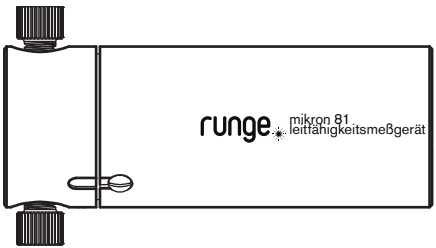
runge



mikron 81 conductivity meter

Operations manual

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Printed in Germany 81.6A0.2106.en

Table of contents

Introduction

Thank you for deciding for a Runge detector.

Our mikron apparatus differs both in its concept and size from traditional detectors: it gives you the the performance of advanced laboratory detectors in the form of a test head. This gives you new application possibilities. Important aims in its development were durability, ease of maintenance and a good price/performance ratio.

We develop and produce all Runge instruments in Germany. We rely on competent suppliers in Brandenburg and in Berlin. We hope that you will be satisfied with our detector in its day to day usage and that we can gain your long-term custom.

Safety regulations

This detector meets the prescribed safety regulations. Incorrect operation can however lead to injury and damage. Consequently read these operating instructions carefully before putting the detector into operation.

Runge cannot accept responsibility for damage caused by not following these instructions.

Intended use

This detector is to be used in analytical and preparative liquid chromatography equipment and in general for the photometric analysis of liquids. The insertion and operation of the detector shall only be carried out by trained laboratory technicians with knowledge in this field and experience in handling the chemicals used.

Occupational safety

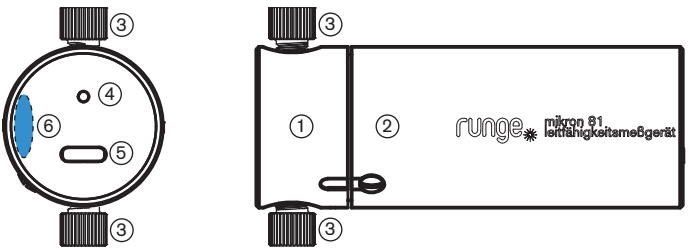
When using the apparatus observe the health and safety regulations (among others those concerning protective clothing and laboratory equipment). In the United Kingdom, relevant information is provided by the Health and Safety Executive. In Ireland it is the Health and Safety authority, in Australia, Safe Work Australia and in New Zealand, Worksafe. In the United States of America it is the OSHA, in Canada the CSC.

Ambient conditions

The detector is to be operated only in the following conditions:

- Temperature 3...45 °C (37.4...113 °F)
- Humidity 0...90 %, non-condensing
- Atmosphere: air in room, inert gas, no explosive or corrosive fumes
- No direct sunlight (danger of overheating)
- No ignition sources in the vicinity of flammable solvents

An overview of the detector



1 measurement cell (various types can be supplied)
2 detector block
3 liquid joint
4 status indicator
5 electrical connection (USB-C or RS-485)
6 name plate

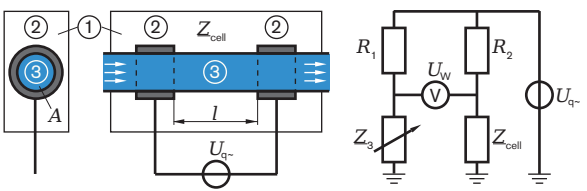
Fig. 1: The mikron 81 detector

Technical data

Type		mikron 81, conductivity meter		
Conduct. measuring range	mS/cm	(Z=10/cm)	indicating 0.002 … 100	linear 0.002 … 100
	mS/cm	(Z=50/cm)	indicating 0.010 … 500	linear 0.010 … 300
Conductivity accuracy	%	(Z=10/cm)	±2 % / ±1 mS/cm	(the higher value applies)
		(Z=50/cm)	±2 % / ±2 mS/cm	(the higher value applies)
Conductivity scanning rate	Hz	10		
Temperature meas. range	°C	0 … 100	+/– 0,1	
Temperature scanning rate	Hz	10		
Power take-up	W	< 2,5		

Method of measurement

The concentration, valence and mobility of the ions dissolved in the liquid indicates its composition, for example the salt content. The electric conductivity of the liquid is proportional to the aforementioned ion properties, with their mobility depending on the temperature of the liquid. The conductivity is measured with a high degree of accuracy by applying an AC voltage to a cuvette (either filled with the liquid or subjected to a flow of the liquid) of known measurements (cross-sectional area, separation of the electrodes) via the zero voltage point ($U_W = 0$) of a Wien bridge.



$$\sigma = G_{cell} \frac{l}{A} \qquad [\sigma] = \text{S/m}$$

1	measuring cell	G	conductance
2	electrode	$\underline{Z}$	impedance
3	sample	$U_{q\sim}$	source voltage
A	cross-section	U_W	Wien voltage
l	distance		

Fig. 2: Using a Wien measurement bridge for measuring electrical conductivity

By using alternating current, polarisation of the investigated liquid during time-consuming measurements is avoided. The influence of the liquid's temperature is compensated for. By using a number of measurement cells differing from each other, each with its own geometry, the measurement range of the detector can be adapted for the measurement task in each case. The materials moistened by the liquid (PEEK for the body of the cell, titanium for the electrodes, PTFE for the seals) are biologically compatible.

Equipment delivered

- Runge mikron 81 conductivity meter
- connecting cable for USB-C to USB-A
- operating instructions
- two pairs of liquid screw joints of the appropriate size
- size 3 Allen key
- table mounting[1]

1 may vary depending on the scope of delivery ordered

Setting up

Mounting, fastening

With the table mounting delivered, the mikron 81 detector can be operated in a laboratory, but can also be inserted into a device insofar as the ambient conditions (temperature, humidity, composition of the atmosphere) are maintained.

When inserting the apparatus into a device, fastening it at the front of the detector block is recommended (see Fig. 4), as this would not constrict the cross-section and otherwise the housing would be deformed. A suitable means of fastening is, for example, pipe clips conforming to DIN 3015.

As liquid only flows through the measurement cell, a leak can occur in the cell. To avoid damage to electronic parts of the detector through the presence of liquid, it is recommended when inserting the measurement cell vertically or at an angle to ensure that its end cap is located at the deepest point. In the case of horizontal insertion the longitudinal alignment groove should be situated at the bottom along with the overflow outlet of the

measurement cell (Fig. 6). As leakages are not recognised by the detector, care must be taken that leakages are discovered in time.

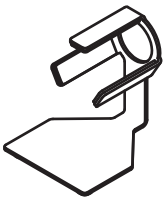


Fig. 3: Table mounting

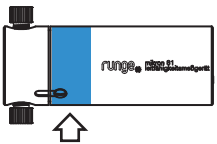


Fig. 4: Preferred position for fastening clip

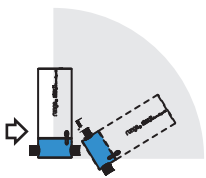


Fig. 5: Measurement cell at the bottom

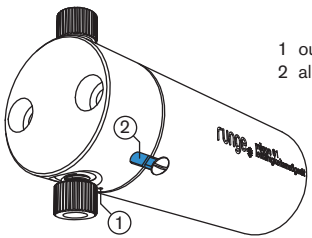


Fig. 6: Alignment groove at the bottom

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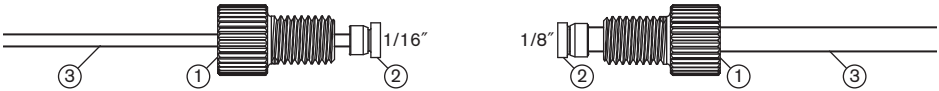
Liquid connectors

The mikron 81 detector can be fitted with various measurement cells. These cells use the following joints:

Part number	Cell constant (1/cm)	Cell geometry	Joint	
81.240.0101	10	$V_{cell} = 53$ µl, $d_{i,\,bore} = 2.2$ mm	1/4″-28 UNF	flat
81.240.0102	50	$V_{cell} = 11$ µl, $d_{i,\,bore} = 1.0$ mm	1/4″-28 UNF	flat

Two pairs of appropriate joints are supplied with the apparatus. The order of the joints is shown in Fig. 7.

Only PEEK joints should be used with this detector. They must be tightened with a torque of 0.5 Nm. Joints of PEEK (polyether ether ketone) are not suitable for all operating pressures and solvents.



1 Knurled-head screw 1/4″-28 UNF
2 Ferrule
3 Tubing

Fig. 7: Liquid joints, alignment of the parts

Electrical connection

The mikron 81 is connected to a computer via a USB connector and is controlled and supplied with energy via the connector. The USB-C type plug is constructed symmetrically and hence can be plugged in in two directions.

Operation

Switching on and off

The detector is supplied via the USB connector with power and is switched on as soon as the supply voltage is applied, i.e. as soon as the connected computer or active USB hub is switched on. The light source(s) are switched on and off via a separate command.

Display of the operating status

The mikron 81 detector can only be remotely controlled via a computer. The apparatus has a 3-coloured status display. This can show the following three operating states:

Colour	Type	Meaning
green	steady light	operational
green	flashing light	measurement in process

Colour	Type	Meaning
yellow	steady light	startup test in process
red	steady light	error

Choice of data rate and time constant

Data rate and time constants concern the processing of the measured signal in the detector before outputting to the computer. The data rate determines the quantity of data points per second on the time axis of the chromatogram, and the time constant defines the communication of the signal within the chosen time interval. The longer the interval, the lower the noise level, and the time-based resolution is also lower. This should be kept in mind when choosing the constant.

A data rate is recommended which is more than double the reverse value of the time constant, so that at least two data points are located in an interval of the time constant. At the same time the data rate should be so chosen that the narrowest expected peak in the chromatogram is defined with at least 20 data points.

In the case of an unknown duration of the signal peaks it is recommended to make a chromatogram with time constant $\tau = 0$ ms or $\tau = 10$ ms and to choose a time constant shorter than half of the narrowest amplitude.

Measurement by temperature equalisation

The temperature of a solution has an influence on its electrical conductivity. This dependency is linear for most materials, as shown in Fig. 8, equation 1. For a few materials e.g. natural water, a non-linear function in accordance with DIN 7888 is applicable. The mikron 81 is fitted with a linear temperature equalisation device. Furthermore, the specific temperature coefficient (in %/°C) of the material investigated, which can be looked up in chemical tables, will be added to the chromatography programme.

$$\sigma(\vartheta) = \sigma(\vartheta_{ref}) \frac{100 + c_{\vartheta}(\vartheta - \vartheta_{ref})}{100} \quad (1)$$

$$c_{\vartheta} = \frac{(\sigma(\vartheta_2) - \sigma(\vartheta_{ref})) \cdot 100}{(\vartheta_2 - \vartheta_{ref}) \cdot \sigma(\vartheta_{ref})} \quad (2)$$

σ	electrical conductivity	S/m
ϑ	temperature	°C
c_{ϑ}	specific temperature coefficient	%/°C
ref	reference	

Fig. 8: Linear temperature dependence of electrical conductivity

Determining the specific temperature coefficient for the material

If the electrical conductivity of the material to be investigated is known for a particular temperature (reference temperature) but the temperature coefficient is not known, the latter can be calculated by measuring the conductivity at another temperature using equation 2 of Fig. 8. In this case, the temperature equalisation function of the mikron 81 must be switched off. The measurement temperature should be at least 10 °C higher than the reference temperature.

Rinsing, cleaning and storing the measurement cell

The cleanliness of the measurement cell is critical for the accuracy and reproducibility of the measuring result. It is recommended to rinse out the measurement cell with distilled water between measurements.

When cleaning a significantly soiled cell a cleaning solution is recommended which consists in equal parts of isopropyl alcohol and a 32% solution of hydrochloric acid. The cell is filled

with this solution, exposed to it for two or three minutes and then rinsed out thoroughly several times with distilled water.

When storing the measurement cell for some time without use (longer than two weeks) the cell is first of all rinsed or cleaned and residual liquid is then forced out from the cell's interior using compressed air.

Replacing the measurement cell

Before disassembling the detector it must be ensured that it is not under electric tension (plug removed). After the Allen screws visible at the end cap have been loosened they can be removed using the spanner supplied.

The parts of the detector remain attached to each other as a result of the spring tension of the plug even after the screws have been loosened. When reassembling the apparatus with a new measurement cell or one of the same type, alignment grooves and the position of the plugs aid the correct settings of the cell.

The plug and socket strips of the electronic modules are protected against accidental contact. When objects are inserted which conduct electrical current the electronics can be damaged as a result of electrostatic discharge.

After the measurement cell has been changed the detector must be calibrated for conductivity (but not for temperature).

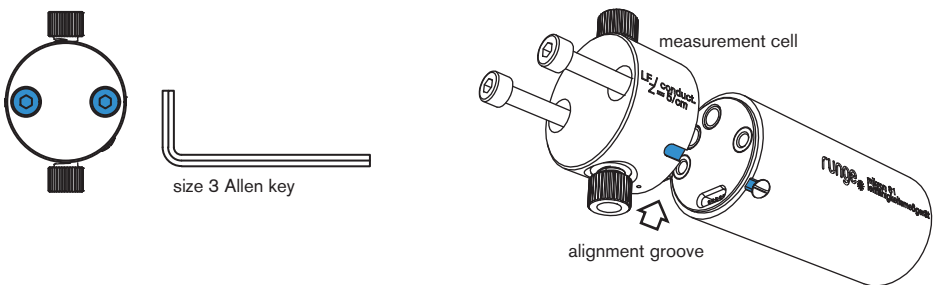


Fig. 9: Replacing the measurement cell

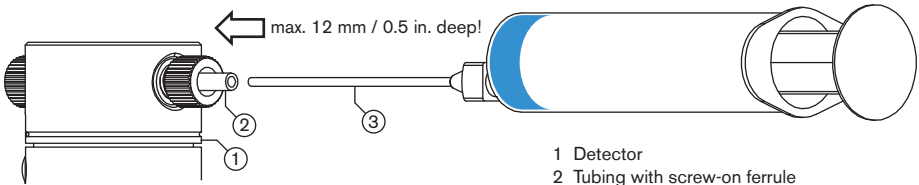


Fig. 10: Calibration with syringe

Calibration

The detector is calibrated in the factory with respect to conductivity and temperature. The conductivity can, if required, be re-calibrated by the user, for example after the measurement cell has been changed. At the same time, for every possible condition of flow, three calibration solutions with increasing salt content are injected one after another. In each case, after the measurement cell value has stabilised, the calibration command is issued (via the chromatography data system or the terminal). To avoid electrical contact with the measurement electrode, which would distort the measurement value, the needle involved must not be inserted into the screw joint at a depth of more than 12 mm or 0.5 inches. The recommended calibration points are shown in Annexe 3.

Trouble shooting

The following table helps when correcting faults occuring in daily use

Error description	Possible cause	Explanations and action taken
Status indicator red	Measurement cell not detected	Make sure connector is plugged in
	Internal calibration defective	Inform customer service
Conductivity still shown on display as zero	Contact between cell and detector block broken	Make sure connector is plugged in
	Contact within the measurement cell broken	Replace measurement cell

Error description	Possible cause	Explanations and action taken
Temperature display still shows 0 / 100 °C	Contact between cell and detector block broken	Make sure connector is plugged in
	Temperature sensor within the measurement cell defective	Replace measurement cell
Unstable or noisy basis line	Bubbles in the solvent	Use degassed solvent
	Measurement cell soiled	Rinse out the measurement cell with a cleaning solution (see above) and switch the equipment off and then on again.

Annexe 1: Spare parts list

The spare parts listed can be ordered directly from Runge or one of Runge's distributors.

Part number	Designation
81.240.0101	Measurement cell conductivity, Z=10/cm, 53 µl, $d_{i,\ bore}$ = 2.2 mm
81.240.0102	Measurement cell conductivity, Z=50/cm, 11 µl, $d_{i,\ bore}$ = 1.0 mm
00.321.0034	Knurled-head screw 1/4″-28 UNF for capillary tube d_o = 1/8″, PEEK
00.321.0035	Knurled-head screw 1/4″-28 UNF for capillary tube d_o = 1/16″, PEEK
00.321.0044	Ferrule for knurled-head screw 1/4″-28 UNF for capillary tube d_o = 1/8″
00.321.0045	Ferrule for knurled-head screw 1/4″-28 UNF for capillary tube d_o = 1/16″
81.6A0.2006.en	Operations manual mikron 81 English
G2.241.0002	Short mikron table mounting
00.521.0001	spanner, size 3 Allen key

Part number	Designation
00.522.0001	USB-C to USB-A cable, length 1.5 m
00.522.0002	USB-C to USB-A cable, length 1.0 m
00.522.0003	USB-C to USB-A cable, length 3 m
00.522.0004	USB-C to USB-A cable, length 5 m
00.522.1001	RS-485 cable (M5 round plug – four open leads), length 5 m

Annexe 2: GLP detector specifications

Component	Specification
apparatus	serial number
	firmware version
	number of switching cycles
	operating hours
	date of last maintenance by customer service
	date of last validity check

Annexe 3: Recommended calibration points

No.	Substance	Cell constant 1/cm	Conductivity mS/cm at 25 °C	Corresp. net wt. NaCl g/l at 25 °C *
1	Water, de-mineralised	10	< 0.001	0
2	KCl	10	50	28.6
3	KCl	10	100	57.6
1	KCl 0.1 mol/l	50	12.88	7.3
2	KCl 1 mol/l	50	111.88	64.1
3	KCl	50	300	172.1

* Check conductivity of solutions you have produced yourselves by using a reference device compensated for temperature.

Conformity declaration

CE

Manufacturer: Wissenschaftliche Gerätebau „F. F. Runge“ GmbH
David-Gilly-Straße 1
14469 Potsdam, Germany

Model: conductivity meter mikron 81 (Typ 81)

en

We declare hereby that the preceding designated product conforms in its conception and type of construction and also the design lauched on the market to following directives:

2014/35/EU	Low-tension directive
2014/30/EU	EMC (electromagnetic compatibility) directive
2011/65/EU	Directive on the restriction of hazardous substances in electric and electronic equipment
2012/19/EU	Directive regarding waste electrical and electronic equipment (WEEE)
DIN EN 61000-3-2:2014	Electromagnetic compatibility (EMC) directive – limits für harmonic current emissions
DIN EN 61010-1:2001	Safety requirements for electrical equipment for measurement, control, and laboratory use
DIN EN 61326-2-3	EMC – Electrical equipment for measurement, control and laboratory use

Potsdam, 1st of March 2018

Ernst Eimer (managing partner)

runge UK Declaration of Conformity acc. to BS EN ISO/IEC 17050-1 UKCA

We, Wissenschaftliche Gerätebau „F. F. Runge“ GmbH, David-Gilly-Straße 1, 14469 Potsdam, Germany

declare under sole responsibility that the product as originally delivered

Conductivity meter mikron 81 (Typ 81)

complies with the essential requirements of the following applicable UK Regulations, and carries the UKCA marking accordingly:

Category	Standard	Classification
Safety	BS EN 61010-1:2010 + Amd 1: 2016	Equipment Class I, Pollution Degree 2
	BS EN 61010-2-010:2020	
EMC	BS EN 61326-1:2013	BS EN 55016-2-1: 2014
	BS EN 61000-3-2: 2014	BS EN 55016-2-2: 2011
	BS EN 61000-3-3: 2013	

The product was tested in a typical configuration.

Year Mark First Applied: 2021

We, the undersigned, hereby declare that the equipment specified above conforms to the above Regulations and Standards.

Ernst Eimer (managing partner)