

canin⁺

Corrosion Analyzing Instrument For the Measurement of Corrosion Potential and Electrical Resistivity

Operating Instructions



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1 Safety

1.1 General Information

These operating instructions contain important information about safety, use and maintenance of the potential and resistance measuring instrument and its components. The operating instructions are intended to safeguard the operator, to prevent damage to the instrument and to ensure a smooth operation.

- Please read these operating instructions carefully before using the instrument for the first time.
- Please keep these operating instructions in a safe place.

1.2 Liability

Our “General Terms and Conditions of Sales and Delivery” always apply. Warranty and liability claims for injuries and damage to property are excluded if they result from one or more of the following causes:

- Incorrect use of the CANIN⁺ corrosion analyzing instrument and the related components
- Improper use of functions, operation or maintenance of the CANIN⁺ corrosion analyzing instrument and the related components
- Failure to observe the instructions in the operating instructions in relation to the use of functions, operation and maintenance of the CANIN⁺ corrosion analyzing instrument and the related components
- Unauthorised modifications to the CANIN⁺ corrosion analyzing instrument and the related components
- Disasters caused by the action of foreign bodies, accidents, vandalism and force majeure

All information contained in this documentation is presented in good faith and believed to be correct. Proceq SA makes no warranties and excludes all liability as to the completeness and/or accuracy of the information. For the use and application of any product manufactured and/or sold by Proceq SA explicit reference is made to the particular applicable operating instructions.

1.3 Safety Instructions

1.3.1 General

- Carry out the stipulated maintenance properly and at the correct time.
- Following completion of the maintenance tasks, perform a functional check.
- Pay attention to the correct use and disposal of the copper sulphate solution and the cleaning material.

1.3.2 Unauthorized operators

Children and persons under the influence of alcohol, drugs or medication are not allowed to operate the CANIN⁺ corrosion analyzing instrument and the related components. Persons who are not familiar with the operating instructions are only allowed to operate the instrument under the supervision of a person familiar with the device.

1.3.3 Symbols used in the operating instructions



Danger! This note indicates a risk of serious or fatal injury in the event that certain rules of behaviour are disregarded



Warning! This note warns you about the risk of material damage, financial loss and legal penalties (e.g. loss of warranty rights, liability cases, etc.)



Caution! Dangers that can lead to major injuries or substantial damage to property

Caution! Dangers that can lead to slight damage to property



This denotes important information

1.4 Correct Usage

- The instrument is only to be used to determine the corrosion potential of rebars in concrete or the electrical resistance of concrete. CANIN⁺ measures electrical voltage and current and stores the data under object numbers.
- Do not perform any unauthorized changes on the instrument.
- Replace faulty components only with original replacement parts from Proceq.
- Only original parts fulfil all of the safety requirements.
- Accessories should only be installed or connected to the instrument if they are expressly authorized by Proceq. If other accessories are installed or connected to the instrument then Proceq will accept no liability and the product guarantee is forfeit.
- Follow the instructions in the operating instructions precisely. Failure to do this forfeits the manufacturer's guarantee.



Note: Alkaline batteries should be appropriately disposed of. Batteries pollute the environment. Old batteries should be recycled or returned to the supplier.

1.5 Standards and Regulations Applied

- ASTM C876-91, USA
- BS 1881, Part 201, UK
- DGZfP B3, Germany
- UNI 10174, Italy

2 Product Description

The CANIN⁺ provides two methods for investigating and assessing the corrosion of steel in concrete. Two types of probe, each with its own measurement method can be attached to the display unit.

- The instrument displays and processes the corrosion potential that is measured with a half-cell rod or wheel electrode.
- The instrument displays and processes the electrical resistivity that is measured with a four-point Wenner probe.

2.1 Application

In the potential measuring mode, the corrosion potential of steel rebars in concrete structures can be measured. It is possible to examine both small areas and also very large areas. Measurements can be made in any direction, downwards, horizontal and upwards.

The resistivity measuring mode is used to measure the specific electrical resistivity of reinforced concrete structures.

Both of these methods provide data that can be used to estimate the threat of corrosion of the rebars.

2.2 Product Characteristics

2.2.1 Display Instrument

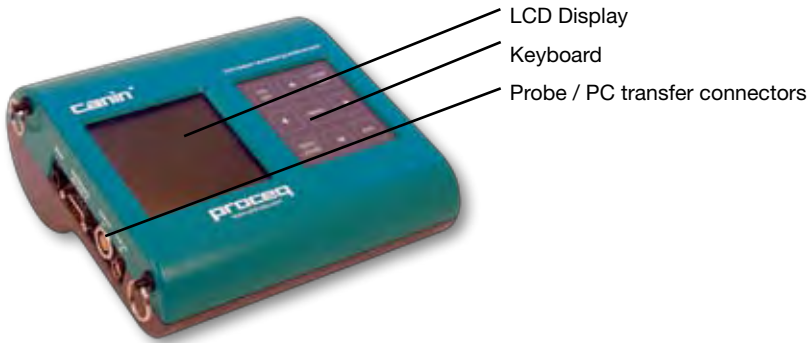


Fig 2.1 Display Instrument

The display instrument CANIN⁺ is micro-processor controlled and together with the half-cell electrodes it provides the following functions:

- Measurement of the corrosion potential (electrical voltage) in mV.
- Configuration of the measurement grid.
- Storage of the measured readings in numbered files called “Objects”.
- An RS232 interface for transferring measurement data to a PC.
- Several display languages.
- Switchable background lighting.

Together with the four-point Wenner probe, the CANIN⁺ provides the following functions:

- Measurement of the electrical resistivity of concrete “ ρ ” in $k\Omega\text{cm}$.
- Configuration of the measurement grid.
- Storage of the measured readings in numbered files called “Objects”.
- An RS232 interface for transferring measurement data to a PC.
- Several display languages.
- Switchable background lighting.

2.2.2 Rod Electrode

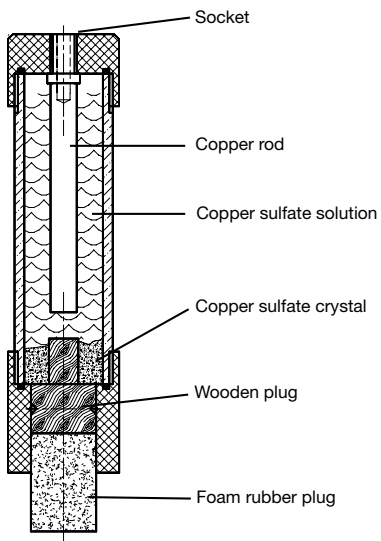


Fig 2.2 Rod electrode

2.2.3 Wheel Electrode

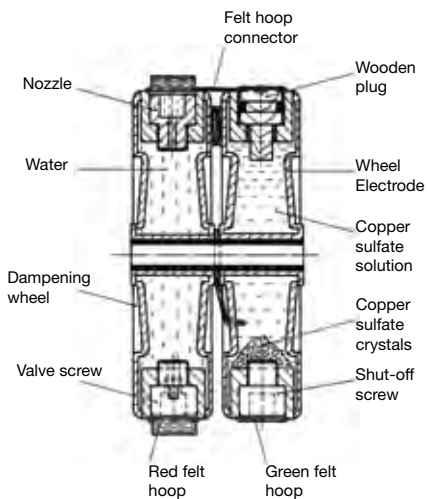


Fig 2.3 Wheel electrode

2.2.4 Resistivity probe



Fig 2.4 Wenner four-point probe with cable and control plate

2.2.5 Scope of delivery



Fig 2.5

- Display instrument CANIN⁺
- Carrying strap, adjustable, padded
- Protective sleeve for the display instrument
- Rod electrode with spare parts
- Electrode cable, single wire, L = 1.5m
- Cable roll, L = 25m
- System with wheel electrode
- Toolkit for CANIN wheel electrode
- CANIN ProVista Software on a memory stick
- Transfer cable 1.5m 9-pin
- USB – serial adapter
- Copper sulphate CuSO₄, 250g
- Citric acid, 250g
- Wenner four-point probe without cable, with spare foam pads
- Cable for Wenner probe
- Control plate for resistivity probe
- Operating instructions for instruments and software
- Carrying case CANIN⁺

2.3 Measurement Methods

CANIN⁺ together with the half-cell rod or wheel electrode measures the corrosion potential of steel reinforcing bars in concrete according to the method that is described in various standards (e.g. ASTM C876-91). In order to measure these voltages it is necessary to connect the ground cable to an exposed section of the reinforcing steel.

The readings are stored in a pre-defined grid and are shown on the display unit as a grey-scale graphic.

Subsequent processing of the measurement readings on a PC with the aid of the evaluation software ProVista, provides the basis for an optimal interpretation and assessment of the corrosion potential of the rebars.

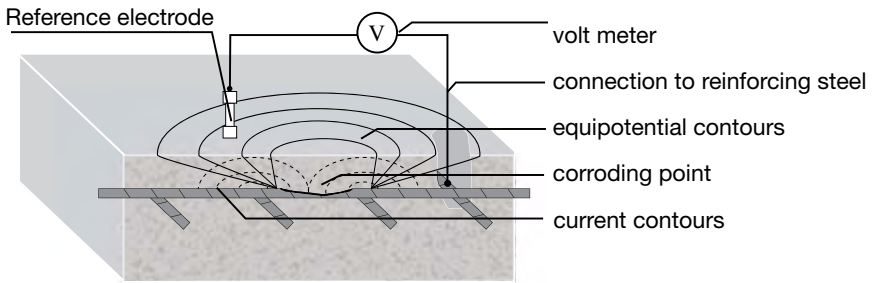


Fig 2.6 Schematic representation of the measuring principle for potential measurements.

CANIN⁺ together with the resistivity probe measures the electrical resistivity of the concrete according to Wenner. See Fig 2.7. The formula shown here is used by the instrument to calculate and display the resistivity.

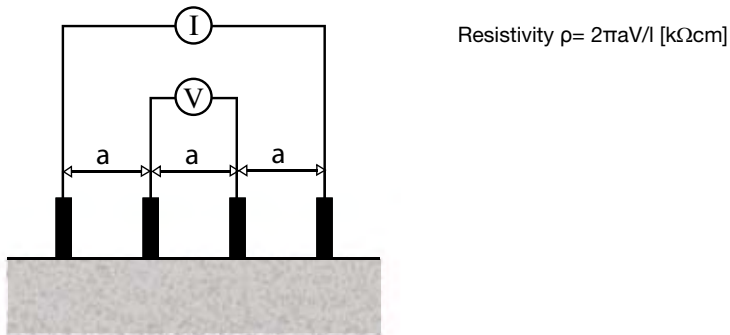


Fig 2.7 Schematic representation of the measuring principle for resistivity measurements.

2.4 Application Examples

Potential measurement can be employed as a non-destructive test method when investigating the condition of building elements made from reinforced concrete e.g. multi-story car parks, slabs and pylons used in bridges.

It can also be used to check the effectiveness of cathodic corrosion protection systems employed to protect reinforced concrete components.

Further to this it can be used for complementary measurements of the electrical resistivity for an estimation of the corrosion rate.

2.5 Measuring Conditions

- The air temperature should be $> 0^{\circ}\text{C}$ to prevent freezing of the water required for wetting and to prevent freezing of the copper sulphate solution.
If the temperature of the building element to be measured is $< 0^{\circ}\text{C}$, the potential readings can be strongly affected to give positive values.
- The surface of the building element to be measured should be clean to enable a good electrical contact between the probes (felt or foam pads) and the concrete.
- If the concrete has a coating on the surface, then the influence of this coating on the potential measurement should be checked by making a measurement with the coating in place and a second measurement with the coating removed.
- Verify that a good electrical contact is made when connecting the ground cable to the reinforcing steel.
- The continuity of the reinforcing steel should be checked. This is done by carrying out a resistance measurement between two separate connections to the steel bars.
The electrical resistance between these two points should be less than $1\ \Omega$ after taking into consideration the resistance of the cable.

3 The Display Instrument

External Connections



Fig 3.1 – External connections

GND – Reference Ground connector

INTERFACE RS232 C – For data transfer to a PC

INPUT A - Electrode connection

INPUT B – Path measurement connector.

User Interface



Fig 3.2 The 9-button keyboard

3.1 Start-up – Selecting the correct measuring mode

The display instrument has two distinct modes of operation. Corrosion potential measurement and electrical resistivity measurement.

Both modes have their own measurement screen, a main menu with sub-menus and their own memory allocation.

Press the ON/OFF button.

On start-up the following information will be temporarily shown on the display:

The version that is shown on the display depends on whether the instrument was last used for potential measurement or resistivity measurement.



Fig 3.3 Start up screens

The lower half of the screen shows the following information.

- The serial number of the instrument.
- The software version installed.
- An indication of whether or not the self test is OK.
- An indication of the battery status.

This will be replaced after a few seconds by the measuring screen that was last used.



Fig 3.4 Potential measurement screen



Fig 3.5 Resistivity measurement screen

3.1.1 Backlight

The display has a back light which can be switched on or off by pressing the **END** button for more than 2 seconds when the measurement screen is displayed. When the backlight is on, an asterisk is shown in the top right hand corner: (See Fig 3.4 and 3.5).



Note: The instrument is powered by six batteries 1.5V (LR6 or AA type). If the instrument is used exclusively for corrosion potential measurements, then the operating lifetime is approximately 60 hours or 30 hours if the back light is activated. We recommend the use of alkaline batteries.

3.2 Switching from Resistivity to Potential measurement

If the instrument starts up in resistivity mode and you wish to perform potential measurements then follow this procedure.

Press the **MENU** button. This will take you to the main menu.

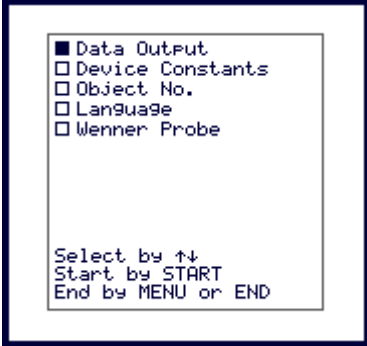


Fig 3.6 The main menu (resistivity mode).

Use the ↑↓ buttons to select the item **Wenner Probe**.

Press the **START** button. This will take you to the following screen.

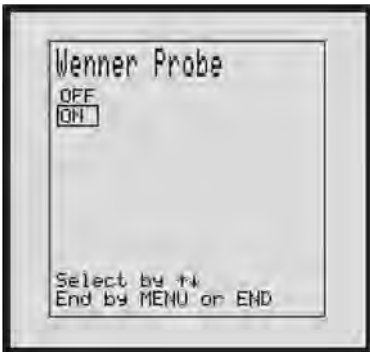


Fig 3.7 Wenner Probe ON/OFF selection

Use the ↑↓ buttons to select **OFF**.

Press the **MENU** button. The Wenner Probe is now switched off and you will be taken back to the main menu for the potential measurement mode.



Fig 3.8 Main menu (potential mode).

3.3 Switching from Potential to Resistivity measurement

If the instrument starts up in potential mode (See Fig 3.4) and you wish to perform resistivity measurements then follow this procedure.

Press the **MENU** button. This will take you to the main menu. (Fig 3.8)

Use the ↑↓ buttons to select the item Wenner Probe.

Press the **START** button. This will take you to the Wenner Probe ON/OFF selection screen (Fig 3.7)

Use the ↑↓ buttons to select **ON**.

Press the **MENU** button. The Wenner Probe is now switched on and you will be taken back to the main menu for the resistivity measurement mode (Fig 3.6).

4 Measuring the Corrosion Potential

4.1 Preparing the electrodes

Rod Electrode

Before filling the electrode, remove the red cap containing the wooden plug and soak it in water for about an hour to allow the wood to saturate and swell.

The saturated copper sulphate solution should be prepared by mixing 40 units by weight of copper sulphate with 100 units by weight of distilled water. In order to ensure that the solution remains saturated add an additional half teaspoonful of copper sulphate crystals into the electrode.

The electrode should be filled as completely as possible with a minimum of air in the tube. This is to make sure that the solution is in contact with the wooden plug even when a measurement is being made in an upwards direction.

Close the red cap firmly by hand.

Wheel Electrode

For this electrode type also, the part of the wheel where the wooden plug is located should be soaked in water for about an hour to allow the wood to saturate and swell.

The saturated copper sulphate solution should be prepared by mixing 40 units by weight of copper sulphate with 100 units by weight of distilled water. In order to ensure that the solution remains saturated, add an additional two teaspoonfuls of copper sulphate crystals into the electrode.

When filling, care should be taken to ensure that as little air as possible is enclosed in the electrode to ensure that the solution remains in contact with the wooden plug, also when this plug is facing upwards.

Carefully fasten the shut-off screw.

4.2 Configuring the instrument for potential measurement

Having selected the potential measurement mode as described above, you are now ready to programme the instrument according to your requirements.

Press the **MENU** button.

Fig 3.8 above shows the main menu. Each menu item is described below in more detail.

4.2.1 Data Output

See Section 4.4. This is used to transfer data to the PC for further evaluation.

4.2.2 Display

This menu item is used for determining how the potential readings are shown on the display.

Use the $\uparrow\downarrow$ buttons to select the item **Display**.

Press the **START** button.

This will bring up the following screen:

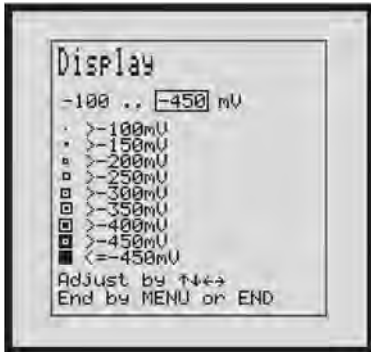


Fig 4.1 Display settings

Use the $\leftarrow \rightarrow$ buttons to select the upper and lower ends of the display range (in this example -100 and -450 mV.)

Use the $\uparrow\downarrow$ buttons to adjust the values.

This determines the grey scale values that will be used on the screen. The total range possible is between +200 and -950 mV.

An optimal base setting is between -0 and -350 mV.

This range can be adjusted at any time later to make the display easier to read. It does not affect any measurements made, only how they are displayed.

Once you have made the settings you have two choices to exit this screen. Pressing **MENU** saves the settings and returns you to the main menu. Pressing **END** saves the settings and takes you to the measurement screen.

4.2.3 Object Number

An "Object" is a file where a particular set of measurements is stored.

The Object No. must be defined before beginning the measurements. This is done as follows:

Use the $\uparrow\downarrow$ buttons to select the menu item **Object No.**

Press the START button. This will take you to Object No. screen.



Fig 4.2 Object No. Screen

The Object No. is six digits long.

Use the $\leftarrow \rightarrow$ buttons to select the digit and use the $\uparrow\downarrow$ buttons to alter the digit.

Pressing **MENU** saves the settings and returns you to the main menu.

Pressing **END** saves the settings and takes you to the measurement screen.

Up to 71 Objects can be stored in the memory. The size of any particular object is unlimited apart from the size of the free memory available. See technical data (section 9) for details.

The Object List consists of three pages each containing 24 objects. This gives a total of 72 objects.

The first object, (Object No. 1) is a Demo-Object consisting of 6 pages of data, which can be edited. However, it should be noted that whenever the instrument is switched off and on, the original demo values will be restored.

4.2.4 Language

The language of the instrument can currently be set to German, English or French.

Use the $\uparrow\downarrow$ buttons to select the menu item **Language**.

Press the **START** button. This will take you to Language screen.



Fig 4.3 Language Selection Screen

Use the $\uparrow\downarrow$ buttons to select the preferred language for the display.

Pressing **MENU** saves the settings and returns you to the main menu.

Pressing **END** saves the settings and takes you to the measurement screen.

4.2.5 Electrodes

This item is used to select the type of electrode to be used for the potential measurements.

Use the $\uparrow\downarrow$ buttons to select the menu item **Electrodes**.

Press the **START** button. This will take you to Electrodes screen.

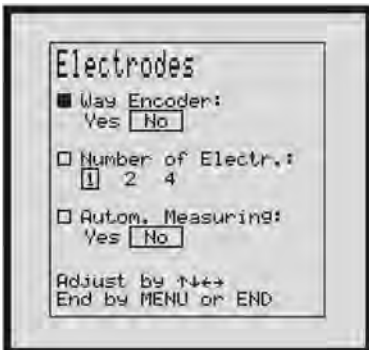


Fig 4.4 Electrode selection screen

Rod Electrode

Use the ↑↓ buttons to select **Way Encoder**.

Use the ← → buttons to select **No**. (The way encoder is only used with the wheel electrode and will now be switched off).

Use the ↑↓ buttons to select **Number of Electr.:**

Use the ← → buttons to select **1**.

Use the ↑↓ buttons to select **Autom. Measuring:**

Use the ← → buttons to select **Yes** or **No**.



Note: If automatic measuring is selected, then measured values of < -50mV will be acquired automatically once the value has stabilized. If automatic measuring is not selected then values have to be acquired by pressing the **START** button. In both cases, values between +200 and -50mV have to be acquired by pressing the **START** button.

Wheel Electrode

Use the ↑↓ buttons to select **Way Encoder**.

Use the ← → buttons to select **Yes**.



Note: If the wheel electrode is selected then the automatic measuring option disappears as all measurements are automatic in this mode.

Select the number of electrodes as described above.

Pressing **MENU** saves the settings and returns you to the main menu.

Pressing **END** saves the settings and takes you to the measurement screen.

4.2.6 XY-Grid

This item is used to define the scale of the measurement grid.

Use the $\uparrow\downarrow$ buttons to select the menu item **XY-Grid**.

Press the **START** button. This will take you to XY-Grid screen.



Fig 4.5 XY-Grid screen.

Use the $\leftarrow \rightarrow$ buttons to select the digits for the **Column Width X** and the **Row Spacing Y**.

Use the $\uparrow\downarrow$ buttons to alter the digits to the required value.

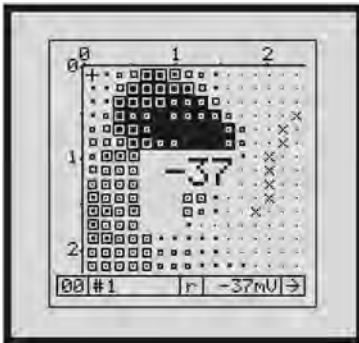


Fig 4.6 Grid Example

This defines the physical distance between two individual measuring points. In the example shown, there is a distance of 150mm between each measuring point in both the X and Y directions. A page on the screen has 16 points x 15 points representing a total area of (2250mm x 2100mm). This will be further explained in section 4.3.

Pressing **MENU** saves the settings and returns you to the main menu.

Pressing **END** saves the settings and takes you to the measurement screen.



Note: The XY-Grid values can only be altered if a new “Object” has been defined. If an Object already contains measurements, then it is no longer possible to change the grid.

4.2.7 Coarse Grid

This function enables the user to make a quick assessment of a test subject with a large surface area.

Use the $\uparrow\downarrow$ buttons to select the menu item **Coarse Grid**.

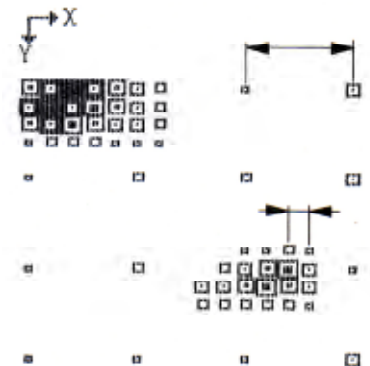
Press the **START** button. This will take you to Coarse Grid screen.



Fig 4.7 Coarse Grid screen.

Use the $\uparrow\downarrow$ buttons to adjust the **Number of Steps**: (up to a maximum of 16).

This defines how many times the coarse grid is larger than the XY-Grid already defined. This can be seen clearly in the next diagram.



Example:

Coarse Grid: (Number of steps = 5),
Grid = 5x 150 = 750mm

XY-Grid: 150mm

Fig 4.8 Coarse Grid Example.

When carrying out actual measurements, it is possible to switch between the coarse grid and the standard XY-grid. A typical measurement procedure of a large surface area would be to do a sweep using the coarse grid. If the operator comes across a location which requires more accurate investigation he can switch to the standard XY-Grid. This is done as follows: In the measurement mode the screen shown will be similar to that of Fig.4.6. The status

row at the bottom of the screen indicates whether the operator is using the standard grid (indicated by a small “r”) or the coarse grid (indicated by a capital “R”). To switch from one to other press the **MENU** button.



Note: When the equipment is switched off the coarse grid number of steps is reset to “1”.

Pressing **MENU** saves the settings and returns you to the main menu.

Pressing **END** saves the settings and takes you to the measurement screen.

4.3 Potential Measurement

4.3.1 Preparing the concrete surface for measurement

The structure to be measured should fulfil the conditions described in section 2.5.

The desired measurement grid should be suitably marked out on the surface.

4.3.2 Reading the display screen

As described in section 3.1 the instrument automatically starts up in measuring mode. (If it begins in Wenner mode the procedure for switching to potential measurement mode is described in section 3.2).

Also as described above, once settings have been made, pressing the **END** button saves the settings and takes the user to the measuring screen. (See Fig 3.4)

The instrument now functions as a digital voltmeter.

Voltages in the range ± 999 mV can be measured.

The electrode is now used to measure the potential in mV at various locations on the test structure. These measurements are shown on the screen and the grey scale can be adjusted to give an optimal display.

From here press the **START** button to begin. This brings up the empty page.

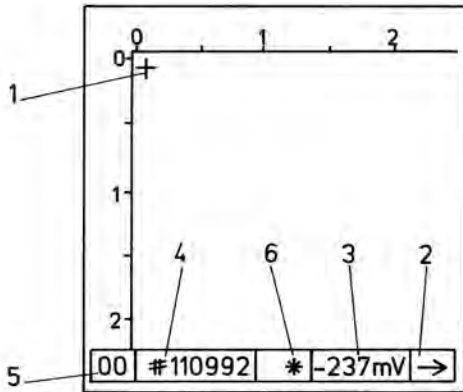


Fig 4.9 Page with a grid of 150/150 mm.

The XY- coordinates are displayed in meters. The display has 16 points x 15 points (240 points) for displaying the measured values as a grey scale. This constitutes a “**page**”. With the XY-grid set to 150/150mm this represents a total area of (2250mm x 2100mm).

A total of 980 pages can be stored in the memory. The number of pages that are still available for use is shown in the top right hand corner of the measuring screen (Fig 3.4). (e.g. 491 P indicates 491 pages are still available.)

The number of pages contained in an object is not limited except by this.

- 1 The cursor shows the next measurement location
- 2 The arrow shows in which direction the cursor will move. This can be altered by pressing the arrow keys.
- 3 The measured value.
- 4 The Object number.
- 5 The meter value. E.g. a 10 will be shown here if we have travelled 10m in the X-direction.
- 6 Indications in this field can be changed with the **MENU** button. Their meaning is as follows:

Rod electrode	r	XY-grid
	R	Coarse grid (see 4.2.7)
Wheel electrode	*	Measurements will be automatically overwritten.
	-	Measurements will not be overwritten.

4.3.3 Measuring with the rod electrode

The electrode should be prepared as directed in section 4.1.

Section 6.1 describes how to carry out a functional check of the electrode.

Maintenance of the electrode is described in section 6.2

- Connect the rod electrode to INPUT A of the display instrument.
- Using the cable roll, connect the GND- connector to the steel reinforcement.
- Press the **ON** button to turn on the instrument.
- Check that all of the settings are correct as described in section 4.2.
- From the measuring screen (Fig 3.4) press **START**.
- The XY-Grid will be shown (Fig 4.9) with the cursor in the top left hand corner. This indicates where the first measurement will be stored, so it is important to take the first measurement in the corresponding point marked on the concrete.



The first measurement must not be made in the top left hand corner. Before making any measurement, you may move the cursor around on the screen using the $\uparrow \downarrow \leftarrow \rightarrow$ buttons to the desired location. This is particularly useful if there is some kind of obstruction on the test object which means that a measurement cannot be made in that position. By moving the cursor as described you can move on the grid to clear the obstruction and continue measuring. The important thing is that your position on the screen should match the actual position on the concrete.

- Moisten the foam rubber plug of the electrode with water and press it lightly onto the first measuring point. The measured value will be shown in mV in the centre of the display. Once it stabilizes, a beep will indicate when the measurement has been acquired automatically. (See 4.2.5). At this point the mV value is blended out and a grey scale indication will be placed on the grid. The cursor will move to the next point to be measured.
- Following the measurement it should be possible to see a wet patch on the concrete. If this is not the case then the foam rubber plug should be moistened with water again.
- The simplest way to proceed is to make the measurements as proposed by the instrument. i.e. begin in the top left hand corner and move along the row in the X-direction according to the column width. E.g 150 mm between measuring points.

- If you come to the end of a page, i.e. after making 16 measurements in the X-direction or 15 measurements in the Y-direction, the cursor automatically jumps to the next page.
- When you come to the end of a row, you must press the ↓ button to indicate this and the cursor will jump down to the next row. The direction arrow (Field 2 in fig 4.9) will automatically change direction to ←.
- Now you can proceed to measure in the opposite direction along this row. When the end is reached. i.e. you are back at the Y-axis, the cursor will automatically jump down to the next row and the direction arrow will change back to →.



Note: The instrument can also be used to measure along the Y-axis, i.e. up and down the columns. This is done by altering the direction arrow to ↓ before starting. In this case you must indicate to the instrument that you have reached the end of a column by pressing the → button.



Note: The **PRINT** button can be used to mark an “X” on the display in the place of a measurement value. This is useful for marking the position of cracks etc.

When you have finished making all of the measurements you require on the concrete press the **END** button. The measured values are stored automatically.

4.3.4 Adjusting the grey scale

If the grey scale is too one-sided with the basic setting (0 to -350 mV), for example everything appears very dark, then this can be adjusted as described in section 4.2.2. A more suitable scale can be chosen (for example -150 to -500mV) to give a clearer representation.



Fig 4.10 Display too dark with 0 to -350 mV

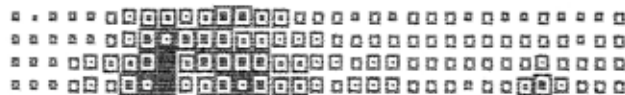


Fig 4.11 Display clear with -150 to -500mV

4.3.5 Re-opening an object

An object can be re-opened and missing measurements can be entered or suspect measurements can be overwritten. (See section 4.4.1). However the following points should be observed.

Once an object has been closed and a new object has been opened, it is no longer possible to increase the number of pages of the previous object.

This means that if it is not possible for any reason to complete in one go, the measurements on a test subject but you know that more pages are required to complete the investigation, then these pages must be reserved.

E.g. The test subject is a concrete surface of 4m by 4m. You have begun measuring with the XY-grid set to 150/150 mm and you are still on the first page when you have to make a break. You know that you will require 4 pages in total for the complete measurement. A page is reserved when it has appeared on the screen. In order to reserve the necessary pages, simply move the cursor to each page you will require. For a better orientation it may help to place an "X" (see Note in 4.3.3) somewhere on the page (but not in the top left hand corner).

The last object that was opened can be re-opened and extended at any time.

4.3.6 Overwriting or deleting readings.

Existing readings can be overwritten by moving the cursor to the appropriate point and making a new reading with the electrode. Once the reading has registered, the cursor will move to the next measuring point along the axis indicated by the direction arrow.

To delete an existing reading, move the cursor to the point you wish to delete and press PRINT for two seconds. Once the reading has been deleted, the cursor will move to the next measuring point along the axis indicated by the direction arrow.

4.3.7 Measuring with the wheel electrode

The electrode should be prepared as directed in section 4.1.

Section 6.1 describes how to carry out a functional check of the electrode.

Maintenance of the electrode is described in section 6.3

Fill the dampening wheel with water. For this purpose water pumps as can be found in gardening supplies are very suitable.

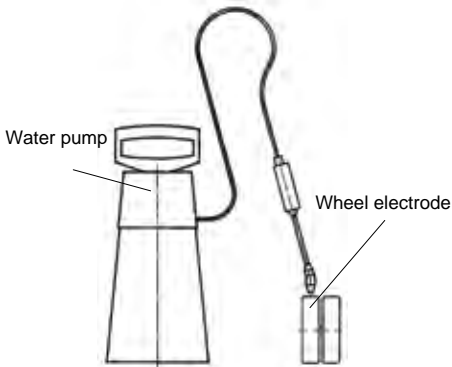


Fig 4.12 Filling the dampening wheel

- Connect the wheel electrode to INPUT A of the display instrument.
- Connect the path measuring device to INPUT B of the display instrument.
- Using the cable roll, connect the GND- connector to the steel reinforcement.
- The hole size of the nozzle has to be selected (\varnothing 1, 2, 4 or 8 mm) according to the character of the concrete surface and the speed of travel. On smooth walls and soffits a nozzle size \varnothing 1 or 2 mm should be used. The red felt hoop should leave a clearly visible trace.
- Before commencement of the measurement, the red and green felt hoops and especially the felt hoop connector (see Fig 2.3) should be saturated with water.
- The wooden plug should also be well soaked as described in section 4.1 and a functional check (see section 6.1) should be carried out.
- The felt hoops should be washed thoroughly at the end of each working day.
- On vertical surfaces, measurements should be made in the downward direction as this is the only way to ensure an even moistening of the surface.

4.3.8 Carrying out the measurement

- Press the **ON** button to turn on the instrument.
- Check that all of the settings are correct as described in section 4.2.
- From the measuring screen (Fig 3.4) press **START**.
- The XY-Grid will be shown (Fig 4.9) with the cursor in the top left hand corner. This indicates where the first measurement will be stored, so it is important to take the first measurement in the corresponding point marked on the concrete.
- The simplest way to proceed is to make the measurements as proposed by the instrument. i.e. place the wheel in the top left hand corner.
- Press the **START** button to acquire the first reading.
- Now proceed to move the wheel electrode in the Y-direction as indicated by the direction arrow (Field 2 in Fig 4.9). The measurement readings will be acquired automatically in the pre-selected row spacing.
- When you come to the end of a column, you must press the → button to indicate this and the cursor will jump right to the next column. The direction arrow (Field 2 in Fig 4.9) will automatically change direction to ↑.
- Now place the wheel physically one column spacing to the right and acquire the first measurement by pressing the START button. Proceed to measure back along the Y-axis as indicated by the direction arrow.
- When you come to the end of the measurement surface, (the X-axis) the cursor will automatically jump to the next column and the direction arrow will change back to ↓.
- Following each manual or automatic change in the direction arrow, the path measurement and the automatic acquisition of the potential reading is halted.
- These breaks in the measurement process can be used for example to refill the dampening wheel. Automatic measurement begins again when the **START** button is pressed.
- During breaks in the automatic measurement, the measured value is shown in the status row. (Field 3 in Fig 4.9)
- At the end of one measurement path, the operator has the option to turn the wheel electrode and push it back in the opposite direction as indicated by the direction arrow, or pull the wheel electrode backwards. Both methods would mean that the wheel electrode is travelling in the direction indicated by the direction arrow. Whichever method the operator chooses is detected by the instrument automatically.
- The maximum speed of travel should not exceed a maximum of 1m/sec.
- Measurements along the X-axis cannot be acquired.

4.4 Data Output

4.4.1 Displaying an object

In the display instrument, stored objects can be re-opened at any time and presented on the display.

From the MENU screen (Fig 3.8).

Use the $\uparrow\downarrow$ buttons to select the item **Data Output**.

Press the **START** button.

This will bring up the following screen:



Fig 4.13 Data Output screen

Use the $\uparrow\downarrow$ buttons to select the item **Object Select**. This will bring up the following screen.



Fig 4.14 Object Select screen

Use the ↑↓ and ← → buttons to select the object you wish to open.

Press the **END** button. This will take you to the measuring screen where the main information of this object will be displayed.

Press the **START** button to display the XY-grid representation of the object.

As mentioned in section 4.3.6, values can be deleted or overwritten at any time. Additional readings can be made within the pages reserved for this object. (See section 4.3.5).

4.4.2 Data Transfer to a PC

Objects can be transferred to a PC by using the CANIN ProVista software. This is described in the CANIN ProVista handbook.

4.5 Erasing the memory

It is not possible to delete single objects.

It is only possible to erase the entire memory, thereby deleting all of the stored objects.

Once this has been confirmed it is not possible to undo the action.

From the Data Output screen (Fig 4.13) use the ↑↓ buttons to select the item **Clear Memory**.

Press the **START** button. You will be asked to confirm the action:

Clear Memory?

To clear the memory press the **START** button.

To abort the action press **MENU** or **END**.



Note: This clears the objects for the potential mode only. The resistivity mode objects are unaffected.

5 Measuring the electrical resistivity

5.1 Resistance probe



Fig 5.1 Wenner four-point probe with cable and control plate

The four foam pads of the probe should be moistened with water.

Connect the resistivity probe to the INTERFACE RS 232 C of the display instrument.
(See Fig 3.1)



Note: The Wenner probe constantly draws current. Therefore it should only be connected to the display instrument when measurements are being carried out.

Follow the instructions in section 3 to select the resistivity mode.

5.2 Configuring the instrument for resistivity measurement

Having selected the resistivity measurement mode as described above, you are now ready to programme the instrument according to your requirements.

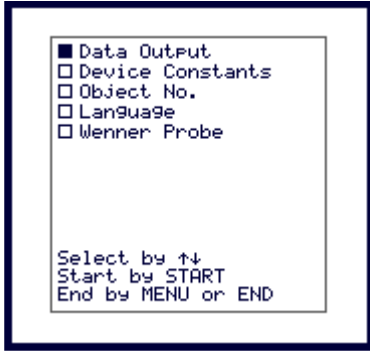


Fig 5.2 The main menu (resistivity mode).

Each menu item is described below in more detail.

5.2.1 Data Output

See section 5.4. This is used to transfer data to the PC for further evaluation.

5.2.2 Device Constants

Use the ↑↓ buttons to select the item **Device Constant**.

Press the **START** button.

This will bring up the following screen:



Fig 5.3 Device Constants

There is a 3-digit code engraved on the resistivity probe. The code must be entered here as a device constant. If that has not already been done, then enter this value here using the ↑↓ ← → buttons.

Pressing **MENU** saves the settings and returns you to the main menu.

Pressing **END** saves the settings and takes you to the measurement screen.

5.2.3 Object No.

An “Object” is a file where a particular set of measurements is stored.

The Object No. must be defined before beginning the measurements. This is done as follows:

Use the ↑↓ buttons to select the item **Object No.**

Press the START button.

This will bring up the following screen:



Fig 5.4 Object No.

The Object No. is six digits long.

Use the ← → buttons to select the digit and use the ↑↓ buttons to alter the digit.

Pressing **MENU** saves the settings and returns you to the main menu.

Pressing **END** saves the settings and takes you to the measurement screen.

Up to 24 Objects can be stored in the memory.

5.2.4 Language

The language of the instrument can currently be set to German, English or French.

Use the $\uparrow\downarrow$ buttons to select the menu item **Language**.

Press the **START** button. This will take you to Language screen.



Fig 5.5 Language Selection Screen

Use the $\uparrow\downarrow$ buttons to select the preferred language for the display.

Pressing **MENU** saves the settings and returns you to the main menu.

Pressing **END** saves the settings and takes you to the measurement screen.

5.2.5 Wenner Probe

This item was described in section 3.2. It is used to select the resistivity measurement mode.

5.3 Resistivity Measurement

5.3.1 Preparing the concrete surface for measurement

The concrete surface must not be coated with any electrically insulating coating and it should be clean.

The desired measurement grid should be suitably marked out on the surface.

5.3.2 Reading the display screen

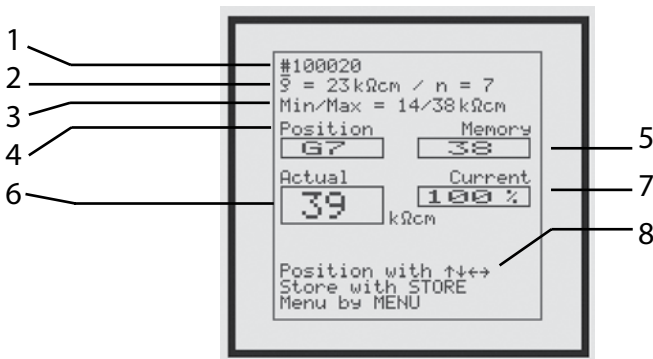


Fig 5.6 Resistivity measurement screen

- 1 Object number
- 2 Mean value / measured values
- 3 Minimum value / maximum value
- 4 Table position
- 5 Value stored at that position in the table
- 6 Actual measurement
- 7 Proportion of current flow through the concrete relative to the nominal current. This provides information about the reliability of the measurement
- 8 The position in which a measured value can be stored in the table can be selected with the cursor keys

5.3.3 Performing the measurement

In order to obtain a reliable reading, it is necessary to have a good electrical contact between the foam pads of the resistivity probe and the concrete surface.

As far as possible, reinforcement bars should not be directly beneath the probe and should not run parallel to the probe.

The foam pads should be well-moistened with water.

For the measurement, the probe should be pressed lightly against the surface of the concrete until the reading is stable.

Following a measurement it should be possible to see damp marks on the surface.

The “Current” display (See item 7 of Fig 5.6) monitors the current flow through the concrete. If there is a bad contact between the electrodes and the concrete or if the conductivity of the concrete is small, the flow of the current will be reduced. This gives an indication as to the reliability of the reading obtained.

50% to 100%	The reading is reliable.
20% to 50%	“Value not exact” will be displayed on the screen.
0% to 20%	The resistance is > 99kΩcm or the contact is very poor.

Once the reading is stable it can be saved by pressing the **STORE** button. It will be saved in a table in the position indicated on the display (See item 4 of Fig 5.6). The table has a maximum size of 16 x16 cells.

The position in the table to store the measurement can be selected from the measurement screen (item 4 of Fig 5.6).

Use the ←→ buttons to select a letter from A to P.

Use the ↑↓←→ buttons to select a number from 1 to 16.

	A	B	C	D	E	F	G	H	I	J	--
1	38	30	27	20	17	14	14	15	25	27	
2	34	29	24	18	12	12	9	6	13	25	
3	32	26	23	15	13			5	11	24	
4	32	28	23	16	13			4			
5	32	28	23	17	13			6			
6	34	29	24	16	14	11	9	7			
7	29	26	25	17	14	13	10	8			
8	28	28	26	20	18	16	14	11			
--											

Fig 5.7 Table for resistivity measurements.

Each time a new reading is stored, the statistical values are re-calculated and displayed. (See items 2 and 3 in Fig 5.6).

An existing reading can be deleted by pressing the **STORE** button for two seconds.

An existing reading can be overwritten by selecting the correct position in the table and performing a new measurement.

The table structure is maintained when the data is transferred to the PC so that the user can generate a graphical representation in EXCEL.

5.3.4 Interpretation of the readings

Based on scientific studies contained in the literature on this topic, indications of possible corrosion have been determined.

e.g.

- When $\rho \geq 12 \text{ k}\Omega\text{cm}$ Corrosion is unlikely
- When $\rho = 8 \text{ to } 12 \text{ k}\Omega\text{cm}$ Corrosion is possible
- When $\rho \leq 8 \text{ k}\Omega\text{cm}$ Corrosion is fairly certain.

5.4 Data Output

Use the $\uparrow\downarrow$ buttons to select the item **Data Output**.

Press the **START** button.

This will bring up the following screen:



Fig 5.8 Data Output screen

Use the $\uparrow\downarrow$ buttons to select the item **Object Select**. Press the **START** button.

This will bring up the following screen.



Fig 5.9 Object Select screen

Use the $\uparrow\downarrow$ and $\leftarrow \rightarrow$ buttons to select the object you wish to open.

Press the **END** button. This will take you to the measuring screen where the main information of this object will be displayed.

5.4.1 Transferring Data to a PC

An object can be transferred to a WINDOWS PC with the help of the Hyperterminal program.

Please refer to Appendix A where the procedure for installing and operating the Hyperterminal is described.

Once the hyperterminal has been set up correctly on the PC data can be transferred as follows:

Use the ↑↓ buttons to select the item **Object to PC**.

Press the **START** button.

Once the data is on the PC it can be opened with a program like EXCEL. A typical sample is shown below:

			SW Version	Serial No			
	Wenner	Resistivity	V6.0	19.0001			
	Object No.	Mean Value	Min. Value	Max. Value	No. Of Readings		
	100020	21.1	9	38	50		
Table	A	B	C	D	E	F	G
1	38	30	27	20	17	14	14
2	34	29	24	18	12	12	9
3	32	26	23	15	13	--	--
4	32	28	23	16	13	--	--
5	32	28	23	17	13	--	--
6	34	29	24	16	14	11	9
7	29	26	25	17	14	13	10
8	28	28	26	20	18	16	14

Fig 5.10 Display of readings in EXCEL.

5.5 Erasing the memory

It is not possible to delete single objects.

It is only possible to erase the entire memory, thereby deleting all of the stored objects.

Once this has been confirmed it is not possible to undo the action.

From the Data Output screen (Fig 6.1) use the $\uparrow\downarrow$ buttons to select the item **Clear Memory**.

Press the **START** button. You will be asked to confirm the action:

Clear Memory?

To clear the memory, press the **START** button.

To abort the action press **MENU** or **END**.



Note: This clears the objects for the resistivity mode only. The potential mode objects are unaffected.

6 Maintenance, Storage and Service

6.1 Functional check of the electrodes

Electrodes can be checked by comparison with a freshly serviced electrode.

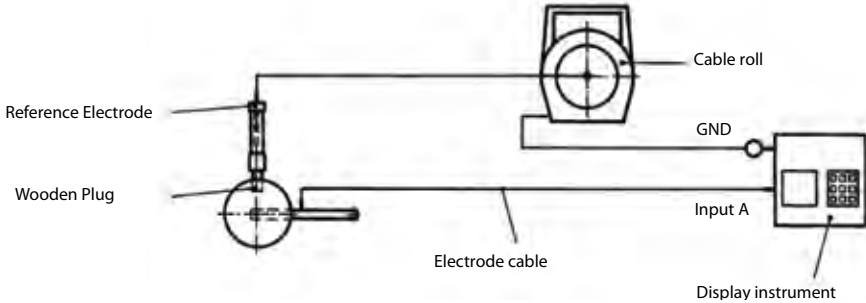


Fig 6.1 Functional control set-up

Fig 6.1 shows a wheel electrode under control. The potential of the two electrodes cancel each other out. For correct operation, the tolerance values indicated below should be observed.

Tolerance values:

Reference electrode with rod electrode	0 ± 5 mV
Reference electrode with wheel electrode	$0 + 20$ mV

6.2 Maintenance of the rod electrode

Cleaning the rod electrode.

- Unscrew the two red caps, wash with water and carefully clean the inner side of the tube.
- Clean the copper rod using emery cloth.
- Refill the electrode with copper sulphate (See section 4.1)



Caution! When handling copper sulphate be careful to take note of the safety instructions on the packaging.

6.3 Maintenance of the wheel electrode

Cleaning the wheel electrode.

Cleaning is required when the values are found to be out of tolerance when carrying out the functional check.

- Remove the felt hoops and wash in lukewarm water.
- Separate the wheel electrode from the dampening wheel by laterally pulling them apart.
- Remove the shut-off screw and pour the copper sulphate solution into a container. (This can be reused.)
- Flush out several times with water.
- Dissolve 1 part citric acid in 10 parts hot water and half fill the wheel. Replace the shut-off screw.
- Leave for 6 hours, shaking occasionally.
- Pour out the citric acid solution (no special disposal procedure is required) and flush out several times with water.
- Refill the electrode with copper sulphate solution. (See section 4.1.)
- Reassemble the wheel electrode and dampening wheel as shown in Fig 2.3. The felt hoop connector must be in place between the nozzle of the dampening wheel and the wooden plug of the wheel electrode.

- When not in use, store the wheel electrode with the wooden plug facing upwards.



Caution! When handling copper sulphate be careful to take note of the safety instructions on the packaging.

6.4 Functional check of the resistivity probe

See section 5.2.2. Check that the “Wenner code” shown on the display instrument corresponds to the code engraved on the probe. If this is not the case, then the setting has to be changed.

Test the probe on the control plate.

To do this it is necessary to moisten the four foam pads.

The display instrument should show the reading marked on the control plate.

(e.g. $\rho = 12 \pm 1 \text{ k}\Omega\text{cm}$.) If the value is outside of the tolerance, the instrument should be returned to Proceq for re-calibration.

7 Troubleshooting by Potential Measurement

Problem The instrument only shows potentials around 0 mV.

Possible cause The measuring circuit has been interrupted. i.e. a connector on the instrument is defective, a cable is broken or the connection to the reinforcing steel is not existing.

Problem The path measurement does not work.

Possible cause The correct setting has not been made on the display instrument, or the path measuring device is defective or the cable connection is defective.

8 Parts and Accessories

8.1 Complete Units

Article No.	Unit	Description
330 00 201	CANIN⁺ Configuration with Rod Electrode	Basic Unit Display instrument CANIN ⁺ , adjustable, padded carrying strap, protection sleeve for display instrument, transfer cable, USB-serial adapter, operating instructions, carrying case CANIN ⁺ Rod electrode accessories Rod electrode with spare parts, electrode cable 1.5m (4.9 ft.), cable coil 25m (82 ft.), bottle with copper sulphate 250g, CANIN ProVista PC software on memory stick.
330 00 202	CANIN⁺ Configuration with Rod and Wheel Electrodes	Basic Unit Display instrument CANIN ⁺ , adjustable, padded carrying strap, protection sleeve for display instrument, transfer cable, USB-serial adapter, operating instructions, carrying case CANIN ⁺ Rod electrode accessories Rod electrode with spare parts, electrode cable 1.5m (4.9 ft.), cable coil 25m (82 ft.), bottle with copper sulphate 250g, Wheel Electrode accessories one-wheel electrode system, tool kit to wheel electrode system, bottle with citric acid 250g CANIN ProVista PC software on memory stick.
330 00 203	CANIN⁺ Configuration with Wenner Probe	Basic Unit Display instrument CANIN ⁺ , adjustable, padded carrying strap, protection sleeve for display instrument, transfer cable, USB-serial adapter, operating instructions, carrying case CANIN ⁺ Wenner Probe accessories Wenner resistance probe with spare rubber foam pads, cable to Wenner probe, control plate to Wenner probe

330 00 204	CANIN⁺ Combined Configuration with Rod and Wheel Electrodes and Wenner Probe	Basic Unit Display instrument CANIN ⁺ , adjustable, padded carrying strap, protection sleeve for display instrument, transfer cable, USB-serial adapter, operating instructions, carrying case CANIN ⁺ Rod electrode accessories Rod electrode with spare parts, electrode cable 1.5m (4.9 ft.), cable coil 25m (82 ft.), bottle with copper sulphate 250g, Wheel Electrode accessories one-wheel electrode system, tool kit to wheel electrode system, bottle with citric acid 250g Wenner Probe accessories Wenner resistance probe with spare rubber foam pads, cable to Wenner probe, control plate to Wenner probe CANIN ProVista PC software on memory stick.
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8.2 Accessories

Article No.	Description
330 00 970	Display Instrument CANIN ⁺
330 00 259	Rod electrode with spare parts
330 00 300	Wheel electrode with spare parts
330 00 358	Path measuring device for wheel electrode system
380 02 520	Wenner probe with cable, with spare foam pads
390 00 361	Telescopic pole with ball socket
330 00 275	Electrode cable, single wire, L = 1.5m
330 00 277	Electrode cable, single wire, L = 3m
330 00 265	Path measurement cable L = 3m
330 00 286	Cable roll L = 25m
330 02 510	Cable for the Wenner probe
330 00 456	Transfer cable 1.5m (9/9 Pole)
390 00 542	USB-serial adapter
380 04 250	Control plate for the resistivity probe
330 00 285	Copper sulphate CuSO ₄ 250g
330 00 290	Citric acid 250g
330 00 470	Protective sleeve for the display instrument
380 00 079	Adjustable, padded carrying strap

9 Technical Data

9.1 Technical Information CANIN⁺

Potential Measurement

Measurement range	±999 mV
Resolution	1mV
Memory	non-volatile memory for up to 235'000 measurements stored in up to 71 object files provides capacity for 980 pages each for 240 measurement readings.
Data Transfer	CANIN ProVista software for downloading data and evaluation on PC
Battery Operation	Six LR 6 batteries, 1.5V for up to 60 hours (or 30 hours with activated backlight)

Resistance Measurement

Measurement range	0 to 99 kΩcm
Resolution	1 kΩcm
Memory	non-volatile memory for up to 5'800 measurements stored in up to 24 object files
Data Transfer	by Windows Hyperterminal for analysis with third party software (e.g. EXCEL)
Battery Operation	Six LR 6 batteries, 1.5V for up to 40 hours (or 20 hours with activated backlight)

General

Impedance	10 MΩ
Temperature range	0° to 60°C
Display	128 x 128 pixel graphic LCD with backlight
Data Output	RS 232 interface, USB with adapter

Case Dimensions 580 x 480 x 210 mm (22.8" x 18.9" x 8.3")

Weight Net. 10.6 kg (23.5 lbs); Shipping 14kg (31.1 lbs)
(for article No. 330 00 204)

Electrodes for potential measurement

Rod electrode copper/copper sulphate for measurement of small areas.

Wheel electrode system with telescopic handle, integrated path measurement and water reservoir.

Resistivity probe

Resistivity probe with integrated electronics for measuring the specific resistivity using the four-point method. Nominal current 180µA, Frequency 72 Hz.

9.2 Technical Information CANIN ProVista software

System requirements	Windows 2000, Windows XP, Windows Vista
Scale of length/ unit length	Selectable grid with metric or imperial units. (Note: XY-grid settings must be equal)
Editing	Individual readings can be deleted or changed.
Inserting	Separately measured objects can be merged to a complete potential map. If required, objects can be rotated and mirrored.
Annotations	Comments about specific points on the concrete structure can be placed directly in the potential map.
Bitmaps	All graphics can be exported as bmp-files into external software for the generation of reports.

10 Reference Literature

Please refer to the standards listed in section 1.5 for descriptions of the half cell measurement method.

A practical example of the application of CANIN ProVista can be found on the Proceq website.

http://www.proceqeuropa.com/en/products/documents/P07005_ProVista_ENG_final.pdf

Appendix A

Data Transfer to PC and Editing by use of Windows Hyperterminal Manual for WINDOWS 95 / 98 / NT / ME / 2000 / XP



Note: The operation is the same under Windows Vista, but the Hyperterminal is not included as standard and has to be installed separately.

Principal Information

The data shall be transferred from the display unit to the PC via the serial port (COM). This is done with the Windows application HyperTerminal, which can also save the transferred data as a TXT-file.

The serial port settings must be as mentioned under “Settings”.

Below the procedure is described in detail for Windows 95, 98, NT, ME, 2000 and XP.

Preparing the Hardware

- Connect the serial port (e.g.COM1/COM2) of the PC with the aid of the transfer cable (Art. No. 33000456) to the serial port RS 232 of the display unit. Or connect the USB port and the transfer cable to the serial port of the display unit with the USB converter (Art. No. 390 00 542).

Preparing the PC for the Data Transfer

- Create directory “C:\PROCEQ”
- HyperTerminal via START-Menu:

Win95

Start/Programs/Accessories/HyperTerminal.

Then start “Hypertrm” or “Hypertrm.exe”. Go to “Settings”

Win98 / WinNT

Start/Programs/Accessories/Communications/HyperTerminal.

Then start “Hypertrm” or “Hypertrm.exe”. Go to “Settings”

WinME

Start/Programs/ Accessories/Communications/HyperTerminal.

Then start “Hypertrm” or “Hypertrm.exe”. Go to “Settings”

Win2000/XP

Start/Programs/Accessories/Communications/HyperTerminal.

If two items "HyperTerminal" are installed, start PC/phone Icon (not the file Icon, where the existing profiles are stored).

Then start "Hypertrm" or "Hypertrm.exe". Go to "Settings"

• HyperTerminal via Internet

If the program HyperTerminal is not installed on the PC/Laptop download it from the internet homepage www.hilgraeve.com and start it. Go to "Settings"

• Settings

- Do not install a Modem * Cancel with «No»
- Enter "PROCEQ" and choose an Icon Confirm with «OK»
- Select line "Connect using e.g. Com 1/COM 2" Confirm with «OK»

- Change the default data to:

Baud rate :	9600
Data Bits :	8
Parity :	none
Stop Bits :	1
Flow control :	Xon/Xoff
	Confirm with «OK»

- Check if you can not get line feeds:

Open "file/properties/settings/ASCII-setup" und activate the checkbox "Append line feeds to incoming line ends".

Confirm twice with «OK»

- Choose "transfer/capture text" in the menu and enter the complete path (folder) of the new file e.g. C:\PROCEQ\Data.txt

in the dialog box. Confirm with «Start»

Now your PC is ready to receive the data.

Start of Transfer

- Switch on the display unit.
- Press "MENU" and select "Data Output"
- Select "Data to PC", or "PC DATA", "Memory Transfer", or "Object select" followed by "Object to PC" as described in the operation instructions of the instruments.
- Start by pressing the button "START".

All data are transferred to and shown on the PC.

Storage of Data in the PC.

After completion of the transfer:

- Choose in the menu “Transfer/capture text/stop”.

The data are stored in the file Data.txt and are ready for further processing (e.g. with Excel).

Saving the HyperTerminal Settings

- Choose “File/Exit” in the menu.
 - Answer the question “You are currently connected. Are you sure you want to disconnect now?” with “Yes”.
 - Answer the question “Do you want to save the connection named PROCEQ ?” with “Yes”.
- (This question is asked only during the first storage.)

Now the session with HyperTerminal is finished.

Display and Processing the Data

The text file “Data.txt” (In the folder “C:\PROCEQ”) can be displayed with any text editor or word processing program.

We recommend to edit the data for further processing with a program like Excel.

How to restart the HyperTerminal?

- Double click the Icon “PROCEQ” .

The Icon “PROCEQ” can be found as follows:

Win95

Start/Programs/Accessories/HyperTerminal

Win98 / WinNT

Start/Programs/Accessories/Communications/HyperTerminal

WinME

Path: C:\Programs/Accessories/HyperTerminal

Alternative solution:

Start/Programs/Accessories/Communications/HyperTerminal.

In the context menu (press right mouse button)

“Properties/Short cut/Find target...”

Win2000/XP

Start/Programs/Accessories/Communications/HyperTerminal (Folder)

In case of frequent use the Icon “PROCEQ” can be installed on the Desktop!

Product Registration

Warranty Card

Product

Equipment type: **CANIN⁺**

Instrument no.:

Date of purchase:

Bought from (Proceq Agent):

Location:

Customer Information

Name:

Address:

Location:

Phone:

E-mail:

Fax it to Proceq:

Proceq Europe: Fax +41-(0)43-355-38-12

Proceq USA, Inc.: Fax +1-724-512-0331

Proceq Asia Pte Ltd: Fax +65-6382-3307

Online Registration:

Link to Online Registration: www.proceq.com/

- Select your area (North/South America, Europe/Africa, Asia/Pacific)
- Use the Link "Register"



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