USER MANUAL

EC-95
Automatic calibration

NIEUWKOOP Sinds 1957 BV

EC-Temperature meter
Microprocessor

Rev: from SN 156708

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1.1 FUNCTIONAL PURPOSE OF THE UNIT

The basic system for EC and temperature measuring is made of three parts:

- the meter described in this instruction manual;
- a conductivity cell with 2 electrodes
- a Pt1000 temperature sensor

The instrument has the necessary electric circuits and firmware to perform the following functions:

1) as the proper sensor is connected, it displays the EC and temperature values;
2) if a Pt1000 temperature sensor is connected, it will display the temperature values;
3) it performs an automatic or manual temperature compensation for EC measures;
4) it performs the manual or automatic EC calibration
5) it allows the memorization and the visualization up to 80 readings

1.2 FUNCTIONAL PRINCIPLES

The conductivity meter is used to detect the electric conductivity of liquids and to control the salt content or the ionic concentrations of liquids.

In order to prevent the electrodes polarisation, the measuring is done by alternate current.
The temperature changing of the sample may cause a considerable error, because of the changing of the ions activity.

This instrument features a manual or automatic temperature compensation, referred to temperature of 20 °C or 25 °C.

1.3 SENSORS AND ACCESSORIES

Electrode:

EC5005 SZ3291.268 EC+Pt1000 electrode, epoxy housing, 1 meter cable

Standard calibration:

EC6010 EC-4 calibrationliquid 125cc
EC6110 Any value between 1 and 100 mS/cm calibrationliquid 125cc
Other packages (250cc, 1000cc of 5000cc) on request

2 GENERAL WARNINGS AND INFORMATION FOR ALL USERS

2.1 WARRANTY

This product is guaranteed for all manufacturing defects.
Please take a look at the terms and conditions described on the Warranty Certificate at the end of the manual.

2.2 AFTER SALES SERVICE

Nieuwkoop offers to all of its Customers the following services:

- a free of charge Technical Assistance over the phone for problems regarding installation, calibration and regular maintenance;
- a Repairing Service in our Aalsmeer (Holland) headquarter for all types of damages, calibration or for a scheduled maintenance.

Please take a look at the Technical Support data sheet at the end of the manual for more details.

2.3 CE MARKING

This instrument is manufactured according to the following European Community directives:

- 72/23/EEC “Electrical safety – low tension” amended in 93/68/EEC

The CE marking is placed on the packaging and on the S/N label of the instrument.

2.4 SAFETY WARNINGS

It is important to underline the fact that electronic instruments are subject to accidents. For this, it is important to take all necessary precautions to avoid damages caused by malfunctions.

All types of operations must be performed by authorized and trained staff.

3 INSTRUCTION MANUAL CONTENTS

This chapter describes the manual and gives suggestions to all users on how to read it and use it.

The manual is written according to the following norms:

- UNI 10893 “Instructions for use”.
- UNI 10653 “Quality of product technical documentation”.

3.1 MANUAL REVISION

This chapter shortly describes the differences between previously released versions of the same manual, so to help users that are already familiar with the product.

Rev. A: First release.

3.2 SYMBOLS

Throughout the manual You may find the following symbols, which are both dictated by a Norm or that are simply conventional:

Symbol	**Meaning**
	*Attention: pay great attention to what written next to this symbol*
---------- **WARNINGS** ----------	*This symbol is used to warn users that if the instructions are ignored or not correctly followed, damage to the instrument can be caused*
Note	*This symbol is to invite the user to pay particular attention to a specific section of the manual.*
“*”	*This symbol can be found in those chapters where there have been changes from the previous releases.*

3.3 HOW TO READ THE INSTRUCTION MANUAL

The manual includes all necessary information to fully comprehend the product, to use it and preserving it, and finally to achieve the performances for which You have selected it and purchased it.

The manual is intended for experienced and prepared personnel, who has knowledge of electronic instrumentations for field application.

The index guides the reader through the chapters and through the contents that he wishes to know or exploit.

In particular, the first chapters narrate the general characteristics and they allow the reader to become more familiar with the product by describing its accessories and its use.
The user can then verify if he/she has the necessary know-how to use the meter.

Note

Maintenance staff could be more interesting in the chapters regarding:

- users instructions;
- calibration;
- maintenance;

3.3.1 Using the instrument on the field

The end user can operate the meter by reading the EC/temperature and eventually recording up to 80 readings through the three keys on the front panel.

3.3.2 Plant maintenance staff

Maintenance staff can select the scales, set the desired parameters of the “set up” menu and perform the calibration of the measuring by using the standard solutions.

The set-up menu allows the selection of:

- the measuring scale;
- the response time value of the filter software;
- the °C/°F temperature measuring unit;
- the reference temperature
- the compensation temperature coefficient
- the auto switching-off time:

4 SPECIFICATIONS

4.1 FUNCTIONAL SPECIFICATION

Display

The instrument has an alphanumeric LCD display 8x1 characters.
The display shows the measures values and the messages to the operator.
After the switching-off time the display will switch off automatically.

Keyboard

The instrument has 3 keys that perform a second functions when pressed for more than 3 seconds.

Input

The meter is connected to a 2 electrodes cell and a temperature PT1000 sensor, the meter also provide the temperature readout.

Scales

The meter can provide the conductivity measuring in µS or mS and the temperature in °C or °F.

Calibration

During the EC calibration, the meter recognize automatically the memorized standard solutions.

Power supply

The meter is operated by a 9 VDC battery.

Instrument setup

The meter has the set up menu to select the measuring scale, the response time value of the filter software, the °C/°F temperature measuring unit; the reference temperature, the compensation temperature coefficient, the auto switching-off time:

Data logger

The meter can memorize up to 80 EC and temperature measures. At the end of the calibration procedure it is possible to enter the date of the last calibration.

4.2 Technische specificaties

The DISP number next to the standard default shows the location of the data in the menu.

SETUP parameters are displayed as: "S x.y"

Default DISP

1.0 SECONDARY MEASURE TEMPERATURE

EC (conductivity) 1.01

Input EC-95: 2-wire K=1 cel, model SZ3291.268

EC range:	Resolution:	under value:	max. range:
20.00 µS	0.01 µS	-1.00 µS	21.00 µS
200.0 µS	0.1 µS	-10.0 µS	210.00 µS
2000 µS	1 µS	-100 µS	2100 µS
20.00 mS	0.01 mS	-1.00 mS	21.00 mS
200.0 mS	0.1 mS	-10.0 mS	210.0 mS

Under range: -<<<<uS/ mS
Above range: >>>>uS/ mS

Zero: +/- 10 % 0 % 1.1
Calibration of zero is performed for each range starting from the lower one.

Sens: 60/160% 100% 1.2
Calibration: manual/automatic with KCL standard liqui

	0.01N	0.1N	1N	Standard Nieuwkoop 4.0 liquid
Temp. ref. 20°C	1278 µS	11.67 mS	102.1 mS	x.x mS
Temp. ref. 25°C	1413 µS	12.88 mS	111.8 mS	4.0 mS

Calibration TC: KCl liquid TC

		Default	DISP
2.0 SECONDAIR MEASURE TEMPERATURE			2.0
Input EC-95:	RTD Pt1000		
Cables:	3-wire direct on PCB		
Temperature unit :	°C / °F	°C	S3.0
Temp. Compensation:	EC-95 automatic with sensor SZ3291.268		
Temperature range:	-10.0 / 110.0°C		
	14.0 / 230.0 °F		
Resolution:	0.1 °C/°F		
Zerol adjustment:	+/- 2.0°C (+/-3.6°F)	0.0°C	2.1
Manual temperature			
Adjustment:	0.0 / 100.0°C	20.0°C	2.0b
	32.0 / 212.0°F	68.0°F	2.0b
Reference temp. :	20 / 25 °C	25°C	S9.0
Temp. coëfficiënt:	0.00 / 3.50 %/°C	2.20 %/°C	S10.0
3.0 SET-UP PARAMETERS			
Model en revision FW:	EC-95 / Rev 1.0 – 01/11		S1.0
EC range:	20/200/2000 µS – 20/200 mS	20 mS	
Reaction time 90%:	0 / 10 sec.	2 s	S5.0
Temp. unit:	°C / °F	°C	S6.0
Reference temp.:	20 / 25 °C	25°C	S7.0
Temp. coëfficiënt:	0.00 / 3.50 %/°C	2.20 %/°C	S8.0
Auto shut-off button	30 / 600 sec.	90 sec.	S9.0
4.0 DATALOGGER			
Memory type:	non volatile EEPROM (100k write)		
Memory capacity:	80 measurements		
Memory numbers:	0 / 79		
Memory format:	REC n°XX / XXXX µS / XXX.X °C		
	(TR=XX °C / X.XX%/ °C)		
5.0 GENERAL SPECIFICATIONS			
Work temperature:	0 / 60°C		
Rel. humidity:	20 / 95% non condensation		
Power:	9V battery (6LR61 680 mAh)		
Low battery:	< 7.5V (<6.5V auto schut-off)		
Battery hours:	ca. 150 uur continuous		
Weight:	ca. 180 gram (incl. battery, ex. electrode and suitcase)		
Character dimension:	125x75x25mm (only instrument)		
Display:	LCD COG 8x1 Character		
Character afmetingen:	11.97x4.97mm		

6.0 KEYBOARD

3 Key push button:

Functionality	Functionality
push < 3 seconds	push > 3 seconds

1) MODE / ON-ESC OFF
2) LOG / INCR Z.CAL
3) SET-UP / SHIFT S.CAL ENTER

KEY push button functionality:

1) MODE /ON-ESC (OFF)
- ON Instrument switch ON
- ESC Escape
- MODE Scrolling display
- OFF Instrument switch OFF for action >3 seconds

2) LOG /INCR (Z.CAL)
- LOG Memo record (when in measure)
- INCR Increase value
  Scrolling vertical menu
- Z.CAL Zero cal for action >3 s (when in measure)

3) SET-UP / SHIFT (S.CAL)(ENTER)
- SET-UP Access to Set-up menu' (when in measure)
- SHIFT Cursor shift
  Horizontal menu
- S.CAL Sensitivity calibration for action >3 s (when in measure)
- ENTER Enter for action >3 s (when in cal o set-up)

RESET functionality is performed by INCR + SHIFT
for action >3 s
- Reset ZERO (when in cal)
- Reset SENS (when in cal)
- Erase all records (when in Log visualization)

5 OPERATING PROCEDURES

5.1 OPERATING INSTRUCTIONS

5.1.1 Main measuring

EC measuring

The model EC -95 is delivered with sensor already connected.
Immerse the sensors in the sample.
Press the key **[MODE]** .
The meter will switch ON and it will show the scale of the last calibration and the date entered at the end of the last zero or sensitivity calibration or reset.
After few seconds it will turn to the display D1.0 and it will show the EC value of the sample in the scale previously selected in the set-up menu.

Temperature measuring

Press one time the key **[MODE]** .
The meter will go to the D2.0 (or D3) display and it will show the temperature value of the sample in °C or °F according to the set-up selection.
The automatic/manual temperature compensation is available for the EC measuring.

Data logging

During the EC, press the key **[LOG]** to memorize:
- the EC value,
- the temperature value,
- the reference temperature value,
- the temperature coefficient value.

The record will be stored in the memory with an assigned number from 0 to 79.
When the memory is full the display will show the message Mem Full.
The memory can be erased by the user by pushing **[INCR] + [SHIFT]** for more than 3 seconds.

Low battery

In case of the battery voltage lower than 7.5 VDC, the message Low Batt will appear when switching on the meter.
If the voltage is lower than 6.5 VDC the power will be switched off automatically.

5.1.2 EC calibration

The meter can perform the manual/automatic calibration with the recognition of the following KCl standard solutions: (only for 2000 µS, 20 mS, 200 mS scales).
The recognition is performed when the reading is within ± 30% of the standard solution value.

	0.01N	**0.1N**	**1N**
Tref 20°C	1278 µS	11.67 mS	102.1 mS
Tref 25°C	1413 µS	12.88 mS	111.8 mS

During the calibration the meter will keep automatically the temperature coefficient of the KCl even if the user has configured the temperature coefficient specific of the sample.

Zero calibration

This calibration is normally not necessary unless the sensor and the cable have lost the isolation or it is necessary to calibrate a customs zero value of the sample.
Switch-on the meter and dip the sensor in the zero solution or keep the clean and dry sensor in air to perform the zero calibration.

[Z.CAL] push the key for 3 seconds.
It appears the D1.1 display and message `Zero Cal` alternate to the EC value (it should be zero or close to zero)
[SHIFT] push the key to read the message `Zeroing` alternate to `Scale x` where `x` will run from 5 to 1 indicating the zeroed scale.

If the new value is out of the accepted limits the display will show the error message `Zero err`
[ENTER] push the key for 3 seconds to delete the message and to turn to main display

If the new value is accepted, the display will show the message `Last cal` for few seconds and then it proposes to insert the date by the flashing cursor under last digit. `XX / XX / XX`
[INCR] push the key to modify the last digit if necessary
[SHIFT] push the key to position the cursor on the other digit to be modified with same procedure.
[ENTER] push the key for 3 seconds to confirm the date value.
The message `Update` indicates the values have been memorized.
This date value will be shown when switching ON the meter and when ending the next zero or sensitivity calibration so to be modified with the new date.

Note:
The zero reset to factory calibration can be done from the main display:
[Z.CAL] push the key for 3 seconds.
It appears the D1.1 display and message `Zero Cal` alternate to the EC value (it should be zero or close to zero)
[SHIFT] + [INCR] push the two keys for 3 seconds to read the messages `RES Zero` and the message `Last cal` for few seconds and then it proposes to insert the date by the flashing cursor under last digit. `XX / XX / XX`
[INCR] push the key to modify the last digit if necessary
[SHIFT] push the key to position the cursor on the other digit to be modified with same procedure.
[ENTER] push the key for 3 seconds to confirm the date value.
The message `Update` indicates the values have been memorized.

Sensitivity calibration

Switch-on the meter and dip the sensor into the standard solution.

[S.CAL] push the key for 3 seconds.
It appears the D1.2 display and message Sens Cal alternate to the EC value.
Allow the EC value stabilization.
[SHIFT] push the key to read the memorized standard solution value.
[ENTER] push the key for 3 seconds to confirm the standard solution value.

If the new value is out of the accepted limits the display will show the error message Sens err
If the new value is accepted, the display will show the message Last cal for few seconds and then it proposes to register the date by the flashing cursor under last digit. XX / XX / XX
[INCR] push the key to modify the last digit if necessary
[SHIFT] push the key to position the cursor on the other digit to be modified with same procedure.
[ENTER] push the key for 3 seconds to confirm the date value.
The message Update indicates the new calibration values have been memorized.

This date value will be shown when switching ON the meter and when ending the next zero or sensitivity calibration so to be modified with the new date.

If the memorized standard solution value doesn't correspond to the buffer solution used for the calibration, proceed as follow:

[SHIFT] push the key to read the memorized standard solution value with the flashing cursor under the digit XX.XX mS (or µS)
[INCR] push the key to modify the last digit if necessary
[SHIFT] push the key to position the cursor on the other digit to be modified with same procedure.
[ENTER] push the key for 3 seconds to confirm the adjusted value.
At this point the procedure is same as the above procedure with the recognized standard solutions.

In many applications it is enough to frequently perform only the sensitivity calibration by using the standard solution close to the measuring value in the process, and the zero check/calibration periodically.

Note:
The sensitivity reset to factory calibration can be done from the main display:
[S.CAL] push the key for 3 seconds.
It appears the D1.1 display and message Sens Cal alternate to the EC value

[SHIFT] + [INCR] push the two keys for 3 seconds to read the messages RES Sens and the message Last cal for few seconds and then it proposes to insert the date by the flashing cursor under last digit. XX / XX / XX
[INCR] push the key to modify the last digit if necessary
[SHIFT] push the key to position the cursor on the other digit to be modified with same procedure.
[ENTER] push the key for 3 seconds to confirm the date value.
The message Update indicates the values have been memorized.

Manual temperature

This calibration can be done when the Pt1000 sensor is not connected or malfunctioning and the user wants to adjust the manual temperature compensation value.

[MODE] push the key from the main display in order to reach the D2.0 display.
[SHIFT] push the key to read the manual temperature value with the flashing cursor on the last digit
XXX.X °CM or (°FM)
[INCR] push the key to modify the last digit if necessary
[SHIFT] push the key to position the cursor on the other digit to be modified with same procedure.
[ENTER] push the key for 3 seconds to confirm the adjusted value.
At this point the procedure is same as the above steps.

The message Update indicates the new calibration values have been memorized.
If the new value is out of the accepted limits, the display will show the message min/Max 0/100 °C or 32/212 °F for few seconds.

5.1.3 Data Logger

This function allows the memorization and the reading of the memorized measuring values.
[LOG] push the key to memorize the actual value of the EC and the temperature.
The meter will memorize the Tref. and the temperature coefficient as well.
The meter will assign and show a progressive number up to 79 to the memorized values.
Follow the next procedure to read the memorized values.

[MODE] push the key two times from the main display in order to reach the D3.0 display View Log.
[SHIFT] push the key to read the number of the record, the alternate values of the EC and temperature.
[SHIFT] push the key to read for few seconds, the alternate values of the Tref and the temperature coefficient.
[INCR] push the key more times to read the previous memorized records.

When the record number will reach 79, the message Mem.Full.

To erase the memorized data
[MODE] push the key two times from the main display in order to reach the D3.0 display.
[SHIFT] push the key to read the number of the record, the alternate values of the EC and temperature
[LOG] + [SHIFT] press the two keys for 3 seconds. The message Logged erased will appear.
[MODE] push the key to turn to the main display.

To verify if records are erased:
[MODE] push the key to reach the display View Log
[SHIFT] push the key to read the message Empty.

5.1.4 Set-up

This function allow the user to:
- select the measuring scale
- choose the filter software response time
- select the temperature measuring unit °C/°F
- select the reference temperature for the temperature compensation
- select the coefficient for the temperature compensation
- choose the time of the automatic switch-off

<u>Measuring scale</u>
The instrument is delivered with the 0-20 mS scale.
The next procedure describes the new scale selection.

[SHIFT] push the key from the main display. The message Set-up will appear.
[SHIFT] push the key. The p/n and the firmware release will appear. EC-95 and Rev. 1.xx
[INCR] push the key. The messages EC scale alternate to scale 20 mS will appear.
[SHIFT] push the key and then **[INCR]** to select the new scale.
[ENTER] push the key for 3 seconds to confirm.
The message Update will.
.
[MODE] push the key one time to turn to the Set-up menu or push two times to turn to the main display...

Response time

The meter is delivered with response time of 2 seconds and it can be modified up to 10 seconds by means of the following procedure.

[SHIFT] push the key from the main display. The message Set-up will appear.
[SHIFT] push the key. The p/n and the firmware release will appear. EC-95 and Rev. 1.xx
[SHIFT] push the key and than **[INCR]** two times. The display Resp.Time and the actual value in seconds will flash.
[SHIFT] push the key. The actual response time with the flashing cursor on the last digit XX.s will appear.
[INCR] push the key to modify the last digit if necessary.
[SHIFT] push the key to position the cursor on the other digit to be modified with the same procedure.
[ENTER] push the key for 3 seconds to confirm the new time in seconds.
The message Update will appear.
If the new value is out of the accepted limits the display will show the message min/Max 1/10 s for few seconds.
The display will show the message T.UNIT °C or °F.
[MODE] push the key two times to turn to the main display, unless it is requested to modify the temperature measuring unit.
The message Update will appear and turn to the temperature unit °C/°F selection..

Temperature measuring unit

The meter is delivered with the °C temperature measuring unit and it can be modified to °F by means of the following procedure.
(Follow the same procedure to turn back to °C unit)

[SHIFT] push the key from the main display. The message Set-up will appear.
[SHIFT] push the key. The p/n and the firmware release will appear. EC-95 and Rev. 1.xx
[INCR] push the key three times. The messages T Unit °C (°F) will appear.
[SHIFT] push the key and then **[INCR]** to set the °F (°C) measuring unit.
[ENTER] push the key for 3 seconds to confirm the °F (°C) measuring unit.
The message Update will appear followed by Temp.Ref and 20.0 °C (or 25 °C) flashing value.
SHIFT] push the key and then **[INCR]** to select 25 °C or (20 °C) reference temperature value.
[ENTER] push the key for 3 seconds to confirm the reference temperature value.
The message Update will appear followed by Temp. CO alternate to the corresponding temperature coefficient 2.20 %/°C .
[SHIFT] push the key. The actual value with the flashing cursor on the last digit X.XX %/°C will appear.
[INCR] push the key to modify the last digit if necessary.
[SHIFT] push the key to position the cursor on the other digit to be modified with the same procedure.
[ENTER] push the key for 3 seconds to confirm the new time in seconds.
The message Update will appear.
If the new value is out of the accepted limits the display will show the message min/Max 0.0/3.50 %/°C for few seconds.

The display will show the message Auto Off 90 s to select the auto switching off time. .

Switching off time

The meter will switch off automatically if any keys is not pressed within the time configured in the Set-up menu.
The meter is delivered with the automatic switching off time of 90 seconds but it can be modified to 30/600 seconds by means of the following procedure.

[[SHIFT] push the key from the main display. The message Set-up will appear.
[SHIFT] push the key. The p/n and the firmware release will appear. EC-95 and Rev. 1.xx
[INCR] push the key four times. The messages Auto Off and the actual value in sec. will appear.
[SHIF] push the key to read the time value with the flashing cursor on the last digit XXX s
[INCR] push the key to modify the last digit if necessary
[SHIFT] push the key to position the cursor on the other digit to be modified with same procedure.
[ENTER] push the key for 3 seconds to confirm the adjusted value.
The message Update will appear
If the new value is out of the accepted limits the display will show the message min/Max 30/600 s for few seconds.

The display will show the p/n and the firmware release EC-95 and Rev. 1.xx
[**MODE**] push the key two times to turn to the main display.

5.1.5 Maintenance of the unit

Quality components are used to give the meter a high reliability.
In this way it needs just the battery replacement.

Battery replacement

The meter controls the voltage of the battery.
If the value is lower than 7.5 volt the display will show the message Low Batt.
The meter will switch off automatically if the battery voltage is lower than 6.5 volt.

To replace the battery, remove the cover of the battery place on the back of the instrument.
Replace the 9 VDC battery,
Place the battery cover in the previous position.

5.1.6 Maintenance of the sensor

The state of the electrode's surface is critical for the normal operation of the system and should be inspected more frequently when using alkaline liquids, oil and grease containing water, and bio-applications.

Suggested methods for cleaning the electrode include chemical cleaning and washing detergents:

- dip the sensor for 30 seconds in a 5% HCl solution or detergent in case of grease contamination,
- rinse thoroughly the sensor into deionised water,.

5.2 STORAGE AND TRANSPORTATION

In case of long storage period, keep the instrument in a dry area.

In case of tranportation, use the original carton box.