

Elcometer 331

Half-Cell Meter

Model H

Operating Instructions



CE The Elcometer 331 Half-Cell Meter has been tested in accordance with EU regulations governing Electro-magnetic compliance and it meets the required directives.

Note: Readings may be affected if the unit is operated within a radio frequency electromagnetic strength of greater than 3 V/m.

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Material Safety Data Sheets for the Elcometer 331 Half Cell Probes can be downloaded via our website:

Elcometer 331 Half Cell Probe Copper-Copper Sulphate (Cu-CuSO₄)

www.elcometer.com/images/MSDS/elcometer_331_half_cell_copper.pdf

Elcometer 331 Half Cell Probe Silver-Silver Chloride (Ag-AgCl)

www.elcometer.com/images/MSDS/elcometer_331_half_cell_silver.pdf

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A copy of this Instruction Manual is available for download on our Website via www.elcometer.com

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Thank you for your purchase of this Elcometer 331 Half-Cell Meter. Welcome to Elcometer.

Elcometer are world leaders in the design, manufacture and supply of inspection equipment for concrete and coatings. Our concrete inspection products include a comprehensive range of concrete, and civil engineering inspection equipment. Our coatings products cover all aspects of coating inspection, from development through application to post application inspection.

The Elcometer 331 Half-Cell Meter is a world beating product. With the purchase of this Half-Cell Meter you now have access to the worldwide service and support network of Elcometer. For more information visit our website at www.elcometer.com

1 ABOUT YOUR HALF-CELL METER

The Elcometer 331 Half-Cell Meter is a portable Half-Cell Meter for fast and accurate assessment of the potential for corrosion of concrete reinforcement bars.

Your Half-Cell Meter measures half-cell potential - an electrochemical technique commonly used to assess the potential for corrosion in reinforced concrete structures. The instrument acts as a voltmeter which measures the potential difference between the steel reinforcement in the concrete structure and a reference electrode (the half-cell) placed on the surface of the concrete.

The Half-Cell Meter is available in two versions:

- Model H (entry level)
- Model HM (with data logging)

This manual describes the operation of the **Elcometer 331 Half-Cell Meter Model H**.

Both versions of the instrument feature an easy-to-use menu-driven graphical interface which guides the user during setup and measurement. A range of half-cell probes is available to suit your requirements.

This instrument is packed in cardboard and plastic packaging. Please ensure that this packaging is disposed of in an environmentally sensitive manner. Consult your Local Environmental Authority for further guidance.

To maximise the benefits of your new Elcometer 331 Half-Cell Meter please take some time to read these Operating Instructions. Do not hesitate to contact Elcometer or your Elcometer supplier if you have any questions.

1.1 FEATURES

Feature	Elcometer 331 Model		Page
	H	HM	
Menu-driven backlit graphical user interface	✓	✓	12
Weather proof to IP65	✓	✓	-
Multiple languages	✓	✓	14
Memory - multiple linear and grid batches, up to 240 000 readings	✗	✓	-
Text fields for input of user data in each batch	✗	✓	-
Date and time stamping	✗	✓	-
Statistical analysis of readings and batches	✗	✓	-
Alarm if reading is outside limits	✗	✓	-
Transfer readings and statistics to a computer	✗	✓	-
CoverMaster [®] software for batch setup, data transfer and reporting	✗	✓	-
Plot mode	✗	✓	-

1.2 STANDARDS

The Elcometer 331 Half-Cell Meter can be used in accordance with the following National and International Standards; ASTM C876, DGZfP:B3, TR60, UNI 10174.

1.3 WHAT THIS BOX CONTAINS

- Elcometer 331 Model H Half-Cell Meter
- Rechargeable battery pack and battery charger (UK, EUR & US)
- 25 m extension cable on spool
- 1.7 m red rebar cable with connecting clip
- 1.7 m black half-cell connecting cable
- Earphone
- Shoulder strap
- Plastic carrying case
- Operating instructions

Note: *Half-Cell probes are not supplied with the main instrument and have to be ordered separately - see "Accessories" on page 25.*

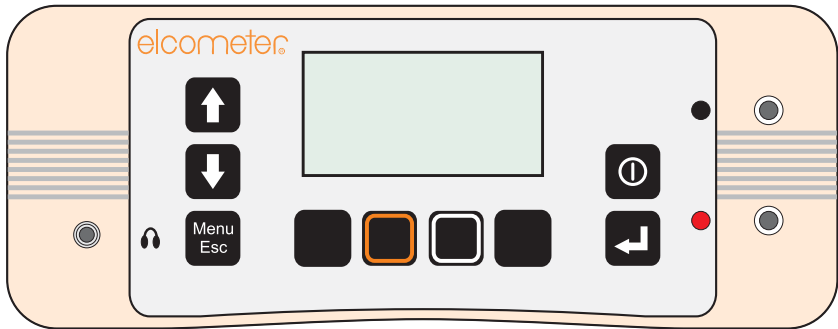


Figure 1. Elcometer 331 Half-Cell Meter

1.4 CONVENTIONS IN THESE INSTRUCTIONS

A simple menu structure helps you get the most from your Half-Cell Meter - see “The menus” on page 16. There are many references to this menu structure in these instructions.

As an example, the LANGUAGE option which is in SETUP from the MAIN MENU would be shown in these instructions as:

 MENU / SETUP / LANGUAGE

2 QUICK-START

Note: Before switching the Half-Cell Meter on for the first time read “Selecting a language” on page 14.

To configure the Half-Cell Meter quickly and start taking readings:

1. Charge the batteries see page 7
2. Fit half-cell probe and cables see page 10
3. Switch on see page 12
4. Select language see page 14
5. Take readings of half-cell potential see page 18

For an overview of your Half-Cell Meter menus and functions, see pages 16 to 17.

3 GETTING STARTED

This section of the instructions is intended for first-time users of the Half-Cell Meter. It contains essential information about batteries, assembling the Half-Cell Meter, the controls and the display. At the end of this section you will be ready to take readings.

3.1 THE POWER SUPPLY

Your Half-Cell Meter is powered by a rechargeable Lithium-Ion^a battery pack which can be charged inside or outside the Half-Cell Meter.

-
- a. The Half-Cell Meter is **not** designed to operate using dry cell batteries.

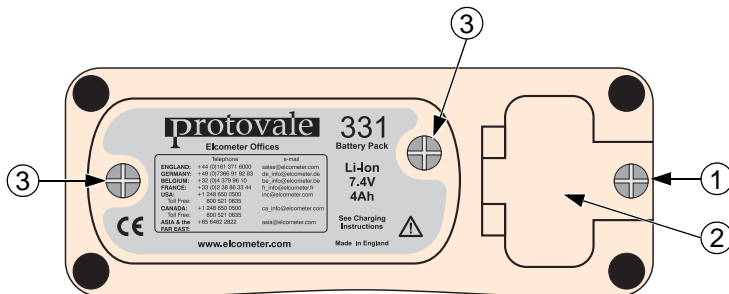
One battery pack is supplied with the Half-Cell Meter. To increase productivity on site, Elcometer recommends that you purchase a spare battery pack which can be charged while you are using your Half-Cell Meter. To order an additional battery pack (see “Accessories” on page 25), contact Elcometer or your local Elcometer supplier.

CHARGING THE BATTERIES

The rechargeable battery must be fully charged before using the Half-Cell Meter for the first time. Use only the charger supplied with your Half-Cell Meter to charge the battery. Use of any other type of charger is a potential hazard, may damage your Half-Cell Meter and will invalidate the warranty. Do not attempt to charge any other batteries with the supplied charger.

Always charge the battery indoors. To prevent overheating, ensure that the charger is not covered.

1. Unscrew the retaining screw (1) and open the interface access cover (2) on the rear of the Half-Cell Meter.



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2. Connect the lead from the charger into the socket marked 'Charger Input' behind the interface access cover.

The Half-Cell Meter will automatically switch off when the lead from the charger is connected.



(battery in the Half-Cell Meter)



(battery removed)

3. Plug the charger supplied into the mains supply. The LED indicator on the charger will glow orange.
4. Leave the gauge charging for at least 4 hours. The LED indicator changes colour from orange to green when charging is complete.
5. When charging is complete, disconnect the charger from the mains supply before removing the lead from the Half-Cell Meter.

To remove the battery pack for charging outside the Half-Cell Meter, unscrew the two battery pack retaining screws (3) at the rear of the Half-Cell Meter and slide out the battery pack. To charge the battery once it has been removed, connect the lead from the charger into the socket on the battery pack.






Warning: Do not allow metallic objects to come into contact with the battery terminals; this may cause a short circuit and result in permanent damage to the battery.



Warning: Do not attempt to connect the supply side of the battery charger to generators or any other medium to high power source other than the single phase 50 Hz AC mains outlet supplied from an approved and safe mains switchboard. Connection to other supply sources such as generators or inverters may have the potential to damage the charger, the battery and/or the gauge, invalidating warranty.

BATTERY CONDITION INDICATOR

The state of charge of the battery is shown by a symbol on the display:

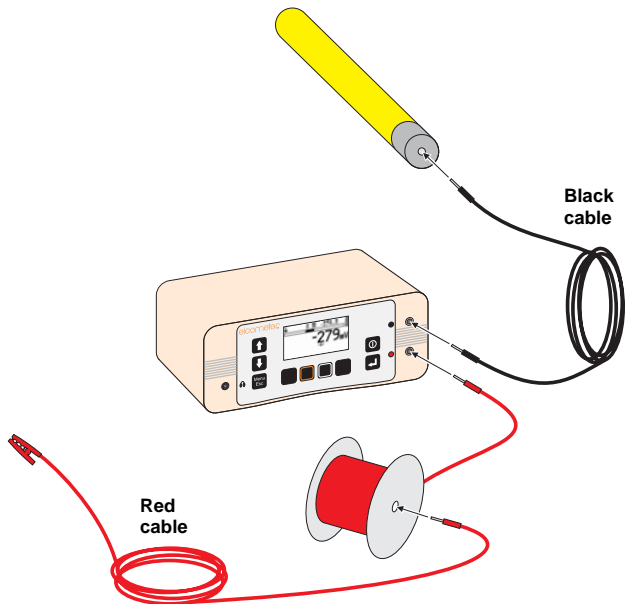
 = full charge,  = low charge,  (flashing + beep every 10 seconds) = charging required

When the battery is completely exhausted the instrument will emit 5 loud beeps and then switch off.

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3.2 FITTING HALF-CELL PROBES

Connect the probe and cables as shown.



3.3 THE CONTROLS

All functions of the Half-Cell Meter can be controlled using the keypad. There are two types of keys on the keypad; fixed function keys and 'soft' keys (Figure 2).

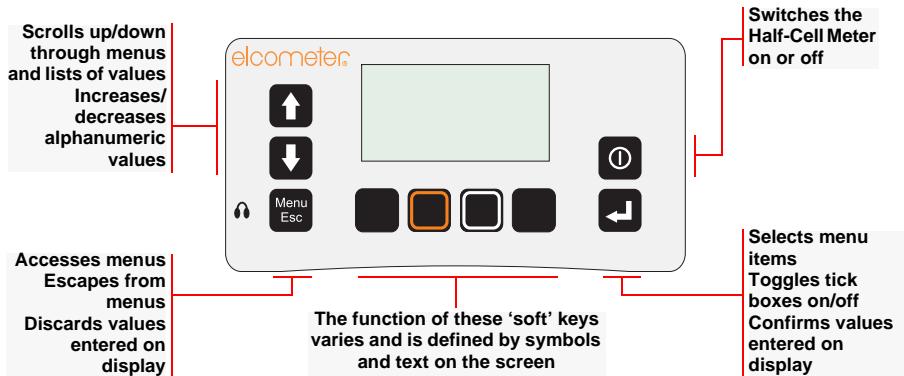


Figure 2. Half-Cell Meter keypad

3.4 SWITCHING THE HALF-CELL METER ON AND OFF

To switch the Half-Cell Meter on, press [**ⓘ**].

To switch the Half-Cell Meter off, press and hold [**ⓘ**] for two seconds.

The Half-Cell Meter includes an automatic switch off feature which will help to extend the battery life (time between charges). The automatic switch off time can be set to OFF, 5, 6, 7, 8, 9 or 10 minutes.



MENU / SETUP / AUTO SWITCH OFF

A countdown timer is displayed on the screen 60 seconds before the Half-Cell Meter switches off automatically. The timer counts down from 60 to 0 to warn you that the Half-Cell Meter is about to switch off. Press any key while the countdown timer is displayed to cancel automatic switch off.

3.5 THE DISPLAY

Take some time to familiarise yourself with the information shown on the display of your Half-Cell Meter. The display shows:

- Welcome information
- Measurement information
- Menus to configure the Half-Cell Meter and control functions
- Help and miscellaneous information

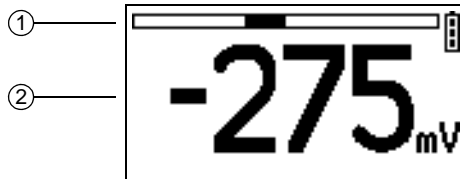
When the Half-Cell Meter is switched on an opening (welcome) information screen^b may be displayed briefly before the main reading screen appears.

The information shown depends upon whether you are taking measurements, reviewing readings or setting up the Half-Cell Meter.

The main screen displayed (while you are taking measurements) is the Reading Screen.

READING SCREEN

1. Half-cell potential - bar graph (zero at centre)
2. Half-cell potential - numerical



SYMBOLS


A wide range of symbols is used on the display. The meaning of all these symbols is stored in the Half-Cell Meter.

 MENU / ABOUT / HELP

LCD CONTRAST

Adjust the contrast of the display to suit lighting conditions.

 MENU / SETUP / LCD CONTRAST

-
- b. The opening (welcome) screen can be disabled.  MENU / SETUP / OPENING SCREEN.
Customised welcome screens can be created on a PC and downloaded into the gauge - see "Personalised welcome screen" on page 22.

BACKLIGHT

The display includes a backlight which illuminates the display for 10 seconds after any key is pressed and during measurements. Switch the backlight on or off as required. Switching the backlight off will increase battery life.

 MENU / BACKLIGHT

3.6 SELECTING A LANGUAGE

Your Half-Cell Meter has a number of built-in languages. When the Half-Cell Meter is switched on for the first time after dispatch from the Elcometer factory the display will show the language selection screen (Figure 3).

AT FIRST SWITCH ON

1. Press [\uparrow] or [\downarrow] to locate language required.
2. Press [\leftarrow] to activate the selected language.

The Half-Cell Meter operates in the new language until changed.

AT ANY TIME

1. Switch the Half-Cell Meter off.
2. Press and hold left hand softkey.
3. Press [⓪] to switch on Half-Cell Meter.

The display will show the language selection screen with the current language highlighted by the cursor.

4. Release left hand softkey.

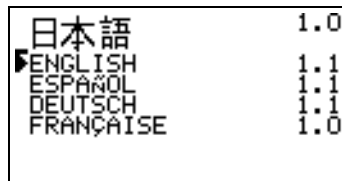


Figure 3. Language selection screen

5. Press [↑] or [↓] to locate language required.
6. Press [↵] to activate the selected language.

Alternatively, select a language at any time.

 MENU / SETUP / LANGUAGE


3.7 COMPUTER INTERFACE

Your Half-Cell Meter is fitted with an RS232 interface. The interface is located under the interface access cover at the rear of the Half-Cell Meter - see page 7.

This 5-pin RS232 interface is used with the data transfer cable to connect the Half-Cell Meter to the RS232 port^c of a computer. When the Half-Cell Meter is connected to a computer you can:

- Download personalised screens to the Half-Cell Meter (see “Personalised welcome screen” on page 22).

3.8 USING THE EARPHONE

To use the earphone, plug the connector into the 3.5 mm socket marked  on the front of the Half-Cell Meter. Replacement earphones are available as an optional accessory - see “Accessories” on page 25.

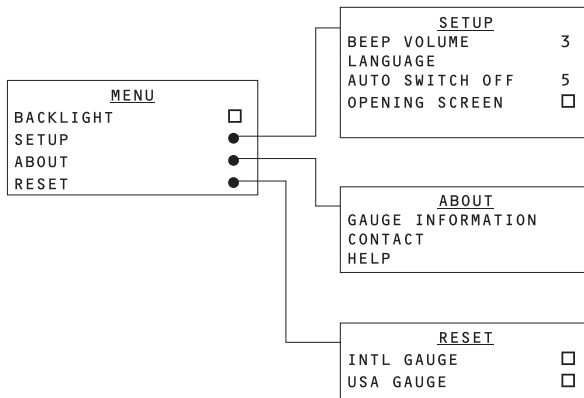
-
- c. An RS232 to USB transfer cable is available which allows you to connect your Half-Cell Meter to a USB port on your computer. For ordering information, see “Accessories” on page 25.

4 THE MENUS

The menus of your instrument are shown in the illustration and a description of each menu item is given in the following paragraphs.

To access the menus press the MENU softkey.

To return to the reading screen quickly, press and hold the MENU softkey.



4.1 MENU

BACKLIGHT	Toggles the display backlight on or off
SETUP	Opens Setup menu. See 4.2 SETUP
ABOUT	Opens About menu. See 4.3 ABOUT
RESET	Opens Reset menu. See 4.4 RESET

Note: *When Backlight is on, the display is lit for 30 seconds after any key press and during measurement.*

4.2 SETUP

BEEP VOLUME.	Use Scroll keys to select beep volume 0 (off) to 5 (maximum), then press Enter
LANGUAGE	Use Scroll keys to select menu language and then press enter
AUTO SWITCH OFF. . .	Use Scroll keys to select auto switch off time, 5 to 10 mins/off, then press Enter
OPENING SCREEN . . .	Press Enter to toggle the opening screen on or off
LCD CONTRAST	Use Scroll keys to select LCD contrast, 0 to 8 and then press Enter

4.3 ABOUT

GAUGE INFORMATION	Press Enter to display technical information about the Half-Cell Meter
CONTACT.	Press Enter to display Elcometer offices worldwide and (if programmed) Supplier contact details
HELP.	Press Enter to display an explanation of all the symbols used on the display

4.4 RESET

INTL GAUGE.	Press Enter to Reset Half-Cell Meter to International settings ^d
USA GAUGE.	Press Enter to Reset Half-Cell Meter to USA settings ^e

Note: *The Half-Cell Meter will display a Yes/No confirmation screen before reset is activated.*

5 MEASURING HALF-CELL POTENTIAL

5.1 BEFORE YOU START

- *Are you using the correct half-cell probe?*
See “Half-cell probes” on page 20.

5.2 PROCEDURE

1. Locate the position of a reinforcing bar (using a metal detector, covermeter or similar instrument).
 2. Expose the bar, e.g. by drilling through the cover using a large drill.
 3. Drill a small diameter hole into the bar suitable for attachment of the positive (red) cable using a screw or lead plug.
 4. Mark out a grid on the concrete. Measurements will be taken at the intersection points of the grid. Typical grid spacing is 1 m x 1 m, however this may be reduced if localised corrosion is suspected. If the measured half-cell potential between two adjacent positions differs by more than 100 mV, it is recommended that the grid spacing is reduced.
 5. If necessary, use tap water to wet the whole of the test area, or just the measurement positions.
 6. Connect the red cable and extension reel between the exposed reinforcing bar and the red terminal on the Half-Cell Meter (Figure 4). Connect the black cable between the probe and the black terminal on the Half-Cell Meter.
-
- d. International settings can also be activated at switch on:
Press and hold third softkey ■■●■■ and switch on gauge.
 - e. USA settings can also be activated at switch on:
Press and hold fourth softkey ■■■● and switch on gauge.

7. Switch on the Half-Cell Meter.
8. Remove the end cap from the probe and store the cap safely.
9. Press the electrode against the concrete surface.
10. View the reading of half-cell potential on the display.
11. If you are satisfied with the reading, record the half-cell potential and then move on to the next measurement location.

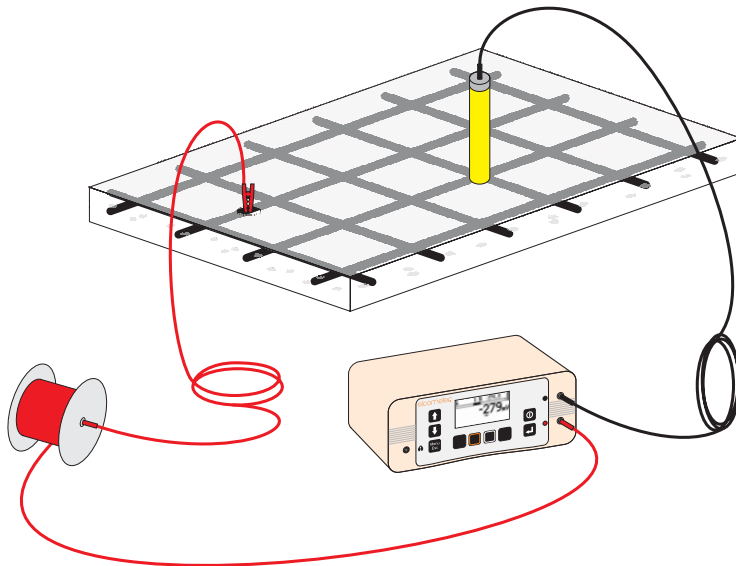


Figure 4. Typical instrument configuration for half-cell measurements

5.3 MEASURING CELL-TO-CELL RATHER THAN CELL-TO-BAR

In some instances it will not be possible to make a direct connection to a reinforcing bar. In this situation it is common practice to use two half-cell probes connected to the inputs of the Half-Cell Meter. One probe is fixed in position on the concrete surface and the other probe is moved over the surface. In this way the surface can be 'mapped'.

Using this method, the absolute value of the reinforcing bar to concrete half-cell will not be measurable, however changes from one point on the surface to the next can be measured and interpreted.

6 HALF-CELL PROBES

Two types of half-cell probe are available for your Half-Cell Meter. The probes can be easily identified by colour:

- Copper-Copper Sulphate (Cu-CuSO₄): Yellow
- Silver-Silver Chloride (Ag-AgCl): Blue

6.1 WETTING YOUR PROBE

For your probe to function properly the ceramic sensing end (the electrode) must be wet. To get a good wet electrode, just place the electrode in tap water for two to three minutes; usually this will be sufficient to keep the sensor going all day. Keeping the plastic end cap on the sensor when it is not being used will also help to keep the electrode wet. During periods of extended storage, place a small amount of water in the end cap before pushing the cap onto the probe.

6.2 CARE OF YOUR PROBE AND CABLES

The probes do not require any maintenance; they do not need recharging and are sealed for life. Any mud or grit should be removed from the electrode by swirling the electrode back and forth in a container of warm, soapy water and then brushing with a wet rag. The soapy water will not harm or contaminate the electrode. Always check that the connecting cables are free of damage such as cuts and tears in the sheathing before use.

The Copper-Copper Sulphate half-cell probe is intentionally filled with a reserve of saturated Cupric Sulfate solution combined with solid Cupric Sulfate crystals to ensure a minimum 10-year design life.

Under certain circumstances a very small percentage of this reserve can leach out from the ceramic sensing tip of the half-cell producing crystals as shown in the photograph.

This does not affect the performance of the cell. The crystals should be removed by washing in distilled water.



6.3 TEMPERATURE

Do not allow the probe to freeze. Although freezing will not damage your probe, it will be impossible to obtain reliable measurements while in this state. All measurements are affected by temperature; if you take two readings in identical conditions, one in the summer at 29°C (85°F) and the other in the winter at 1°C (34°F), the half-cell potential readings will be different.

Each probe is tested at 25°C to be within ± 10 mV of a standard Calomel reference cell. The following values relative to a standard Calomel cell are used as the test limits during manufacture:

	Lower limit	Reference value for Calomel	Upper limit
Copper-Copper Sulphate (Cu-CuSO ₄)	+50 mV	+60 mV	+70 mV
Silver-Silver Chloride (Ag-AgCl)	-50 mV	-40 mV	-30 mV

6.4 SHELF LIFE

Your probe does not degrade when stored.

7 PERSONALISED WELCOME SCREEN

A personalised welcome screen can be designed on a computer and then downloaded into the Half-Cell Meter. Screen dimensions are 128 pixels x 64 pixels. The welcome screen is typically used to personalise the Half-Cell Meter with a logo, serial number, user name, etc. This is the first screen displayed when the Half-Cell Meter is switched on.

7.1 CREATING THE SCREEN

1. Download Elcometer 'Welcome Screen Wizard' software. This software is available free of charge from the downloads section of the Elcometer website, www.elcometer.com
2. Connect Half-Cell Meter to PC using optional Data Transfer Cable - see "Accessories" on page 25.
3. Switch on the Half-Cell Meter.
4. Ensure that the reading screen is displayed.
5. Run 'Welcome Screen Wizard' software and follow the on-screen instructions.

7.2 DELETING THE SCREEN

1. Run the 'Welcome Screen Wizard' software.

2. Click 'Next'.
3. Select 'Create a new screen setup'.
4. Click 'Next'.
5. Select 'Disabled'.
6. Click 'Next'.

Follow the remaining on-screen instructions to delete the welcome screen.

8 ERROR MESSAGES

Under certain conditions the Half-Cell Meter will display error messages. These messages are normally cleared by pressing any one of the softkeys. The cause of the error will be indicated by the message and should be corrected before proceeding. If any error persists, contact Elcometer or your Elcometer Supplier.

9 STORAGE



This Half-Cell Meter incorporates a Liquid Crystal Display (LCD). If the display is heated above 50°C (120°F) it may be damaged. This can happen if the Half-Cell Meter is left in a car parked in strong sunlight. Always store the Half-Cell Meter in its case when it is not being used.

10 MAINTENANCE

You own one of the finest Half-Cell Meters in the world. If looked after, it will last a lifetime.

Regular calibration checks over the life of the Half-Cell Meter are a requirement of quality management procedures, e.g. ISO 9000, and other similar standards. For checks and certification contact Elcometer or your Elcometer supplier.

The Half-Cell Meter does not contain any user-serviceable components. In the unlikely event of a fault, the Half-Cell Meter should be returned to your Elcometer supplier or directly to Elcometer. The warranty will be invalidated if the gauge has been opened.

Contact details can be found:

- Stored in the Half-Cell Meter (MENU / ABOUT / CONTACT).
- On the outside cover of these operating instructions.
- At www.elcometer.com

11 TECHNICAL DATA

Range:	-999 mV to +999 mV
Accuracy:	±5 mV
Half-cell probe stability:	10 mV with 3 µA load
Weight:	1.6 kg (3.5 lb)
Dimensions:	230 mm x 130 mm x 125 mm (9" x 5.1" x 4.9")
Operating temperature ^f :	0°C to 50°C (32°F to 120°F)

Case:	High impact ABS
Power supply:	Internal rechargeable Lithium Ion battery ^g .
Fuse rating of charger:	3 A
Battery life:	Up to 48 hours continuous use without backlight. Up to 20 hours with backlight.

12 ACCESSORIES

Your Half-Cell Meter is complete with all the items required to get started.

The following optional accessories are available from Elcometer, or your Elcometer supplier. To place an order please quote the sales part number which follows the description of each accessory.

Rechargeable battery pack:	TW33119038
Earphone:	TW99912220
Data transfer cable ^h (Half-Cell Meter to PC):	T99916217
RS232 to USB transfer cable:	T99916716
Half-Cell probe, Copper-Copper Sulphate (Cu-CuSO ₄):	TW33119668-1

-
- f. Operation outside these limits depends upon climatic conditions.
 - g. Battery packs must be disposed of carefully to avoid environmental contamination. Please consult your local environmental authority for information on disposal in your region. Do not dispose of the battery pack in a fire.
 - h. A 9-pin to 25-pin adapter may be required for certain PC RS232 ports.

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Half-Cell probe, Silver-Silver Chloride (Ag-AgCl): TW33119668-2

Half-cell probe kit, Copper-Copper Sulphate (Cu-CuSO₄): TW331CUKIT
(probe, 2 x connecting cables, 1 x 25 m cable reel, carry case)

Half-cell probe kit, Silver-Silver Chloride (Ag-AgCl): TW331AGKIT
(probe, 2 x connecting cables, 1 x 25 m cable reel, carry case)

Half-cell probe cable reel, extendable to 100 m, with carry handle: TW33119683

Calibration Certificates traceable to National Standards including UKAS and NIST are available at the time of order, or alternatively, the gauge must be returned to Elcometer for certification. Calibration Certificates cannot be issued retrospectively.

13 RELATED EQUIPMENT

Elcometer produces a wide range of concrete and coatings inspection equipment. Users of the Elcometer 331 Half-Cell Meter may also benefit from the following Elcometer products:

- Elcometer 331 Concrete Covermeter
- Elcometer Adhesion and Bond Strength Testers
- Elcometer Concrete Crack Microscopes
- Elcometer Concrete Moisture Meters
- Elcometer Concrete Test Hammers

For further information contact Elcometer, your Elcometer supplier or visit www.elcometer.com

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