

elcometer®
inspection equipment



Concrete Inspection
& Metal Detection

Concrete Inspection & Metal Detection



A covermeter, or rebar locator, is a gauge that measures the thickness of concrete cover over steel reinforcement bars and metal pipes. The covermeter can tell you the depth of the rebar, the location and orientation of reinforcement bar (rebar) and determine the diameter of the rebar.

A rebar locator is used to determine the presence and orientation of steel reinforcement rebars under the surface of the concrete.

A contractor engaged in maintenance work will be familiar with the problem of accurately locating the exact position of rebar, wall ties, studs and other metal fasteners. These low cost, simple to use gauges can meet their everyday requirements.

Test hammers are used to determine the surface hardness of concrete and are one of the most widely used instruments to assess concrete compressive strength. It is the quickest, simplest and least expensive method to obtain an estimate of the quality and strength of the concrete.

Test Hammers with both analogue and digital displays are available.

Many concrete structures have a protective or cosmetic coating. Premature failure of this coating can, at the very least, result in additional costs of rework.

Adhesion tests verify that both surface preparation and coating application are within specification.

Concrete structures are porous and will absorb moisture, our range of moisture meters and climate monitoring gauges allows moisture content to be measured.

The range also includes gauges used for the measurement of crack width in concrete and other structures.

The Elcometer Metal Detection range includes Valve Box Locators that are rugged and simple to use making them the ideal choice for all location work in all types of terrain.

Analogue Concrete Test Hammer

Elcometer 181

The concrete test hammer provides a quick, simple and inexpensive method for non-destructive evaluation of concrete compression strength and other masonry materials. Concrete test hammers are one of the most widely used instruments in the field of non-destructive testing.

This gauge consists of a spring loaded plunger which, when released, strikes the surface with fixed and constant impact energy. During the rebound stroke, the mass moves a pointer that indicates the maximum point of return and at the same time indicates a reference value called Rebound Number.

This number, converted by the correlations available on the hammer, gives the compression resistance value in respect of the impact angle.

Key Features:

- Impact Energy 2.207Nm
- Supplied with grinding stone to prepare test surface
- Aluminium body
- Rebound value indicated on test hammer
- Rebound value chart on body, for quick calculation of compressive strength
- Curve selection on chart dependant on testing angle



STANDARDS:

ASTM C805, BS 1881:202, DIN 1048, EN 12504-2, ISO 8045, NFP18-417, UNI 9189

Technical Specification

Part Number	Description	Certificate
W181----1	Elcometer 181 Analogue Concrete Test Hammer - MPa / psi scale	○
Accuracy	Better than ± 2 Rebound Number (When tested on Calibration Anvil at 80)	
Resolution	2 Rebound Number(s)	
Range	10 to 100 Rebound Number(s)	
Dimensions	Hammer: 280mm (11.02") length x 55mm (2.17") diameter In Case: 350mm (13.78") length x 80mm (3.15") diameter	
Weight	1.5kg (3.3lb) with case	
Packing List	Elcometer 181 analogue concrete test hammer, plastic storage case, abrasive stone & operating instructions	

Accessories

TW99919563	Calibration Anvil (supplied complete with Test Certificate)
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○ Optional Calibration Certificate available.

Concrete Inspection - Covermeter & Half-Cell

Elcometer 331HM

Half-Cell Meter

The rugged Elcometer 331HM half-cell meters measure the condition and potential corrosion of rebars and steel structures within concrete.

Single handed operation: all functions can be accessed & controlled through 4 simple keys/buttons

Measures the condition and potential corrosion of rebars and steel structures within concrete quickly

Up to 240,000 readings can be stored on the gauge for detailed reporting

Interchangeable Half-Cell probes are available (see page 22-14)

Memory and data logging with data output to PC or direct to printer

Links to CoverMaster™ software

STANDARDS:

ASTM C876-91, DGZfP:B3,
Concrete Society Technical Report 60,
UNI 10174



How does a Half-Cell Meter work?

When corrosion occurs the ferric oxide protective layer surrounding the concrete breaks down allowing an electrochemical reaction between the steel and the concrete.

In the half-cell test, a reference electrode is passed over the surface of the concrete and the potential voltage difference is recorded. These potential voltage readings show where corrosion is likely to be, or is currently present.

Elcometer 331HM Half-Cell Meter is supplied with memory and allows users to store up to 240,000 readings in either linear or grid batches.

Half-Cell Meter

Elcometer 331HM

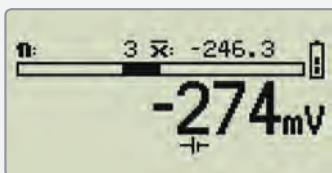
Product Features

Description	Elcometer 331HM
Model	HM
Part Number	W331HM--4
Half-Cell measurement	■
Large graphics display with backlight	■
Multiple language menu structure	■
Rugged waterproof case (IP65)	■
Adjustable beep volume & earphone socket	■
CoverMaster™ software	■
Statistics	■
Number of readings (η), Mean (average) (\bar{x})	■
Standard deviation (σ), Coefficient of variation (CV%)	■
Lowest reading (\downarrow), Highest Reading (\uparrow)	■
Under range (\ll)	■
Low Limit (∇ or $<$), Within Limit (\dagger), High Limit (\triangle or $>$)	■
Over range (∞)	■
Blank readings (□)	■
Date & Time	■
Memory	■
Linear batch memory	Up to 200 batches of 1,000 readings ¹
Grid batch memory	Up to 240,000 readings ¹
Graphics plot	■
Threshold plot	■

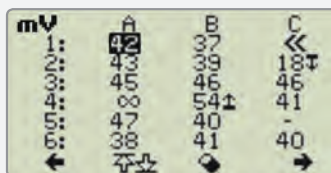
Technical Specification

Range	-999mV to +999mV	Accuracy	±5mV
Operating temperature	0 to 50°C (32 to 120°F)		
Power supply	7.4V battery pack provides up to 32 hours of continuous use (20 hours if backlight is on). Rechargeable in 4 hours, using an external charger, either inside or outside the gauge.		
Dimensions	230 x 130 x 125mm (9 x 5.1 x 4.9")	Weight	1.6kg (3.5lb)
Packing List ²	Elcometer 331HM Half Cell Meter, 25m extension cable on spool, 1.7m red rebar connecting cable with connecting clip, 1.7m black half-cell connecting cable, rechargeable battery pack & charger (UK, US & EU), earphone, shoulder strap, plastic carry case, operating instructions, CoverMaster™ software & PC cable		

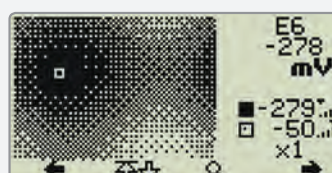
Displays



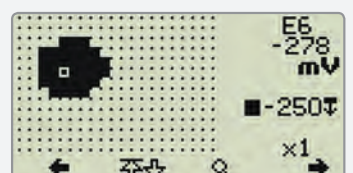
Reading Screen with Statistics



Grid Batch feature facilitates fast surveying for Half-Cell readings



Graphics plot Allows an immediate visual indication of results



Threshold plot for a quick pass or fail analysis

¹ Linear Batch Mode: up to 200 batches of 1,000 readings each. Grid Batch Mode: up to 1,000 batches, maximum number of readings: 240,000

² Search Heads and Half-Cell Probes are not included as standard and must be ordered separately, see page 22-14

Elcometer 331B

Covermeter

The easy to use **Elcometer 331B** covermeter quickly and accurately locates/orientates reinforcement bars in concrete and measures the depth of cover over the rebar.



Locate and determine orientation of rebar quickly, easily & accurately

Single handed operation: All functions can be accessed & controlled through 4 simple keys/buttons

International bar sizes:
User selectable bar sizes: Metric, Imperial, ASTM/Canadian and Japanese

Range of fully interchangeable search heads (see page 22-14)

STANDARDS:

ACI 318, ASTM C876-91, BS1881:201, BS1881:204, BS8110, CP 110, DGZfP:B2, DGZfP:B3, DIN 1045, EC2, SIA 262, SS-EN 206, UNI 10174, Concrete Society Technical Report 60,

How does a Covermeter work?

To identify the location and orientation of the rebar under the surface of the concrete, a search head is connected to the Covermeter and is used to scan across the designated search area of the concrete.

When the search head approaches a reinforcement bar, the LED on the search head will start to glow. The Covermeter will start to emit a sound which will increase in pitch and the signal strength indicator bar on the display will increase in length.

When the bar is positioned below the centre of the search head then the pitch of the sound will be at its highest and the depth of cover will be shown on the Covermeter display. The signal strength indicator bar is at its maximum.

If the reinforcement bar is too deep to measure, the depth of cover will be displayed as infinite.

The Elcometer 331B Covermeter is an entry level gauge without memory that is only used to quickly locate and measure the depth of cover over the rebar.

Covermeter

Elcometer 331B

Interchangeable Search Heads & Borehole Probes

A range of fully interchangeable search heads and borehole probes are available to suit the requirements without the need to return your gauge to Elcometer.

There are four types of search heads available for use with the Elcometer 331B; Standard, Narrow Pitch, Deep Cover and Borehole.

The Standard Search Head is designed to meet most of the measurement requirements whereas the Narrow Pitch Search Head accurately measures the cover thickness when the gaps (pitch) between each of the rebars are close together.

The Deep Cover Search Head is ideal for accurately measuring rebars that are deep within the structure. The Borehole Probe is ideal for locating tendon ducts and multiple layers of rebar lying deep within the concrete.

Changing from one type of search head to another is quick and easy; simply switch off the Covermeter, swap search heads, switch on again and zero the Covermeter.

For full details on search heads please see page 22-14.



Product Features

Description	Elcometer 331B
Model	B
Part Number	W331B---4
Covermeter/rebar location	■
Rebar orientation	■
Depth of cover	■
Large cover (thickness) reading mm or inches	■
Large graphics display with backlight	■
Multiple language menu structure	■
Signal strength bar	■
Interchangeable heads with LED & keypad	■
User selectable bar range sizes & numbers	■
Rugged waterproof case (IP65)	■
Adjustable beep volume & earphone socket	■
Measurement sound modes	
Locate (<i>tone increases as head approaches rebar</i>)	■

Technical Specification

Operating temperature	0 to 50°C (32 to 120°F)
Power supply	7.4V battery pack provides up to 32 hours of continuous use (20 hours if backlight is on). Rechargeable in 4 hours, using an external charger, either inside or outside the gauge.
Dimensions	230 x 130 x 125mm (9 x 5.1 x 4.9") Weight 1.6kg (3.5lb)
Packing List	Elcometer 331B Covermeter, standard search head & search head connecting cable, rechargeable battery pack & charger (UK, US & EU), earphone, shoulder strap, plastic carry case & operating instructions.

Elcometer 331

Covermeters & Half-Cell Meters

The **Elcometer 331** is an all in one gauge that combines the rebar locator, concrete covermeter and half-cell measurement, making site visits quicker and more convenient.

Locate and determine orientation of rebar quickly, easily & accurately in Cover Mode

Measures the condition and potential corrosion of rebars and steel structures within concrete quickly in Half-Cell Mode

Up to 240,000 readings can be stored on the gauge for detailed reporting

Single handed operation: all functions can be accessed & controlled easily through 4 keys/buttons

Memory and data logging with data output to PC or direct to printer

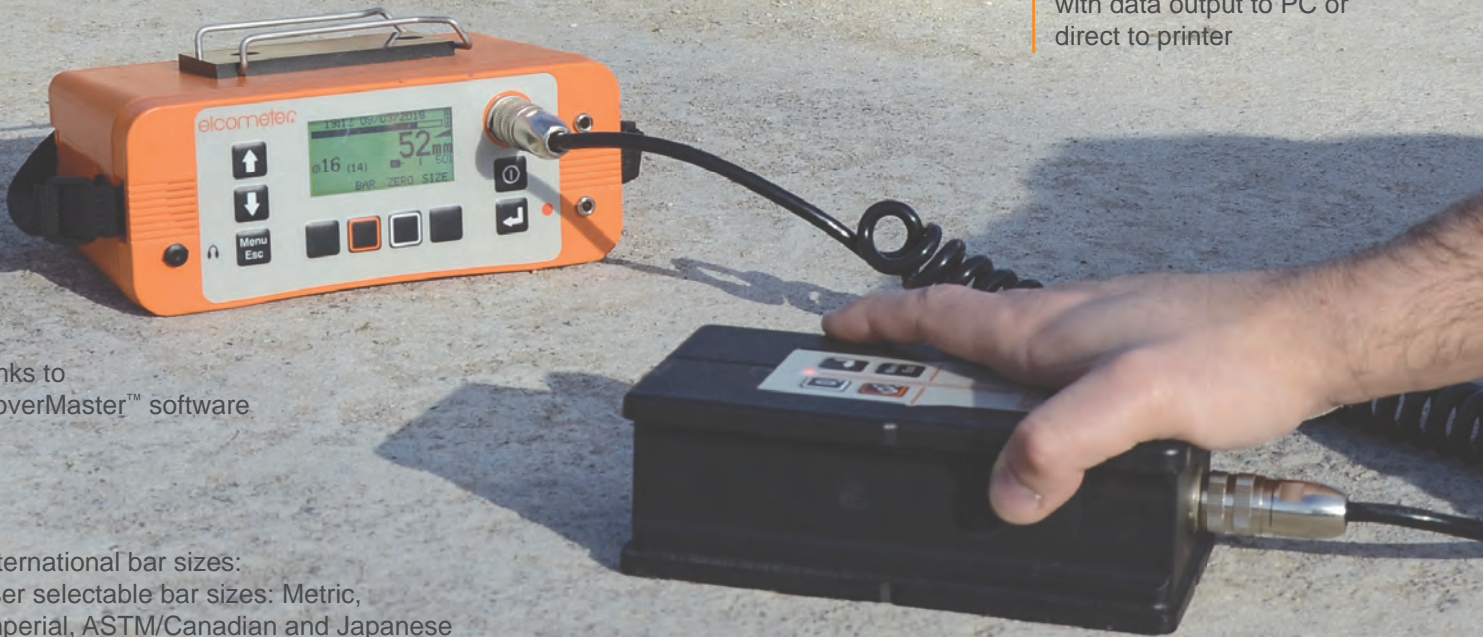
Links to CoverMaster™ software

International bar sizes: user selectable bar sizes: Metric, Imperial, ASTM/Canadian and Japanese Available in Cover Mode

Full range of interchangeable search heads, borehole probe & half-cell probes available to suit the requirements (see page 22-14)

STANDARDS:

ACI 318, ASTM C876-91, BS1881:201, BS1881:204, BS8110, CP 110, DGZfP:B2, DGZfP:B3, DIN 1045, EC2, SIA 262, SS-EN 206, Concrete Society Technical Report 60, UNI 10174



Covermeters & Half-Cell Meters

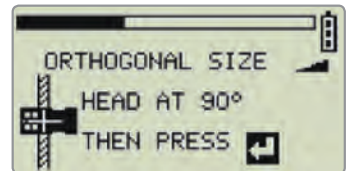
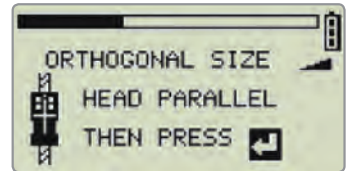
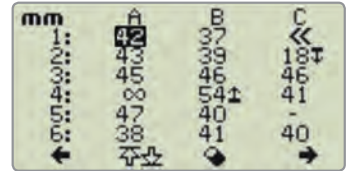
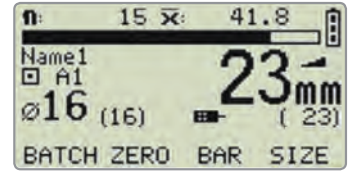
Elcometer 331

Interchangeable Search Heads, Borehole Probes & Half-Cell Probes

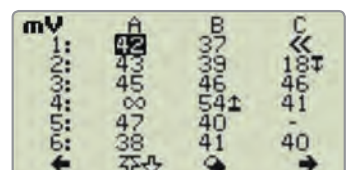
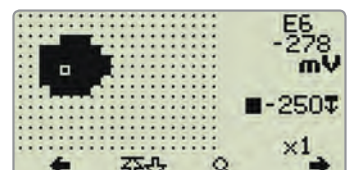
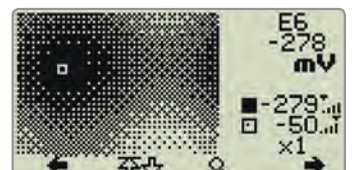
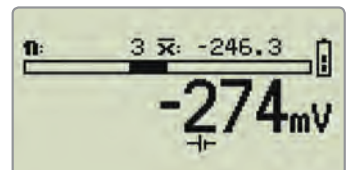
A range of fully interchangeable search heads, borehole probes and half-cell probes are available to suit the requirements without the need to return your gauge to Elcometer.

Changing from one search head to another is quick and easy; simply switch off the Covermeter, swap search heads, switch on again and zero the Covermeter.

Cover Mode Displays



Half-Cell Mode Displays



Standard Search Head

- Designed to meet most measurement requirements



Narrow Pitch Search Head

- Accurately measures the cover thickness when the gaps (pitch) between each of the rebars are close together



Deep Cover Search Head

- Ideal for accurately measuring rebars that are deep within the structure



Dual Search Head

- Designed to locate high tensile steel & stainless steels



Borehole Probe

- Ideal for accurately measuring rebars that are deep within the structure



Half-Cell Kit

- Consists of either a copper electrode in a copper sulphate solution or a silver electrode in a sodium chloride solution
- Each half cell is a sealed unit - no need to mix chemicals
- Supplied with a 25m/80ft cable
- Every half-cell probe is guaranteed for 5 years

Product Features

Description	Covermeter & Half Cell			
	BH	SH	TH	THD
Model				
Part Number	W331BH--4	W331SH--4	W331TH--4	W331THD-4
Covermeter	■	■	■	■
Half-Cell measurement	■	■	■	■
Rebar orientation	■	■	■	■
Depth of cover	■	■	■	■
Large cover (thickness) reading mm or inches	■	■	■	■
Large graphics display with backlight	■	■	■	■
Multiple language menu structure	■	■	■	■
Signal strength bar	■	■	■	■
Interchangeable heads with LED & keypad	■	■	■	■
User selectable bar range sizes & numbers	■	■	■	■
Rugged waterproof case (IP65)	■	■	■	■
Adjustable beep volume & earphone socket	■	■	■	■
Measurement Sound Modes				
Locate (<i>tone increases as head approaches rebar</i>)	■	■	■	■
Under Cover (<i>tone only sound for low cover</i>)		■	■	■
Maxpip™ (<i>tone only as head passes rebar centre</i>)		■	■	■
Large half cell reading mV	■	■	■	■
Automatic bar size estimate		■	■	■
Orthogonal bar size calculation		■	■	■
RS232 Output - direct to printer or PC		■	■	■
CoverMaster™ software		■	■	■
Statistics		■	■	■
Number of readings (n)		■	■	■
Mean (average) (\bar{x})		■	■	■
Standard deviation (σ)		■	■	■
Coefficient of variation (CV%)		■	■	■
Lowest reading (\downarrow), Highest Reading (\uparrow)		■	■	■
Under range ($<<$)		■	■	■
Low Limit (∇ or $<$), Within Limit (\dagger), High Limit (\triangle or $>$)		■	■	■
Over range (∞)		■	■	■
Blank readings (\square)		■	■	■
Minimum & maximum cover limits		■	■	■
Date & Time		■	■	■
Memory		■	■	■
Linear batch memory		10 linear batches of 1,000 readings each	Up to 200 batches of 1,000 readings*	Up to 200 batches of 1,000 readings*
Grid batch memory			Up to 240,000 readings*	Up to 240,000 readings*
User customised batch size			■	■
Graphics plot			■	■
Threshold plot			■	■
Stainless Steel Measurement Mode				■

* Linear Batch Mode: up to 200 batches of 1,000 readings each Grid Batch Mode: up to 1,000 batches, maximum number of readings: 240,000

Covermeters & Half-Cell Meters

Elcometer 331

Technical Specification

Range	-999mV to +999mV	Accuracy	±5mV
Operating temperature	0 to 50°C (32 to 120°F)		
Power supply	7.4V battery pack provides up to 32 hours of continuous use (20 hours if backlight is on). Rechargeable in 4 hours, using an external charger, either inside or outside the gauge.		
Dimensions	230 x 130 x 125mm (9 x 5.1 x 4.9")	Weight	1.6kg (3.5lb)
Packing List:	Elcometer 331 Covermeter & Half-Cell Meter, half-cell & search head connecting cable, rechargeable battery pack & charger (UK, US & EU), earphone, shoulder strap, plastic carry case, operating instructions, CoverMaster™ software (SH, TH & THD) & PC cable (SH, TH & THD)		

Cover Mode and Half-Cell Mode

This all in one gauge combines the rebar locator, concrete covermeter and half-cell measurement, which allows the user to easily switch from Cover Mode to Half-Cell Mode depending on the type of measurement required on site.

Cover Mode: Measures the depth of cover over the rebar, detecting the location, orientation and depth of the rebar under the surface of the concrete using either a Standard, Narrow Pitch, Deep Cover, Dual Search Head or a Borehole Probe.

Half-Cell Mode: Measures the condition and potential corrosion of rebars and steel structures within concrete using either a copper electrode in a copper sulphate solution or a silver electrode in a silver chloride solution.

The Elcometer 331 Covermeter and Half-Cell meter is available in four models - Model BH, SH, TH and THD.

Elcometer 331 Model BH: entry level gauge without memory.

Elcometer 331 Model SH: intermediate level gauge supplied with memory and allows users to store up to 1,000 readings in linear batches.

Elcometer 331 Model TH: supplied with memory and allows users to store up to 240,000 readings in either linear or grid batches.

Elcometer 331 Model THD: supplied with memory and allows users to store up to 240,000 readings in either linear or grid batches. Also able to detect stainless steel reinforcement bars.

Elcometer 331

Covermeters & Half-Cell

Bar Size Dimensions available on the Elcometer 331 Models B, BH, SH, TH & THD in Cover Mode

The bar size can be selected when using a Covermeter only or the Covermeter & Half-Cell meter in Cover Mode. Dimensions of reinforcement bars are stored in the Elcometer 331 Models B, BH, SH, TH & THD and includes the following four standards bar series: Metric, US Bar, ASTM/Canadian and Japanese. Due to this wide selection of bar sizing, the Elcometer 331 Covermeters can be utilised worldwide with accurate results.

When taking measurements for high tensile steel or Grades 304, 316 and Duplex Stainless Steel using the Elcometer 331 Model THD, details for the Bar Grade and Bar Size can be manually input into the covermeter, alternatively the gauge can be used in Autosizing Mode.

Metric		Imperial		ASTM/Canadian		Japanese	
Bar Size	Diam. (mm)	Bar Size	Diam. (Inch)	Bar Size	Diam. (mm ²)	Bar Size	Diam. (mm)
5	5	#2	0.250	10M	100	6	6
5.5	5.5	#3	0.375	15M	200	10	10
6	6	#4	0.500	20M	300	13	13
7	7	#5	0.625	25M	500	16	16
8	8	#6	0.750	30M	700	19	19
9	9	#7	0.875	35M	1000	22	22
10	10	#8	1.000	45M	1500	25	25
11	11	#9	1.125	55M	2500	29	29
12	12	#10	1.250			32	32
14	14	#11	1.375			35	35
16	16	#12	1.500			38	38
18	18	#13	1.625			41	41
20	20	#14	1.750			44	44
22	22	#15	1.875			48	48
25	25	#16	2.000			51	51
28	28	#18	2.250			57	57
32	32						
36	36						
40	40						
44	44						
50	50						

CoverMaster™ Software

Elcometer 331

Elcometer's CoverMaster™ software will manage your data efficiently and effectively.

Available with the Elcometer 331 Models HM, SH, TH & THD.

Data is transferred quickly into the CoverMaster™ software data management system via RS232 connection.

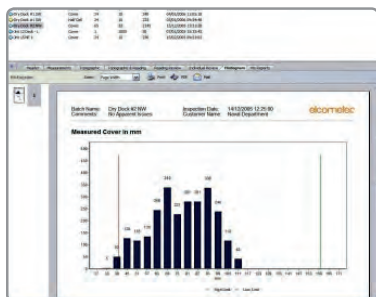
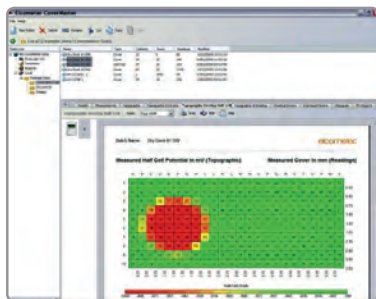
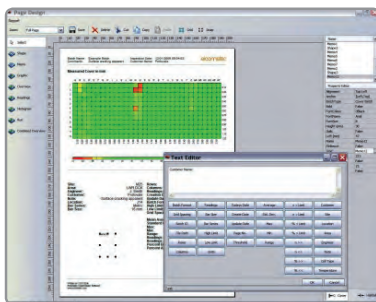
Both Covermeter and Half-Cell readings can be stored together with associated photos, Word documents, Excel spreadsheets and other files.



CoverMaster™ software is supplied free of charge with all Elcometer 331 models that have batch data storage.

Features:

- Data easily translated into a typographic view giving you all the information you need at a glance
- Data for each reading can be presented in colour or can be shown in greyscale, complete with reading values in each grid
- Site survey data from both cover and half cell measurements can be shown on the same typographic (or gradient) chart
- Reports can be fully customised allowing corporate logos, photos and memos to be added providing a fully comprehensive report for clients
- All survey information in one place, CoverMaster™ links directly with Excel, Word and PowerPoint files, it is simple to analyse and assess your results
- CoverMaster™ - one platform for the storage of data, notes, photos, PDF files for the creation of comprehensive reports



Elcometer 331

Accessories

For the Elcometer 331 BH, SH, TH and THD models, all search heads, the borehole probe and half-cell probes are fully interchangeable there is no requirement to return your gauge to Elcometer.

Elcometer 331 SH, TH and THD models are also supplied with CoverMaster™ & EDTS Excel link transfer software and PC Cable.

The Elcometer 331 Model B does not have half-cell capability and cannot be used with the half-cell probes.



Standard Search Head

Designed to meet most of your measurement requirements.

Part Number	TW33119124-1A
Range	40mm / 1.6" bar 15mm to 95mm / 0.6" to 3.75" 8mm / 0.3" bar 8mm to 70mm / 0.3" to 2.75"

Dimensions	155 x 88 x 42mm / 6.1 x 3.5 x 1.65"
Sensing area	120 x 60mm / 4.72 x 2.36"



Narrow Pitch Search Head

Accurately measures the cover thickness when the gaps (pitch) between each of the rebars are close together.

Part Number	TW33119124-2A
Range	40mm / 1.6" bar 8mm to 80mm / 0.3" to 3.1" 8mm / 0.3" bar 5mm to 60mm / 0.2" to 2.4"

Dimensions	155 x 88 x 42mm / 6.1 x 3.5 x 1.65"
Sensing area	120 x 60mm / 4.72 x 2.36"



Deep Cover Search Head

The ideal search head for accurately measuring rebars that are deep within the structure.

Part Number	TW33119171A
Range	40mm / 1.6" bar 35mm to 180mm / 1.4" to 7" 8mm / 0.3" bar 25mm to 160mm / 1" to 6.3"

Dimensions	170 x 94 x 54mm / 6.7 x 3.7 x 2.1"
Sensing area	160 x 80mm / 6.3 x 3.15"



Dual Search Head for high tensile and stainless steels

The search head is designed to locate High Tensile and Stainless Steel.

Part Number	TW33120014D
Range	40mm / 1.6" bar 35mm to 180mm / 1.4" to 7" 8mm / 0.3" bar 25mm to 160mm / 1" to 6.3"

Dimensions	170 x 94 x 54mm / 6.7 x 3.7 x 2.1"
Sensing area	160 x 80mm / 6.3 x 3.15"

Accessories

Elcometer 331

Borehole Probe

The solution for locating tendon ducts and multiple layers of rebar lying deep within the concrete.

		Metric	Imperial
Part Number	Short	TW33119223-1A	TW33119223-3A
	Long	TW33119223-2A	TW33119223-4A
Measurement depth	Short Probe: 0 - 400mm / 0 - 16" Long Probe: 0 - 1000mm / 0 - 40"		
Approximate detection ranges	Tendon duct (70mm / 2.75" diameter): up to 90mm / 3.54"		



Half-Cell Kit

Consists of either a copper electrode in a copper sulphate solution or a silver electrode in a sodium chloride solution, each half cell is a sealed unit - no need to mix chemicals. Supplied with a 25m / 80' cable, every half-cell probe is guaranteed for 5 years.

Part Number	TW331CUKIT	Copper/Copper Sulphate
	TW331AGKIT	Silver/Silver Chloride



Extension Cable 100m / 325ft

The extension cable for use with the half-cell kits gives the flexibility to take readings in difficult to reach areas.

Part Number	TW33119683
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Verification Block

The verification block allows the user to check the calibration of their gauge in order to ensure maximum measurement accuracy.

Part Number	TW33119218
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Extension Arm Kit

This kit allows the user to scan bridge decks and floor areas using the hand-held search heads from a standing position as both the standard or narrow pitch search head can be attached to the extension arm.

Part Number	TW33119222
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Elcometer P500

Metal Box Locator



Although originally designed to accurately locate valve boxes and manhole covers, the Elcometer P500 can also be used as a general metal detector. It is straight forward to use and very rugged making it a popular choice in the market.

Detects metal objects to a maximum depth of 1m (39.4"), the Elcometer P500 has a number of key unique features:

- Manufactured from a single moulded design, in high impact ABS plastic, the Elcometer P500 stands up to a tough environment
- A balanced, lightweight unit with a single control button for ease of use
- Audio signal with headphone socket and an ultra-bright LED visual indicator identify when metal has been detected

Technical Specification

Part Number	Description
W500157F	Elcometer P500 Metal Box Locator
Overall Length	960mm (38")
Search Head Diameter	210mm (8")
Weight	1.1kg (2.5lb)
Power Supply	4 x 1.5V AA Cells or 4 x 1.5V NiMH Rechargeable Cells
Packing List	Elcometer P500 Metal Box Locator, 4x LR6 (AA) batteries, operating instructions

Approximate Detection Ranges

Typical Object Type	Metric	Imperial
Stop Top Box	500mm	19"
Fire Hydrant Cover	870mm	34"
Inspection Cover	950mm	37"

Metal Box Locator

The Elcometer P500 submits a strong, focused downwards search field ensuring the accurate location of objects, even when close to metal fencing and vehicles.

The metal box locator ignores any ghost signals from cigarette packets, drinks cans and other metallic waste materials, making your search more efficient.



Crack Width Ruler

This simple gauge is designed specifically to provide inspectors with a low cost alternative to a graduated microscope when determining the width of a crack in concrete or other building materials.

Similar in size to a standard credit card, this transparent gauge is marked with a range of graded lines. Each line is a specified width.

To use, position the gauge over the crack and identify which line is a similar width to the crack. Read off the width value.

Elcometer 143



Technical Specification

Part Number	Description
E143----1	Elcometer 143 Crack Width Ruler
Range	0.10 - 2.50mm / 0.004 - 0.100 inches

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Declaration

We hereby declare that our product 'Battery Pack **6973**' part no **6023710** has been tested according to the UN Transport regulations ST/SG/AC.10/27/Add.2. 'Amendment to the third revised edition of the recommendations on the transport of dangerous goods, manual of tests and criteria'

Performed Tests	Result
38.3.4.1 Altitude simulation	passed
38.3.4.2 Thermal Test	passed
38.3.4.3 Vibration	passed
38.3.4.4 Shock	passed
38.3.4.5 External Short Circuit	passed
38.3.4.6 Impact	not required
38.3.4.7 Overcharge	passed
38.3.4.8 Forced Discharge	not required

For and on behalf of
ANSMANN ENERGY GMBH

A handwritten signature in blue ink, appearing to read "U. Dietz".

i.V Ulrich Dietz
[Quality and Approval]

Authorized Signature

Date of issue: October 26, 2006



MATERIAL SAFETY DATA SHEET

“Stelth” Reference Electrode – SRE-010-CPY

I. PRODUCT IDENTIFICATION: *“Stelth” Reference Electrode*

Supplier: BORIN Manufacturing Inc. 5741 Buckingham Parkway, Suite B, Culver City CA, 90230

II. HAZARDOUS INGREDIENTS: Cupric Sulfate

III. HEALTH HAZARD INFORMATION:

Chemical ingredients are compounded with inert materials and subsequently encapsulated in a ceramic casing. In the hardened and solid state form, these chemicals pose no threat because they cannot be ingested or inhaled.

IV. EMERGENCY AND FIRST AID PROCEDURES:

If swallowed, induce vomiting immediately by giving two glasses of water and sticking finger down throat. Never give anything by mouth to an unconscious person. In case of contact, immediately flush skin or eyes with plenty of water for at least 15 minutes. In all cases, call a physician.

V. SPILL OR LEAK PROCEDURES: Cannot occur in a solid-state form.

VI. WASTE DISPOSAL METHOD: Handle as a non-hazardous material.

VII. VENTILATION REQUIREMENTS: None.

VIII. SPECIFIC PERSONAL PROTECTIVE EQUIPMENT: None.

IX. SPECIAL PRECAUTIONS: None.

Prepared by:
Borin Manufacturing
Environmental Services
March 2009

5741 Buckingham Parkway, Suite B, Culver City, California 90230 USA
Telephone: 310 822-1000 • Facsimile 310 338-3434
e-mail: borin@borin.com • www.borin.com



Borin
Manufacturing Inc

MATERIAL SAFETY DATA SHEET

“*Stelth*” SRE-011-SPB

SILVER

Section 1 - Identification

Product:	Silver
CAS Number:	7440-22-4
Product Code:	12-000
Chemical Family:	Metal
Chemical Formula:	Ag
Molecular Weight:	107.90
RTECS Number:	VW3500000
Synonyms:	Commercial Fine Silver

Section 2 - Hazardous Chemical Components

Component:	Silver	Percent of Mixture:	g 99.9
CAS Number:	7440-22-4	ACGIH TLV	(1991 -92)
OSHA PEL:	0.01 mg. / m3 (TWA)		0.1 mg. / m3 (TWA)

Section 3 - Physical Data

Boiling Point:	4014 degrees F	2212 degrees C
Melting Point:	1764 degrees F	962 degrees C
Vapor Pressure:	N/A	
Vapor Density:	(Air+1) : N/A	
Specific Gravity:	10.5	
Solubility (H2O):	Insoluble	
Percent Volatile:	N/A	
Evaporation Rate:	Solid - N/A	
Appearance:	Gray-White metal in form of wire, rod, tubing, sheet, strip, grain, powder or anode.	
Odor:	Solid - N/A	

Section 4 - Fire Fighting & Explosion Data

Flash Point:	N/A degrees F
Autoignition:	N/A degrees F
Flammability Class:	N/A
Lower Explosive Limit (%):	N/A
Upper Explosive Limit (%):	N/A
Fire & Explosive Hazards:	In finely-divided form, this material may ignite when exposed to flame or by reaction with incompatible materials. Fires or

explosions involving this material, may release potentially toxic emissions of silver or silver oxide fume.

Section 4 - Fire Fighting & Explosion Data (Continued)

Extinguishing Media: Use dry powder. Do not use water.
 Special Fire Fighting Instruc: Use self-contained breathing apparatus with full-facepiece operated in pressure-demand or other positive pressure mode.

Section 5 - Exposure Effects and First Aid

Route of Exposure: (Inhalation) Chronic exposure to silver may produce argyria, a permanent blue-gray discoloration of the skin, eyes, mucous membrane and the respiratory tract.

First Aid: (Inhalation) If signs and symptoms of toxicity are observed, remove subject from contaminated area, administer oxygen and seek medical attention. Keep the subject warm and at rest. Perform artificial respiration if breathing has stopped.

Route of Exposure: (Skin) Skin contact with this material in solid forms is not known to be hazardous. In powdered form, skin contact may produce localized irritation and/or argyria.

Fist Aid: (Skin) Following repeated or prolonged contact, remove contaminated clothing. Wash affected area with large quantities of water for at least five minutes. Seek medical attention if necessary.

Route of Exposure: (Eyes) Exposure of the eyes to this material in powdered form may produce localized argyria and / or irritation.

First Aid: (Eyes) Flush affected areas with water for at least 15 minutes. Seek medical attention if necessary.

Route of Exposure: (Ingestion) Ingestion of this material in finely-divided form may produce vomiting, abdominal pain and / or collapse.

First Aid: (Ingestion) If subject is conscious, induce vomiting. If unconscious or convulsive, seek immediate medical assistance.

Miscellaneous Toxicological Information: Silver is not classified as a potential or demonstrated human carcinogen by IARC, NIOSH, NTP, OSHA, or ACGIH.

Health Conditions Aggravated by Exposure: Pre-existing skin diseases (e.g., dermatitis) may be aggravated by sustained dermal exposure to this material in finely-divided form.

Section 6 - Reactivity & Polymerization

Stability: Stable

Conditions to Avoid: (Stability) Stable at room temperature.

Incompatible Material: Acetylene; ammonia; nitric acid; ethylene imine; chlorine trifluoride; H₂SO₄; inorganic and organic peroxides; peroxyformic acid; bromoazide; oxalic acid; 1-bromo-2-propyne; tartaric acid, permonosulfuric acid.

Hazardous Decomposition Product: Heating to elevated temperatures may volatilize silver as fume.

Conditions to Avoid: (Polymerization) N/A Hazardous Polymerization: does not occur.

Section 7 - Spill, Leak and Disposal Procedures:

Steps to be taken: Clean up spilled material so as to minimize dispersion of dust. Wet sweeping or vacuuming using HEPA filtration are recommended methods.

Waste Disposal Methods: Return to manufacturer for reclaim.

SARA Title III Notifications: Reportable Quantity is 1000 pounds

SARA Title III Hazard

Classifications: Chronic Health Hazard Fire Hazard

Section 7 - Spill, Leak and Disposal Procedures (Continued):

SARA Title III Section 313: (Supplier Notification) This product contains the following toxic chemicals subject to the reporting requirement of section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and of 40 CFR 372:

<u>CAS #</u>	<u>Chemical Name</u>	<u>Percent of Mixture</u>
7440-22-4	Silver	99.9

This information must be included on all MSDS's that are copied and distributed for this material.

Section 8 - Special Protective Measures

Ventilation:	Use mechanical local exhaust ventilation adequate to maintain airborne concentrations of all components and reaction products to within their respective OSHA PEL's.
Eye Protection:	If this material is used in finely-divided form, wear eye protection (safety glasses, dust proof goggles) adequate to prevent eye contact with this material.
Skin Protection:	Wear appropriate protective gloves and clothing for prolonged or repeated contact with finely-divided material.
Respiratory Protection:	If exposure levels exceed the OSHA PEL, wear a NIOSH/MSHA approved respirator having a protection factor appropriate to the airborne concentrations of the contaminants generated.
Work/Hygienic Practices:	To avoid ingestion of material, wash hands and face before eating, drinking or consumption of tobacco.

Section 9 - Special Precautions (Storage and Handling)

Storage and Handling
Conditions: Do not store in proximity to incompatible materials (see Section 6).

Section 10 - Shipping Information

Hazard Class: Not controlled by DOT, IATA, ICAO or IMO regulations.

DISCLAIMER OF EXPRESSED IMPLIED WARRANTIES

Although reasonable care has been taken in the preparation of this document, we extend no warranties and make no representations as to the accuracy or completeness of the information contained therein, and assume no responsibility regarding the suitability of this information for the user's intended purposes or for the consequences of this product's use. Each individual must make his or her own determination as to the suitability of the information for each purpose (s) or use.

SODIUM CHLORIDE

Manufactured by Cargill Salt

Section 1 - General Information

Chemical Name: Sodium Chloride
Formula: NaCl
Trade Name (Synonym): Salt
CAS Number: 7647-14-5
Molecular Weight: 58.44

Section 2 - Hazardous Ingredients / Identity Information

Component: Specific Chemical Identity and / or common names: none

Section 3 - Physical Data

Boiling Point: 760mm Hg 1465 degrees C
Specific Gravity: (H2O = 1) 2.16

Section 4 - Fire Fighting & Explosion Data

Flash Point: N/A
Flammable Limits: LEL - N/A UEL - N/A
Extinguishing Media: N/A This product is nonflammable
Special Fire Fighting Procedures: N/A
Unusual Fire and Explosive Hazards: None

Section 5 - Reactivity Data

Stability: Stable
Conditions to Avoid: Contact with strong acids
Incompatible Material: Becomes corrosive to metals when wet
Hazardous Decomposition or Byproducts: May evolve chlorine gas when in contact with strong acids.
Hazardous Polymerization: Will not occur

Section 6 - Health Hazard Data

Route of Exposure: (Inhalation) May cause mild irritation of nose and throat.
(Skin) Dust may cause mild irritation.
(Ingestion) Ingestion of large amounts may cause gastrointestinal upset.

Carcinogenicity: NTP - Not listed as a carcinogen or mutagen.
IARC Monographs - Not listed as a carcinogen or mutagen.
OSHA Regulated - Not listed as a carcinogen or mutagen.

Signs and Symptoms of Exposure: (Inhalation) Slight irritation of the nose; sneezing.
(Skin) Irritation; inflammation.
(Ingestion) Nausea; vomiting.

Medical Conditions generally aggravated by Exposure: In some cases of confirmed hypertension, ingestion may result in elevated blood pressure. (This applies only to salt-sensitive individuals).

First Aid: (Inhalation) If person breathes large quantities, remove to fresh air

at once. If breathing stops, apply artificial respiration immediately.
 (Skin) Remove clothing from affected area. Wash skin thoroughly

Section 6 - Health Hazard Data (Continued)

and rinse carefully. For eye contact, flush with water immediately, lifting eyelids occasionally.

(Ingestion) Less than a few grams would not be harmful. For larger quantities, drink large amount of water or milk.

Section 7 - Precautions for Safe Handling and Use

Waste Disposal Method:	For disposal of this material as a waste, act in accordance with all applicable Federal, state and local waste management regulations.
Handling & Storage:	Avoid humid or wet conditions as product will cake and become hard.
Other Precautions:	N/A

Section 8 - Control Measures

Respiratory Protection:	NIOSH/MSHA approved respirator for particulates.
Ventilation:	Local exhaust - Ventilate as required to maintain airborne particulates below occupational exposure limits. Mechanical - Dust collection equipment may be employed. Special - N/A
Special Protective Measures:	Wear protective gloves. Normal work gloves are adequate. Wear eyeglasses or goggles in dusty areas. Other protective clothing or equipment - Protective clothing may be worn in dusty areas, but is generally not required.
Work / Hygiene Practices:	Warm water showering and handwashing is suggested after working in extremely dusty areas.

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It is the responsibility of the user to comply with all applicable federal, state and local laws and regulations. It is also the responsibility of the user to maintain a safe workplace. The user should consider the health hazards and safety measures.