



DR359TX - Ion Meter - Users Manual

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SECTION 1 - Introduction

Description

The DR359Tx Ion Concentration/pH meter can be used with pH, Ion selective and redox electrodes. The meter will automatically calculate the relationship between up to 5 ion standards allowing sample concentration to be read directly, avoiding the plotting of calibration graphs.

Unpacking

Verify that you have received all equipment. If you have any questions about the shipment, please call EDT Direct ION Ltd. or your agent.

When you receive the shipment, inspect the container for any signs of damage. Note any evidence of rough handling in transit. Immediately 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 contents, save packing material in the event that re-shipment be necessary.

The following items are packed in the box:

DR359Tx Ion Meter • E8060 Electrode Stand • AC Adapter • 9V Battery
• Operator's Manual

Setting Up - 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.

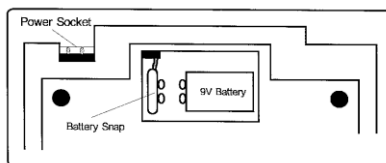


Figure 1. Bottom view of instrument showing power connections

Instrument Test Procedure

1. Ensure that the shorting plug is connected to the BNC pH in-input at the back of the meter. Switch on using the switch on the back panel.
2. Press the Mode key to select pH mode and clear any calibration data by pressing the Clear key for 5 seconds.
3. The displayed reading should read $7.00 \pm 0.02\text{pH}$
4. Switch to mV mode by pressing the mode key. Display should read $0.0 \pm 0.2\text{mV}$
5. Switch to $^{\circ}\text{C}$ key by pressing the mode key. Ensure that the display has a value in the range 0.0 to 19.0°C and is adjustable.
i.e. responds to the use of the \blacktriangle \blacktriangledown keys. Adjust to 20.0°C
6. Switch to concentration mode (CONC) and ensure that the display reads 10.0 ± 0.2
7. The meter is ready for calibration

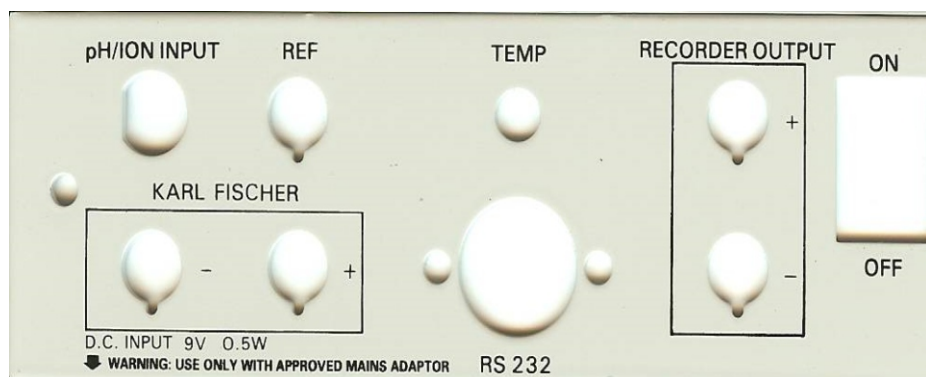
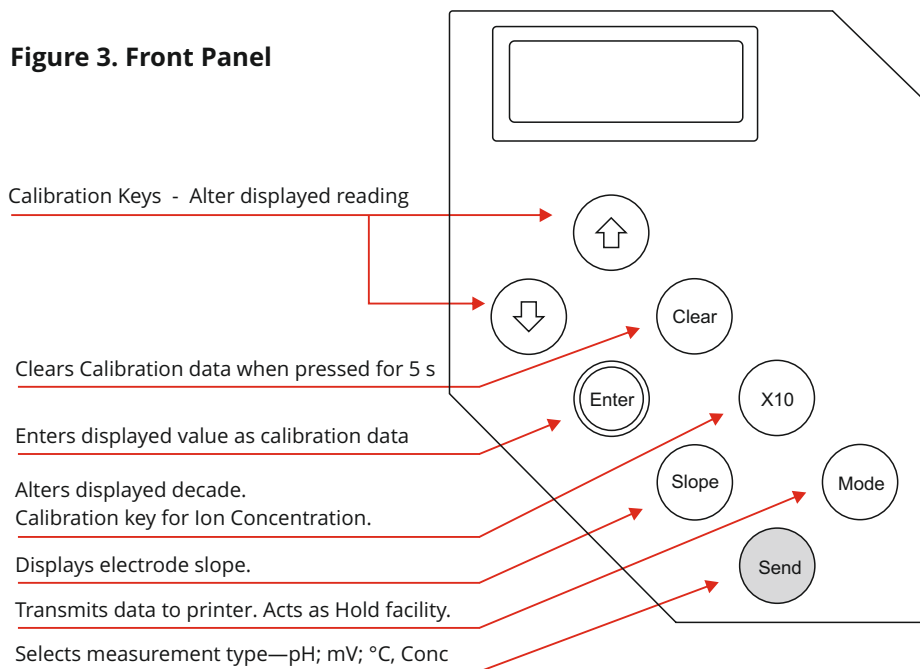


Figure 2. Rear view of DR359Tx

A Note on Electrodes

pH, Ion Selective and Redox electrodes may all be used with the DR359Tx. These may be combination or half-cell types. Combination or sensing half-cells should have a BNC terminal and be connected to the socket marked pH/ION input at the back of the meter. Reference half-cells should have a 4mm bunched terminal and be connected to the socket marked REF. Always refer to electrode instructions before use. See also, Appendix 1.

Figure 3. Front Panel



Section 2 - pH Calibration and Measurement

For accurate results, stir all buffers and samples. Always rinse electrodes and blot dry before transferring from one solution to another to prevent contamination. Ensure that any electrode filling holes are left uncovered during use.

Automatic Calibration & Temperature Compensation

1. Connect the pH electrode(s) and temperature probe and switch on using the power ON/OFF switch on the back panel.
2. In order to calibrate in pH mode, any existing ion calibration data MUST be cleared. Presence of calibration data is indicated by the CAL flag in the left hand corner of the display. Select Conc mode and then press Clear for 5 seconds. Select pH mode.
3. Place the pH electrode(s) and the temperature probe in the first buffer and wait for a stable reading. Press the Enter key. The first calibration point will now be entered automatically at the correct value for the temperature of measurement. The Cal flag will be displayed.
4. Rinse, blot and place the pH electrode(s) and temperature probe in the second buffer. Wait for a stable reading. Press the Enter key. The second calibration point will now be entered automatically at the correct value for the temperature of measurement.
5. Rinse, blot and place pH electrode(s) and temperature probe in the sample. Wait for a stable reading and record pH value.

Note: The performance/condition of the electrode(s) may be monitored by pressing the Slope key. This displays the slope of the electrode as a % of the Nernstian or Theoretical Slope. The value should lie between 80 and 110%.

Manual Calibration

If buffers other than 4,7 and 10pH are to be used, then the calibration must be performed manually. That is the correct pH values must be entered using the \uparrow/\downarrow keys

Follow the procedure for Auto calibration above but before pressing the enter key (points 3 and 4) carry out the following procedure:

1. Check the temperature of the buffer
2. Look up the value of the buffer for this temperature
3. Use the \uparrow/\downarrow keys to adjust the displayed reading to the value displayed in \square (the CAL flag will flash). Press Enter (the CAL flag will stop flashing)

Manual Temperature Compensation

If the use of a temperature probe is inappropriate, e.g. small sample size then manual temperature compensation can be used. With the temperature probe disconnected, follow the procedure for Automatic Temperature compensation on page ?. points **1** to **3**.

4. Press the Mode key to select °C function. Note that the °C flag will flash when no temperature probe is connected. Use the \uparrow/\downarrow keys to adjust the displayed reading to the temperature of the first buffer.
 5. Press the Mode key to return to pH function.
 6. The meter may now be calibrated automatically or manually following either of the procedures above.
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Section 3 - Ion Concentration General tips for accurate results

Temperature

Always ensure that standards and samples are kept at the same temperature and remain constant

Stirring

It is preferable to stir standards and samples. Stir such that no vortex is visible

If using a magnetic stirrer, it is advisable to put a piece of insulating material between the plate and the vessel to eliminate any temperature effects arising from the stirrer itself.

Some samples are impossible to stir consistently. If this is the case, it may be better not to stir but be sure to treat all standards in the same way. Alternatively consider using an incremental method of analysis such as Known addition or subtraction.

Avoiding Contamination

Always rinse the electrodes and blot dry before transferring from one solution to another
Move from the most to the least dilute standard

Ionic Strength Adjustment

A solution of high ionic strength is added to all standards and samples. This minimises differences in background ionic strength between solution and enables conductivity (as opposed to activity) to be measured directly.

Calibration and Measurement

Note: Refer to Appendix 2 on concentration units before proceeding

1. Up to 5 calibration points may be entered. Standards should be prepared such that their concentrations lie either side of the expected sample range. If 2 standards are to be used then ideally they should be 10fold apart in concentration. E.g. for an expected sample concentration of 5ppm, standards of 1 and 10ppm should be prepared.
2. Connect the Ion selective electrode to the BNC input at the back of the meter. If using a separate reference electrode, connect to the 4mm input. Switch on using the black ON/OFF
3. In order to work in Concentration mode, any existing pH calibration data MUST be cleared. Select pH mode. If the CAL flag is displayed, press the Clear key until it disappears.
4. Press the mode key until Conc is displayed.
5. Place electrodes in the first standard and wait for a stable reading (the value displayed is an arbitrary number at this stage).
6. Press the x 10 key (if necessary) to adjust the value to the correct decade, then use the \uparrow/\downarrow keys to adjust to the exact value of the standard. (The CAL flag will flash during this procedure.). Press Enter. (The CAL flag will stop flashing).
7. Place electrodes in the next standard and repeat \uparrow/\downarrow and Enter
8. If further standards are to be used repeat from 6 for each standard.
9. Ion concentration measurements may now be made by immersing the electrodes in the prepared sample and recording the displayed reading.

Note: The performance of the electrodes can be assessed by pressing the Slope key. This will display the mV/decade slope which can then be compared with the theoretical value

Section 4 - mV Calibration and Measurement

The mV mode has two ranges. The meter will automatically select the most appropriate range as follows:

0 to ± 400 mV with resolution 0.1mV

± 400 mV to ± 2000 mV with resolution 1mV

Absolute mV

1. Connect the electrodes
2. Press the Mode key to select mV function
3. Clear any existing data. (Press Clear for 5 seconds)
4. Absolute mV readings may now be made by immersing the electrodes in the sample and recording the reading.

Relative mV

Follow the procedure for Absolute mV from 1 to 3

- 4. Immerse electrode(s) in the standard or blank solution. Wait for a stable reading and press Enter. The display will automatically zero and the CAL flag will be displayed.
- 5. mV values relative to the standard solution may now be taken by immersing in the sample and recording the reading.

Section 5 - Use of the recorder output

Connect the recorder via the red and black 4mm sockets on the back panel.
(Red positive, Black negative)

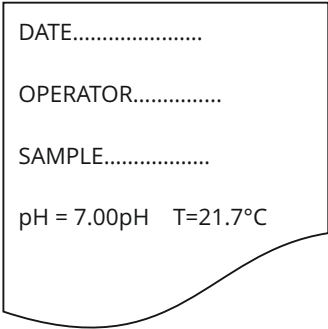
Ensure that the recorder is set for the appropriate range, as shown.

Mode	Range	Display	Recorder
Ion	0-200	-----	mV/10
pH	0-200	7.00pH	70.0mV
mV	±200	500mV	50.0mV
°C	±200	25.0°C	25.0mV

Section 6 - Operation With a Printer or Computer

Printer

- 1. Connect a printer (set at 1200 Baud) to the meter via the RS232C port on the back panel.
- 2. Follow the calibration procedure given in Section 2 or 3
- 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.



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

Three commands, CA, PR and RD can be sent from the computer:

CA—Send Calibration Data

Command—CA
1 CR LF
pH = 7.06 CR LF
T = 15.8 °C CR LF
mV = -0.2mV CR LF
2 CR LF
Second calibration point

PR –Send Probe Status Data

Command—PR
SI = 95.3% NERNST CRLF

E° = 5.2mV CR LF

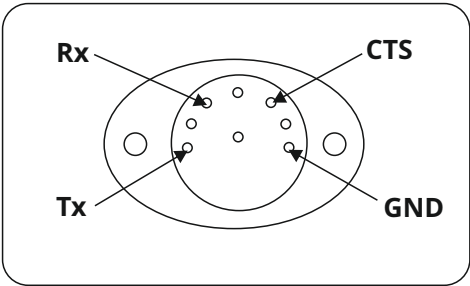
RD –Send Current Readings

Command—RD
pH = 7.00pH CR LF

T = 21.5°C CR LF

mV = 0.2mV CR LF

RS232 Connection details



Section 7 - Troubleshooting

Symptom	Probable Cause
No display	Battery is flat or not installed Power supply disconnected
'BAT' flag displayed	Battery Low
Wildly erratic readings or display reads -- on left hand side	Electrodes disconnected Electrodes not immersed in solution Reference electrode not filled Reference junction dry
Drifting readings	Inconsistent or lack of stirring Reference filling solution contaminated Buffers contaminated
Erratic/drifting readings or display reads – on left hand side when shorting plug is attached.	Return meter for servicing

Error Codes

PRO - Temperature probe malfunction

Buf - Wrong or Contaminated Buffer (pH Mode only)

SL - Poor Electrode Slope caused by faulty electrode or poor buffers/ standards

E° - Faulty or Aged electrode

E6, E7 - Calibration error. Recalibrate with fresh standards or buffers Electrodes out of solution.

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 Ltd or the agent with a full description of the symptoms.

No attempt should be made to repair the meter.

Section 8 - Specifications

Concentration Display Range	0.001 to 9990units
Resolution	3 significant figures
Accuracy	±0.5%
Slope Units	mV/Decade
pH Range/Resolution	0.00 to 15.00
pH Accuracy	±0.02pH
Slope Units	% Nernstian
Temperature Compensation	0-100°C
Auto Calibration	2 points, 4,7 or 10
Manual Calibration	2 points at any value
mV Range/Resolution	±400.0 & ±2000 mV
mV Accuracy	±2% ±1 digit
Relative mV offset	±2000mV
Auto Range change at	400mV
°C Range/Resolution	-30.0 to +130.0°C
°C Accuracy	±0.3°C
Recorder Output	±200mV
Karl Fischer Output	10µA
Display	12.7mm LCD
Power	9V Battery or AC
Instrument Size	210 x 150 x 88mm
Instrument Weight	550g

Appendix 1 - pH electrodes

Before Use

Remove the protective cap covering the glass sensing bulb and replace with the protective guard if applicable. Inspect the filling solution for air bubbles and remove by shaking in a downward direction. Soak the electrode in pH storage solution for 30 minutes.

Cleaning

Soak the electrode in 0.1M HCl for 15 minutes followed by soaking in pH storage solution for 30 minutes

Storage.

Put some pH storage solution in the protective cap and place over the glass bulb. Never store the electrode in distilled or de-ionised water. Never allow the electrode to dry out.

pH electrode storage solution is made up by dissolving 1g KCl in 100mL of pH 7 buffer

pH Buffers - Buffer Capsules

Buffer capsules are made up as follows For each buffer, empty the powder into a suitable container. Using deionised water, make up to 100mL ensuring that the powder is fully dissolved before use. The coloured outer skin may be added to colour code the resulting buffer. This may take up to 4 hours to dissolve but will not affect the pH of the buffer.

Buffer Solutions

If using ready made solutions, use ones supplied with temperature coefficient information.

Please See Table of Temperature Coefficients For EDT Buffers Adjacent

°C	pH	4 pH	7 pH	pH10
10		3.99	7.07	10.18
15		4.00	7.04	10.14
20		4.00	7.02	10.06
25		4.00	7.00	10.00
30		4.00	6.99	9.95
35		4.01	6.98	9.91
40		4.02	6.97	9.85
50		4.05	6.96	9.78
60		4.07	6.96	9.75

Appendix 2 - Concentration Units

The DR359Tx can measure concentration in the range 0.001 to 9990 units. If this range is insufficient, then a multiplier must be applied to all readings e.g.

- Calibration Standard A = 10^{-6} M
- User keys in value of 0.001 and records a multiplier of 10^{-3}
- Calibration standard B = 10^{-5} M
- User keys in value of 0.01
- Sample reads 0.007, say, then the actual sample concentration should be recorded as 0.007×10^{-3} M i.e. 7×10^{-6} M

Accessories - Ion Selective Electrodes (Combinations)

Species	Code	Species	Code
Ammonia	3302	Lead	3231
Ammonium	3051	Mercury	3251
Barium	3081	Nitrate	3021
Bromide	3271	Nitrite	3071
Cadmium	3241	Perchlorate	3061
Calcium	3041	Potassium	3031
Carbonate	3091	Silver	3211
Chloride	3261	Sodium	3301
Cupric	3227	Sulphide	3225
Cyanide	3291	Thiocyanate	3229
Fluoride	3221	Water Hardness	3100
Iodide	3281		

Accessories - pH Electrodes (Combinations)

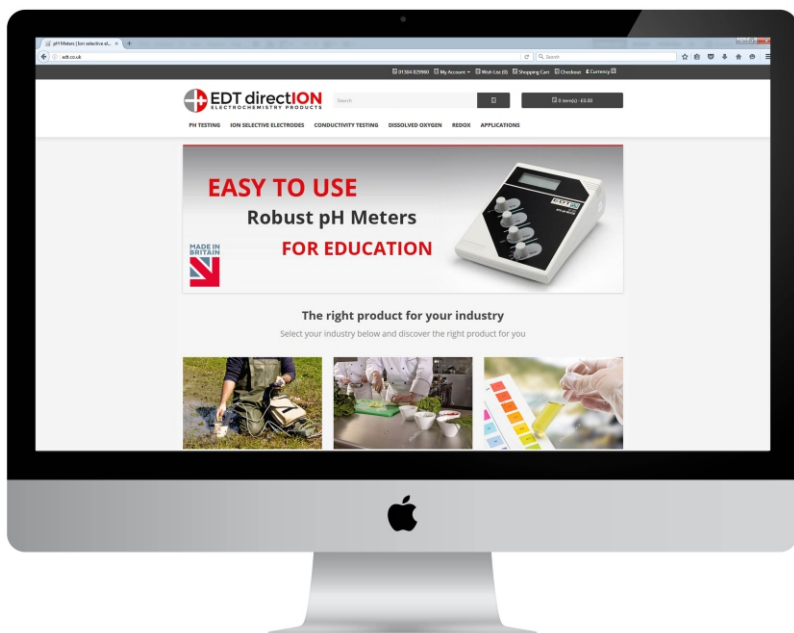
Description	Code
Glass Body General Purpose	E8081
Plastic Body General Purpose	E8080
Spear Tip (6mm)	E8083
Penetration	E8084
Low Conductivity	E8085
Long Reach	E8086
Flat Surface	E8087
Tris Buffers	E8099
Semi Micro	E8100
Semi Micro for Tris	E8101

Other Accessories

Description	Code
Temperature Probe	E8051
Electrode Stand	E8060
AC Adaptor	E8040 (FE)
	E8041 (UK)
	E8042 (US)
	E8043 (EU)

Please contact EDT Direct ION or your agent for further information on accessories available or visit www.edt.co.uk

For more information on our products
please visit our website www.edt.co.uk



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