Cell
2. Select Salinity mode by pressing the mode key until the correct units are displayed
3. Place cell in the sample. (The correct range will be selected automatically).
4. Wait for a stable reading and record result noting units.
5. If the sample is out of range then the display will show L for a low reading and H for a high reading.

Section 6

Temperature

Temperature Measurement

Please refer to page 9 before proceeding

1. Connect Cell and place in solution
2. Select Temperature by pressing the Mode key until the correct units are displayed then record the value
3. To change from Centigrade to Fahrenheit, press Enter.
4. Return to the function you require by pressing the Mode key.

Section 7

Concentration

Please refer to page 9 before proceeding.
The following can only be carried out if the instrument has not been calibrated in Conductivity Mode.

Calibration and Measurement

❶ Prepare up to four calibration solutions, each with a known concentration
❷ Connect cell and select concentration mode
❸ Place cell in first standard and wait for a stable reading. The ⇩ key can be used to adjust the value to the correct decade of concentration. The exact value may then be entered by adjusting the reading using the ⇩⇧ keys, (CAL flag will flash). And then pressing Enter. (CAL flag will stop flashing).
❹ Repeat ❸ for each standard.
❺ Place cell in sample and read concentration.

The calibration points may be inspected at any time as follows:

① Press CHK
② First a number identifier is displayed and then the standard value.
③ This is repeated for each standard.
④ Return to the function you require by pressing the Mode key.

To Back off the background conductivity

Follow points ❶to ❹

❺ Place cell in background sample and enter 0.00
❻ Place cell in sample and read concentration

Section 8

Use of the Recorder Output

Refer to the recorder instructions

❶ Connect the recorder via the red and black 4mm sockets on the back panel. (Red positive, Black negative)
❷ Ensure that the recorder is set for the appropriate range, i.e.

Mode	Range	Display	Recorder
Cond	0-200	1000µS/cm	100mV
TDS	0-200	666mg/L	66.6mV
Res	0-200	10.0MΩ.cm	10.0mV
Sal	0-200	35.0	35.0mV
°C	±200	25.0°C	25.0mV

Range Hold

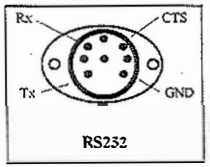
The auto-ranging facility on the RE388Tx selects the most appropriate range for the current reading automatically.

To disable the auto- ranging facility

❶ Place cell in the sample and select the required mode.
❷ Press the Send key followed by the Enter key.
❸ The range currently in use is now held.
❹ To disable range hold press Clear key
❺ Exit Hold facility by pressing the Send key.

Section 9

Operation With a Printer or Computer



Port Specification	
Baud Rate:	1200
Data Format:	1 start bit, 8 Data bits
	2 stop bits, No parity bit
Voltage levels:	±5V

Connection Details

Printer

1. Connect a printer (set at 1200 Baud) to the meter via the RS232C port on the back of the meter
2. Follow the calibration procedure given in Section 2
3. To print out a sample reading, press the Send key. The first time the key is pressed the following printout is obtained
4. Pressing and releasing the Send key subsequently will result in a printout of the displayed reading and temperature only.
5. To obtain a printout of other parameters for the same sample, press the Mode key and then the Send key
6. To print a new identifier, press and hold down the Send key.

DATE.....

OPERATOR.....

SAMPLE.....

COND=1000µS/cm T=21.7°C

Computer

Connect a computer using 1200 Baud via the RS232C port at 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 by pressing the Send key. Each line is terminated with a Carriage Return (CR), Line Feed (LF). 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 = 1413µS/cm CR LF
T=22.0°C CR LF
K=0.997/cm CR LF
Tb = 25.0°C CR LF

RD –Send Current Readings

Command—RD
COND = 1413µS/cm CR LF
TDS =944mg/LCR LF
Res = 0.001MΩ.cm CR LF
T = 21.5°C CR LF

Section 10

Platinizing

When using platinum plate conductivity cells, it is important to keep the plates covered with a platinum oxide film (fine black deposits over the entire plate surface). Should the oxide layer deteriorate, it can be restored as detailed below:


Care should be taken as the chemical used in this procedure are hazardous

Cleaning

1. Degrease with a dilute solution of liquid detergent. Wash in chromic acid if using glass-platinum cells
2. Rinse with deionised water
3. Rinse with 1M Nitric Acid
4. Wash well with deionised water

Re-Platinizing

This process can only be carried out if the power adaptor is connected.

1. Prepare platinizing solution by dissolving 1.0g of chloroplatinic acid and 0.015 lead acetate in 50mL of deionised water
2. Connect the cell to the meter and immerse in the platinizing solution
3. Move the platinizing switch on the back panel to the plate 1 position. (Plat will be displayed). After 30 seconds select plate 2. Continue to reverse the polarity for 9 more minutes.
4. The plates should now have an even layer. If not, clean and repeat the process. Wash with deionised water.
5. Soak in deionised water for 48 hours before use. Re-check the cell constant before reusing.

Section 11

Troubleshooting

Symptom	Probable Cause
No display	Power supply disconnected Battery is flat or not installed
'BAT' flag displayed	Battery Low
Display reads zero	Cell disconnected Cell not immersed in solution Cell has an open circuit. (replace)
Display shows -- in left hand digit (Over-range condition)	Solution outside instrument range (>200mS/cm).
Drifting readings	Inconsistent or lack of stirring Cell contaminated
Flashing °C flag when temperature probe connected	Faulty temperature probe

Error Codes

E4	Loss of Factory Calibration
E6, E7	Calibration point error
SC, OC	Temperature probe short or open circuit
H, L	Salinity value above or below measurement range

In the event of a malfunction, it is important to pinpoint the problem to either the meter 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 instrument, together with all accessories, is returned to EDT Direct ION or the agent with a full description of the symptoms. No attempt should be made to repair the meter.

Section 12

Specifications

Conductivity Ranges and Resolution (Accuracy ±0.3% of reading)	0-19.99µS/cm or 1.999mS/m 0-199.9µS/cm or 19.00mS/m 0-1999µS/cm or 199.9mS/m 0-19.9mS/cm or 1999mS/m 0-199mS/cm or 19.99S/m
TDS Ranges and Resolution. (Accuracy ±0.3% of reading)	0-13.20mg/L 0-132.0mg/L 0-1320mg/L 0-13.2g/L 0-132g/L
Resistivity Ranges and Resolution. (Accuracy ±0.3% of reading)	0-1.999MΩ.cm or 0.019MΩ.m 0-19.99MΩ.cm or 0.199MΩ.m
Salinity (Accuracy ±0.3% of reading)	In accordance with UNESCO data 2.0-42
Salinity Temperature compensation	-2.0 to +35°C
Concentration	Auto ranging, choice of units, background off set
Temperature Range and Resolution (Accuracy ±0.3°C)	-30.0 to +130.0°C
Temp compensation range	0-50°C
Reference Temperature	25°C Factory selectable to 20°
Temperature Coefficient	Default 2% User adjustable 0—5%/°C
Recorder Output	±200mV, 2 x 4mm sockets
Power	9V Battery or power adaptor
Instrument Size	210 x 150 x 88mm
Instrument Weight	550g

Section 13

Conductivity Cells

Available from EDT Direct ION.

All cell listed have ATC. Standard cable length is 1 metre. Other cable lengths are available on request.

Dip Cells

Part No	Type	Range	Cell	Use
E8071	Glass K=1 (12mm)	100µS-100mS	Platinum plates	General use
E8070	Polymer K=1 (12mm)	100µS-100mS	Platinum plates	General use
E8072	Glass K=0.1 (12mm)	0.01µS-100µS	Platinum plates	Pure Water
A5004	Epoxy K=10 (25mm)	100mS-2000mS	Graphite plates	Industrial & Field
A5010	Epoxy K=1 (25mm)	100µs-100mS	Graphite plates	Industrial & Field
A5011	Epoxy K=.1 (25mm)	0.01µS-200mS	Graphite plates	Industrial & Field
A5019	Epoxy K=1 (12mm)	100µS-100mS	Graphite plates	General use

Flow Cells

Part No	Type	Range	Cell Type	Use
A5005	Glass K=1 (12mm)	100µS-100mS	Platinum plates	General use
A5008	Epoxy K=10 (25mm)	100mS-2000mS	Graphite plates	Industrial & Field
A5012	Epoxy K=1 (25mm)	100µs-100mS	Graphite plates	Industrial & Field
A5013	Epoxy K=.1 (25mm)	0.01µS-200mS	Graphite plates	Industrial & Field

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 the sample. Conductivities of various waters and common solutions, together with the most suitable cell constants are given below.

K=0.1/cm

For measurement of solutions with very low conductivity e.g.: pure water, de-mineralise water; distilled water; boiler feed water

K=1.0/cm

For measurement of solutions with medium conductivity e.g.: Surface water; waste water; diluted salt solutions; fertilizers; electroplating rinses.

K=10/cm

For measurement of solutions with high conductivity e.g.: Strong acid; strong alkali; strong salt solutions; sea water

Cell Conversion Table

c.g.s. Units	SI Units
K=1.0/cm	K=100.0/m
K=0.1/cm	K=10/m
K=10.0/cm	K=1000/m

Appendix 2

Calibration Solutions

1413µS/cm @25°C 0.01M KCl

°C	µS/cm	mS/m	°C	µS/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	1571	157.1
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	-	-

12.88mS/cm @25°C 0.1M KCl

°C	µS/cm	mS/m	°C	µS/cm	mS/m
5	8220	822	25	**12880**	**1288**
10	9330	933	26	13130	1313
15	10480	1048	27	13370	1337
16	10720	1072	28	13620	1362
17	10950	1095	29	13870	1387
18	11190	1119	30	14120	1412
19	11430	1143	31	-	-
20	11670	1167	32	-	-
21	11910	1191	33	-	-
22	12150	1215	34	-	-
23	12390	1239	35	-	-
24	12640	1264	36	-	-

Calibration Solutions

2.765mS/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
24	2.712	271.2	36	3.368	336.8

2111.8mS/cm @25°C—0.02M KCl

°C	mS/cm	mS/m	°C	mS/cm	mS/m
5	74.14	7.41	25	111.80	11.18
10	83.19	8.32	26	113.77	11.38
15	92.52	9.25	27	115.74	11.57
16	94.41	9.44	28	-	-
17	96.31	9.63	29	-	-
18	98.22	9.82	30	-	-
19	100.01	10.01	31	-	-
20	102.07	10.21	32	-	-
21	104.00	10.40	33	-	-
22	105.54	10.55	34	-	-
23	107.89	10.79	35	-	-
24	109.84	10.98	36	-	-