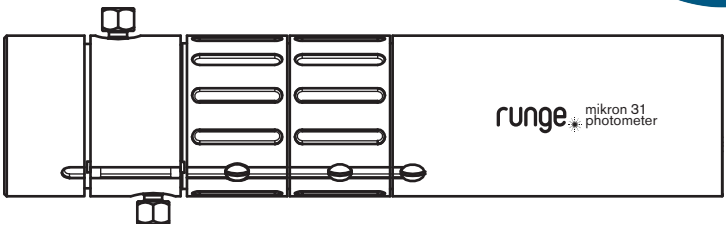


mikron 31 photometer

Operations manual

Wissenschaftliche Gerätebau „F. F. Runge“ GmbH
(“F. F. Runge” Scientific Instruments)
David-Gilly-Straße 1
14469 Potsdam
Germany

Telephone +49 (0) 3 31 / 96 79 75 00
Telefax +49 (0) 3 31 / 96 79 75 02

E-Mail info@ff-runge.de
Internet www.ff-runge.de

Printed in Germany 31.6A0.1803.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

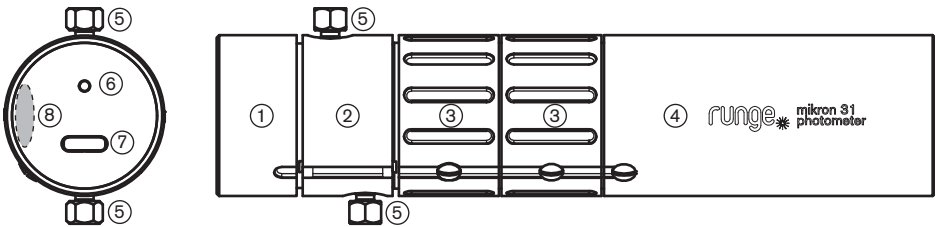
When using the apparatus observe the health and safety regulations (among others those concerning protective clothing and laboratory equipment). In the United Kingdom, relevant information is provided by the Health and Safety Executive. In Ireland it is the Health and Safety authority, in Australia, 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 end cap
2 measurement cell (various types can be supplied)
3 light source (one or two)
4 detector block
5 liquid joint
6 status indicator
7 electrical connection (USB-C), max. 500 mA
8 name plate

Fig. 1: The mikron 31 detector

Technical data

Type		mikron 31, UV/Vis/IR photometer	
No. of wavelengths		1; 2	
Construction type		portable	
Wavelength	nm	240 … 1050 nm discrete values	
Accuracy of wavelength	nm	+/– 2.5	
Precision of wavelength	nm	+/– 0.5	
Scanning rate	Hz	1 … 100	
Noise level	AU	typ. $< \pm 10^{-5}$	at 255 nm, time constant 1 s, depending on λ
Linearity range	AU	typ. > 2.5	at 255 nm, depending on λ
Optical band width	nm	< 15	
Power take-up	W	< 2.5	

Method of measurement

The individual components dissolved in a liquid absorb light of a particular wavelength (ultraviolet, visible light or infrared) of various intensities. The detector is fitted with one or two light sources of particular wavelengths (monochromatic light).

The intensity of the light beam after passing through the sample is measured by a photodiode and compared with that of a reference beam which has not passed through the sample.

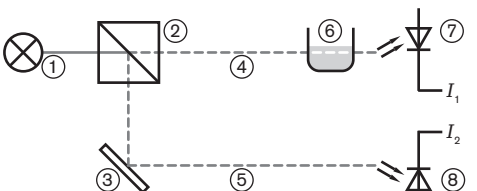


Fig. 2: Photometry with reference channel

$$A = \log_{10}\left(\frac{I_2}{I_1}\right) + K_{ZA} \qquad [A] = \text{AU}$$

1	light source	7	object signal photodiode
2	beam splitter	8	reference signal photodiode
3	mirror		
4	object beam	I_1	object signal intensity
5	reference beam	I_2	reference signal intensity
6	sample	K_{ZA}	constant zero adjustment

If the detector is equipped with two light sources, two wavelengths can be measured simultaneously by rapid switching between the two sources. This rapid scanning type of operation is available otherwise only by significantly larger table instruments with a discharge lamp and monochromator.

Equipment delivered

- Runge mikron 31 (UV/Vis/IR) photometer
- connecting cable for USB-C to USB-A, 1.5 m
- operating instructions
- two pairs of liquid screw joints of the appropriate size (according to the measurement cell supplied)
- size 3 Allen key
- table mounting[1]
- instrument case[1]

1 only in the delivered equipment for end users

Setting up

Mounting, fastening

With the table mounting delivered, the mikron 31 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 channels of the

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

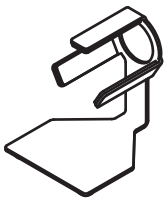


Fig. 3: Table mounting

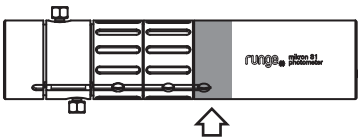


Fig. 4: Preferred position for fastening clip

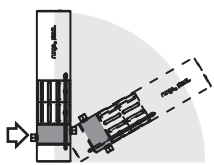


Fig. 5: Measurement cell at the bottom

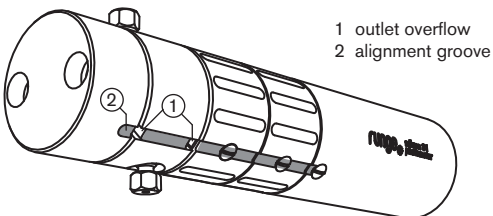


Fig. 6: Alignment groove at the bottom

Liquid connectors

The mikron 31 detector can be fitted with various measurement cells. These cells use the following joints:

Part number	Measurement cell	OD Capillary tube (mm)	Joint	
00.240.0001.x	analytic 10 µl	1.5875 (1/16 inch)	10-32 UNF	cone
00.240.0002.x	preparative	3.1750 (1/8 inch)	1/4"-28 UNF	cone
00.240.0003.x	analytic 2,5 µl	1.5875 (1/16 inch)	10-32 UNF	cone

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

Stainless steel joints are tightened with a torque of 5 Nm, PEEK joints with a torque of 0.5 Nm. Joints of PEEK (polyether ether ketone) are not suitable for all operating pressures and solvents.

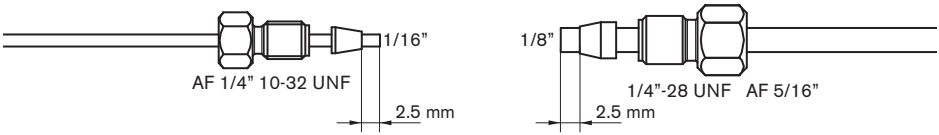


Fig. 7: Liquid joints, alignment of the parts

Electrical connection

The mikron 31 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 31 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

Switching between the light sources

If the detector is fitted with two light sources it is possible to switch to an fro between them.

The light sources are queried when the detector is being tested by its control electronics, and signal their wavelengths and other specifications to the control electronics. All specifications required by the guidelines of good laboratory practice (cf. Annexe 2) can be shown in the chromatography program.

The apparatus driver sorts the light sources internally in ascending order of wavelength, irrespective of the order the cassettes are located in the apparatus. Consequently, when creating a method, it is always the wavelength which is used for selecting a light source and not the channel number. This means that when the detector has other light sources than the one required by a method this situation is recognised when the method is created.

Rapid scanning of two wavelengths

If the detector is fitted with two light sources, both wavelengths can in practice be measured at the same time as a result of the rapid scanning. The scanning rate for this mode of operation is at the most 100 Hz.

Zero adjustment

If a command is issued for zero adjustment, the current numerical value of the signal level is subtracted from this value and all following values. A zero comparison is carried out automatically also at the commencement of each measurement.

Switching over the type of signal

The measurement signal output can be positive, inverted or, for two light sources, as the ratio of the signal wavelength 1 to wavelength 2 and vice versa (amplitude rating).

Choice of scanning rate, integration time, data rate and time constant

The scanning rate reflects the quantity of measurements of light intensity for each interval of time. The integration time is the reverse value of this rate and corresponds to the exposure time of photography. Similarly a short integration time (high scanning rate), along with a weak light intensity leads to a poor signal/noise ratio. On the other hand, a long integration time together with a high light intensity can lead to saturation of the signal amplifier. The detector determines the integration time by measurung the light intensity when it is switched on and, by command, renews it.

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.

Time constant τ (ms)	Data rate (Hz)	Peak width (s)
40	> 50	< 0,4
20	> 100	< 0,2

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.

Replacing the measurement cell

Before disassebmling 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.

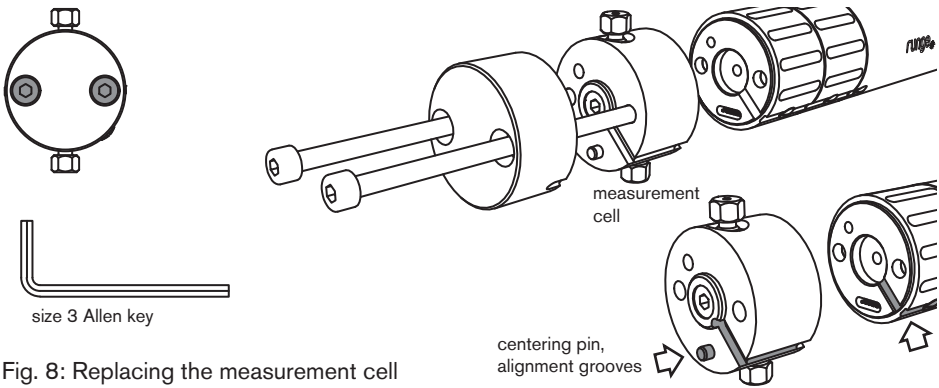


Fig. 8: Replacing the measurement cell

If, in spite of these instructions, the detector is disassembled when it is still under electric tension and the light source is still switched on, there is a danger of damage to eyes and burns resulting from optical radiation.

The detector has now been disassembled and separated into three components: the end cap, measurement cell and the combination of detector block and cassettes. The loose parts must be prevented from falling out as the optical properties and the density would suffer. When reassembling the apparatus with a new measurement cell of one of the same type, centering pins and alignment grooves aid the correct settings of the cell.

Replacing a light source

The apparatus is switched off and then disassembled. (cf. Fig. 8).

Light source cassette(s) and detector block remain attached to each other as a result of the spring tension of the plug even after the screws have been loosened. The alignment depends on the positions of plug and socket. When being tested, the light sources are recognised automatically by the detector indepen-dently of their order.

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.

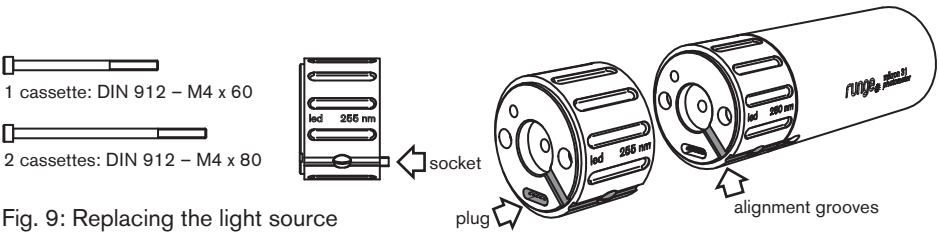


Fig. 9: Replacing the light source

Adding a light source

The detector can be fitted with 2 light sources. Retrofitting is carried out, analogously to the description in the preceding section, simply by plugging in a second light source cassette. More than 2 light sources are not supported.

As a result of adding light sources the length of the apparatus changes. Consequently the traction bolts must be replaced by longer types (DIN 912 – M4x80) (cf. Fig. 9). These are

supplied, for retrofitting, in a cassette. By changing back from two light sources to one, only the shorter bolts (DIN 912 – M4x60) may be used.

Trouble shooting

The following table helps when correcting faults occuring in daily use

Error description	Possible cause	Explanations and action taken
Status indicator red	no light source(s) recognised	Are the plugs firmly in the sockets?
	wrong type of cassette recognised	Have only light source cassettes been inserted?
	extraneous light present	Are the various modules positioned so that there are no gaps between them? Bolts/screws tightened up?

Error description	Possible cause	Explanations and action taken
Status indicator red	light source too bright	Light source current set too high. Inform customer service.
	measurement cell soiled or contains air bubbles	Measurement cell soiled? Rinse through measurement cell with acetonitrile or methanol; then switch the apparatus off and on. Are air bubbles in the cell? Remove the bubbles with a spray.
	Light source too dark because of age	How long is the service life? UV light sources should be replaced after 5,000 hours
	Integration time too short	Have integration time newly determined.
Signal value always zero	light source not switched on	Switch on light source.

Error description	Possible cause	Explanations and action taken
Unsettled or fading base line	extraneous light present	Are the various modules positioned so that there no gaps between them? Bolts/screws tightened up?
	measurement cell soiled	Rinse through measurement cell with acetonitrile or methanol; then switch the apparatus off and on (automatic determination of the integration time).
	weak light source	Light source aged? Light source currently set too low. Inform customer service. Integration time too short? Increase, have integration time determined automatically (switch off and on).

Annexe 1: Spare parts list

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

Part number	Designation
00.240.0001.x	measurement cell absorption, analytic, 10 µl, x: 1=stainless stell, 2=titanium, 3=PEEK
00.240.0002.x	measurement cell absorption, preparative, 1.6...6.4 µl
00.240.0003.x	measurement cell absorption, analytic, 2.5 µl
30.241.0002	end cap
31.241.0002.xxx	cassette with LED light source, wavelength λ = xxx nm
31.6A0.1803.en	mikron 31 operating instructions, English
G2.241.0003	Long mikron table mounting
00.311.DIN912.M04x60	Short bolt, DIN 912 – M4x60
00.311.DIN912.M04x80	Long bolt, DIN 912 – M4x80

Part number	Designation
00.521.0001	spanner, size 3 Allen key
00.522.0001	USB-C to USB-A cable, length 1.5 m
00.321.0031	10-32 UNF cone joint for capillary tube d_a=1/16", for CR, stainless steel
00.321.0032	10-32 UNF cone joint for capillary tube d_a=1/16", one piece, PEEK
00.321.0033	1/4"-28 UNF cone joint for capillary tube d_a=1/8", for CR, stainless steel
00.321.0041	Cutting ring (CR) for 10-32 UNF cone joint, stainless steel
00.321.0042	Cutting ring for 1/4"-28 UNF cone joint, stainless steel
00.321.0043	Cutting ring for 1/4"-28 UNF cone joint, PEEK

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
module	serial number
	operating hours
	highest value of operating current though illuminants (indication of demands.)

For ordering and technical support, please contact:
Europe: Biotech AB Tel: +46 (0)300-56 91 80. info@biotechfluidics.com
USA: Biotech USA LLC Tel: +1 612 703 5718. sales@ biotechfluidics.com
www.biotechfluidics.com

Conformity declaration

CE

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

Model: UV/Vis/IR photometer mikron 31 (Typ 31)

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)