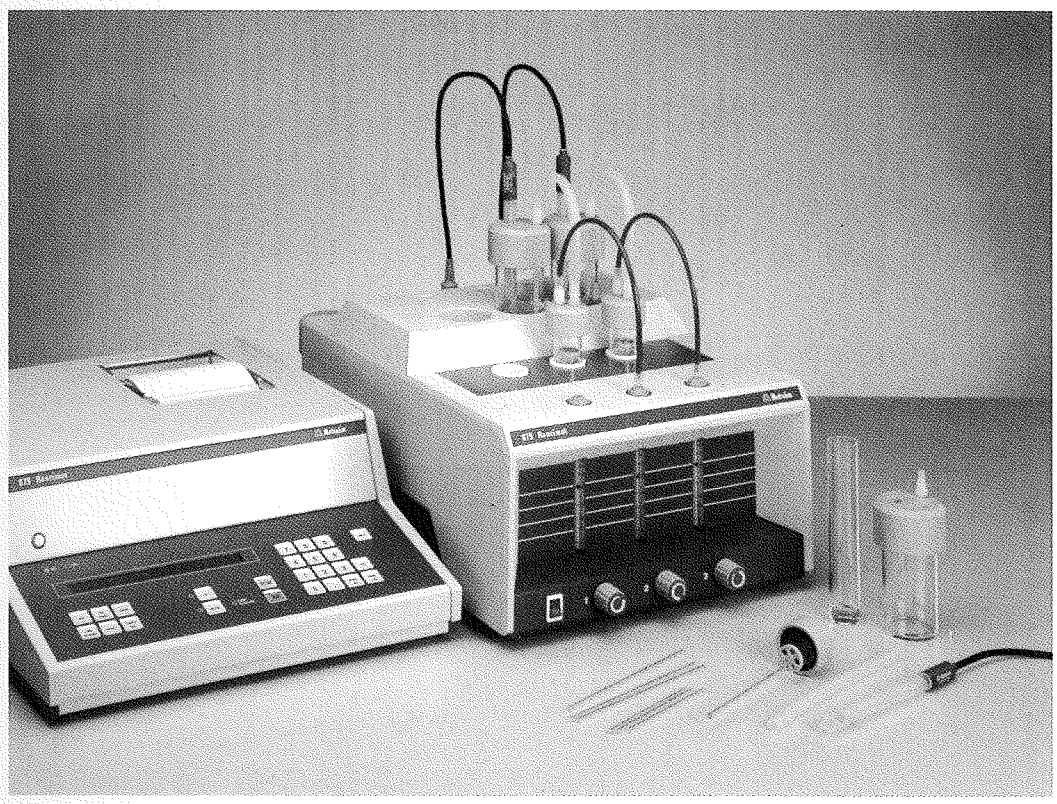
679 Rancimat



Instructions for use

8.679.1013

Metrohm
Ion analysis
Metrohm Ltd.
CH-9101 Herisau
Switzerland

679 Rancimat

8.679.1033 Annex to the 8.679.1013 Instructions for use

In the 679 Ramcimat the **5.679.0024 program version** is installed as standard from series 13 upwards. The corresponding **innovations** and **corrections** to the 8.679.1013 Instructions for use are described below.

New format of date

The main modification of the new program version concerns the format of the date. The **year** is now entered, displayed and printed with **4 digits**.

Modification of technical data

The technical date of the 2.679.0XXX Rancimat wet section (p. 62) are modified as follows:

Temperature difference between the different measuring positions	**< 0.5 °C** (when operating temperature reached, identically filled reaction vessels inserted and with 20 L/h air flow rate)

Metrohm

METROHM Ltd. CH-9100 Herisau (Switzerland)

679 Rancimat

Instrument for the determination of oxidative and thermal stabilities

Mains connection:

	Mains voltage	Mains frequency	Power consumption
Control unit	100, 120, 220, 240 V (±10%) switchable	50 ... 60 Hz	40 VA
Wet section (6 samples)			
2.679.0121 version	100 ... 117 V (± 10%)	60 Hz	<500 VA
2.679.0126 version	220 ... 240 V (± 10%)	60 Hz	<500 VA
2.679.0127 version	220 ... 240 V (± 10%)	50 Hz	<500 VA
2.679.0128 version	100 ... 117 V (± 10%)	50 Hz	<500 VA
Wet section (3 samples)			
2.679.0221 version	100 ... 117 V (± 10%)	60 Hz	<300 VA
2.679.0226 version	220 ... 240 V (± 10%)	60 Hz	<300 VA
2.679.0227 version	220 ... 240 V (± 10%)	50 Hz	<300 VA
2.679.0228 version	100 ... 117 V (± 10%)	50 Hz	<300 VA

8.679.1013 Instructions for use

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Operating steps

1	Switch on instruments	6	Switch on air pump: press <AIR>, regulate air flow
2	Select method: → <USER METHODS>	7	Fill measuring vessels and insert
3	Change method: → <PARAM> (→ <CELL CONST>)	8	Sample preparation, fill reaction vessels and insert
4	Enter active channels and sample identifications: → <SAMPLE DATA>	9	Readjust air flow
5	Switch on heating: press <HEATER> when the set temperature is reached, the lamp "TEMP REACHED" lights up and a beep sounds	10	Start measurement: press <GO> Automatic measurement with evaluation and printout of the result report

Dialogue

Change: – call up parameters to be changed
– enter new value
– confirm with <ENTER>

Exit: press <QUIT>

Key	*Display*	*Meaning*	*Initial value*	*Input range*
USER METHODS	▸ recall method: Y/N ?	Method recall: yes/no	–	Y; N
	▸ recall method (1 - 9) ?	Entry of method number of current method required	–	1 ... 9
	▸ store method: Y/N ?	Storage of current method: yes/no	–	Y; N
	▸ store actual method (1 - 9) ?	Entry of number under which current method should be stored	–	1 ... 9
	▸ method x is occupied! overwrite method x: Y/N ?	Overwriting of a stored method: yes/no (appears if the method number specified is already in use)	–	Y; N
	▸ delete method: Y/N ?	Clearing of a method: yes/no	–	Y; N
	▸ delete method (1 - 9) ?	Entry of method number of method to be cleared	–	1 ... 9
	▸ method report: Y/N ?	Printout of method report with the most important parameters	–	Y; N
SAMPLE DATA	▸ active channels: x x x x x x ok: Y/N ?	Display of active channels confirm: yes/no	1 2 3 4 5 6	Y; N
	▸ active channels (1 - 6) ?	Entry of active channels for current measurement (0 = all channels)	–	0; 1 ... 6
	▸ identification channel X:	Entry of sample identification for channel X (max. 10 characters)	–	0 ... 9; .
REPORT	▸ parameter report: Y/N ?	Printout of parameter report	–	Y; N
	▸ full report: Y/N ?	Printout of results and the parameter report	–	Y; N
	▸ method report: Y/N ?	Printout of method report with the most important parameters	–	Y; N
	▸ report of stored cell const.: Y/N ?	Printout of values stored in cell constant memory	–	Y; N
	▸ RS 232 send XXX : Y/N ?	On/off switching of RS 232 output Y = confirm ; N = OFF→ON→OFF→...	OFF	Y; N
	▸ RS 232 baud rate XXXX : Y/N ?	Baud rate for RS 232 output Y = confirm ; N = change: 1200 → 2400 → 4800 → 9600 → 1200 → ...	1200	Y; N
	▸ RS 232 handshake XXX : Y/N ?	On/off switching of RS 232 handshake Y = confirm ; N = OFF→ON→OFF→...	ON	Y; N
DATE	▸ date (YY-MM-DD) : XX	Entry of date: XX = YY year XX = MM month XX = DD day	00 01 01	YY: 0 ... 99 MM: 1 ... 12 DD: 1 ... 31
	▸ time (hh:mm) : XX	Entry of time: XX = hh hours XX = mm minutes	00 00	hh: 0 ... 23 mm: 0 ... 59

Key	Display	Meaning	Initial value	Input range
PARAM	▶ temperature (50 - 220 °C)	Sample set temperature	50 °C	50 ... 220 °C
	▶ temp. correction (0.0-9.9 °C)	Temperature correction (deviation of the actual temperature of the sample from the set temperature, measured with calibration thermometer)	0 °C	+0.0 ... 9.9 °C
	▶ cond.range (20,100,200 uS/cm)	Conductivity measuring range	200 µS/cm	20; 100; 200 µS/cm
	▶ evaluation modes: x/x/x	Evaluation modes: 1 = induction time 2 = time Δt to the attainment of the preset conductivity change Δκ 3 = conductivity change Δκ during the preset time interval Δt	1/-/-	1; 2; 3
	▶ ev.mode 2: delta K (1 - 200)	Entry of conductivity change Δκ for evaluation mode 2 (requested only when ev. mode 2 is set)	50 µS/cm	1 ... 200 µS/cm
	▶ ev.mode 3: delta t (1 - 48 h)	Entry of time interval Δt for evaluation mode 3 (requested only when ev. mode 3 is set)	1 h	1 ... 48 h
	▶ delay time (0 - 48 h)	Delay time for the definitive end-point recognition; the end points appearing during this time interval are overwritten by a following end point.	0 h	0 ... 48 h
	▶ paper feed (1 - 20 cm/h)	Paper feed rate of printer	1 cm/h	1 ... 20 cm/h
	▶ x.xx x.xx x.xx x.xx x.xx x.xx cell constants ok: Y/N ?	Display of method-specific cell constants confirm: yes/no	-	Y; N
	▶ new cell constants: stored/stand.values (1/2): x?	Transfer of new cell constants to current method: 1 = stored cell constants 2 = standard cell constants (1.00 /cm)	1	1; 2
	▶ meas. time (1-48 h, >48=INF)	Analysis time; after expiry of this time the measurement is terminated automatically	48 h	1 ... 48 h; >48 = INF
	▶ end mode EP stop XXX : Y/N ?	XXX = ON: Automatic measurement termination when every active channel has reached all end points (EP) Y = confirm ; N = OFF→ON→OFF→...	OFF	Y; N
	▶ end mode heater stop XXX : Y/N ?	XXX = ON: Automatic switching off of heating on completion of measurement Y = confirm ; N = OFF→ON→OFF→...	OFF	Y; N
	▶ end mode air stop XXX : Y/N ?	XXX = ON: Automatic switching off of air supply on completion of measurement Y = confirm ; N = OFF→ON→OFF→...	OFF	Y; N
	▶ parameter report: Y/N ?	Printout of parameter report	-	Y; N
CELL CONST	▶ manual change: Y/N ?	Change in cell constants by entry via keypad	-	Y; N
	▶ cell constant (0.10-9.99 /cm) channel X:	Entry of cell constants for channel X	1.00 /cm	0.10 ... 9.99 /cm
	▶ new calibration: Y/N ?	New cell constant calibration: yes/no	-	Y; N
	▶ calibration channels: x x x x x x ok: Y/N ?	Display of channels for the calibration confirm: yes/no	1 2 3 4 5 6	Y; N
	▶ which channels (1 - 6) ?	Entry of channels to be calibrated (0 = all channels)	-	0; 1 ... 6
	▶ stand.sol.cond. (10-400 uS/cm)	Conductivity κ of standard solution	200 µS/cm	10 ... 400 µS/cm
	▶ start calibration: Y/N ?	Start calibration: yes/no	-	Y; N
	▶ * Calibration Run *	Automatic calibration is running	-	-
	▶ x.xx x.xx x.xx x.xx x.xx x.xx calibration data ok: Y/N ?	Display of new cell constant values confirm: yes/no	-	Y; N
	▶ x.xx x.xx x.xx x.xx x.xx x.xx insert into actual method:Y/N?	Transfer of displayed cell constants to current method (method 0): yes/no	-	Y; N
	▶ x.xx x.xx x.xx x.xx x.xx x.xx store new cell constants: Y/N?	Transfer of displayed cell constants to cell constant memory: yes/no	-	Y; N
	▶ report of stored cell const.: Y/N	Printout of values stored in cell constant memory	-	Y; N

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8.679.1013 Instructions for Use
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679 Rancimat

Instructions for Use

1. Introduction

The 679 Rancimat is an instrument for the determination of oxidative and thermal stabilities. In the case of oils and fats or substances containing oils and fats, the stability towards oxidative decomposition can be determined; for PVC or similar halogenated plastics determination of the thermal stability is possible.

The 679 Rancimat comprises a control unit and a wet section for 3 or 6 rection and measuring vessels (see *Fig. 1*).

In the **wet section**, the samples are exposed to a stream of atmospheric oxygen at elevated temperature. In the case of oils and fats, this gives rise to organic acids; with PVC or other halogenated polymers, hydrogen halides are formed. The volatile decomposition products are trapped in a measuring vessel filled with distilled water and continuously detected with a conductivity cell.

The **control unit** assumes control and evaluation of the measurements running in the wet section. The dialogue is effected via the two-line LCD display and the keypad. Curves and results are outputted on the built-in printer.

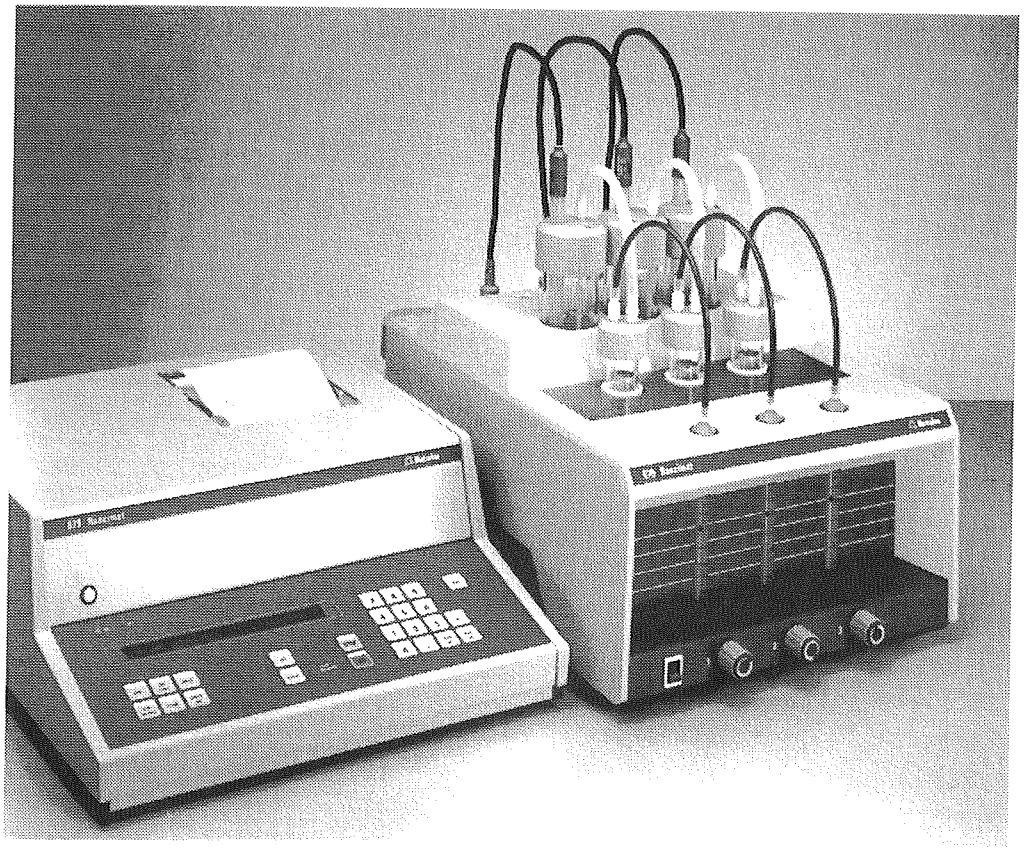


Fig. 1: 679 Rancimat with control unit and wet section

2. Control Elements

2.1. Control unit

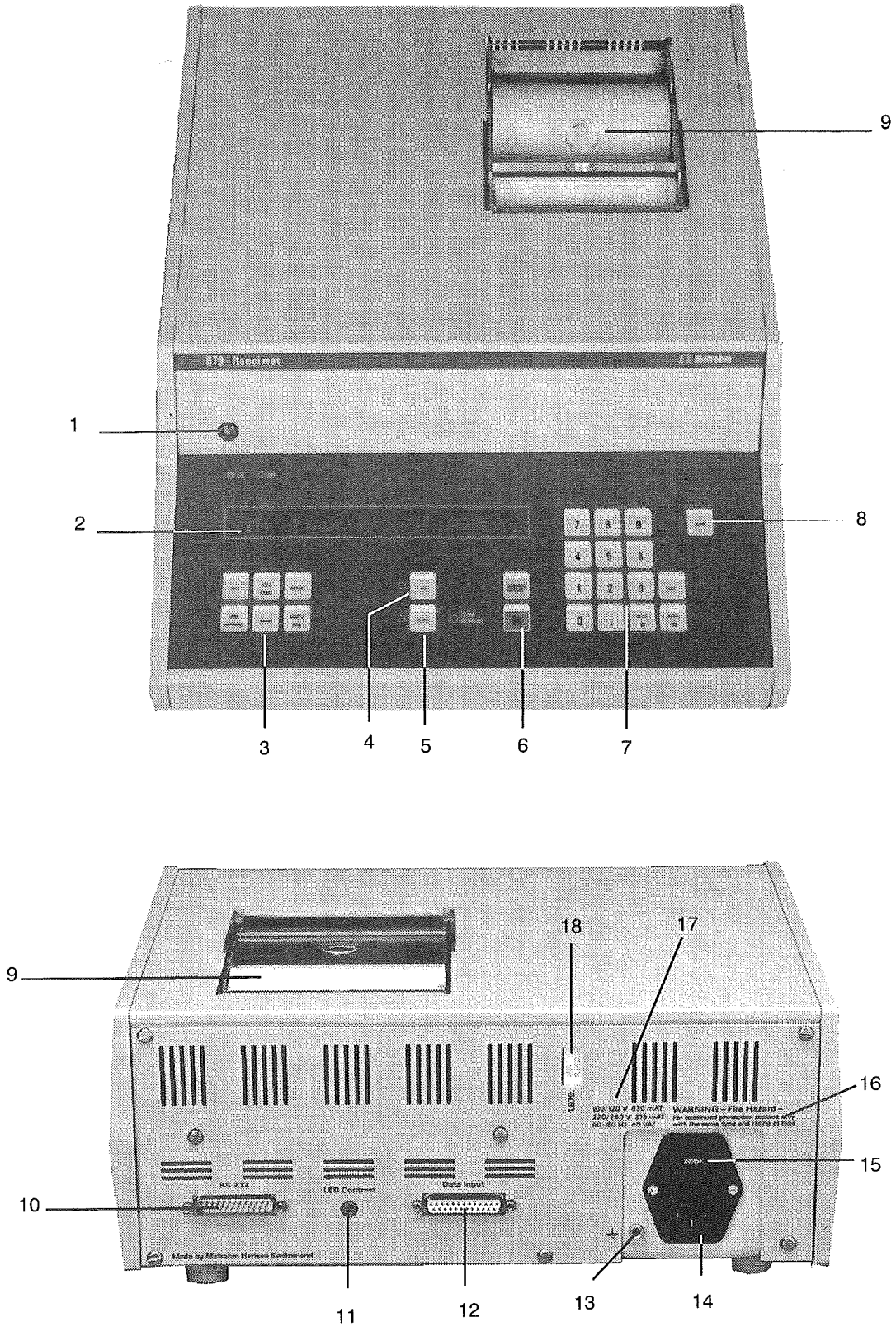


Fig. 2: Front and rear of the Rancimat control unit

1 ***ON/OFF***
Pushbutton to switch the instrument on and off (mains switch)

Switching on: Press button in firmly.
Operational readiness is shown by lighting up of the LCD display (**2**).

Switching off: Press button in firmly.
The LCD display (**2**) blanks out.

2 ***LCD display*** (2 × 40 characters)
The contrast of the LCD display can be adjusted with adjustment screw (***11***).

3 ***Function keys*** (for a detailed description, see Section 4.1)

4 ***On/off key for air supply pump in wet section***
When the pump is switched on, the red LED lamp at the *left* of the key lights up.

5 ***On/off key for heating in wet section***
When the heating is switched on, the red LED at the *left* of the key lights up.
The red LED at the *right* of the key ("TEMP REACHED") lights up as soon as the set temperature is reached and remains stable (temperature constancy ± 0.1 °C).

6 ***Main function keys***

GO: start the measurement

STOP: terminate the measurement

7 ***Numeric keypad*** (for a detailed description, see Section 4.1)

8 ***Key for printer paper feed***

9 ***Built-in thermal printer*** (paper insertion, see Section 3.5)

10 ***RS 232 C data output*** (details, see Section 8.3)

11 ***Adjustment screw for LCD display contrast (2)***

12 ***Socket for connection of Rancimat wet section via 6.2127.000 Connecting Cable***

13 ***Earth socket***

14 ***Mains connection***
Cold appliance plug, type CEE(22), VI

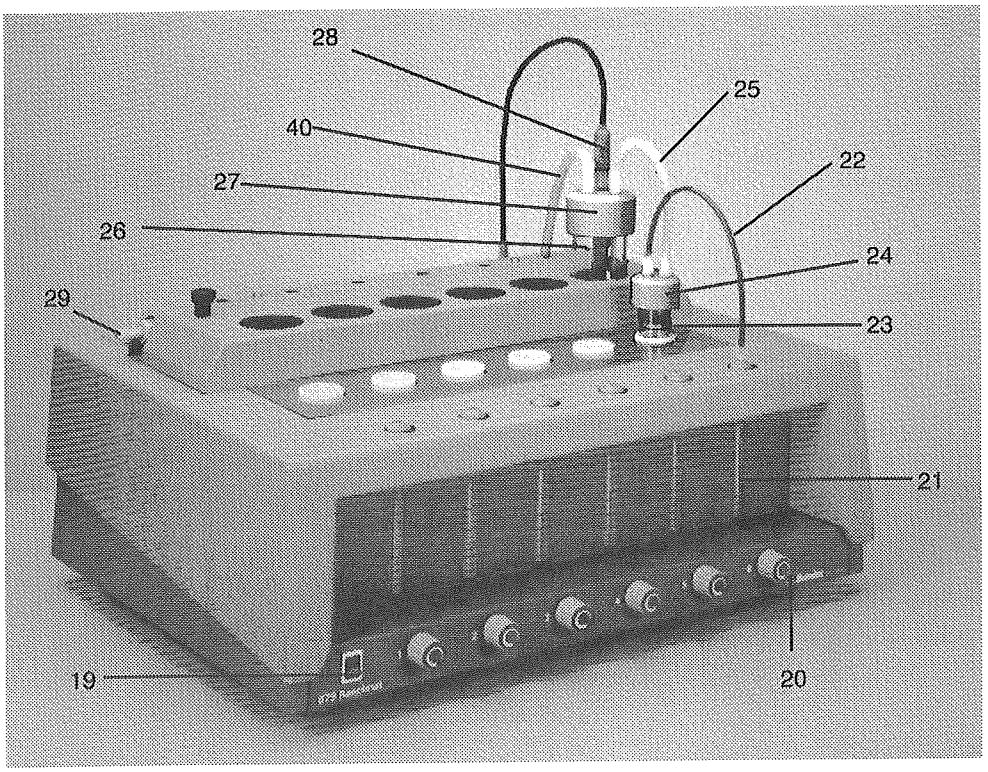
15 ***Display of set mains voltage***
(mains voltage alteration and fuse replacement, see Section 3.3)

16 ***Important information:***
"WARNING - Fire Hazard –
For continued protection replace only with the same type and rating of fuse"

17 ***Fuse and power consumption data***

18 ***Rating plate***
Specification of model, series and instrument number.
In any inquiry to Metrohm Switzerland or your national Metrohm agency, all these numbers must be quoted in full!

2.2. Wet section for 6 samples



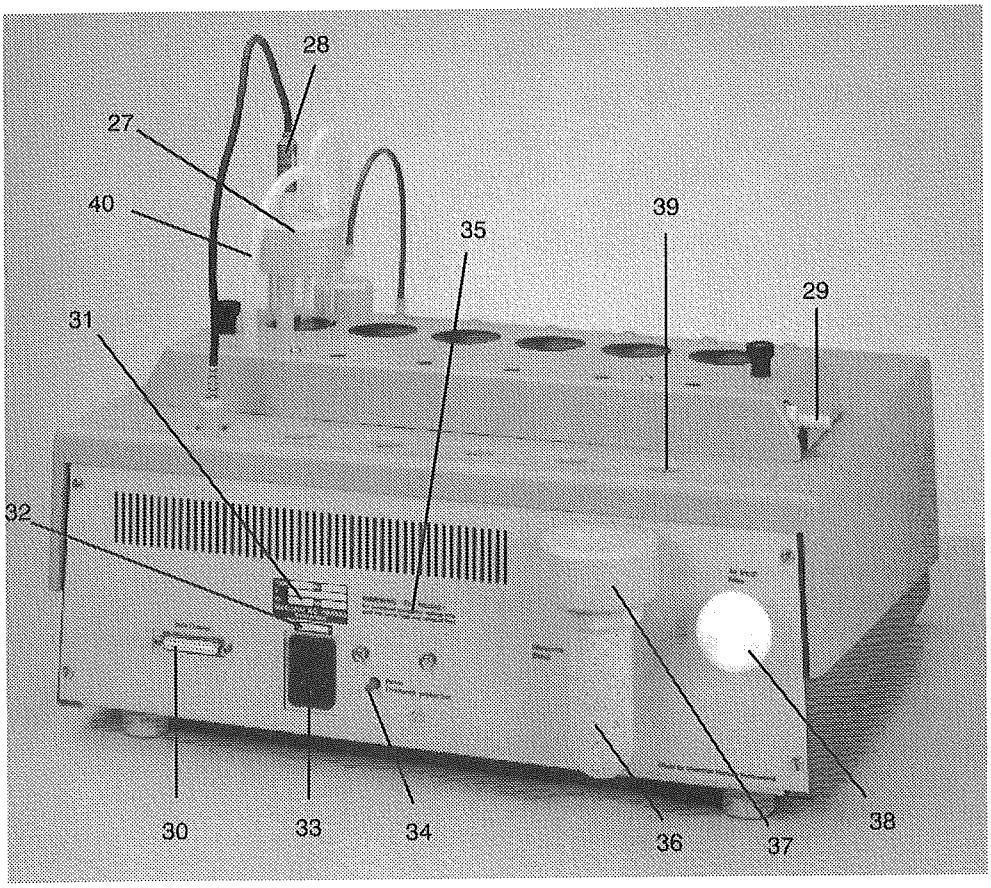


Fig. 3: Front and rear of Rancimat wet section for 6 samples

No.	Designation	Order Number
19	***Mains switch*** On/off switching of instrument (0 = OFF) The lamp in the switch lights up on operational readiness	–
20	***Air regulation*** Adjustment of the air flow through the reaction vessel (***23***)	–
21	***Flowmeter*** Adjustable range: 4 ... 25 L/h	–
22	***Connecting tubing*** between flowmeter and reaction vessel (***23***). The plastic screw connections may be tightened on assembly only by hand or with the 6.2739.000 Open-end Wrench	***6.1805.080***
23	***Reaction vessel***	***6.1429.030***
24	***Reaction vessel attachment***	***6.2753.010***
25	***Transfer tubing***	***6.1816.010***
26	***Measuring vessel***	***6.1428.010***
27	***Measuring vessel attachment***	***6.2753.020***
28	***Double platinum conductivity cell***	***6.0911.120***
29	***Waste air outlet*** Tubing for controlled lead-off of the waste air can be connected to the outlet nipple	–
30	***Socket for connection of the Rancimat control unit via 6.2127.000 Connecting Cable***	–
31	***Rating plate*** 1st line: Specification of the model, serial and instrument number. In any inquiry to Metrohm Switzerland or your national Metrohm agency, all these numbers must be quoted in full! 2nd line: Mains voltage data 3rd line: Mains frequency and power consumption data	–
32	***Fuse data*** (fuse replacement, see Section 3.3)	–
33	***Mains connection*** Cold appliance plug, type CEE(22), VI	–
34	***Button to reset the overtemperature fuse*** The overtemperature fuse blows at 250°C.	–
35	***Important information:*** "WARNING - Fire Hazard - For continued protection replace only with the same type and rating of fuse"	–
36	***Molecular sieves container with molecular sieves*** for the absorption of interfering oxidizing gases as well as water in the air stream (filling, see Section 3.2.1; maintenance, see section 7.1)	***6.2811.000***
37	***Screw collar*** for clamping the molecular sieves container	–
38	***Dust filter*** for filtering the air aspirated by the pump (maintenance, see Section 7.1)	***6.2724.010***
39	***Connection of the 6.0911.120 Conductivity Cell***	–
40	***Connecting tubing between measuring vessel and waste air manifold*** (tubing replacement, see Section 7.1)	***6.1816.010***

2.2. Wet section for 3 samples

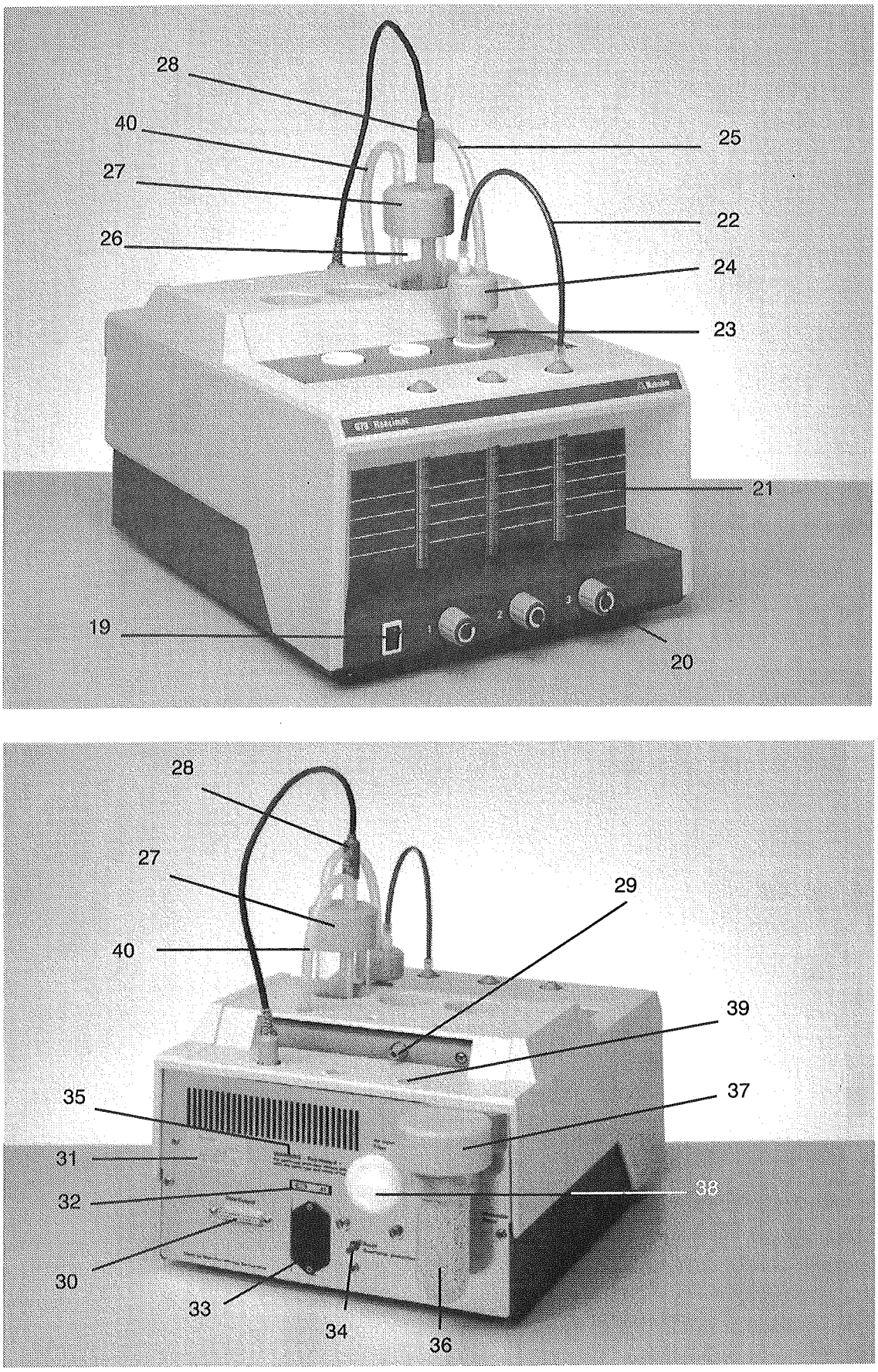


Fig. 4: Front and rear of Rancimat wet section for 3 samples

No.	Designation	Order Number
19	***Mains switch*** On/off switching of instrument (0 = OFF) The lamp in the switch lights up on operational readiness	–
20	***Air regulation*** Adjustment of the air flow through the reaction vessel (***23***)	–
21	***Flowmeter*** Adjustable range: 4 ... 25 L/h	–
22	***Connecting tubing*** between flowmeter and reaction vessel (***23***). The plastic screw connections may be tightened on assembly only by hand or with the 6.2739.000 Open-end Wrench	***6.1805.080***
23	***Reaction vessel***	***6.1429.030***
24	***Reaction vessel attachment***	***6.2753.010***
25	***Transfer tubing***	***6.1816.010***
26	***Measuring vessel***	***6.1428.010***
27	***Measuring vessel attachment***	***6.2753.020***
28	***Double platinum conductivity cell***	***6.0911.120***
29	***Waste air outlet*** Tubing for controlled lead-off of the waste air can be connected to the outlet nipple	–
30	***Socket for connection of the Rancimat control unit via 6.2127.000 Connecting Cable***	–
31	***Rating plate*** 1st line: Specification of the model, serial and instrument number. In any inquiry to Metrohm Switzerland or your national Metrohm agency, all these numbers must be quoted in full! 2nd line: Mains voltage data 3rd line: Mains frequency and power consumption data	–
32	***Fuse data*** (fuse replacement, see Section 3.3)	–
33	***Mains connection*** Cold appliance plug, type CEE(22), VI	–
34	***Button to reset the overtemperature fuse*** The overtemperature fuse blows at 250°C.	–
35	***Important information:*** "WARNING - Fire Hazard - For continued protection replace only with the same type and rating of fuse"	–
36	***Molecular sieves container with molecular sieves*** for the absorption of interfering oxidizing gases as well as water in the air stream (filling, see Section 3.2.1; maintenance, see section 7.1)	***6.2811.000***
37	***Screw collar*** for clamping the molecular sieves container	–
38	***Dust filter*** for filtering the air aspirated by the pump (maintenance, see Section 7.1)	***6.2724.010***
39	***Connection of the 6.0911.120 Conductivity Cell***	–
40	***Connecting tubing between measuring vessel and waste air manifold*** (tubing replacement, see Section 7.1)	***6.1816.010***

2.3. Wet section accessories

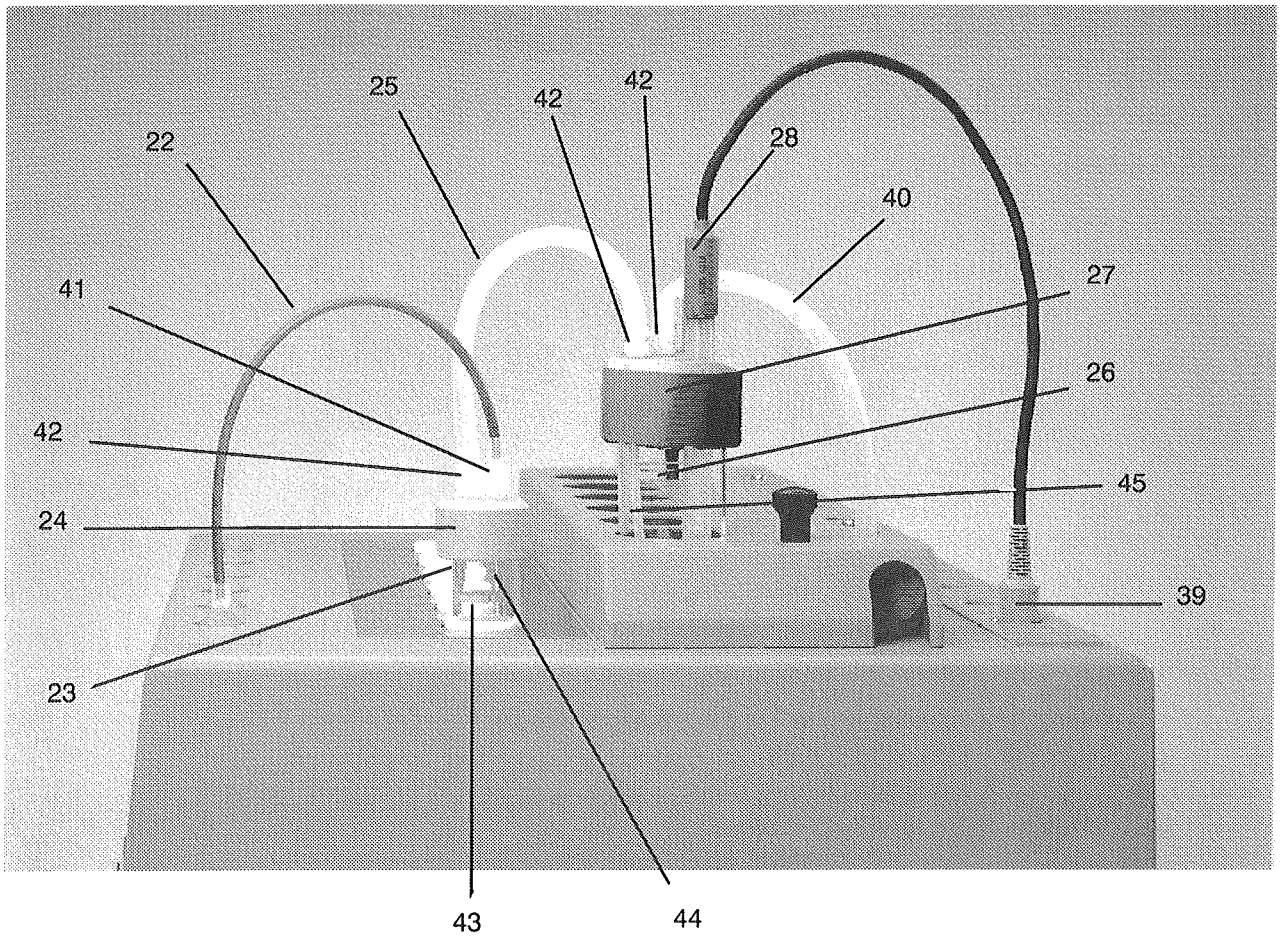


Fig. 5: Accessories for the measurement

No.	Designation	Order Number
22	***Connecting tubing*** between flowmeter and reaction vessel (***23***). The plastic screw connections may be tightened on assembly only by hand or with the 6.2739.000 Open-end Wrench.	***6.1805.080***
23	***Reaction vessel***	***6.1429.030***
24	***Reaction vessel attachment***	***6.2753.010***
25	***Transfer tubing***	***6.1816.010***
26	***Measuring vessel***	***6.1428.020***
27	***Measuring vessel attachment***	***6.2753.020***
28	***Double platinum conductivity cell***	***6.0911.120***
39	***Connection of the 6.0911.120 Conductivity Cell***	–
40	***Connecting tubing between measuring vessel and waste air manifold*** (tubing replacement, see Section 7.1)	***6.1816.010***
41	***Adapter M8/M6*** with thread lug for connecting tubing (***22***)	***6.1808.090***
42	***Olive connector***	***6.1808.050***
43	***Foam barrier*** cramped on the air inlet tube (***44***)	***6.1451.010***
44	***Air inlet tube*** for oil/fat for PVC	***6.2418.0X0*** 6.2418.000 6.2418.010
45	***PTFE tubing***	***6.1819.050***

3. Installation and Preparations

3.1. Setting up the instruments

The 679 Rancimat (comprising control unit and wet section) is supplied together with the separately packed accessories in two special packages designed to afford maximum protection. These contain shock-absorbent foam liners foamed to the individual shape and wrapped in blue plastic sheeting. The instruments themselves are packed in an evacuated, dustproof polyethylene bag. It is advisable to keep the special packaging since it alone ensures that the instruments suffer no damage if they have to be returned.

Immediately after receipt of the shipment, a check must be made to ensure that it is complete and free from damage (compare with delivery note and accessories list in Section 9). If transport damage has occurred, see instructions in Section 10 "Warranty".

The 679 Rancimat should be set up in the laboratory at a location suitable for operation, free from vibration and protected from any corrosive atmosphere and contamination by chemicals. Since the control unit and the wet section are linked by a 5 m cable, each unit can be set up at a different location. It is advisable to set up the wet section in a fume cupboard to guard against odour emission, but the control unit can be positioned outside on the regular laboratory bench.

3.2. Preparation of the wet section

3.2.1. Fitting the dust filter and filling the molecular sieves container

The 6.2724.010 **Dust Filter** (***38***) in the accessories is mounted on the opening at the rear of the Rancimat wet section designated "Air Input Filter" (see *Fig. 3/4*). The dust filter is used to filter the air aspirated by the air pump and must be replaced at intervals (see Section 7.1).

For the absorption of interfering oxidizing gases as well as water in the aspirated air, the accessories of the 679 Rancimat include a bottle of **molecular sieves** with indicator which must be added to the molecular sieves container (***36***) (see *Fig. 3/4*) at the rear of the wet section. The procedure is as follows:

1. Undo screw collar (***37***) and remove molecular sieves container (***36***)
2. Remove attachment with inlet tube from the molecular sieves container (***36***)
3. Fill molecular sieves container (***36***) with 6.2811.000 Molecular Sieves
4. Replace attachment with inlet tube on molecular sieves container (***36***)
5. Lay a circular 6.2810.000 Paper Filter on the closed molecular sieves container (***36***)
6. Reattach molecular sieves container (***36***) to the Rancimat wet section by tightening the screw collar (***37***) firmly.

If the majority of molecular sieves pellets have become brown, their capacity to absorb water is exhausted; they can be regenerated in a drying oven at approx. +140 ... +180°C for a period of 24 ... 48 h (see Section 7.1). The 6.2810.000 Paper Filter should also be replaced periodically (see Section 7.1).

3.2.2. Attaching the accessories

Fig. 5 shows in detail how the accessories for the **measurement** of the oxidative stability and thermal stability are attached and connected with one another. The procedure is as follows:

1. Insert air inlet tube (***44***) (for oil/fat 6.2418.000, for PVC 6.2418.010) from below in one of the two openings of the reaction vessel attachment (***24***). Push ring seal 6.1454.040 over the air inlet tube (***44***). Mount adapter (***41***) on air inlet tube (***44***) and screw into the opening of the reaction vessel attachment (***24***) by hand. Screw olive connector (***42***) into the other opening of the reaction vessel attachment (***24***). If need be, clamp foam barrier (***43***) from the side to the air inlet tube (***44***).

2. Insert reaction vessel (***23***) in the opening provided on the wet part. Mount the prepared reaction vessel attachment (***24***) on the reaction vessel (***23***) to the stop.

3. Screw one end of the connecting tubing (***22***) to the air supply connection on the top section of the wet part and the other end to the adapter (***41***) on the reaction vessel attachment (***24***). Tighten the plastic screw fittings only by hand or using open-end spanner 6.2739.000.

4. Insert measuring vessel (***26***) in the opening provided on the wet part. Mount measuring vessel attachment (***27***) on measuring vessel (***26***).

5. Insert PTFE tubing (***45***) from above in one of the two smaller openings of the measuring vessel attachment (***27***) and screw olive connector (***42***) into this opening. Attach one end of the transfer tubing (***25***) to this olive connector (***42***) and the other end to olive connector (***42***) screwed to the reaction vessel attachment (***24***).

   Note: *It must be ensured that there is no obstruction between the reaction vessel and the measuring vessel otherwise there is a danger that an overpressure will build up in the reaction vessel and the sample will be sucked back when the air supply is shut off!*

6. Also screw a olive connector (***42***) into the ot her small opening of the measuring vessel attachment (***27***) and attach connecting tubing (***40***) to this. Place the other end of the connecting tubing (***40***) in the opening of the exhaust air manifold on the wet part.

7. Insert double platinum conductivity cell (***28***) in the large opening of the measuring vessel attachment (***27***) as far as it will go and attach to connection (***39***) of the wet part.

To lead off the waste air in a specific direction (e.g. into a fume hood), tubing can be attached to the outlet (***28***) of the waste air manifold (see *Fig. 3/4*).

To hold the assembled reaction vessels before and after the measurement, the 6.2041.190 Vessel Holder supplied as an accessory is used.

3.2.3. Connecting the wet section to the control unit

The Rancimat wet section is attached to the control unit with the 5 m 6.2127.000 Connecting Cable. The cable connector is plugged into socket (***30***) "Data Output" (see *Fig. 3/4*) of the wet section and into socket (***12***) "Data Input" (see *Fig. 2*) of the control unit, and firmly attached to the instruments by tightening the two black screws.

3.3. Mains connection

Control unit

Before the Rancimat control unit is switched on for the first time, a check should be made to see whether the mains voltage set on the instrument (seen in display (***15***) above the mains connection (***14***), see *Fig. 2*) matches the local mains voltage. If this is not the case, the voltage must be reset as follows:

1. Disconnect mains cable.
2. Open plastic cover above the mains connection (***14***) with the aid of a screwdriver.
3. Take out voltage selector drum and turn to correct position. (Never try to turn the drum while still inserted!)
4. Remove fuse below the voltage selector drum and compare its specifications with the data (***17***) on the rear panel. Replace fuse if necessary.
5. Press plastic cover in until it engages properly.

The instrument is supplied with one of three mains cables:

6.2122.020	with plug	SEV 12 (Switzerland ...)
6.2122.040	with plug	CEE(7), VII (Federal Republic of Germany ...)
6.2122.070	with plug	NEMA/ASA (USA ...)

which are three-core and equipped with a plug with earthing pin. If a different plug has to be fitted, the yellow/green lead (IEC standard) must be connected to the protective earth. If no socket with earthing is available, the instrument must be connected to a perfect earthing conductor via its earthing socket (***13***) (⏚, protection class 1). The mains cable is plugged into connection socket (***14***).

Wet section

Before the Rancimat wet section is switched on for the first time, a check should be made to see whether the data specified on the rating plate (***31***) for mains voltage and mains frequency (see *Fig. 3/4*) match the local voltage (this had to be specified when ordering). If this is not the case, Metrohm Service must be informed.
To check or to replace the fuse, the procedure is as follows:

1. Disconnect mains cable.
2. Release arrestment of the fuse holder above the mains connection (***33***) with the aid of a screwdriver.
3. Take out fuse holder and compare specifications of the fuse with the data (***32***) on the rear panel of the instrument. Replace fuse if necessary.
4. Replace fuse holder until the arrestment engages.

The instrument is supplied with one of three mains cables:

6.2122.020	with plug	SEV 12 (Switzerland ...)
6.2122.040	with plug	CEE(7), VII (Federal Republic of Germany ...)
6.2122.070	with plug	NEMA/ASA (USA ...)

which are three-cored and equipped with a plug with earthing pin. If a different plug has to be fitted, the yellow/green lead (IEC standard) must be connected to the protective earth (protection class 1). If the wet section is connected to the control unit via the 6.2127.000 Connecting Cable, it is earthed automatically via the control unit. The mains cable is plugged into connection socket (***33***).

3.4. Switching the instruments on and off

Control unit

The control unit is switched on using the mains pushbutton (*1*) at the front of the instrument: Press the button firmly and wait for check of the display dots. Operational readiness is shown by lighting up of the LCD display (*2*).

The contrast of the LCD display (*2*) can be adjusted by means of the adjustment screw (*11*) at the rear of the Rancimat control unit (see *Fig. 2*).

Wet section

The wet section is switched on with the mains switch (*19*) at the front of the instrument. Operational readiness is shown by lighting up of the red lamp in the mains switch.

3.5. Paper insertion, printer

Replacing and insertion of the heat-sensitive paper of the control unit printer (*9*) must be performed when the instrument is switched on. Pull out old heat-sensitive paper strip and cut the top of the paper of the new roll to form a point. When inserting the heat-sensitive paper, lift up the movable plexiglass plate and hold the roll such that the paper runs off the roll from below. Push the paper strip from behind under the transport roller until it is picked up when the key <PAPER> is pressed. Insert the spindle in the heat-sensitive paper roll then position spindle in the appropriate slots.

Please note:

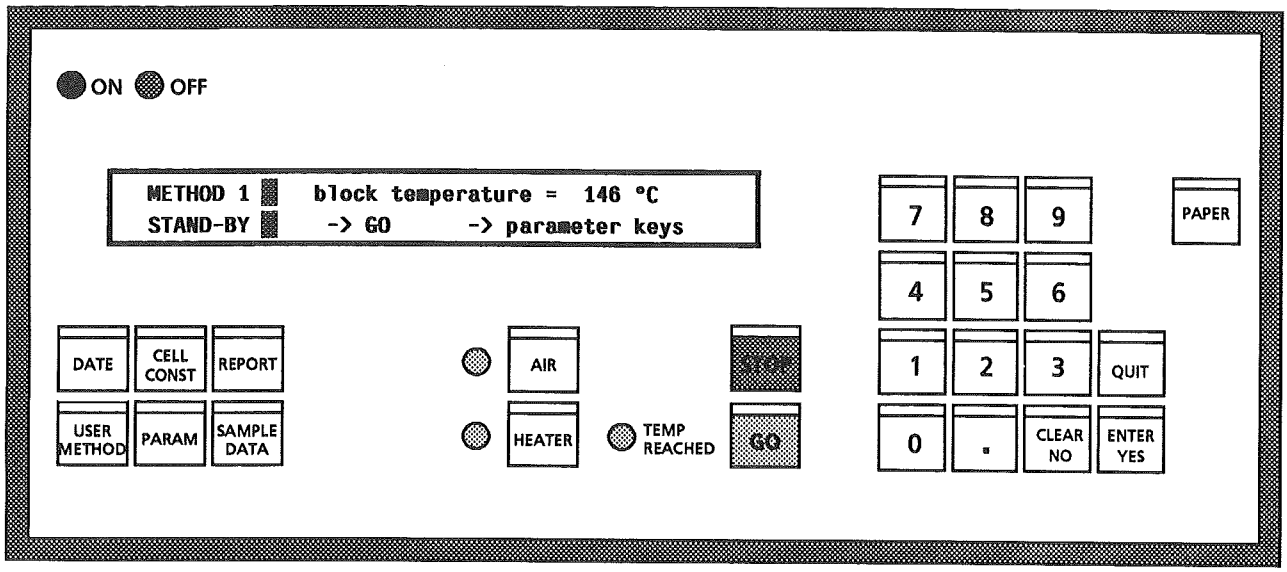
- Heat-sensitive paper has only a limited light resistance.
- When stored in plastic folders, printed heat-sensitive paper can become unreadable (plasticizer).
- Use only the original 6.2237.030 heat-sensitive paper (otherwise damage to the print head can ensue).
- Never operate printer without heat-sensitive paper.

If the printer no longer works properly, it is possible that the print head is dirty. Cleaning of the print head can be effected by inserting a strip of heat-sensitive paper of sufficient length back to front in the printer and "printing out" a report a few times.

4. Operation of the Control Unit

4.1. Keypad

The keypad of the 1.679.0020 Control Unit has the following appearance:

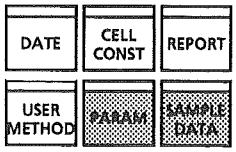


LCD display (2 x 40 characters)

Inquiries and displays:
Parameters, entries, special and error messages

Display of instrument status:

METHOD X	Loaded user method
STAND-BY	Standby condition
HEAT UP	Heating phase with measurement started
* RUN *	Measurement
<KEY>	Display of selected function key



Function keys

Keys with rolling inquiry, i.e. repeated pressing of these keys continues to bring new inquiries into the display. A new value can be entered with the aid of the numeric keys and the <ENTER> key. After the <ENTER> key has been pressed, the next inquiry appears automatically. On completion of such an inquiry sequence, the instrument returns to the standby condition.

<DATE>	Entry/change of date and time
<CELL CONST>	Entry/change of cell constants
<REPORT>	Printout of reports
<USER METHODS>	Management of method memory
<PARAM>	Entry/change of method parameters
<SAMPLE DATA>	Entry of sample data

Keys which are also accessible via **live keyboard**, i.e. certain inquiries under these keys are accessible during a measurement up to output of the data.

On/off key for the heating in the wet section

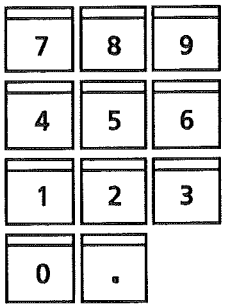
When the heating is switched on, the red lamp at the *left* of the key lights up. The red lamp at the *right* of the key ("TEMP REACHED") lights up as soon as the set temperature is reached and remains stable within ±0.1°C. The Rancimat is then ready for the analysis of samples.

On/off key for the air supply pump in the wet section

When the pump is switched on, the red lamp at the *left* of the key lights up.

Key to start measurement

Key to stop measurement



Numeric keypad

Numeric keys 1 ... 9 and . (decimal point)

Key <CLEAR / NO>

- clears inputted and displayed values
- used to reject (NO) certain inquiries
- used to actuate (ON↔OFF) certain input parameters

Key <ENTER / YES>

- acceptance key, parameter values are acknowledged with <ENTER> and stored
- used to affirm (YES) certain inquiries

Key <QUIT>

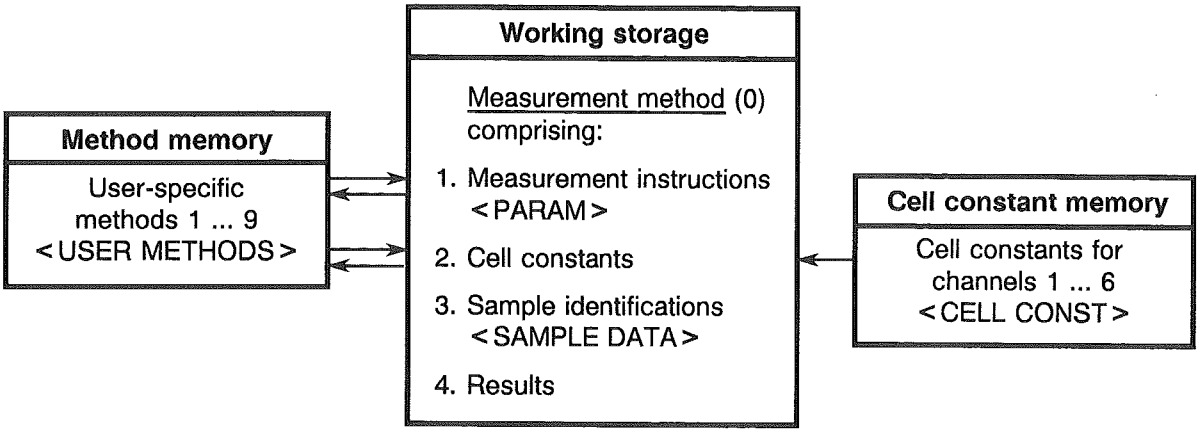
used for immediate exit from a partially completed task and return to instrument standby condition

- exit from rolling inquiries
- exit from calibration of cell constants
- exit from value entry
- exit from measurement started before set temperature reached
- exit from data output (aborts printout of a data record)

Key for printer paper feed

4.2. Memory organization

The non-volatile memory area (RAM) of the 679 Rancimat is organized as follows:



The arrows indicate the communication direction:

- (Modified) measurement methods with the method-specific data (measurement instructions and cell constants) can be stored in the method memory.
- Measurement methods with the method-specific data (measurement instructions and cell constants) can be loaded from the method memory into the working memory.
- Values for the cell constants can be loaded into the working memory from the cell constant memory.

The working memory

The following types of data are stored in the working memory:

- **Method-specific data**
  1 complete measurement method with all details specific to the method (method 0)
  (key <PARAM>)
  A current measurement method in the working memory is overwritten when another measurement method is loaded into the working memory from the method memory.

- **Cell constants**
  Method-specific values for channels 1 ... 6
  The current values of the loaded method can be overwritten by transfer of cell constants from the cell constant memory or by standard values.

- **Sample identifications**
  Sample identifications are entered under the key <SAMPLE DATA> and remain stored (even after the instrument has been switched off) until overwritten by new identifications.

- **Results**
  The calculated results remain stored until the start of a new measurement (by pressing the <GO> key) (even after the instrument has been switched off).

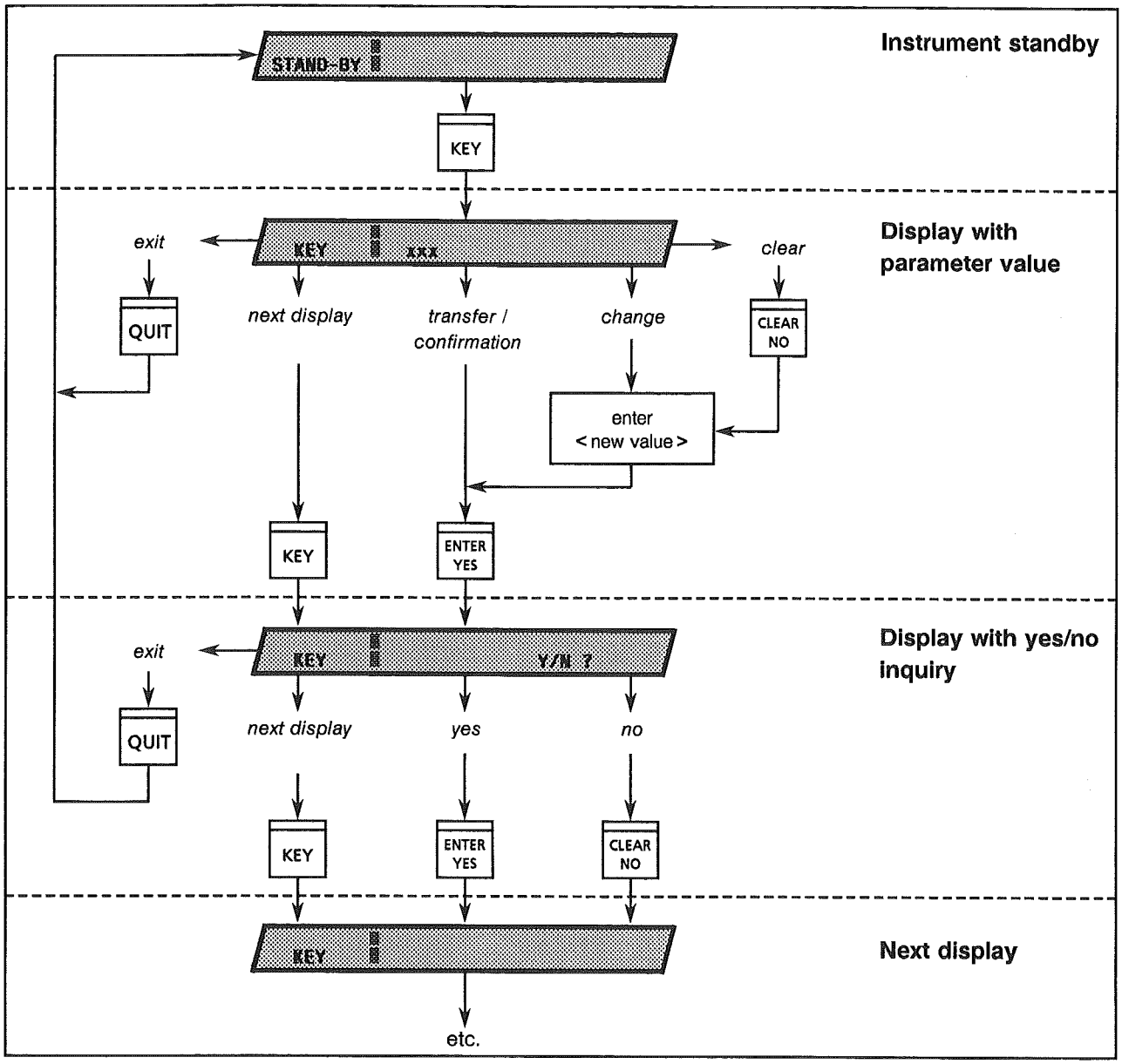
The method memory

The method memory offers storage space for max. 9 user methods. This memory is managed with the key <USER METHODS>.

The cell constant memory

A set of values specific to the instrument for the cell constants of channels 1 ... 6 is stored in the cell constant memory. These values are entered either manually or in the automatic calibration with the key <CELL CONST>.

4.3. Flow chart for rolling inquiries



In the instrument standby condition (display: STAND-BY) rolling inquiries can be initiated with the following keys: <PARAM>, <USER METHODS>, <CELL CONST>, <SAMPLE DATA>, <DATE>, <REPORT>. In addition, certain inquiries can also be accessed during the measurement with the keys <PARAM> and <SAMPLE DATA> (display: * RUN *) (*live keyboard*).

- **Stepping through the inquiry drum:** press <key X>
  at end of the inquiry drum, return to instrument standby
- **Confirm parameter values:** press <ENTER / YES>
- **Change parameter values:** enter new value (the old value is overwritten) and press <ENTER / YES>, *or*
  press <CLEAR / NO> (the displayed value is cleared), enter new value and press <ENTER / YES>
- ***Affirm inquiry:*** press <ENTER / YES>
- ***Reject inquiry:*** press <CLEAR / NO>
- ***Exit rolling inquiries:*** press <QUIT>
  possible at any time (even during the entry of new values), return to instrument standby

4.4. Data entries

4.4.1. Key <USER METHODS>

The key <USER METHODS> is used for management of the method memory. It is organized as a rolling inquiry and is not accessible during the measurement.

Detailed description of the inquiries

```
USER    recall method:
METHODS      Y/N ?
```

Recall of a stored user method to the working memory: yes/no ?

Entry: <YES>
<NO>

```
USER    recall method (1 - 9) ?
METHODS      x
```

Recall of the user method to the working memory:
Entry of the method number (1 ... 9).

Entry: <X> X: 1...9
<ENTER>

If nothing is stored under the recalled method number, the default values are loaded.

```
USER    store method:
METHODS      Y/N ?
```

Storage of the current method (method 0) in the method memory: yes/no ?

Entry: <YES>
<NO>

```
USER    store actual method (1 - 9) ?
METHODS      x
```

Storage of the current method (method 0) in the method memory:
Entry of the method number (1 ... 9).

Entry: <X> X: 1...9
<ENTER>

If a method is already stored under the recalled method number, the following display appears:

```
USER    method x is occupied!
METHODS overwrite method x:  Y/N ?
```

Method X in the method memory is already occupied! Should this method be overwritten: yes/no ?

Entry: <YES>
<NO>

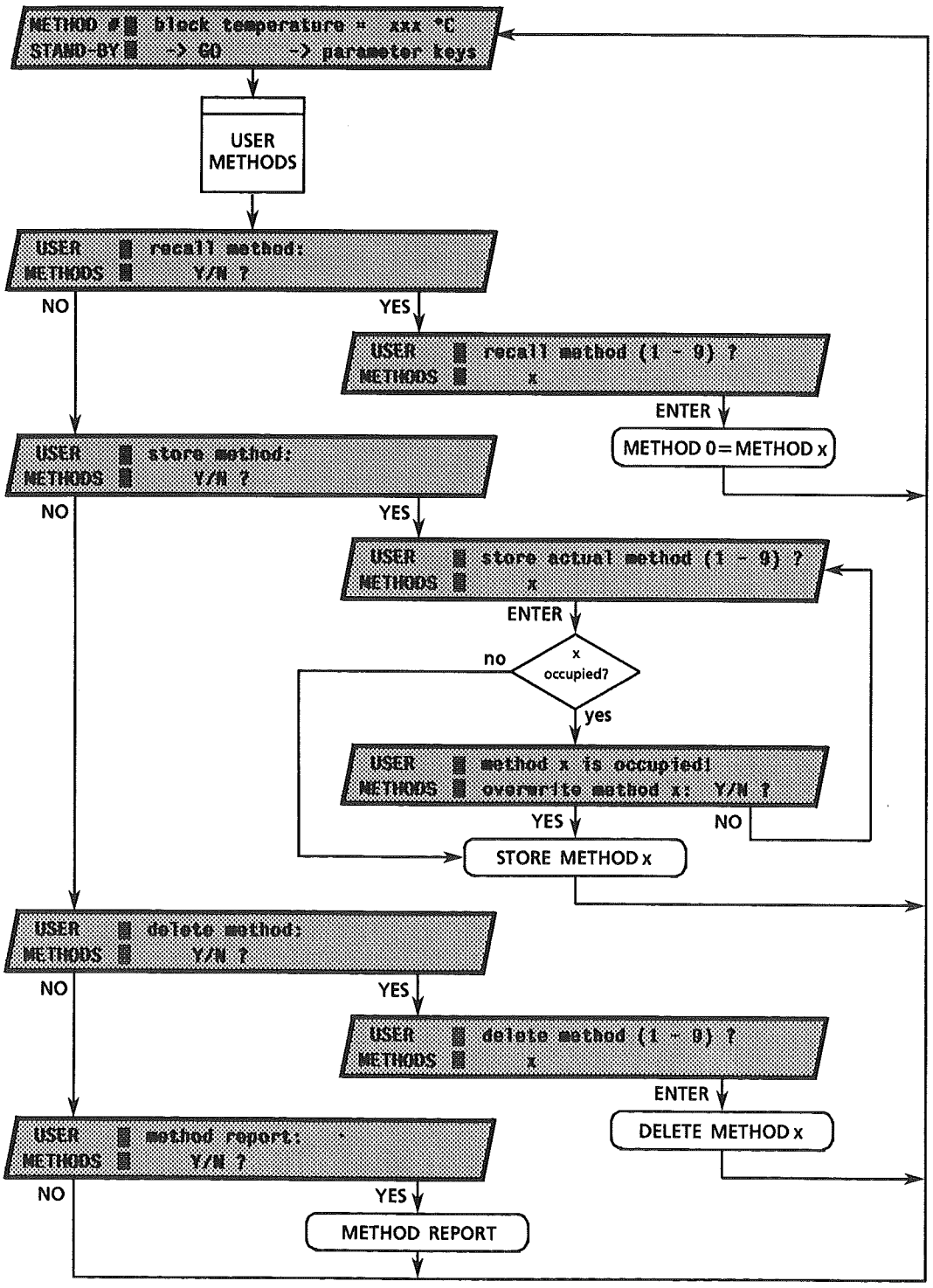
```
USER    delete method:
METHODS      Y/N ?
```

Clearing a method in the method memory: yes/no ?

Entry: <YES>
<NO>

USER ▒ delete method (1 - 9) ? METHODS ▒ x	*Clearing a method in the method memory:* Entry of the method number (1 ... 9). Entry: <X> X: 1...9 <ENTER>
USER ▒ method report: METHODS ▒ Y/N ?	*Printout of the method report: yes/no ?* Entry: <YES> <NO> Method report: see Section 4.5.4

Flow chart <USER METHODS>



4.4.2. Key <PARAM>

The key <PARAM> is used to enter parameters for the current measurement method. It is organized as a rolling inquiry. The displays marked with "**live keyboard*" can also be accessed during the measurement.

Detailed description of the inquiries

PARA- temperature (50 - 220 °C)
METERS xxx °C

**live-keyboard*

Set temperature of the sample in the wet section (50...220°C)

Entry: <XXX> XXX: 50 ... 220
<ENTER>

Default value: 50°C

This parameter can be changed during the measurement. The following message then appears in the result report: `Temperature has been changed!`

PARA- temp. correction (0.0-9.9 °C)
METERS x.x °C

Temperature correction (0.0 ... 9.9°C)

Entry: <X.X> X.X: 0.0 ... 9.9
<ENTER>

Default value: 0°C

The temperature correction ΔT is used to compensate deviations of the temperature in the reaction vessel from that in the heating block. The temperature correction ΔT can be determined by a temperature calibration (see Section 5.1) from the values T_{set} (set temperature) and T_{cal} (measured temperature in the sample).

$$\Delta T = T_{set} - T_{cal}$$

In the actual measurement, the heating block is heated above the set temperature by the amount ΔT so that the temperature in the reaction vessel is exactly the same as the set temperature entered as "`temperature`".

PARA- cond. range (20,100,200 uS/cm)
METERS xxx uS/cm

Conductivity measuring range (20; 100; 200 µS/cm)

Entry: <XXX> XXX: 20, 100, 200
<ENTER>

Default value: 200 µS/cm

PARA- evaluation modes:
METERS x/x/x ok: Y/N ?

Display of the evaluation modes:

1 = induction time
2 = stability time Δt up to attainment of the preset conductivity change $\Delta\kappa$
3 = conductivity change $\Delta\kappa$ during the preset time interval Δt

Entry: <YES> ⇒ confirmation
<NO> ⇒ change of the evaluation modes (next display)

You will find more detailed information regarding the individual evaluation modes in Section 6.3.

PARA- evaluation modes (1 2 3) ?
METERS xyz

Entry/change of the evaluation modes (1; 2; 3)

Entry: <XXX> XXX: 1;2;3;
<ENTER> 12;13;23;123

Default value: 1

The displayed values can be overwritten directly or first cleared with <CLEAR>.

```
PARA- ▒ ev.mode 2: delta K (1 - 200)
METERS ▒      xxx  uS/cm
```

Conductivity change $\Delta\kappa$
in µS/cm (1 ... 200 µS/cm) for evaluation mode 2 (determination of the time interval Δt during which this conductivity change occurs).

Entry: <XXX> XXX: 1 ... 200
<ENTER>

Default value: 50 µS/cm

This display appears only if evaluation mode 2 has been selected (see also Section 6.3.3).

```
PARA- ▒ ev.mode 3: delta t (1 - 48 h)
METERS ▒      xx  h
```

Time interval Δt
in hours (1 ... 48 h) for evaluation mode 3 (determination of the conductivity change $\Delta\kappa$ which occurs during this time interval).

Entry: <XX> XX: 1 ... 48
<ENTER>

Default value: 1 h

This display appears only if evaluation mode 3 has been selected (see also Section 6.3.4).

```
PARA- ▒ delay time (0 - 48 h)
METERS ▒      xx  h
```

Delay time
in hours (0 ... 48 h) for the definitive end-point recognition. The end points appearing during this time interval are overwritten by a following end point (see also Section 6.3.2).

Entry: <XX> XX: 0 ... 48
<ENTER>

Default value: 0 h

```
PARA- ▒ paper feed  (1 - 20 cm/h)
METERS ▒      xx  cm/h
```

**live-keyboard*

Paper feed rate
of the printer in cm/h (1 ... 20 cm/h)

Entry: <XX> XX: 1 ... 20
<ENTER>

Default value: 1 cm/h

This parameter can be altered during the measurement. The time of alteration is marked on the curve printout with an asterisk (*).

```
PARA- ▒ x.xx x.xx x.xx x.xx x.xx x.xx
METERS ▒ cell constants ok:  Y/N ?
```

Cell constants for channels 1 to 6 (in cm^{-1})

Eingabe: <YES> ⇒ confirmation
<NO> ⇒ change of the cell constants (next display)

```
PARA- ▒ new cell constants:
METERS ▒ stored/stand.values (1/2): x ?
```

Transfer of the stored (1) or the standard cell constants (2) to the current method

Entry: <1>
<ENTER> ⇒ transfer values from the cell constant memory
<2>
<ENTER> ⇒ transfer standard values (1.00 /cm)

Default value: 1

```
PARA- ▒ meas. time (1-48 h, >48=INF)
METERS ▒      xx  h
```

*live-keyboard

Analysis time in hours (1 ... 48 h)
After this time the measurement is terminated automatically.
If no automatic termination is desired, a number >48 must be entered. INF (= infinite analysis time, maximum 11 days) then appears in the display.

Entry: <XX> XX: 1 ... 48; 49 ... 99 = INF
<ENTER>

Default value: 48 h

This parameter can be changed during the measurement.

```
PARA- ▒ end mode
METERS ▒ EP stop  XXX :  Y/N ?
```

*live-keyboard

End mode **EP stop ON***:*
The measurement is terminated automatically as soon as each active channel for each enabled evaluation mode has reached an end point.

End mode **EP stop OFF***:*
The measurement is terminated only after the inputted analysis time.

Entry: <YES> ⇒ confirmation
<NO> ⇒ change of the end mode: ON ↔ OFF

Default value: OFF

This parameter can be changed during the measurement.

```
PARA- ▒ end mode
METERS ▒ heater stop  XXX :  Y/N ?
```

*live-keyboard

End mode **heater stop ON***:*
The heating is switched off automatically after termination of the measurement.

End mode **heater stop OFF***:*
The heating remains switched on after termination of the measurement.

Entry: <YES> ⇒ confirmation
<NO> ⇒ change of the end mode: ON ↔ OFF

Default value: OFF

This parameter can be changed during the measurement.

```
PARA- ▒ end mode
METERS ▒ air stop  XXX :  Y/N ?
```

*live-keyboard

End mode **air stop ON***:*
The air pump is switched off automatically after termination of the measurement.

End mod **air stop OFF***:*
The air pump remains switched on after termination of the measurement.

Entry: <YES> ⇒ confirmation
<NO> ⇒ change of the end mode: ON ↔ OFF

Default value: OFF

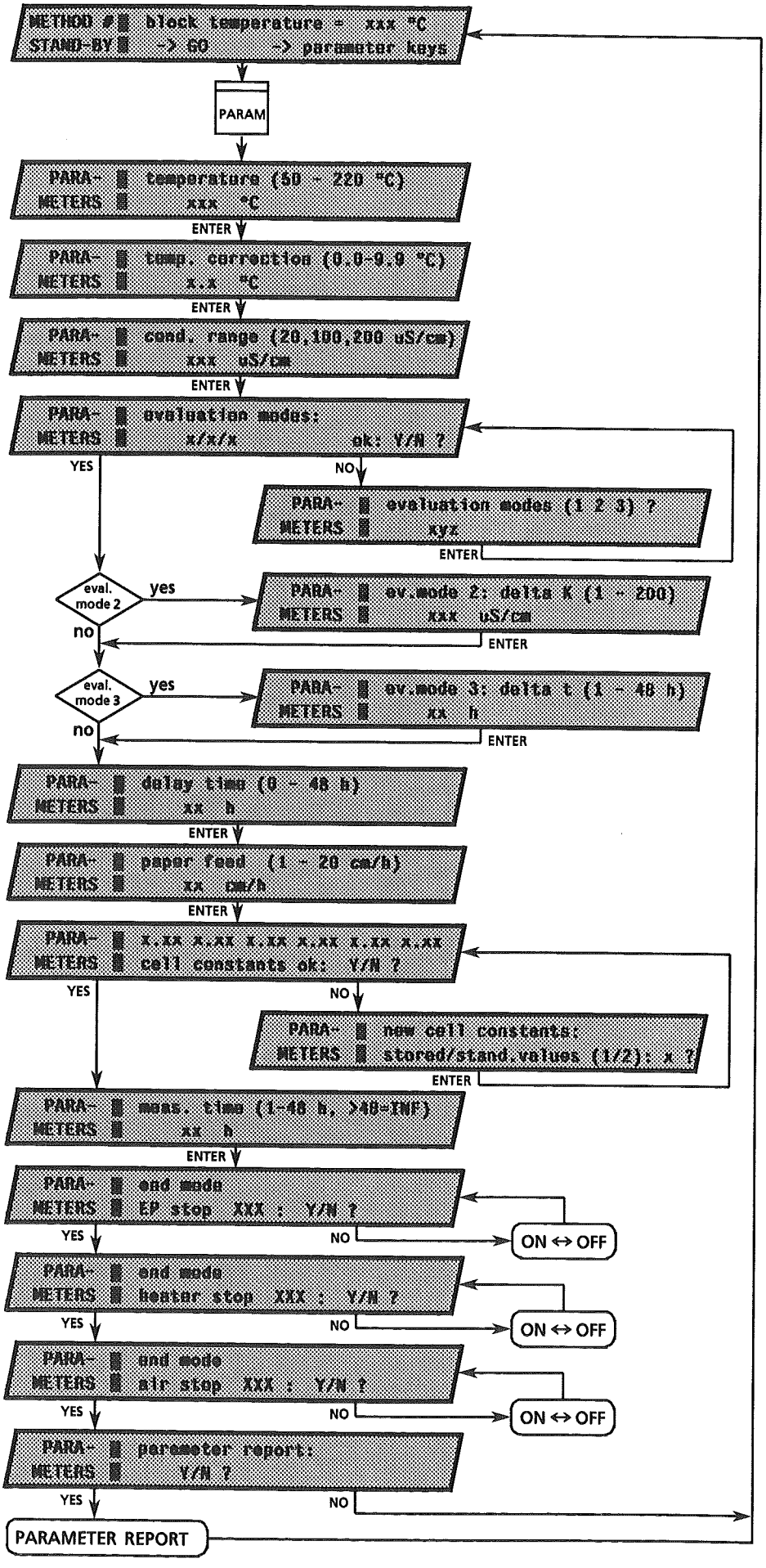
This parameter can be changed during the measurement.

```
PARA- ▒ parameter report:
METERS ▒      Y/N ?
```

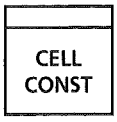
Printout of the parameter report: yes/no

Entry: <YES>
<NO>

Flow chart <PARAM>



4.4.3. Key <CELL CONST>



The key <CELL CONST> is used for manual change or automatic calibration of the cell constants. It is organized as a rolling inquiry and is not accessible during the measurement.

Detailed description of the inquiries

```
CELL     cell constants
CONSTANT manual change:  Y/N ?
```

Manual change of cell contants: yes/no

Entry: <YES>
<NO>

```
CELL     cell constant (0.10-9.99 /cm)
CONSTANT channel 1:  x.xx  /cm
```

↓

```
CELL     cell constant (0.10-9.99 /cm)
CONSTANT channel 6:  x.xx  /cm
```

Entry of cell constants (0.10 ... 9.99 /cm) for channel 1 to channel 6

Entry: <X.XX> X.X: 0.10 ... 9.99
<ENTER>

Default value: 1.00 /cm

Appears only when the previous inquiry has been answered with <YES>

```
CELL     cell constants
CONSTANT new calibration:  Y/N ?
```

New automatic cell constant calibration: yes/no

Entry: <YES>
<NO>

```
CELL     calibration channels:
CONSTANT  1  2  3  4  5  6    ok: Y/N ?
```

Channels for the calibration

Entry: <YES> ⇒ confirmation of the displayed channels
<NO> ⇒ change (next inquiry)

Default value: 1 2 3 4 5 6

Appears only when the previous inquiry has been answered with <YES>

```
CELL     which channels (1 - 6) ?
CONSTANT
```

Entry of new channels for the calibration

Entry: <XXXXXX> X: 1 ... 6
<ENTER>

The channel number sequence in the entry is immaterial.

Entry of 0 selects all channels.

Appears only when the previous inquiry has been answered with <NO>

```
CELL     ▒ stand.sol.cond. (10-400 uS/cm)
CONSTANT ▒      xxx  uS/cm
```

Conductivity κ of standard calibration solution in µS/cm (10 ... 400 µS/cm)

Entry: <XXX> XXX: 10 ... 400
<ENTER>

Default value: 200 µS/cm

```
CELL     ▒
CONSTANT ▒ start calibration:  Y/N ?
```

Start calibration: yes/no

Entry: <YES> ⇒ start
<NO> ⇒ return to inquiry
`new calibration: Y/N ?`

```
CELL     ▒ * Calibration Run *
CONSTANT ▒
```

Automatic calibration is running

Entry: none

This display is shown until the calibration is finished.

```
CELL     ▒ x.xx x.xx x.xx x.xx x.xx x.xx
CONSTANT ▒ calibration data ok:  Y/N ?
```

Display of calibration data
(cell constants for channels 1 to 6)

Entry: <YES> ⇒ confirmation
<NO> ⇒ return to inquiry
`new calibration: Y/N ?`

```
CELL     ▒ x.xx x.xx x.xx x.xx x.xx x.xx
CONSTANT ▒ insert into actual method:Y/N?
```

Transfer of displayed cell constants to current method: yes/no

Entry: <YES>
<NO>

```
CELL     ▒ x.xx x.xx x.xx x.xx x.xx x.xx
CONSTANT ▒ store new cell constants: Y/N?
```

Storage of displayed cell constants in cell constant memory: yes/no

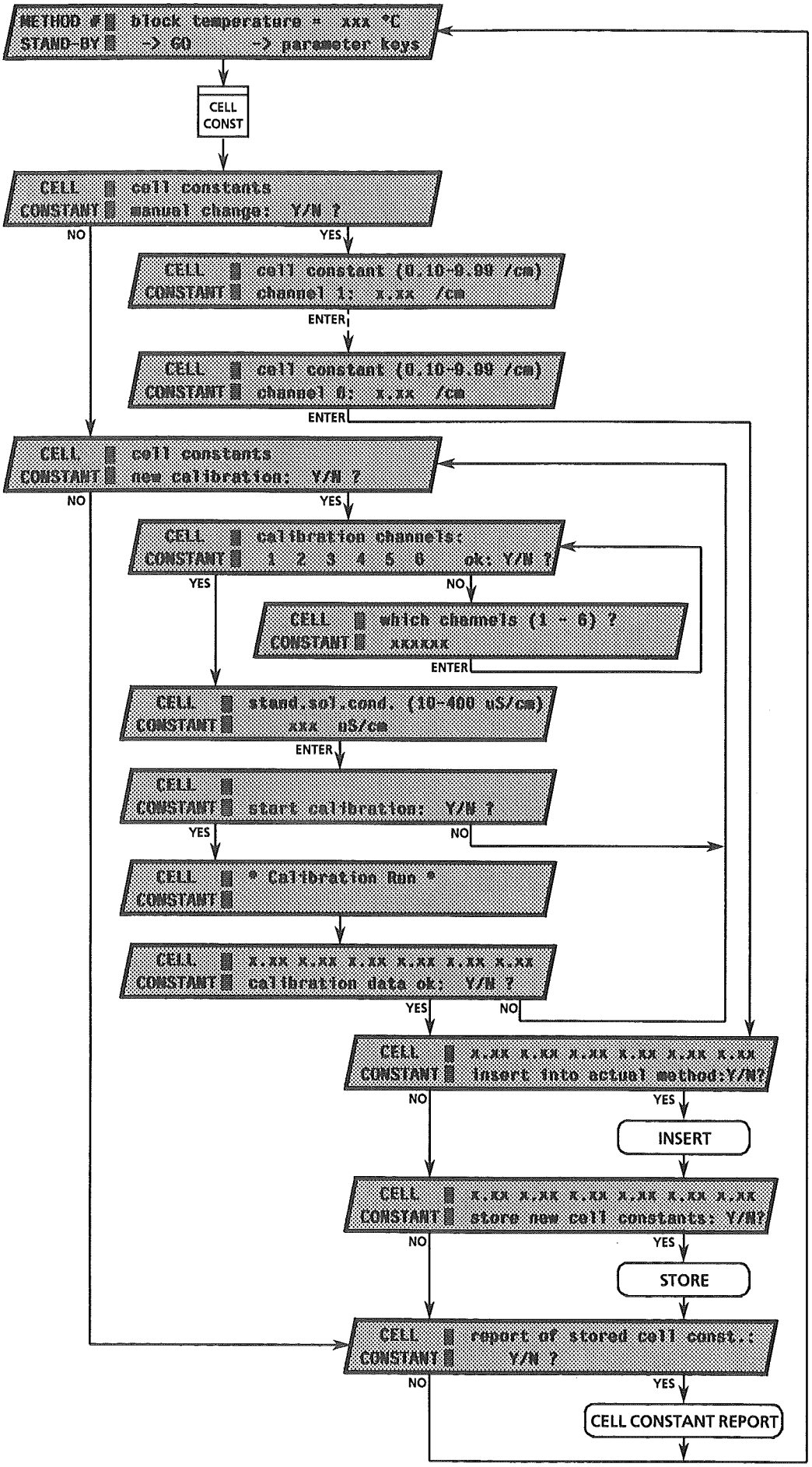
Entry: <YES>
<NO>

```
CELL     ▒ report of stored cell const.:
CONSTANT ▒     Y/N ?
```

Printout of values stored in cell constant memory: yes/no

Entry: <YES>
<NO>

Flow chart <CELL CONST>



4.4.4. Key <SAMPLE DATA>

The key <SAMPLE DATA> is used for entry of sample identification numbers as well as for determination of the active channels. It is organized as a rolling inquiry. The displays marked with "*live keyboard*" are also accessible during the measurement.

Detailed description of the inquiries

```
SAMPLE ▒ active channels:
 DATA  ▒  1  2  3  4  5  6    ok: Y/N ?
```

Active channels for the measurement

Entry: <YES> ⇒ confirmation of the displayed channels
<NO> ⇒ change (next inquiry)

```
SAMPLE ▒ active channels (1 - 6) ?
 DATA  ▒
```

Entry of new active channels

Entry: <XXXXXX> X: 1 ... 6
<ENTER>

Default value: 1 2 3 4 5 6

The channel number sequence in the entry is immaterial.

Entry of 0 selects all channels.

Appears only when the previous inquiry has been answered with <NO>

```
SAMPLE ▒ identification channel 1 :
 DATA  ▒      xxxxxxxxxx
```

↓

```
SAMPLE ▒ identification channel 6 :
 DATA  ▒      xxxxxxxxxx
```

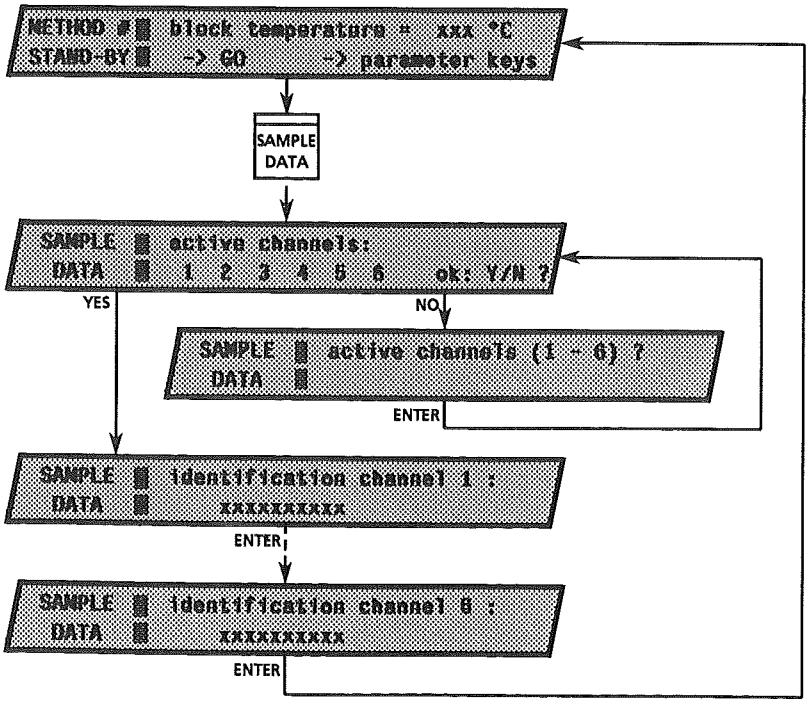
Entry of sample identification
(max. 10 characters) for channel 1 to channel 6

Entry: <XXXXXXXXXX> X: 0 ... 9; .
<ENTER>

Example: 1.503.1087

*live-keyboard

Flow chart <SAMPLE DATA>



4.4.5. Key <DATE>

The key <DATE> is used for entry of the date and time. It is organized as a rolling inquiry and is not accessible during the measurement.

Detailed description of the inquiries

DATE date (YY-MM-DD) : YY
XX-xx-xx

Display of the date (year–month–day):
Entry of the year number (00 ... 99)

Entry: <XX> XX: 0 ... 99
<ENTER>

Default value: 00

If no new value is entered, the displayed year number is confirmed.

DATE date (YY-MM-DD) : MM
xx-XX-xx

Display of the date (year–month–day):
Entry of the month number (01 ... 12)

Entry: <XX> XX: 1 ... 12
<ENTER>

Default value: 01

If no new value is entered, the displayed month number is confirmed.

DATE date (YY-MM-DD) : DD
xx-xx-XX

Display of the date (year–month–day):
Entry of the day of the month (01 ... 31)

Entry: <XX> XX: 1 ... 31
<ENTER>

Default value: 01

If no new value is entered, the displayed day of the month is confirmed.

DATE time (hh:mm) : hh
XX:xx

Display of the time (hours:minutes):
Entry of the hours (00 ... 23)

Entry: <XX> XX: 0 ... 23
<ENTER>

Default value: 00

If no new value is entered, the displayed hour is confirmed.

DATE time (hh:mm) : mm
xx:XX

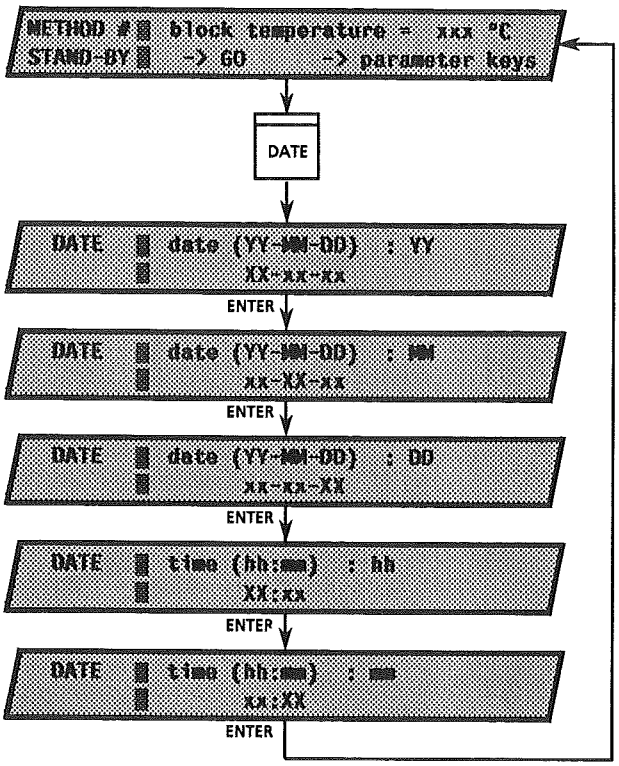
Display of the time (hours:minutes):
Entry of the minutes (00 ... 59)

Entry: <XX> XX: 0 ... 59
<ENTER>

Default value: 00

If no new value is entered, the displayed number of minutes is confirmed.

Flow chart <DATE>



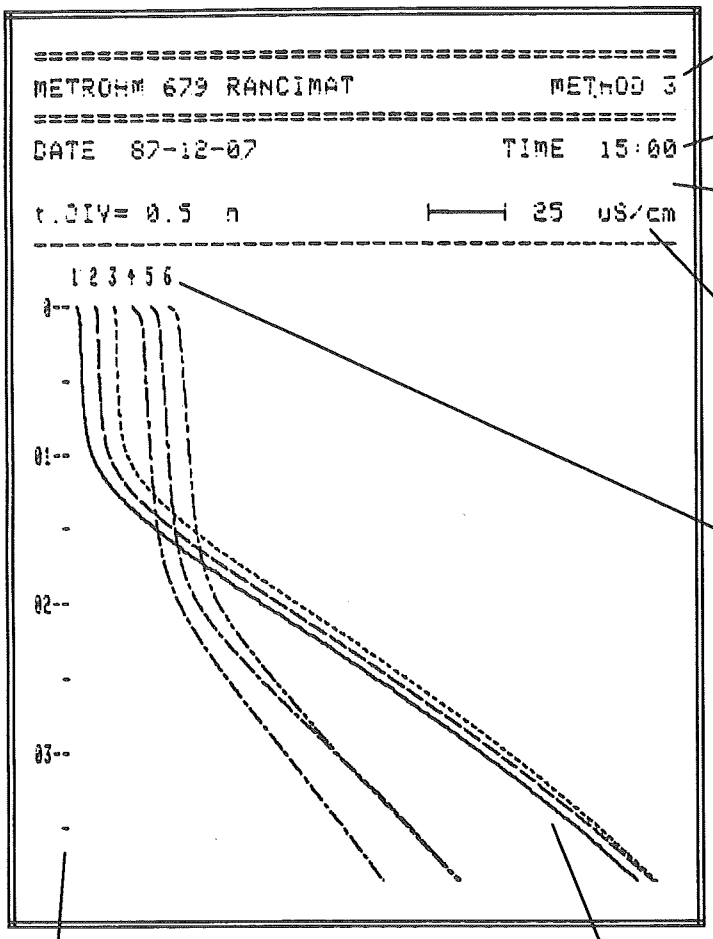
4.5. Data outputs

4.5.1. Printout of the experimental curves

The experimental curves are printed out automatically after the start of measurement. A header with instrument designation, method number, date, time and scale divisions is printed out first. This is followed by a continuous plot of the conductivity of the active channels up to termination of the measurement. The curve printout is illustrated in what follows with the aid of an example.

Note: The experimental values are not stored; the curves can thus not be printed out again later.

Example: Olive oil (samples 1, 2, 3) and deepfrying oil (samples 4, 5, 6)



Instrument designation and method
Display of the number of the user method loaded from the method memory.

Date and time
at the start of the measurement

Error message
If the measurement is started before the set temperature is reached, the following message appears at this point:
`NOTE: Temperature not reached at START!`

Conductivity axis
The length of the bar (1 cm) corresponds to the specified value in µS/cm. This depends on the measuring range selected:

at	20 µS/cm:	2.5	µS/cm
at	100 µS/cm:	12.5	µS/cm
at	200 µS/cm:	25	µS/cm

Channel numbers
Only the active channels defined under <SAMPLE DATA> are outputted.

Time axis
The division t.DIV of the time axis depends on the selected paper feed rate of the printer:

at	1	cm/h:	1 h
at	2	cm/h:	0.5 h
at	3	cm/h:	0.33 h
at	4	cm/h:	0.25 h
at	5	cm/h:	0.2 h
at	6...15	cm/h:	0.1 h
at	16...20	cm/h:	0.05 h

In all cases, each complete hour is marked and numbered.

If the paper feed rate is changed during the measurement, this is marked on the time scale with an asterisk (*).

Conductivity curves
At the start of the measurement, the conductivity is set to zero for each channel. The individual channels are plotted in the sequence 1 ... 6 displaced by 2.5 mm.

Channel	Line type
1	solid line
2	long/long
3	short/short
4	long/short
5	long/long/short
6	long/short/short

4.5.2. Printout of the result report

After termination of the measurement, a full report is printed out immediately following the printout of the curves. It comprises the result block and the parameter report (see example). The printout of the full report can be called up at any time after the measurement with the key <REPORT> ("full report", see Section 4.5.6).

The values in the result block "RESULTS" remain stored (even after the instrument has been switched off) until the key <GO> is pressed again and a new measurement is started.

Example: Olive oil (samples 1.1, 1.2, 1.3) and deepfrying oil (samples 2.1, 2.2, 2.3)

```
========================================
METROHM 679 RANCIMAT            METHOD 3
========================================

RESULTS
=======

NOTE: Temperature not reached at START!
NOTE: Temperature has been changed!
NOTE: Temperature not reached at STOP!

ch smpl.ident eval.1  eval.2    eval.3
-- ---------- ------  ------  ----------
1  1.1        1.17 h  1.86 h  60.4 uS/cm
2  1.2        1.18 h  1.86 h  60.2 uS/cm
3  1.3        1.15 h  1.86 h  59.9 uS/cm
4  2.1        1.93 h  3.00 h  15.5 uS/cm
5  2.2        1.95 h  2.80 h  15.4 uS/cm
6  2.3        1.97 h  2.88 h  16.2 uS/cm

  eval.1:   induction time
  eval.2:   time at delta K =   50 uS/cm
  eval.3:   delta K  at   t =    2 h

DATE  87-12-07              TIME  18:52


PARAMETERS
==========
temperature                    130  Cel
temperature correction         0.0  Cel
conductivity range             200  uS/cm
evaluation modes             1/2/3
    eval.2:  delta K            50  uS/cm
    eval.3:  delta t             2  h
delay time                       0  h
paper feed                       2  cm/h
cell constants: channel 1    0.80  /cm
                channel 2    0.79  /cm
                channel 3    0.80  /cm
                channel 4    0.79  /cm
                channel 5    0.76  /cm
                channel 6    0.80  /cm
measuring time                  48  h
end mode:  EP stop              ON
           heater stop          ON
           air stop             ON
```

Instrument designation and method
Display of the number of the user method loaded from the method memory.

Optional error messages
The measurement has been started before the set temperature was reached.

The temperature has been altered during the measurement (the parameter report lists the temperature last entered).

The set temperature was not reached at the end of the measurement.

Result block

ch:	Channels; only results for the active channels defined under <SAMPLE DATA> are outputted
smpl.ident:	Sample identification (see Section 4.4.4)
eval.1:	Induction time in h (decimal places signify tenths or hundredths of seconds)
eval.2:	Stability time Δt in h up to attainment of the preset conductivity change Δκ (decimal places signify tenths or hundredths of hours)
eval.3:	Conductivity change Δκ in µS/cm found during the preset time interval Δt.

"– h" or " – uS/cm" in the result signifies that no end point could be found for this channel.

Date and time
on termination of the measurement

Parameter report
All values of the current analysis method entered with the key <PARAM> are listed (see Section 4.4.2).

The parameter report can also be recalled separately (see Section 4.5.6).

4.5.3. Printout of the parameter report

```
=======================================
METROHM 679 RANCIMAT            METHOD 3
=======================================

PARAMETERS
==========
temperature                      130  Cel
temperature correction           0.0  Cel
conductivity range               200  uS/cm
evaluation modes                1/2/3
    eval.2:  delta K              50  uS/cm
    eval.3:  delta t               2  h
delay time                         0  h
paper feed                         2  cm/h
cell constants: channel 1     0.80  /cm
                channel 2     0.79  /cm
                channel 3     0.80  /cm
                channel 4     0.79  /cm
                channel 5     0.76  /cm
                channel 6     0.80  /cm
measuring time                    48  h
end mode:  EP stop                ON
           heater stop            ON
           air stop               ON
```

The parameter report is an integral part of the full report and is printed out together with the results automatically on completion of the measurement (see Section 4.5.2).

It can also be printed out separately, however, under the key <PARAM> (see Section 4.4.2) or under the key <REPORT> (see Section 4.5.6).

The parameter report lists all current values of the methods located in the working memory.

4.5.4. Printout of the method report

```
METHODS
=======
#    temp.      range     meas.time  eval.
-    -------  ---------  ---------  -----
0   110 Cel  200 uS/cm      48 h    1/-/-
1   150 Cel  200 uS/cm      48 h    1/-/-
2   200 Cel   20 uS/cm       5 h    -/2/-
3   125 Cel  100 uS/cm      15 h    1/2/3
4    60 Cel  200 uS/cm      48 h    1/2/-
5   132 Cel  200 uS/cm      20 h    1/-/-
6     *        *             *       *
7     *        *             *       *
8     *        *             *       *
9     *        *             *       *
```

The printout of the method report must be called up under the key <REPORT> (see Section 4.5.6).

The method report contains the most important parameters of the stored user methods:

temp.	temperature
range	measuring range
meas.time	analysis time
eval.	evaluation modes

Mthod 0 is the current method stored in the working storage. Asterisks (*) in the table signify that no method is stored under this number. If such a method is loaded into the working storage, the default values are assumed.

4.5.5. Printout of the cell constant report

```
STORED CELL CONSTANTS
=====================
channel  cell constant
-------  -------------
   1        0.80  /cm
   2        0.81  /cm
   3        0.78  /cm
   4        0.81  /cm
   5        0.79  /cm
   6        0.82  /cm
```

The printout of the cell constant report is called up under the key <CELL CONSTANT> (see Section 4.4.3) or under the key <REPORT> (see Section 4.5.6).

The cell constant report lists the values for the six measurement channels stored in the cell constant memory.

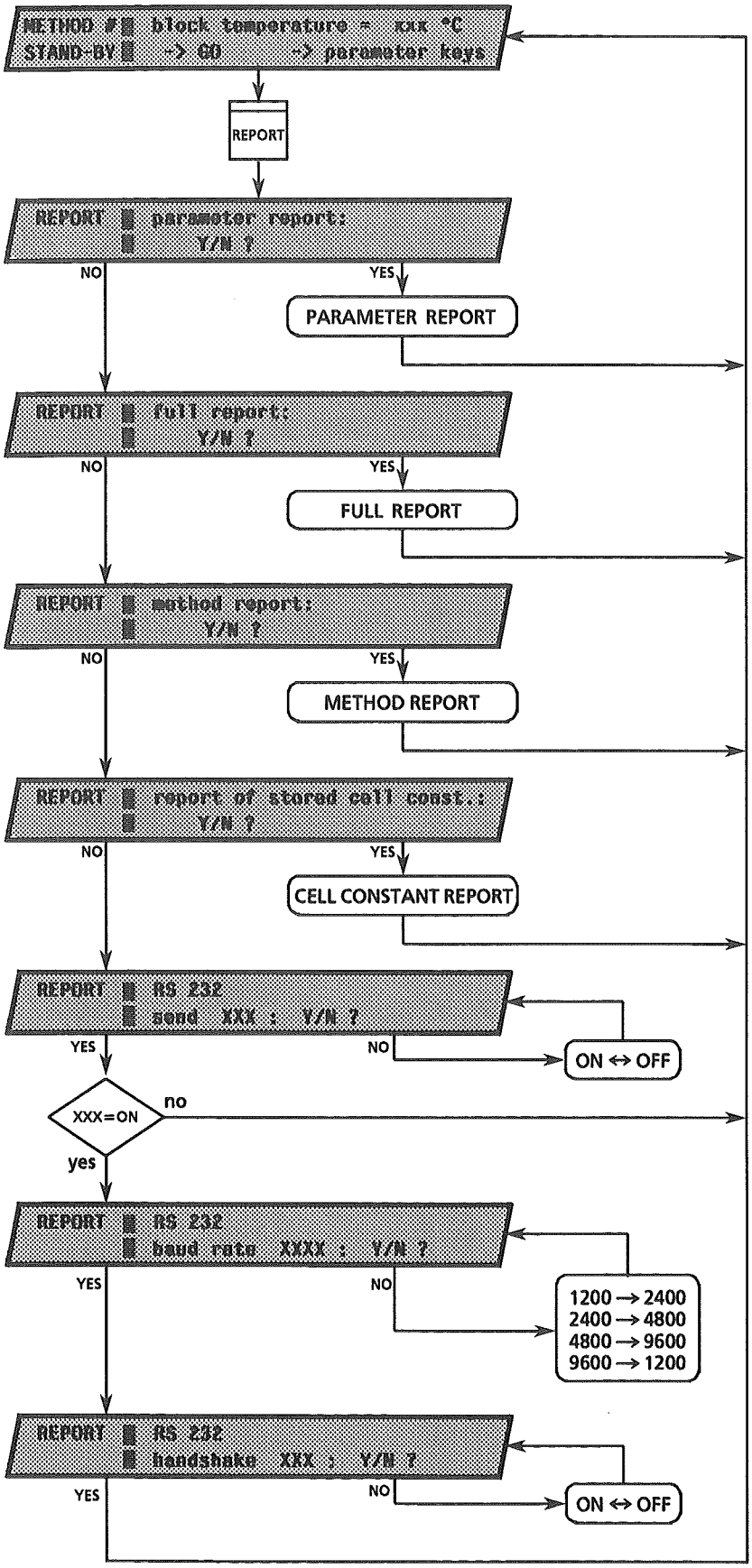
4.5.6. Key <REPORT>

The key <REPORT> is used to print out the various reports as well as to enable or disable the RS 232C output. It is organized as a rolling inquiry and is not accessible during the measurement.

Detailed description of the inquiries

REPORT ▒ parameter report: ▒ Y/N ?	*Printout of the parameter report: yes/no* Entry: <YES> <NO>
REPORT ▒ full report: ▒ Y/N ?	*Printout of the result record and parameter report: yes/no* Entry: <YES> <NO>
REPORT ▒ method report: ▒ Y/N ?	*Printout of the method report: yes/no* Entry: <YES> <NO>
REPORT ▒ report of stored cell const.: ▒ Y/N ?	*Printout of the values stored in the cell constant memory: yes/no* Entry: <YES> <NO>
REPORT ▒ RS 232 ▒ send XXX : Y/N ?	*RS 232* **send ON**: The RS 232 output is enabled. All results as well as the experimental data are outputted to an external data system (see Section 8.3 for detail). *RS 232* **send OFF**: The RS 232 output is disabled. Entry: <YES> ⇒ confirmation <NO> ⇒ change: ON ↔ OFF Default value: OFF
REPORT ▒ RS 232 ▒ baud rate XXXX : Y/N ?	*RS 232* **baud rate XXXX**: Setting of the baud rate for the RS 232 output. XXXX: 1200; 2400; 4800; 9600 Entry: <YES> ⇒ confirmation <NO> ⇒ change: 1200 → 2400 → 4800 → 9600 → 1200 → ... Default value 1200 This display appears only when "send ON" has been selected.
REPORT ▒ RS 232 ▒ handshake XXX : Y/N ?	*RS 232* **handshake ON**: The RS 232 handshake is initialised. RS 232 **handshake OFF**: The RS 232 handshake is not initialised. Entry: <YES> ⇒ confirmation <NO> ⇒ change : ON ↔ OFF Initialwert: ON This display appears only when "send ON" has been selected.

Flow chart <REPORT>



5. Calibration

5.1. Temperature calibration

The temperature of the heating block in the Rancimat wet section can be set in the range 50 ... 220°C in steps of 1°C. After the heating has been switched on with the <HEATER> key, the aluminium heating block is heated up to the set temperature electrically. As soon as this temperature remains constant within ±0.1°C for a reasonable length of time, the lamp "TEMP REACHED" lights up, and a beep sounds at the same time. The Rancimat is then ready for the measurement or calibration. The maximum time to heat up the block is 60 min (from 20°C to 220°C). The reproducibility of a set temperature is ±0.2°C for any particular measuring position, the maximum temperature difference between the individual measuring positions is less than 0.3°C. These values apply only under the following conditions, however:

- The working temperature has been reached (see above).
- All reaction vessels are inserted.
- The air flow rate is set to the same value for all measuring positions.

Relatively large heat losses can occur in the reaction vessel compared with the heating block temperature, above all at elevated temperatures; these losses depend on the nature and fill height of the sample and the set air flow. To compensate these temperature deviations, the temperature correction ΔT (`temp. correction`, see Section 4.4.2) can be entered under the key <PARAM>. This temperature correction ΔT must be determined by a temperature calibration from the values T_{set} (set temperature of the sample) and T_{cal} (measured temperature in the sample).

$$\Delta T = T_{set} - T_{cal}$$

ΔT:	temperature correction "`temp. correction`"
T_{set}:	set temperature "`temperature`"
T_{cal}:	temperature in the reaction vessel with a temperature correction ΔT of 0.0°C (measured with a calibration thermometer)

The determination of the temperature correction ΔT for a particular temperature, type of sample, sample volume and air flow is very tricky and should be performed only if absolutely necessary. The following conditions must be met to ensure the temperature measurement in the sample is as accurate as possible:

- **Thermometer**
  Calibration thermometer and temperature measuring device must comply with the conditions for highly precise temperature determinations in the desired temperature range (absolute deviation max. ±0.5°C). We plan to offer an appropriate Pt1000 temperature sensor with a suitable reaction vessel attachment as an option (please ask your Metrohm agency).
- **Air supply**
  The air supply must be set to the desired value for every measurement station and readjusted after ca. 1 h operation.
- **Reaction vessels**
  A reaction vessel is filled with the same amount of sample material as used in the subsequent Rancimat measurement (in general, approximately 2.5 g, see section 6.1). Instead of the sample, silicone oil (thermostat oil, e.g. Metrohm special oil 6.2803.040 available as an option) can be used. The important factor here is that calibration is performed with exactly the same volume of oil as used in subsequent work with the samples. An empty reaction vessel (**23**) equipped with a reaction vessel attachment (**24**) is installed in each of the other five measurement stations and connected to the air supply (see *Fig. 5*).
- **Procedure**
  As soon as the lamp "TEMP REACHED" lights up and the temperature has stabilized, the difference between the set temperature and the actual temperature read off is determined and entered as a correction value (`temp. correction`) under the key <PARAM>. Then wait until the lamp "TEMP REACHED" lights up again. If the set temperature in the reaction vessel is not yet reached, the calibration must be repeated by adjusting the correction value until the measured temperature matches the set temperature.

5.2. Calibration of the cell constants

Whereas exact calibration of the cell constants is not absolutely necessary for the determination of the induction time (ev. mode 1), the cell constants of the conductivity cells used must be known exactly for the two other evaluations (ev.mode 2 and 3). There are two possibilities available:

- The cell constants printed on the conductivity cells are entered manually under the key <CELL CONSTANT> (see Section 4.4.3).
- The cell constants are determined by the instrument using a standard solution of known conductivity (see Section 4.4.3).

Since the cell constants of the conductivity cells can change with time owing to contamination or mechanical action, it is advisable to make use of the second method from time to time if reproducible results are to be achieved. For this automatic calibration of the cell constants, which can be performed simultaneously for all channels together or for just some of the channels, the procedure is as follows:

1. **Switch on control unit and wet section**
   Start-up procedure, see Section 3.4.

2. **Fill measuring vessels with standard solution**
   The measuring vessels (***26***) are filled with at least 60 mL standard solution. The standard solution must have a known specific conductance in the range 10 ... 400 µS/cm. Such a solution can be prepared by means of the 6.2301.060 Conductivity standard solution c(KCl) = 0.1000 mol/L by diluting this solution 1:100 with CO_2-free, ultra-pure water. The specific conductance of this solution c(KCl) = 0.001 mol/L is

Temperature (°C)	18	19	20	21	22	23	24	25	30
Conductivity (µS/cm)	127.4	130.3	133.2	136.1	139.0	141.8	144.7	147.6	162.1

3. **Insert the measuring vessels**
   The filled measuring vessels (***26***) are inserted in the openings provided in the Rancimat wet section (see *Fig. 5*). A conductivity cell (***28***) is inserted through the measuring vessel attachment (***27***) in each measuring vessel (***26***) such that the inner chamber between the two platinized electrodes is completely filled with solution. The cable connectors of the measuring cells are then plugged into the connections (***39***).

4. **Automatic calibration**
   The automatic calibration is called up under the key <CELL CONST> (see also Section 4.4.3):
   - Press key <YES> when the display "`new calibration: Y/N ?`" appears.
   - Designate the channels for the calibration (procedure, see Section 4.4.3).
   - When the display "`stand.sol.cond`" appears, enter the conductivity κ of the standard calibration solution in the measuring vessels and confirm with key <YES>.
   - Press key <YES> on appearance of the display "`start calibration: Y/N ?`". The calibration now runs automatically (display: `* Calibration Run *`).
   - When the calibration is finished, the new cell constants determined by the instrument appear in the display. If these data are accepted by the user, they can not only be incorporated directly in the current method stored in the working memory, but also stored in the cell constant memory (procedure, see Section 4.4.3).

5. **Transfer the new cell constants to the stored user methods**
   A set of cell constants specific to the method is included with the parameters of every stored user method. If these cell constants should be replaced by the new values determined in the calibration and stored in the cell constant memory, the procedure is as follows:
   - Load method into the working memory with the key <USER METHODS> (see Section 4.4.1)
   - Press key <NO> when the display "`cell constants ok: Y/N ?`" appears under key <parameters> (see Section 4.4.2)
   - Enter 1 when the display "`new cell constants: stored/stand.values (1/2): ?`" appears.
   - Store method again in the method memory with the key <USER METHODS> (the old method is overwritten, see Section 4.4.1).

6. Measurements

6.1. Sample preparation

6.1.1. Pure oils and fats

If the oil or melted fat is completely pure and transparent, 2.5 g sample material are weighed into the reaction vessel (*23*) directly. When in liquid form, the melted sample material must rise in the reaction vessel cylinder to a height which ensures sufficient immersion of the air inlet tube (*44*); if necessary, more than 2.5 g sample material must be used.

Fats must be completely liquefied in a water bath or in a drying oven at a temperature 10°C above their melting point. Prewarmed pipettes should be used for transfer to the reaction vessels.

It is also possible to weigh in the pure fats in solid form. The reaction vessel cylinders with the solid fat are inserted briefly in the heating block of the Rancimat wet section to melt the fat, the attachments are fitted and a check is made to ensure that the immersion depth of the air inlet tubes is sufficient.

Further details regarding the handling of oil and fat samples can be found in [8] (see Section 11).

6.1.2. Oils and fats from oil- and fat-containing products

Oils and fats from oil- and fat-containing products must be extracted before analysis with the 679 Rancimat using 40/60 petroleum ether with exclusion of light. The dried, purified extract is then used as sample material in accordance with the instructions in Section 6.1.1.

Preparation for the extraction
Oil seeds, cocoa beans and other coarse-grained solids must be ground before extraction to a fine, homogeneous powder in a knife grinder or other suitable chrome steel pulverising apparatus. The extraction of oils and fats by pressing has not proved sufficiently reliable for the present purpose.

Extraction of oils and fats
Samples (50 - 100 g, depending on the oil/fat content) of powdered products (e.g. milk powder, cocoa powder, hazelnut powder) or of material finely ground in the manner described above are weighed out in a 300 mL Erlenmeyer flask with standard ground-glass joint. This sample material is then covered with 40/60 petroleum ether to a depth of 1 cm. The oil or fat is now extracted with constant stirring and in the absence of light over a period of 12 h (e.g. overnight). In order to perform at least a duplicate determination with the 679 rancimat, about 10 g pure oil or fat must be extracted to allow for transfer losses (correspondingly more for more than 2 determinations). When the extraction is complete, the solution is filtered, if possible with exclusion of light, through a fluted filter into a clean 250 mL round-bottomed flask with standard ground-glass joint; the residue can be washed with a little petroleum ether. If the consistency of the sample material is such that the fluted filter paper easily becomes clogged, a soxhlet apparatus for solid/liquid separation should be used. This allows extraction of up to 40 g sample material in a single batch.

The petroleum ether is then distilled off from the clear or slightly yellowish extract. The safest and most convenient method involves use of a rotary evaporator; the petroleum ether can be removed gently and efficiently under low vacuum at a temperature of +40...50°C with exclusion of direct light (cover the water bath with aluminium foil, for example). After completion of the distillation, the oil/fat sample is dried over a period of about 30 min at a pressure of $p < 1330$ Pa ($\triangleq 13.3$ mbar $\triangleq 10$ Torr). This oil/fat sample is then filtered together with anhydrous Na_2SO_4 (to adsorb water and clarify the solution) through a fluted filter at a temperature 10°C above the melting point of the particular fat (generally about +50°C) in a drying oven.

Emulsified fats
Emulsified fats (e.g. butter, margarine) are melted at a temperature 10°C above the melting point of the fat in question (generally about +50°C) and then centrifuged. The resulting oil phase is pipetted off and filtered together with anhydrous Na_2SO_4 (to adsorb water and clarify the solution) through a fluted filter. Many of these emulsified fats can possibly be employed in the same manner as pure substances; the water is vaporized at the start of the analysis period and led off by the air flow. Correspondingly more sample material is naturally needed for such determinations.

Storage of extracted samples
When the oil/fat samples isolated in this manner are not analysed immediately in the 679 Rancimat, the samples must be stored in a cool place in the absence of light; the samples should be stored in their vessels under a blanket of nitrogen. While this method of storage does not provide complete protection against involuntary and uncontrollable changes in the oxidative stability, it does represent a useful means of preservation in many cases.

Further details regarding the handling of oil- and fat-containing samples can be found in [8] (see Section 11).

6.1.3. PVC and other halogenated plastics

PVC or other plastics which decompose through the action of heat with cleavage of hydrogen halides are prepared in accordance with DIN 53 381 ([2], (see Section 11):

Powdery samples
Polymers, dry blends and coating powders need no special sample pretreatment.

Pastes
Pastes are fused on a glass plate in a drying oven to a sheet with a thickness of about 0.5 mm. After cooling, the sheet is cut into pieces of edge length about 2 mm.

Solid samples
Moulding compounds in granular form, moulded and finished parts, semi-finished products as well as coatings separated from the substrate are pulverized in accordance with DIN 53 733 and screened to separate the screening fraction between the analytical screens with wire mesh screen DIN 4188 – 1.4 (wire mesh of stainless steel with 1.4 mm inside diameter mesh size) and wire mesh screen DIN 4188 – 2 (wire mesh of stainless steel with 2 mm inside diameter mesh size) for the experiments.

Sheets
Sheets are cut into pieces with an edge length of about 2 mm.

0.5 g of the prepared samples is added directly to the prewarmed reaction vessels (**23**) inserted in the heating block (see Section 6.2.1).

6.2. Measurement procedure

6.2.1. Preparing the measurement

1. **Switch on instruments**
   See Section 3.4 (the instruments must be installed correctly, see Section 3)

2. **Select the method**
   The method in use immediately before the instrument was last switched off is stored in the working memory. The key <USER METHODS> can be used to load another of the user methods stored in the method memory (see Section 4.4.1).

3. **Change the method**
   - The parameter values of the loaded user method can be changed for the subsequent measurement with the key <PARAM> (see Section 4.4.2).
   - On first-time use of the method or if the conductivity cells have been changed, a cell constant calibration may be necessary (see Section 5.2).

4. **Enter the active channels and sample identifications**
   The active channels and sample identifications are entered under the key <SAMPLE DATA> (see Section 4.4.4). In general, six or three samples are analysed at once, but simultaneous analysis of less samples is also possible. However, even in the latter case all six reaction vessels must be inserted in the heating block to avoid an inadmissible temperature drop between the individual measuring positions.

5. **Switch on the heating**
   Press key <HEATER> (the control lamp lights up).
   The heating block of the Rancimat wet section is heated electrically. As soon as the set temperature is reached and remains constant within ±0.1°C, the lamp "TEMP REACHED" lights up and a beep sounds. This takes about 40 min for a temperature of 120°C and around 60 min for one of 220°C.

6. **Switch on air pump**
   Press key <AIR> (the control lamp lights up).
   Set the air flow with the aid of the flowmeter (***21***) and the regulating screw (***20***) to the desired value for each measuring position (see *Fig. 3/4*).

standard values for oil and fat samples:	20 L/h
standard values for PVC samples:	7 L/h

   Note: The set flow rate requires ca. 1 h before constancy is achieved.

7. **Fill and insert measuring vessels**
   - The cleaned measuring vessels (***26***) are each filled with 60 mL dist. water. For very long analysis times (>24 h), more than 60 mL dist. water must be added to take into account the evaporation loss of ca. 7 mL/d and hence to ensure that the conductivity cells remain immersed in the solution.
   - The filled measuring cells (***26***) are inserted in the openings provided in the Rancimat wet section (see *Fig. 5*) and the preprared measuring vessel attachments (***27***) are mounted on the measuring vessels.
   - The connecting tubings (***40***) attached to the measuring vessel attachments (***27***) are inserted in the openings of the waste air manifold (see *Fig. 5*).
   - A 6.0911.120 conductivity cell (***28***) is inserted into each measuring cell (***26***) such that the inner chamber between the two platinized electrodes is completely filled with solution. The cable connectors of the measuring cells are then plugged into the connection sockets (***39***).

8. Fill and insert the reaction vessels

- All reaction vessels must be perfectly clean (see Section 6.4). The procedure for filling and inserting the reaction vessels depends on the nature of the sample:

Oil and fat samples:

- For oil and fat samples, the longer air inlet tube (***44***) 6.2418.000 is mounted on the reaction vessel attachment (***24***). If there is a danger of foam formation, the foam barrier (***43***) must be mounted on the air inlet tube (***44***) (see section 3.2.2).
- The samples prepared according to Section 6.1 are weighed out in the reaction vessels (***23***). In many cases, a sample quantity of 2.5 g has proved ideal, but a check must be made to ensure that the immersion depth of the air inlet tube (***44***) in the melted sample is sufficient. If this is not the case, then more sample material must be used.
- The reaction vessel attachments (***24***) are mounted on the reaction vessels (***23***) to the stop (see *Fig. 5*).
- When the set temperature is reached (lamp "TEMP REACHED" must light up), the assembled reaction vessels are inserted in the six cavities in the heating block of the Rancimat wet section. The samples are then heated for 10 min before being connected to the air supply and the measuring vessel. If the lamp "TEMP REACHED" goes out when the reaction vessels are inserted, wait until this lamp lights up again before proceeding.
- The reaction vessels (***23***) are connected to the air supply using connecting tubing (***22***) and to the measuring vessel (***26***) using the transfer tubing (***25***) (see *Fig. 5*).

> *Note: It must be ensured that there is no obstruction between the reaction vessel and the measuring vessel otherwise there is a danger that an overpressure will build up in the reaction vessel and the sample will be sucked back when the air supply is shut off!*

PVC samples:

- For PVC samples, the shorter air inlet tube (***44***) 6.2418.010 is mounted on the reaction vessel attachment (***24***) (see section 3.2.2).
- The empty reaction vessels are inserted in the six cavities in the heating block of the Rancimat wet section.
- As soon as the set temperature is reached (lamp "TEMP REACHED" must light up), 0.5 g of the sample prepared according to Section 6.1.3 is added directly to each of the reaction vessels (***23***) inserted in the heating block.
- The reaction vessel attachments (***24***) are mounted on the reaction vessels (***23***) to the stop (see *Fig. 5*). The end of the air pipe must not be immersed in the PVC sample.
- The reaction vessels (***23***) are connected to the air supply using connecting tubing (***22***) and to the measuring vessel (***26***) using the transfer tubing (***25***) (see Fig. 5).

9. Readjust air supply

Readjust the air supply for each measuring station using the flowmeter (***21***) and the regulating screw (***20***) to exactly the desired value. The 679 Rancimat is now ready for the start of the measurement.

6.2.2. Starting the measurement

The measurement is started by pressing the <GO> key.

When the set temperature is reached (lamp "TEMP REACHED" lights up), the measured conductivity values of the active channels are plotted continuously following printout of a header with instrument designation, method number, date, time and scale divisions (see Section 4.5.1).

The Rancimat will wait until the set temperature is reached before starting the measurement automatically.

The detailed flow chart of the measurement with all input possibilities and relationships is illustrated on the following page.

6.2.3. Stopping the measurement

Automatic measurement termination

During the measurement, a continuous check is performed to see whether a stop criterion has been satisfied. The *analysis time* (`meas. time`) and the *end-point stop* (with `EP stop ON`) are checked as stop criteria.

analysis time: The measurement is terminated in all cases as soon as the analysis time entered under `"meas. time"` is reached. The maximum analysis time when an unlimited analysis duration is entered (`meas. time = INF`) is 11 days.

end-point stop: If the end-point stop is switched on in the current method (`EP stop ON`), the measurement is terminated for each active channel as soon as all end points of the switched-in evaluation modes (`evaluation modes 1/2/3`) have been found (see Section 6.3) or when the measured conductivity has exceeded 400 µS/cm.

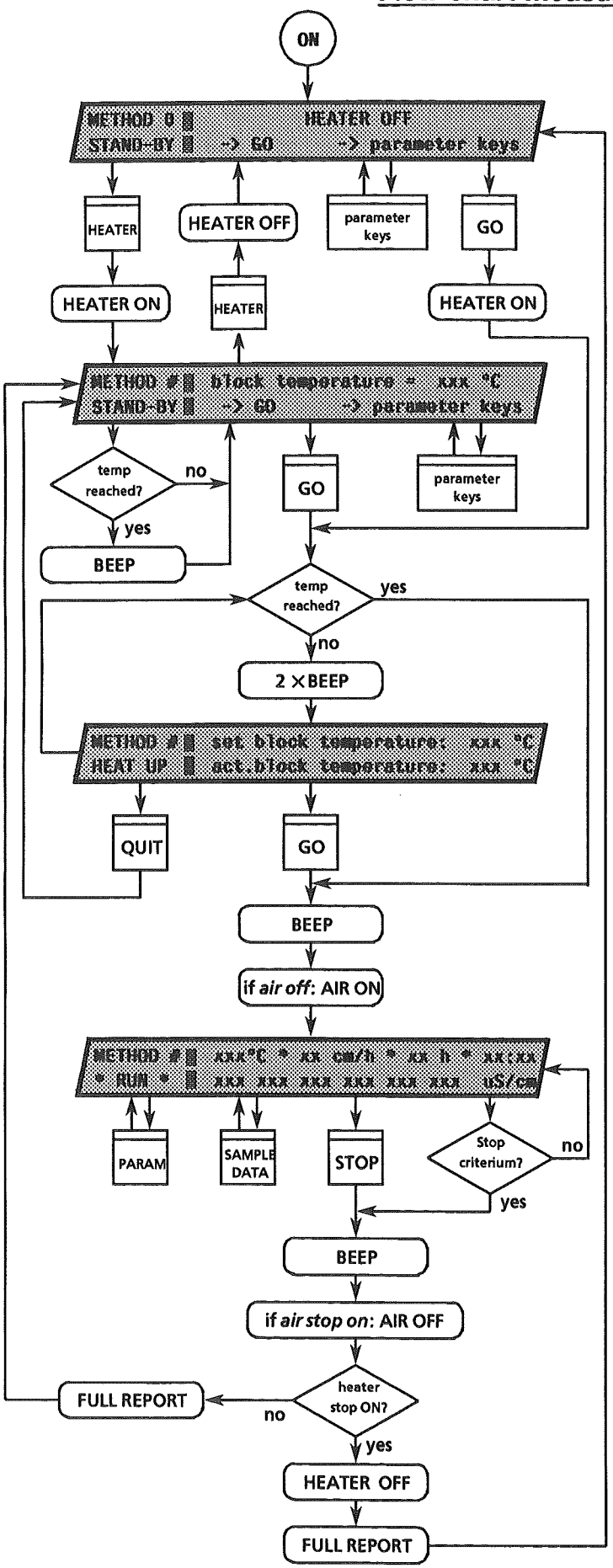
Note:
For channels in which all end points of the switched-in evaluation modes (`evaluation modes 1/2/3`) have already been found, the display of the measured conductivity value is switched off. The channels in which the measurement is still being performed are thus apparent at all times from the display. Here it should be noted that measurement is continued up to a conductivity value of 400 µS/cm even though the curve is plotted only up to a value of maximum 200 µS/cm.

Manual measurement termination

The measurement is terminated immediately the <STOP> key is pressed, and a full report with the results found up to this point is printed out.

The printout of the full report can be stopped at any time by pressing the <QUIT> key.

Flow chart measurement



Switching on the instruments

Instrument standby with heating switched off

Entries:

<HEATER>: Switches heating on
<parameter keys>: Entries via the six function keys
<GO>: Start of measurement, the heating is switched on automatically

Instrument standby with heating switched on

Display of the current heating block temperature. When the set temperature is reached (= set temperature of the sample + temperature correction), the lamp "TEMP REACHED" lights up and a beep sounds.

Entries:

<parameter keys>: Entries via the six function keys
<GO>: Start of measurement. At the set temperature, the measurement is started immediately. If the set temperature has not been reached, two beeps are sounded as a warning, the measurement is started automatically only when the set temperature is attained.

Heating phase when measurement running

This display appears only when the measurement was started before the set temperature was reached. Display of the set heating block temperature (= set temperature of the sample + temperature correction) and the current heating block temperature.

Entries:

<QUIT>: Return to the instrument standby condition
<GO>: Start of measurement with set temperature not reached

Display during the measurement

The first line shows the most important parameters of the measurement in progress:

xxx°C set temperature of the sample
xx cm/h paper feed rate
xx h analysis time up to meas. termination
xx:xx clock with time since meas. start

The second line displays the current experimental conductivity values in µS/cm for the 6 channels. For inactive channels and those in which all end points have already been found, the corresponding display remains blank.

Entries:

<PARAM>: The following values can be changed live during the measurement (see Section 4.4.2):

```
temperature
paper feed
meas. time
end mode EP stop
end mode heater stop
end mode air stop
```

<SAMPLE DATA>: During the measurement, the sample identifications for all active channels can be changed live (see Section 4.4.4):

<STOP>: Immediate termination of measurement

6.3. Evaluation

6.3.1. General information

Processing and evaluation of the recorded experimental values are performed in the 679 Rancimat automatically. The original experimental values used for plotting the curves are subjected to a smoothing procedure for the evaluation. For the determination of the results from the smoothed curves three evaluation modes can be selected individually or in combination (see Section 4.4.2):

Evaluation mode 1: Determination of the induction time

Evaluation mode 2: Determination of the stability time (time until attainment of the preset conductivity change $\Delta\kappa$)

Evaluation mode 3: Determination of the conductivity change $\Delta\kappa$ during the preset time interval Δt

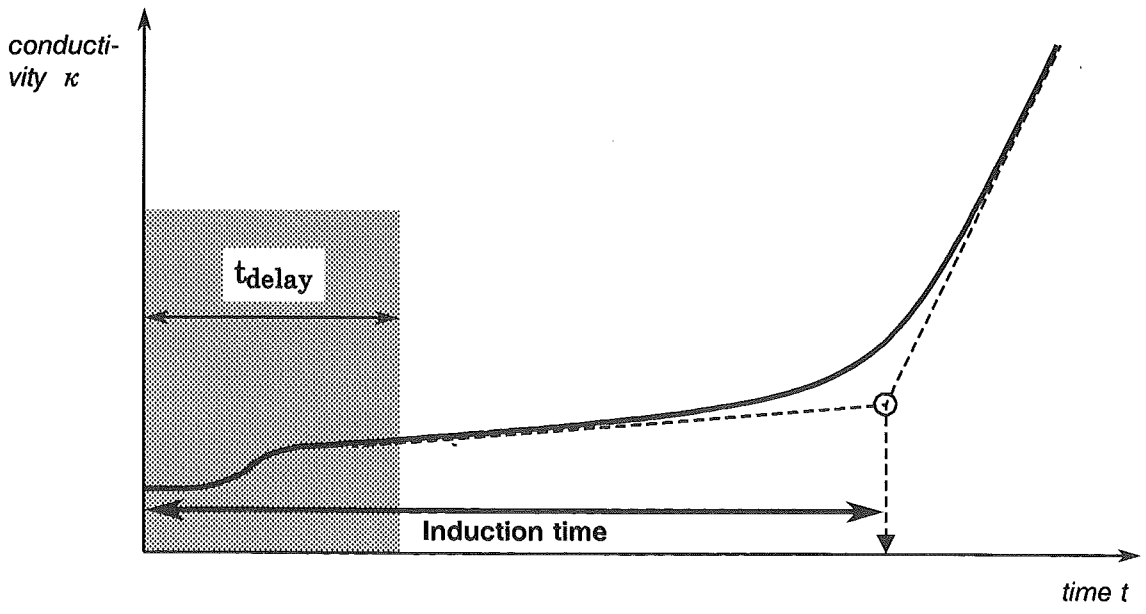
For each active channel, the curve is evaluated during the measurement with a certain delay (due to smoothing and interpolation range). If a result has been found for each of the selected evaluation modes (also designated in the instrument as end point EP), the evaluation for this channel is terminated and the display of the measured conductivity value cleared (see Section 6.2.2), but the actual curve continues to be recorded until the limit is reached.

The 679 Rancimat offers the possibility to terminate the measurement automatically as soon as all end points have been found for all active channels (if the measured conductivity exceeds 400 µS/cm, this is also considered an end point). The end mode `"EP stop ON"` must be set under the key <PARAM> for this (see Section 4.4.2).

6.3.2. Evaluation mode 1

With this evaluation mode, the **induction time** is calculated from the curve $\kappa = f(t)$. The induction time is the time needed to reach the break point of this curve (point of greatest curvature). The break point is designated as the intersection point of the two extrapolated straight parts of the curve. The induction time is a characteristic of the oxidative stability of the sample under investigation and is in almost complete agreement with the results of the time-consuming AOM method (see [18], Section 11).

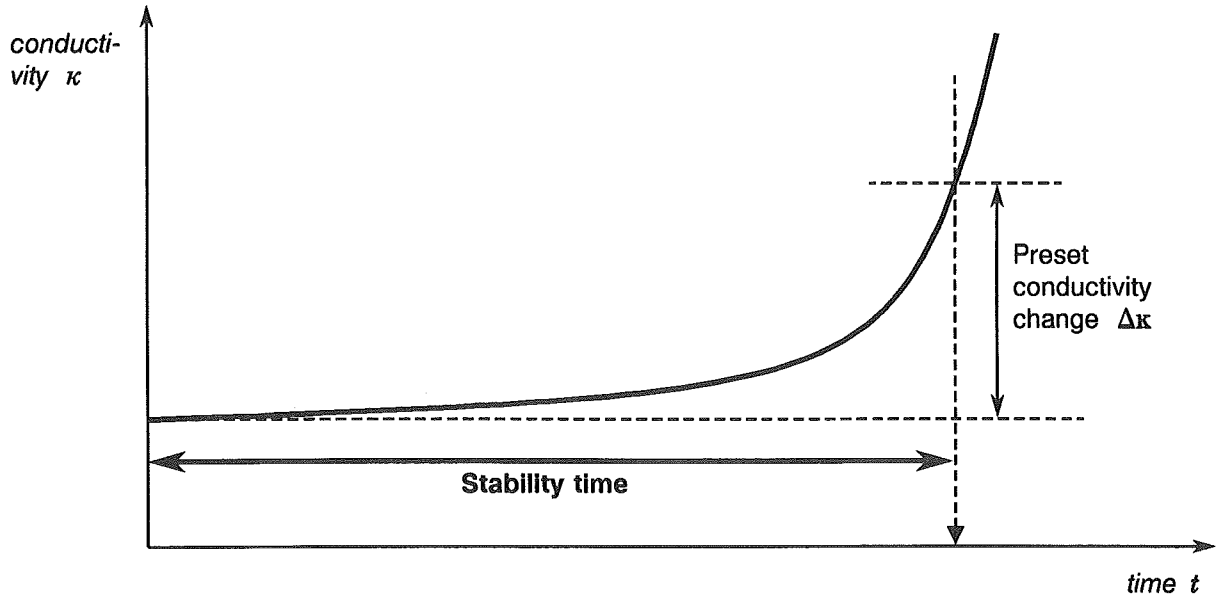
With certain samples, it may be found that the conductivity very occasionally rises in steps long before the actual induction time (e.g. through loss of water in the case of emulsions). Since such an increase could possibly be evaluated as an end point, the user can enter a delay time for the definitive end-point recognition (see section 4.4.2). A consequence of this is that all end points appearing during this time interval are overwritten by a following end point.



6.3.3. Evaluation mode 2

This evaluation mode is used to calculate the **stability time** from the curve $\kappa = f(t)$. The stability time is the time needed for a preset conductivity change $\Delta\kappa$ to be attained. It is used primarily to characterize the thermal stability of PVC or similar plastics in accordance with DIN 53 381 ([2], see Section 11).

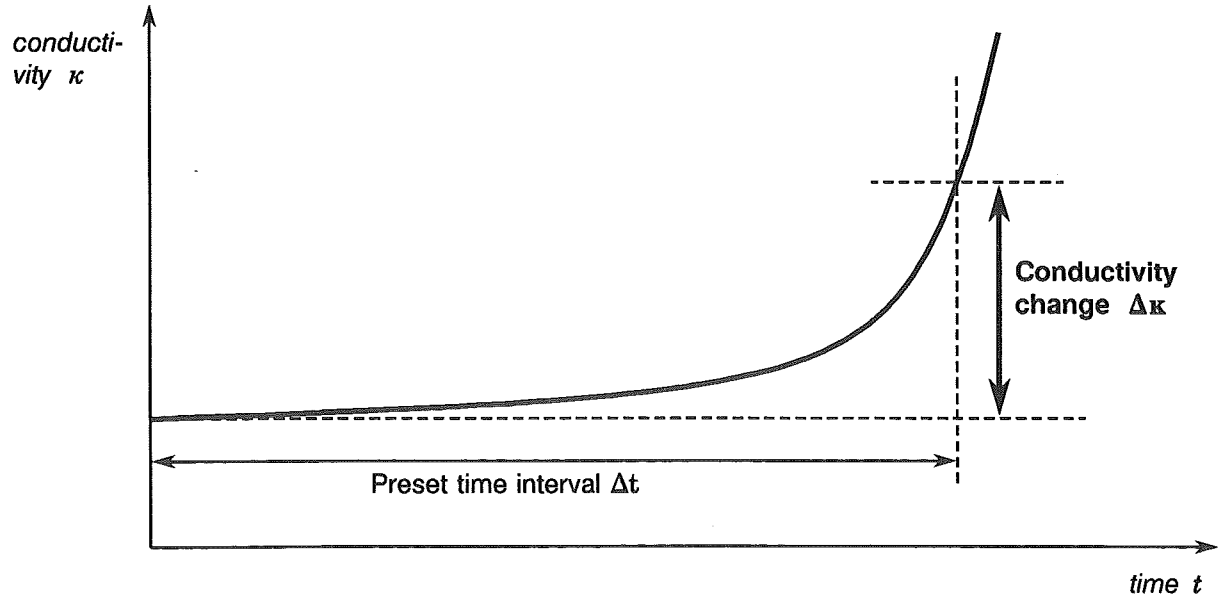
If evaluation mode 2 has been selected under the key <parameters>, the desired conductivity change $\Delta\kappa$ must then be entered in µS/cm (`delta K (1 - 200)`). For PVC investigations, a difference of 50 µS/cm is specified in DIN 53 381. Entry of a delay time has no effect in this evaluation mode; the time elapsed since the start of measurement is calculated in every case.



6.3.4. Evaluation mode 3

This evaluation mode is used to calculate the **conductivity change** $\Delta\kappa$ during the preset time interval Δt from the curve $\kappa = f(t)$.

If evaluation mode 3 has been selected under the key <PARAM>, the desired time interval Δt must then be entered in h (`delta t (1 - 48 h)`). Entry of a delay time has no effect in this evaluation mode; the start of time interval Δt is the starting point of the measurement in all cases.



6.4. Cleaning

6.4.1. Reaction vessels

Clean reaction vessels are an indispensible requirement for reliable, reproducible and correct analysis results; slight traces of dirt can act as a catalyst and accelerate the oxidative decomposition leading to completely wrong results. The cleaning of the reaction vessels depends on the nature of the sample and the decomposition products formed. Depending on the degree of contamination, a single- or multistage cleaning process is necessary.

Oil and fat samples

Stage 1 (slightly contaminated glassware):

Substances such as margarine, butter, etc. lead in many cases to unpolymerised decomposition products virtually all of which can be removed by washing out with hot water. Subsequent rinsing with acetone (followed by water) often removes the remaining residues.

Stage 2 (moderately contaminated glassware):

Dirty glassware which can not be cleaned using the above method should be cleaned as follows:

- Immerse the glassware in a solution of RBS 25 (or a similar product) at 80°C for 1 hour (RBS is a special cleaning agent for laboratory apparatus from FLUKA AG, CH-9470 Buchs SG, Switzerland, and is available worldwide through chemical dealers). All glassware is then washed thoroughly with clean water, rinsed with distilled or deionised water and allowed to dry.

Stage 3 (heavily contaminated glassware)

For samples with a high content of linolenic and linoleic acids (e.g. sunflower seed oil, sojabean oil, etc.), resinified, highly polymerised decomposition products which can no longer be removed with the usual solvents are often found after relatively long analysis times. These residues must be saponified and then dissolved in water. The following method has proved reliable:

- Isopropanol $CH_3CH(OH)CH_3$ is diluted with 10% water. Excess solid potassium hydroxide KOH_{solid} is added to this aqueous isopropanol solution and the whole shaken until the solution is saturated.
- The reaction vessels are half filled with this isopropanol solution of potassium hydroxide and placed in a boiling water bath for several hours. The vessels are shaken from time to time, and at the end of the treatment rinsed out with clean water. If the glassware is still not clean, the saponification is repeated.
- The cleaned glassware is then placed in a 80°C solution of RBS 25 (or a similar product) for 1 hour as in stage 2. All glassware is then washed thoroughly with clean water, rinsed with distilled or deionised water and allowed to dry.

PVC samples

Stage 1 (moderately contaminated glassware):

The normal cleaning comprises treatment with RBS solution according to the following method:

- The glassware is placed in a boiling solution of RBS 25 (or a similar product) for 1-2 hours (RBS is a special cleaning agent for laboratory apparatus from FLUKA AG, CH-9470 Buchs SG, Switzerland and is available worldwide through chemical dealers). All glassware is then washed thoroughly with clean water, rinsed with distilled or deionised water and allowed to dry.

Stage 2 (highly contaminated glassware):
If PVC residues still adhere to the glassware surface after stage 1 treatment, the procedure is as follows:

- THF (50 mL) is added to the reaction vessels, which are then allowed to stand overnight.
- The remaining residues are removed mechanically with a spatula.
- The glassware is then placed in a boiling solution of RBS 25 (or a similar product) for 1–2 hours as for stage 1. All glassware is then washed with clean water, rinsed with distilled or deionized water and allowed to dry.

6.4.2. Measuring vessels

The 60 mL water contained in each of the six measuring vessels (**26**) with conductivity cell (**28**) is poured off together with the dissolved organic acids and other decomposition products at the end of the experiment. Vessels and conductivity cells are then cleaned thoroughly by repeated washing with pure acetone (CH_3COCH_3); the simplest method involves squirting acetone (e.g. from a plastic wash bottle) over the walls of the measuring vessel, inserting the conductivity cell and then shaking both vigorously. After this cleaning with acetone, measuring vessel and conductivity cell are rinsed out thoroughly several times with clean water (H_2O dist./deion.).

If this simple cleaning procedure proves unsatisfactory, the method described above for reaction vessels must be used.

To have the clean measuring vessels ready for the next series of experiments, fill the vessels with 60 mL H_2O dist./deion. and seal by inserting the conductivity cells.

6.4.3. General directions for cleaning

The surfactants used in virtually all present-day synthetic detergents and washing-up liquids can change the oxidative behaviour of oils and fats and of oil- and fat-containing samples drastically. Since trace amounts of these detergents remain on the glass surface even after extremely thorough rinsing with water, no cleaning agents of this type should be used to clean reaction vessels, measuring vessels or connections!

Watch out for heavy metals, which can have a strong catalytic effect even in trace amounts (ppm range)!

The cleaning procedures described here have proved their worth with numerous sample materials and can be used by every 679 Rancimat user without the slightest hesitation. Possibly, somewhat modified, more specific and optimized cleaning procedures will have to be developed by the user and adapted to the "individual" cleaning requirements. No matter what the situation, however, once a cleaning procedure has been selected it should not be modified without a compelling reason (to avoid altering a possible unknown parameter in an uncontrolled manner).

7. Maintenance, Malfunctions

7.1. Maintenance

The following maintenance work should be carried out at regular intervals on the Rancimat wet section:

Replacement of dust filter

The 6.2724.010 Dust Filter (***38***) is mounted on the opening designated "Air Input Filter" at the rear of the Rancimat wet section (see *Fig. 3/4*) and is used to filter the air aspirated by the air pump. It must be checked periodically and replaced if heavily contaminated. A spare dust filter is included in the accessories of the 679 Rancimat, additional filters can be ordered separately (Order Number: 6.2724.010).

Regeneration or replacement of molecular sieves

The molecular sieves with indicator in the molecular sieves holder (***36***) at the rear of the wet section are used for the absorption of interfering oxidizing gases as well as of water in the aspirated air (see *Fig. 3/4*). When most of the molecular sieves pellets have become brown, the capacity to absorb water is exhausted; they can be regenerated in a drying oven at about +140 ... +180°C for 24 ... 48 h. Fresh molecular sieves can be ordered with the Order Number 6.2811.000.

Filling of the molecular sieves container (***36***) is described in Section 3.2.1. On assembly, it must be ensured that the O-ring seal is tight. The circular 6.2810.000 Paper Filter on the molecular sieves holder must be replaced occasionally. The 679 Rancimat accessories contain a set of 100 6.2810.000 filter papers for this purpose.

Replacement of tubing between measuring vessel and waste air manifold

When the connecting tubing (***40***) attached to the measuring vessels (***26***) (see *Fig. 5*) is heavily contaminated, it must be replaced.

Washing out the waste air manifold

Depending on the degree of contamination, the waste air manifold must occasionally be washed out with hot water. The procedure is as follows:

1. Disconnect the measuring vessel holder from the Rancimat wet section by undoing the two black plastic screws (only with wet section for 6 samples, cf. *Fig. 3*)

2. Remove the waste air manifold screwed to the measuring vessel holder from the holder by undoing the two screws.

3. Clean the waste air manifold with hot water. Care is called for with regard to the resistance towards organic solvents: the waste air manifold is made of polyvinyl chloride (PVC), the connecting piece (***29***) of the wet section for 6 samples of polypropylene (PP).

4. Screw the waste air manifold firmly to the measuring vessel holder and attach this to the Rancimat wet section (only with wet section for 6 samples).

7.2. Special messages, error messages

In addition to the displays which appear during normal operation of the control unit (see Section 4), the following special messages can also appear:

`report printing` `.....`	This display appears when the built-in printer is in operation. The printing operation can be aborted at any time by pressing the <QUIT> key.
`report printing and RS232 sending` `.....`	This display appears when the printer and the data output at the RS 232 output are active at the same time. This operation can be aborted at any time by pressing the <QUIT> key.
`No paper ! load paper please!` `########################################`	Error message without beep: The built-in printer is out of paper. A new 6.2237.030 Paper Roll must be inserted (see Section 3.5 for procedure).

If any type of malfunction occurs in the control unit or the wet section, numbered error messages which indicate the nature of the malfunction appear in the display. All error messages begin with "`ERROR XX:`" and are underlined with the symbol "#". Simultaneously with the appearance of the error message, three beeps are sounded as a warning.

The error messages together with their possible causes and the measures for their rectification are listed in the Table below. It contains all error messages which can occur during normal operation as well as error messages marked with an asterisk (*), which appear only in the diagnostic program (see Section 7.3).

Error message	Possible cause(s)	Rectification
`ERROR 01: ROM checksum error`	EPROM faulty	inform Metrohm Service
`ERROR 02: ON-CHIP-RAM error`	microprocessor defective	inform Metrohm Service
`ERROR 03: OFF-CHIP-RAM error*`	RAM faulty	inform Metrohm Service
`ERROR 04: ON-/OFF-CHIP-RAM error*`	microprocessor and RAM defective	inform Metrohm Service
`ERROR 05: BATTERY-RAM error`	– RAM storage battery flat – RAM faulty	– perform RAM initialisation (see Section 7.3) – inform Metrohm Service
`ERROR 06: printer error`	printer faulty	press <QUIT>, switch instrument off, then on, check again. if the error message appears again, inform Metrohm Service.
`ERROR 07: printer is not ready`	printer not ready	press <QUIT>, check again. if the error message appears again, inform Metrohm Service.
`ERROR 08: printer doesn't read data`	fault at interface control unit/printer	press <QUIT>, switch instrument off, then on, check again. if the error message appears again, inform Metrohm Service.
`ERROR 09: printer hasn't data accepted 0`	fault at interface control unit/printer	press <QUIT>, switch instrument off, then on, check again. if the error message appears again, inform Metrohm Service.

Error message	Possible cause(s)	Rectification
ERROR 10: invalid printer-error-code	unspecified printer fault	press <QUIT>, switch instrument off, then on, check again. if the error message appears again, inform Metrohm Service.
ERROR 11: invalid error code	unspecified ROM/RAM fault	press <QUIT>, switch instrument off, then on, check again. if the error message appears again, inform Metrohm Service.
ERROR 12: DCD is ON, receiver will send	fault in data transmission via RS 232 output	see Section 8.3.4
ERROR 13: CTS is ON before RTS was ON	fault in data transmission via RS 232 output	see Section 8.3.4
ERROR 14: CTS is always ON before RTS	fault in data transmission via RS 232 output	see Section 8.3.4
ERROR 15: CTS isn't ON after RTS	– RS 232 output enabled but no unit attached – unit attached to RS 232 output is not switched on	– connect unit to RS 232 output or disable RS 232 output (see Section 4.5.6) – switch on unit attached to RS 232 output
ERROR 16: DSR isn't ON after RTS	fault in data transmission via RS 232 output	see Section 8.3.4
ERROR 17: invalid RS232 error code	unspecified fault in data transmission via RS 232 output	see Section 8.3.4
ERROR 18: TI flag is never ON	microprocessor defective	press <QUIT>, check again. if the error message appears again, inform Metrohm Service.
ERROR 19...23: .....*	clock generator fault	inform Metrohm Service
ERROR 24: .....*	keyboard fault	inform Metrohm Service
ERROR 25...36: .....*	fault at RS 232 interface	inform Metrohm Service
ERROR 37: wet section not connected !	wet section not properly connected to control unit	attach wet section correctly to control unit with 6.2127.000 Connecting Cable (see Section 3.2.3)
ERROR 38: heater error !	wet section not switched on	switch on wet section (see Section 3.4)
ERROR 39: overheat !	heating fault (heating block has been heated to more than 235°C)	inform Metrohm Service
ERROR 40: calibration channel error !	the internal calibration of the measurement channels doesn't work (hardware fault at the control unit or the wet section)	inform Metrohm Service

7.3. Diagnosis instructions

Program 5.679.002X

The 679 Rancimat is an extremly precise measuring instrument of high performance and reliability. Its solide construction hardly allows its functions to be impaired by any external mechanical or electrical influence.

It can never be fully excluded that a fault occurs inside the unit, however, the chance is greater that possible troubles are due to improper operation or handling, to incorrect interconnections or improper operation of peripheral units.

In all cases it is advisable to localize faults by means of these diagnosis instructions which are easy to follow and carry out. The customer thus only needs to call for factory service if a fault is found in the unit. Moreover the numbered diagnosis steps allow the customer to give more precise information about the nature of the fault.

For inquiries to Metrohm always advise the serial number and program number (see item 15) of the instrument. If displayed, also state the fault indication.

Procedure

- Carry out the test steps in order and check whether the instrument responds as described. If this is the case, carry out the next step.
- If the instrument does not respond as expected repeat the corresponding diagnosis step in order to exclude possible handling error. If the instrument's response differs from what it should be, the instrument is likely to be defective.
- Normally the display shows points in the 2nd line. In case of an error these points are replaced by ####.
- Sections underlined in broken lines mean that they are displayed in flashing mode.
- The diagnosis steps denoted by the symbol ≫ can be used as re-entry points for repetitions provided the display shows:

```
diagnosis key 0...9 / heater
.....
```

  If the above message is not in the display, press <QUIT> (possibly keep pressed)

  If necessary switch power off and, after a few seconds, on again. Simultaneously press key <0> until the display shows "diagnosis key 0...9".

- If <QUIT> is pressed while the display shows "diagnosis key 0...9", the instrument is switched back to the basic program. To re-assume diagnosis, proceed as described above.
- Fault indication: A fault is displayed in the following way:

```
ERROR XX: YYY....
#########.... (40 signs)
```

  A fault is signalled by three audible beeps.

Instruments:

1.679.0020 control unit

1.679.0XXX wet section

6.2127.000 connecting cable

Test plug:

The test plugs mentioned are not absolutely necessary to carry out the diagnosis. However, they allow to carry out the test in an economic way. The plugs can be ordered ex stock Herisau.

3.496.8480 test plug RS 232

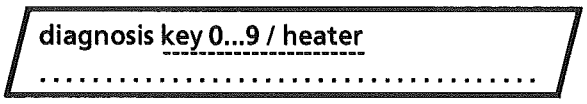
3.496.8440 test plug for measuring cell

≫ 1.1 Power off

1.2 On control unit disconnect connecting cable for 679 wet section

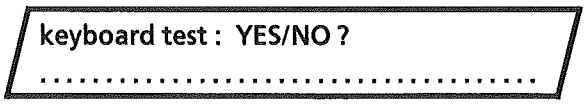
1.3 Remove external connections (from RS 232-connector)

1.4 679 control unit: Power on and immediately press key <0>
(keep pressed until the switch-on pattern disappears)

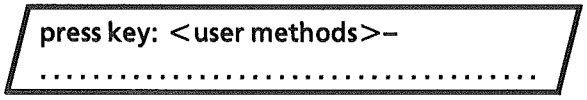


≫ **2. Diagnosis keyboard**

2.1 Press <0>



2.2 Press <YES>



The display requests to press a key ('user methods' in our example). After pressing this key the name of the key biefly appears on the right-hand side of the display.

If the test is positive, the name of the next key to be pressed will be displayed, etc.

After pressing the last key (paper) :

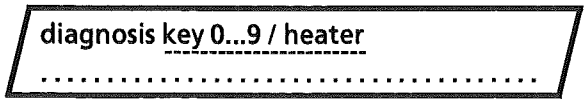
Possible faults:

a) If the name of the actuated key is not displayed on the right-hand side (and the display does not indicate the next key), the respective key is faulty (or the signal path interrupted).

b) If the display reads 'ERROR 24' and on the right-hand side there appears the name of a different key, this will indicate a fault in the keyboard matrix, or the wrong key has been pressed.

A fault indication may be cancelled by pressing <QUIT> (or <CLEAR> or <ENTER>). 'keyboard test continue' is then displayed, asking you whether you want to stop the test or not. (To continue press <YES>, to stop press <NO>). 'keyboard test END ' will be displayed at the end of the test

2.3 Press <QUIT> (or <CLEAR> or <ENTER>)



≫ 3. Diagnosis of display

3.1 Press <1>

display test: YES/NO?
.....

3.2 Press <YES>

Characters are generated in 5 groups for an optical check of the display:

1. The display will be completed with the signe that shows all dots (see FF in the table Fig. 1).

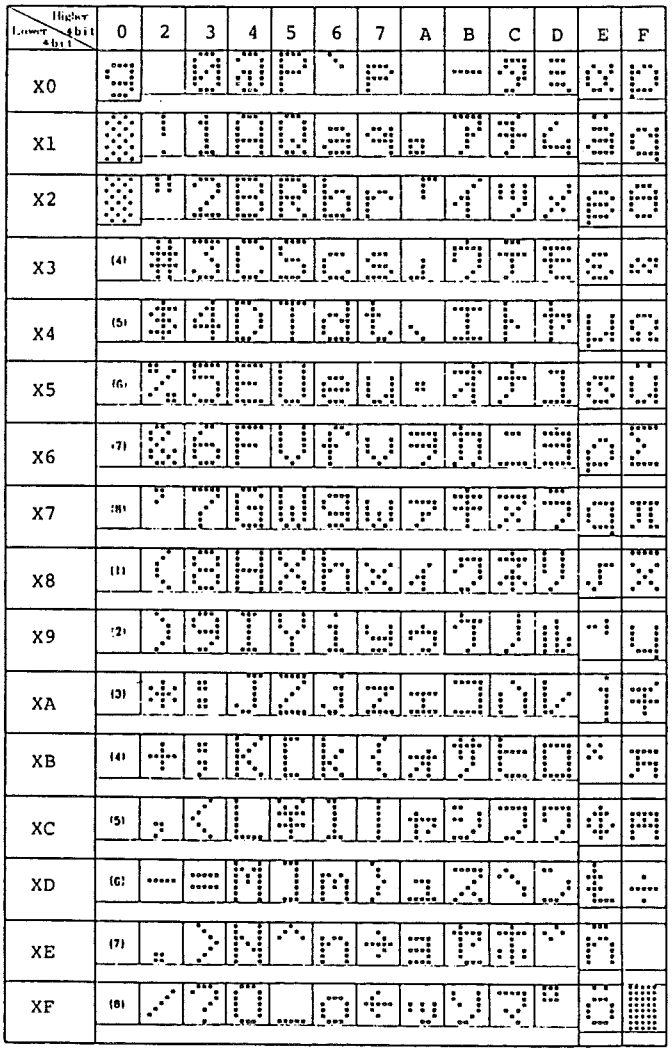
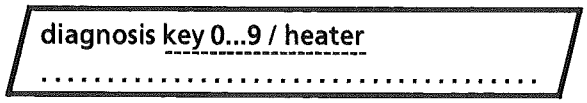


Fig. 1 Table of characters

2. Display is blanked (about 1 s, according to 20 in the table).
3. A chessboard pattern (02) appears all over the display; it changes 5 times into its inverse character (01)
4. The alphabet is displayed in capital letters, the same letter being displayed 80 times.
5. The whole character composition is shown in endless moving picture.

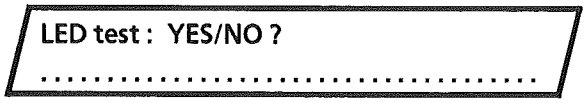
To stop the running test: <STOP>
To restart the test: <GO>
Breaking off a cycle in process (excepted group 3): <QUIT> (the next group will be displayed)
Group 5 is displayed endlessly unless breaking off by <QUIT>.

After breaking off group 5:



≫ 4. Diagnosis LED

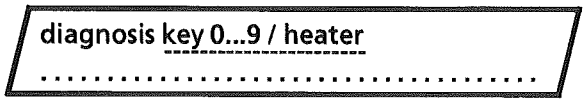
4.1 Press <6>



4.2 Press <YES>

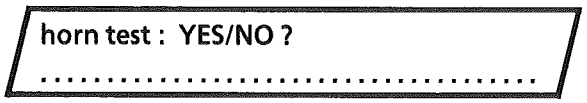
LEDs 'AIR', 'HEATER' and 'TEMP REACHED' are switched on and off in sequence. The test can be stopped with <STOP> and restarted with <GO>.

4.3 Press <QUIT>



≫ 5. Diagnosis horn

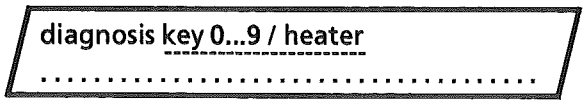
5.1 Press <7>



5.2 Press <YES>

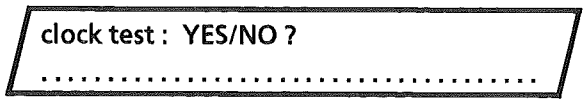
The horn sounds periodically. <STOP> holds the horn in the 'on' or 'off' state. <GO> restarts the cycle.

5.3 Press <QUIT>



≫ 6. Diagnosis of clock generator

6.1 Press <8>



6.2 Press <YES>

The test is terminated after about 12 s.

If the test is positive the display reads:

```
clock O.K.
.....
```

An error message in the display signals a fault in the clock generation.

6.3 Press <QUIT> (or <CLEAR> or <ENTER>)

```
diagnosis key 0...9 / heater
.....
```

≫ 7. Diagnosis of printer

Items 7.1 to 7.5 are to check the paper monitor.

7.1 Open plexicover of thermoprinter and cut off the paper between paper roller and inlet of paper.

7.2 Press <5>

```
printer diagnosis key 0...3/paper  1)
.....
```

7.3 Press <PAPER> until the paper is removed.

7.4 Press <0>

```
test print : YES/NO ?
.....
```

7.5 Press <YES>

```
printer diagnosis key 0...3/paper
.....
```

The printer must not operate!

7.6 Introduce paper (see instr. for use 3.5) and press <PAPER> until the paper reaches the tear off rail.

7.7 Press <0>

```
test print : YES/NO ?
.....
```

7.8 Press <YES>

A test print out is produced.

---

1) keys 1, 2, 3 are not used

- The printing must be equally black.
- It should be identical to the copy below, Fig. 2 or Fig. 3.
- The length of the diagram must comply with the stated measure.

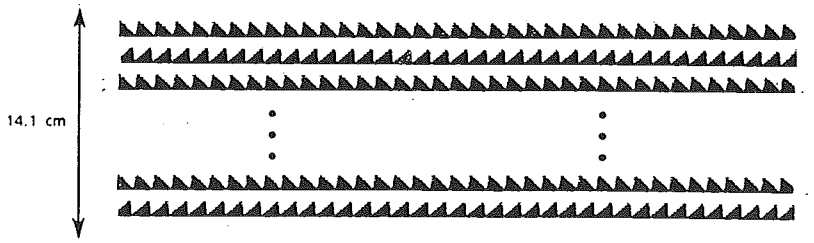


Fig. 2 Test print out (for instruments up to series 2)

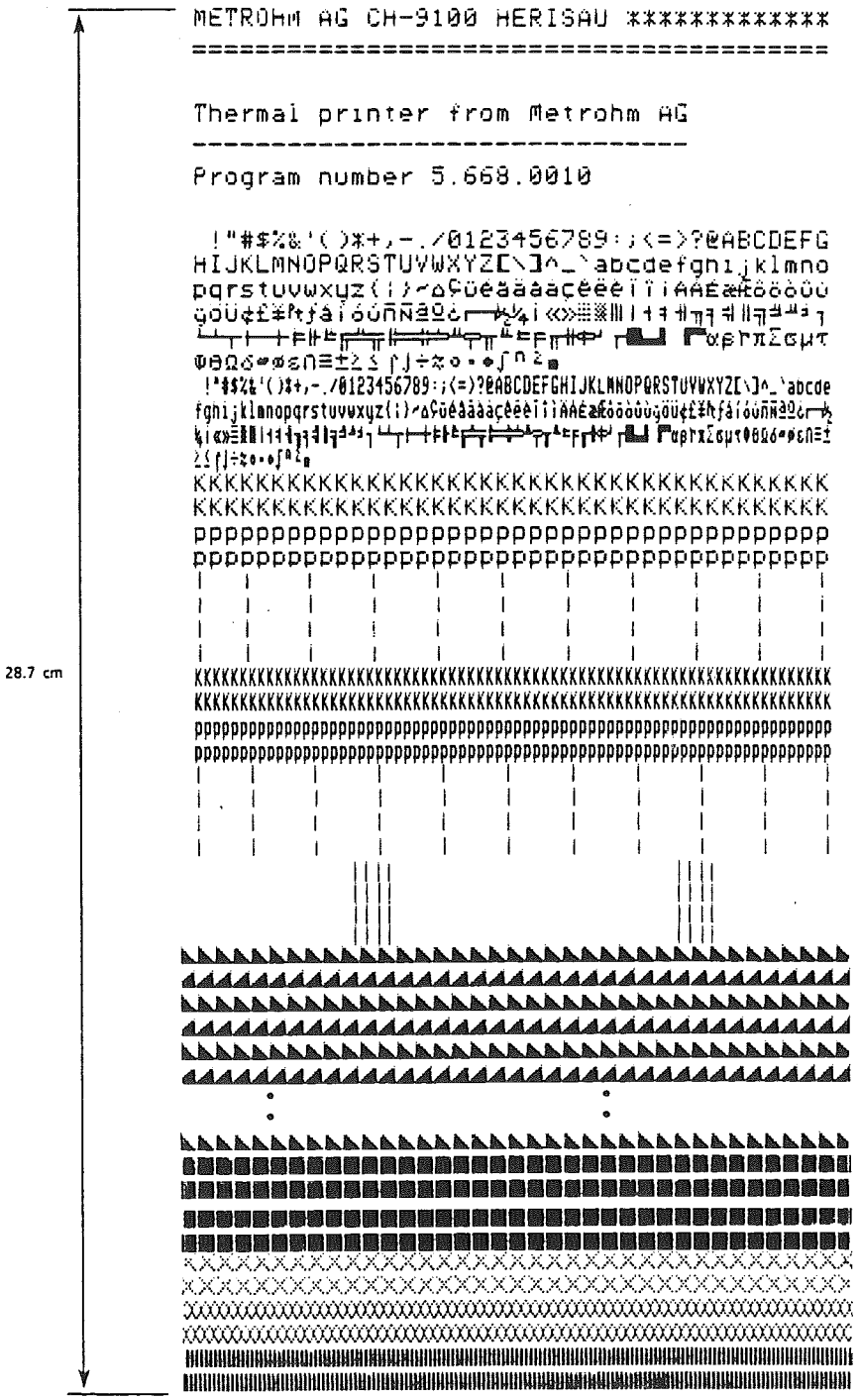
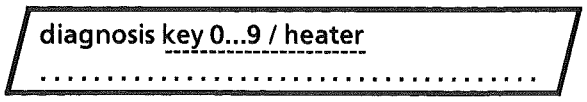


Fig. 3 Test print out (for instruments up to series 3)

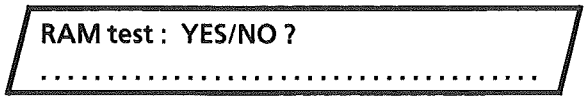
7.9 Press <QUIT>



≫ 8. Diagnosis RAM

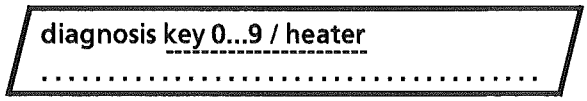
The existing RAM content will not be destroyed with this test.

8.1 Press <9>



8.2 Press <YES>

after about 3 s



In case of error message one (or both) RAM(s) are defective.

≫ 9. Diagnosis of external inputs/outputs

Test plug 3.496.8480 is required for this test. It is primarily intended for the repair service. (However, it can also be purchased by customers).

If not available go on with item 10.

Connections inside the test plug:

Pin	OUT		IN	Pin
4	RTS	–	CTS	5
20	DTR	–	DSR	6
2	T×D	–	DCD und R×D	3,8

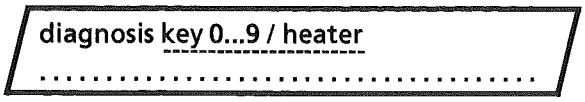
9.1 Insert plug 3.496.8480 to location RS 232. (Do not disconnect instrument!)

9.2 Press <2>

9.3 Press <YES>

A possible error message signals a defective interface or the test plug is not o.k.

9.4 Press <QUIT> (or <CLEAR> or <ENTER>)



9.5 Remove test plug.

≫ 10. Diagnosis of conductance measurement

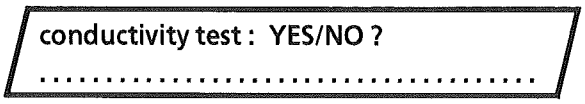
Using cable 6.2127.000 connect the wet system to 679 control unit and switch on wet system.

If test plug 3.496.8440[1)] available carry out item 10.1.

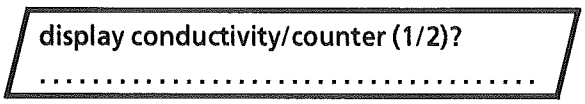
If test plug 3.496.8440 not available carry out item 10.2 .

10.1 If test plug 3.496.8440 available

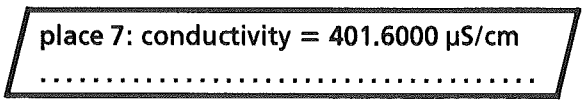
10.1.1 Press <4>



10.1.2 Press <YES>



10.1.3 Press <1>



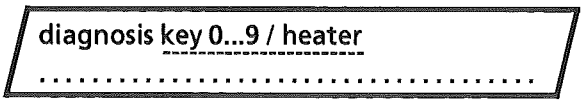
(Tol. ±1 %)

Software calibration in measuring channel 7 (built-in in the instrument) is executed.

10.1.4 Insert plug 3.496.8440 at measuring place 1 and switch to measuring place 1 with <GO>. Mesuring value as with 10.1.3.

10.1.5 Insert plug at measuring place 2
<GO> etc.
check all measuring places
(Tol. between the measuring places ±1%)

10.1.6 Press <QUIT>



---

1) The test can be simplified by means of a 3.496.8440 test plug. This plug is used in our repair service. However, it can also be purchased by customers with the above order number.

This test plug is used at the place of an electrode. A resistor of 2490 Ω fitted between plug terminals 1 and 3 provides a conductance of 401.6 µS/cm.

10.2 If test plug not available

Conductance measurement is examined with the following test by way of the cell conatant calibration.

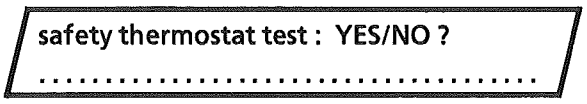
10.2.1 Calibrate the cell constant according to page 35, item 5.2, substeps 1 to 4.

10.2.2 Compare the measured cell constants with those labelled on the electrodes. Tolerace: ±0.007

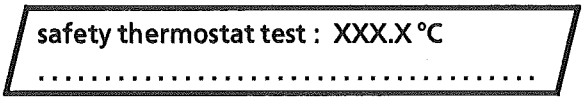
(Also for the above test the mentioned test plug can be used instead of the electrode. When calibrating the cell contant and entering 401.6 µS, there results a constant of 1.00)

≫ 11. Diagnosis of heating (needs to be carried out only if a trouble is suspected)

11.1 Press <HEATER>



11.2 Press <YES>



allow the unit to warm up (approx. 30 min)

When the heater block reaches about 250° to 260°C the overtemperature fuse will respond and the heat lamp will go out. The reset button must be actuated when the heater block has cooled. Exit with <QUIT>.

≫ 12. Diagnosis of air pump

With <QUIT> or power 'off' and after 5 s 'on' again select the stand-by mode.

all further readings depend on the stored methods

It must be possible to switch the air flow on and off by pressing they <AIR> key.

When switched on the red LED must be illuminated.

The air pump, when operative, can be heard.

In all the 6 measuring places the rate of air flow must be adjustable within the flowmeter scale by means of the rotary knob.

End of test

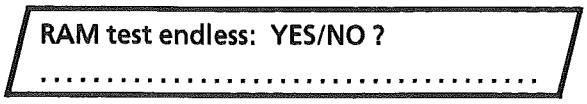
Most of the functions of the 679 Rancimat are examined with the above diagnosis steps. However, in case of suspicion that date stored in the Rancimat might get lost although the RAM test under item 8 was positive, the endless RAM test can be carried out in addition (see item 13).

≫ 13. Endless-RAM-test

(This test does not distroy the RAM content)

13.1 Power 'off' (wait for 5 s)

13.2 Power 'on' and simultaneously press <3> until the displayed dot pattern disappears



13.3 Press <YES>

Both RAMs are tested (non-destructive). The test can be continued at will.

One run lasts 3 seconds.
To break off keep <QUIT> pressed until the displayed dot pattern disappears.

Note: Never leave the test by power 'off'; otherwise the RAM content may get lost!

≫ 14. RAM - Initialization

The initialization data of the RAM are lost if Error 5 is displayed after power 'on'. The keyboard is then blocked, no entering is possible until the RAM is initialized again.

Note: A RAM-initialization distroys the self-entered methods (user methods)!

Procedure:

14.1 Power 'off' (wait for 5 s)

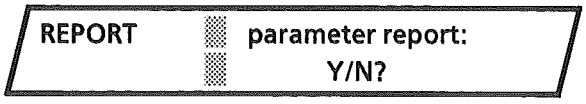
14.2 Power 'on' and simultaneously press <2> until the displayed dot pattern disappears

14.3 Press <YES>

The RAM is initialized.
The system jumps into the stand-by mode.

The user memories (working memories) 0 to 9 are loaded with the standard method.

14.4 Press <REPORT>



14.5 Press <YES>

```
report printing
.....
```

The printer gives the parameter report according to Fig. 4

```
=======================================
METROHM 679 RANCIMAT            METHOD 0
=======================================

PARAMETERS
==========
temperature                       50  Cel
temperature correction           0.0  Cel
conductivity range               200  uS/cm
evaluation modes                1/-/-
delay time                         0  h
paper feed                         1  cm/h
cell constants: channel 1       1.00  /cm
                channel 2       1.00  /cm
                channel 3       1.00  /cm
                channel 4       1.00  /cm
                channel 5       1.00  /cm
                channel 6       1.00  /cm
measuring time                    48  h
end mode:  EP stop               OFF
           heater stop           OFF
           air stop              OFF
```

Fig. 4 Parameter report

(For further standard parameters see 'Short instructions for use')

14.6 Setting the clock

Standard data of clock initialization are: date: 00-01-01
time: 00:00

Set the clock to the actual time according to page 28 item 4.4.5.

≫ 15. To indicate program number

Switch off mains and switch on after 5 s and continuously depress <1>.
In the display there appears:

```
program number 5.679.00XX
.....
```

Exit with <QUIT>

8. Technical Data

8.1. 679.0020 Rancimat control unit

Function	Control and evaluation of the Rancimat measurement in the wet section
Operation	Dialogue-guided operation via function and numeric keys
Display	LCD, 2×40 alphanumeric characters, 5×8 dot matrix contrast adjustable at rear of instrument
Printer	Built-in thermal printer, paper width = 111 mm 40 characters per line, 5×9 dot matrix
Data storage	Non-volatile
Method memory	For 9 Rancimat user methods
Sample data memory	For 6 sample identifications (each max. 10 characters)
Cell constant memory	For 6 cell constants
Evaluation	Automatic evaluation with three different modes, which can be used singly or in combination
evaluation mode 1	Determination of the induction time by detection of the greatest curvature of the experimental curve (asymptotic method)
evaluation mode 2	Determination of the stability time Δt needed for the preset conductivity change $\Delta\kappa$
evaluation mode 3	Determination of the conductivity change $\Delta\kappa$ during the preset time interval Δt
Reports	Automatic plotting of the experimental curves and printout of the result report and parameter report
Function keys	
USER METHODS	Call up and storage of max. 9 user methods
PARAM	Entry of the measurement parameters: temperature, temperature correction, conductivity measuring range, evaluation mode, delay time, paper feed, cell constants, analysis time, end mode
SAMPLE DATA	Entry of sample identifications (max. 10 characters) for each measurement channel
CELL CONST	Manual entry of cell constants or automatic determination of the cell constants with the aid of a calibration solution
REPORT	Printout of result, parameter, method and cell constant report
DATE	Entry of date and time
Diagnostic program	Special dialogue-guided program to test the hardware
RS 232C interface	Possibility to output list of experimental points, result, parameter, method and cell constant report
Ambient temperature	
Nominal operating range	+5 ... +40°C
Storage, transport	– 40 ... +70°C

Safety specifications

Construction / Testing	According to IEC 1010, EN 6101, UL 3101-1 instrument protection class I, protection level IP20
Warnings	These instructions for use contain information and warnings which must be heeded by the user if safe operation of the instrument is to be assured

Electromagnetic compatibility (EMC)

Emitted interference	The instrument complies with the basic specifications EN 55011 (class B), EN 55022 (class B), EN 50081-1
Interference immunity	The instrument complies with the basic specifications EN 50082-1, EN 60555-2, IEC801-2 (class 4), IEC801-3 (class 2), IEC801-4 (class 3), IEC801-5 (class 2/3)

Mains connection

Mains voltage	$U_{\sim}$ = 100, 120, 220, 240 V ± 10 %, adjustable
Mains frequency	f = 50...60 Hz
Power consumption	ca. 40 VA
Fuse	5 mm Ø, length 20 mm 100 and 120 V: 0.63 A (slow-blow) 220 and 240 V: 0.315 A (slow-blow)

Dimensions

Width	358 mm
Height	150 mm
Depth	415 mm

Weight 8.5 kg

8.2. 679.0XXX Rancimat wet section

Number of samples

679.012X versions: 1 ... 6
679.022X versions: 1 ... 3

Sample quantity Size: a few grams/a few millilitres

Temperature regulation

Temperature range	50 ... 220°C, adjustable in 1°C steps
Temperatur correction	0 ... 9.9°C, adjustable in 0.1°C steps This correction allows the deviation of the set temperature of the samples from the heating block temperature to be taken into account (the deviation must be measured with a calibration thermometer)
Reproducibility of the set temperature	±0.2°C (when operating temperature reached, identically filled reaction vessels inserted and with 20 L/h air flow rate)
Temperature variations	<0.1°C (when operating temperature reached, identically filled reaction vessels inserted and with 20 L/h air flow rate)
Temperature difference between the different measuring positions	<0.3°C (when operating temperature reached, identically filled reaction vessels inserted and with 20 L/h air flow rate)
Response temperature of thermal fuse	250°C
Temperature of instrument housing	<50°C (at an operating temperature of 220°C)

Heat transmission Electrically heated aluminium block with copper baseplate

Heating

Control	Via 679.0020 Control Unit
Heating time of complete system from + 20 °C	
to + 120 °C	Approx. 40 min (to a temperature constancy of ± 0.1 °C)
to + 220 °C	Approx. 60 min (to a temperature constancy of ± 0.1 °C)

Air flow rate

Pump	Diaphragm pump
Measurement	Flowmeter
Adjustable range	4 ... 25 L/h

Conductivity measurement

Measurement range	0 ... 400 µS/cm
Electrodes	6.0911.120 Double Platinum Conductivity Cell

Ambient temperature

Nomial function range	+ 5 ... + 40 °C
Storage, transport	– 40 ... + 70 °C

Housing Polyurethane (PUR) - rigid foam

Safety specifications See Rancimat Contrul Unit (Section 8.1)

Mains connection	*Wet section for 6 samples*	*Wet section for 3 samples*
2.679.0X21 version		
Mains voltage	100 ... 117 V (± 10%)	100 ... 117 V (± 10%)
Mains frequency	60 Hz	60 Hz
Power consumption	< 500 VA	< 300 VA
Fuse	5 A (TH), 5 mm Ø, 20 mm (slow-blow, high break. cap.)	2.5 A (TH), 5 mm Ø, 20 mm (slow-blow, high break. cap.)
2.679.0X26 version		
Mains voltage	220 ... 240 V (± 10%)	220 ... 240 V (± 10%)
Mains frequency	60 Hz	60 Hz
Power consumption	< 500 VA	< 300 VA
Fuse	2.5 A (TH), 5 mm Ø, 20 mm (slow-blow, high break. cap.)	1.6 A (TH), 5 mm Ø, 20 mm (slow-blow, high break. cap.)
2.679.0X27 version		
Mains voltage	220 ... 240 V (± 10%)	220 ... 240 V (± 10%)
Mains frequency	50 Hz	50 Hz
Power consumption	< 500 VA	< 300 VA
Fuse	2.5 A (TH), 5 mm Ø, 20 mm (slow-blow, high break. cap.)	1.6 A (TH), 5 mm Ø, 20 mm (slow-blow, high break. cap.)
2.679.0X28 version		
Mains voltage	100 ... 117 V (± 10%)	100 ... 117 V (± 10%)
Mains frequency	50 Hz	50 Hz
Power consumption	< 500 VA	< 300 VA
Fuse	5 A (TH), 5 mm Ø, 20 mm (slow-blow, high break. cap.)	2.5 A (TH), 5 mm Ø, 20 mm (slow-blow, high break. cap.)

Dimensions	*Wet section for 6 samples*	*Wet section for 3 samples*
Width	506 mm	304 mm
Height	410 mm (incl. cable)	420 mm (incl. cable)
Depth	465 mm	455 mm

Weight 28 kg (incl. accessories) 17 kg (incl. accessories)

8.3. RS 232C Interface

8.3.1. General information

The RS 232C interface built into the 679 Rancimat as standard is used solely for the output of measured values and reports to a printer or an external data system. The interface is wired as a DTE device (DTE: Data Terminal Equipment) and has the following technical data:

Data interface in accordance with EIA standard RS 232C (DIN 66020, sheet 1)

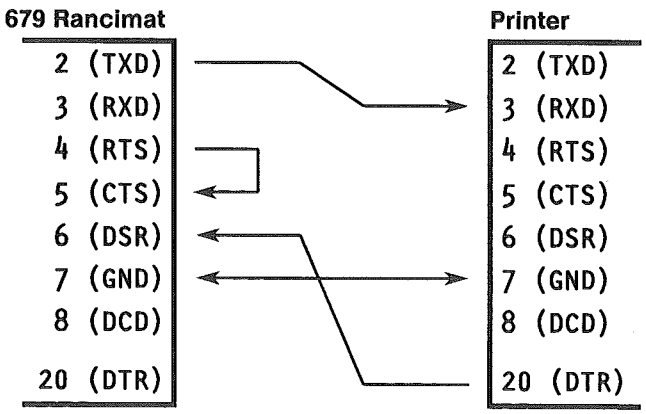
Code:	ISO-7-bit (ISO 646-1973)	
Baud rates:	1200, 2400, 4800, 9600 (adjustable)	
Handshake:	on/off setting	
Parity:	even	
Stop bits:	1	
Word length:	7-bit	
max. line length:	68 characters	
Control characters used:	CR (Carriage Return)	ASCII Dec. 13
	LF (Line Feed)	ASCII Dec. 10
	ETX (End of Text)	ASCII Dec. 3
	EOT (End of Transmission)	ASCII Dec. 4
Cable length:	max. ca. 20 m	

The RS 232C interface is enabled and disabled under the <REPORT> key (see Section 4.5.6). When the RS 232C output is enabled (RS 232 send ON), the additional inquiries regarding the baud rate setting and on/off setting of the handshake appear under the <REPORT> key.

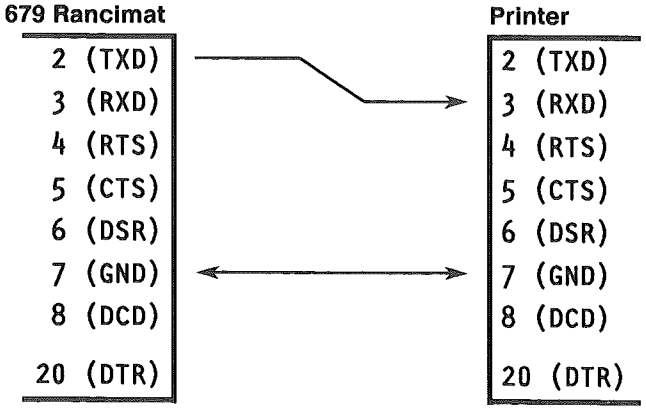
Interconnection of the 679 Rancimat with units of other manufacture may be effected only with a shielded data cable (e.g. Metrohm D.104.0201). Earthing of the cable shield at both units must be perfect (bear current loops in mind; always use radial earthing). Only connectors with adequate shielding may be employed (e.g. Metrohm K.210.0001 with K210.9004). As examples, the attachment of a printer and a personal computer (PC) to the RS 232C interface are described in detail in this section; other units are attached in an analogous manner.

8.3.2. Attachment of a printer to the RS 232C interface

A) *with handshake*
(RS 232 handshake ON)



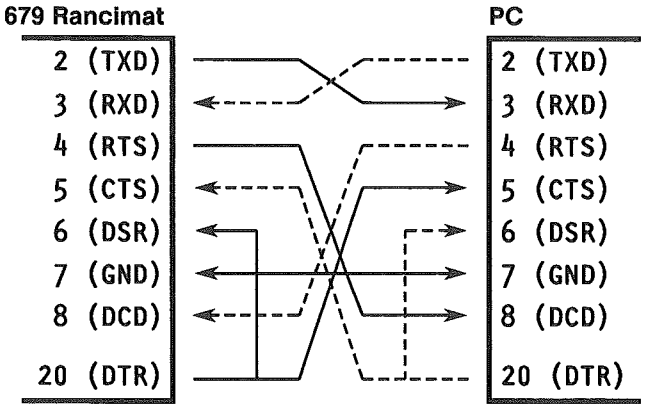
B) *without handshake*
(RS 232 handshake OFF)



8.3.3. Attachment of a PC to the RS 232C interface

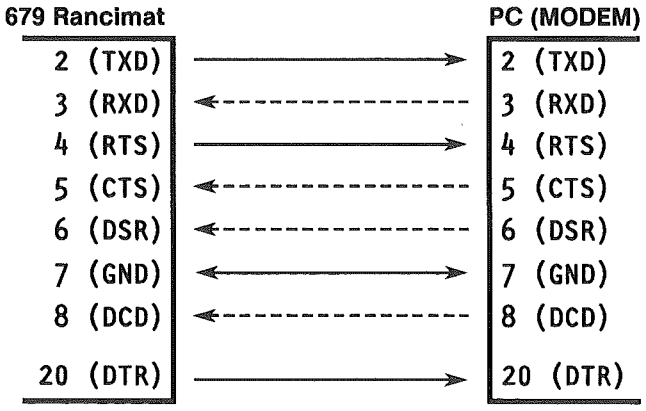
A) *with handshake*
(RS 232 handshake ON)

DTE – DTE connection
(DTE: Data Terminal Equipment)
Standard cable with two standard DB-25 connectors (D-type subminiature connector), both female, in accordance with RS 232C standard
(usual designation: null modem cable)

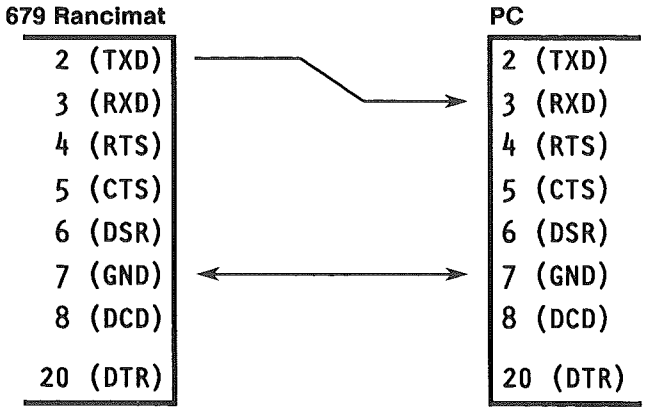


B) *with handshake*
(RS 232 handshake ON)

DTE – DCE connection
(DCE: Data Communication Equipment, MODEM)
Standard cable with two standard DB-25 connectors (D-type subminiature connector), 1 female (679), 1 male (MODEM), in accordance with RS 232C standard



C) *without handshake*
(RS 232 handshake OFF)



Program example for data transmission to a PC (without handshake)

```
10 REM Demoprogram 679
20 ' baudrate 1200
30 ' databits    7
40 ' stopbit     1
50 ' parity      E
60 ' handshake off
70 '
80 EOT$=CHR$(4)                        ' End of Transmission Character
90 C$="COM1:1200,E,7,1,RS,CS,DS,CD"          ' Communication Code
100 '
110 CLS:RESET
120 PRINT:PRINT "Save data       1"
130 PRINT "Read data       2"
140 X$=INPUT$(1)
150   IF X$="1" THEN GOSUB 1000
160   IF X$="2" THEN GOSUB 2000
170 GOTO 110
180 '
1000 INPUT "Name of data file:      [<drive:>] <filename.ext> ";F$
1010 OPEN C$ FOR INPUT AS #1
1020 OPEN F$ FOR OUTPUT AS #2
1030 SOUND 800,1:PRINT "R e a d y"
1040   INPUT #1,A$
1050   PRINT A$
1060   IF INSTR(A$,EOT$) THEN CLOSE:RETURN
1070   PRINT #2,A$
1080 GOTO 1040
1090 '
2000 INPUT "Name of data file:      [<drive:>] <filename.ext> ";F$
2010 OPEN F$ FOR INPUT AS #2
2020   INPUT #2,A$
2030   IF EOF(2) THEN 2060
2040   PRINT A$
2050 GOTO 2020
2060 CLOSE
2070 COLOR 10:PRINT:PRINT "End of Text      Press key....":COLOR 7
2080 X$=INPUT$(1)
2090 RETURN
```

Remarks

PC:	baud rate	1200
	handshake	OFF
	program language	GWBASIC

	commands	`Save data`
		storing of data on the desired drive
		`[<drive:>]` under the name `<filename.ext>`
		`Read data`
		reading of data on the desired drive
		`[<drive:>]` under the name `<filename.ext>`

Rancimat 679:	baud rate	1200
	handshake	OFF
Cable:	cable according to ***C)*** or ***A)*** (see page 65)	

8.3.4. Data transmission

Transmission of reports

When the RS 232 output is enabled (`RS 232 send ON`), the reports called up under the key <REPORT> are transmitted to the unit attached to the RS 232 output at the same time as they are printed out. The form of the report is identical to the representation on the 679 Rancimat printer (see Section 4.5). The text is transmitted line by line, each line ending with CR/LF. When the report is finished, the following characters are transmitted:

ETX (End of Text) with CR/LF
EOT (End of Transmission) with CR/LF

Note: When the heating is switched on (heater ON), the reports are transmitted in the time cycle "2 s send, 3 s wait"

Transmission of measurement data

When the RS 232 output is enabled (`RS 232 send ON`), the conductivity values recorded during the measurement are transmitted directly to the unit attached to the RS 232 output. The data have the following format (see also below example):

1. Box head with details of the instrument designation, method number, date, time, measurement variable with unit and table header with the channel numbers (only channels defined under <SAMPLE DATA> are specified). Each line is ended with CR/LF.

2. Data lines with specification of the index number and the measured values in µS/cm for the active channels. Each line is ended with CR/LF.

   The index number denotes the number of time units (1 time unit = 30 s).

   Each measured value is represented in a field of maximum 10 right-aligned digits with 4 fixed decimal places. Measured values are transmitted singly every 5 s (it must therefore be ensured that timeout is always longer than 5 s in the receiver). When the handshake is set to on (`handshake ON`), data transmission must not be interrupted by the receiver (leads to an error message and termination of transmission).

   After the last data line, the character ETX (End of Text) is transmitted with CR/LF.

3. Full Report with result and parameter reports (see Section 4.5.2)
   The text is transmitted line by line with CR/LF at the end of every line. At the end of the report, the following characters are transmitted:

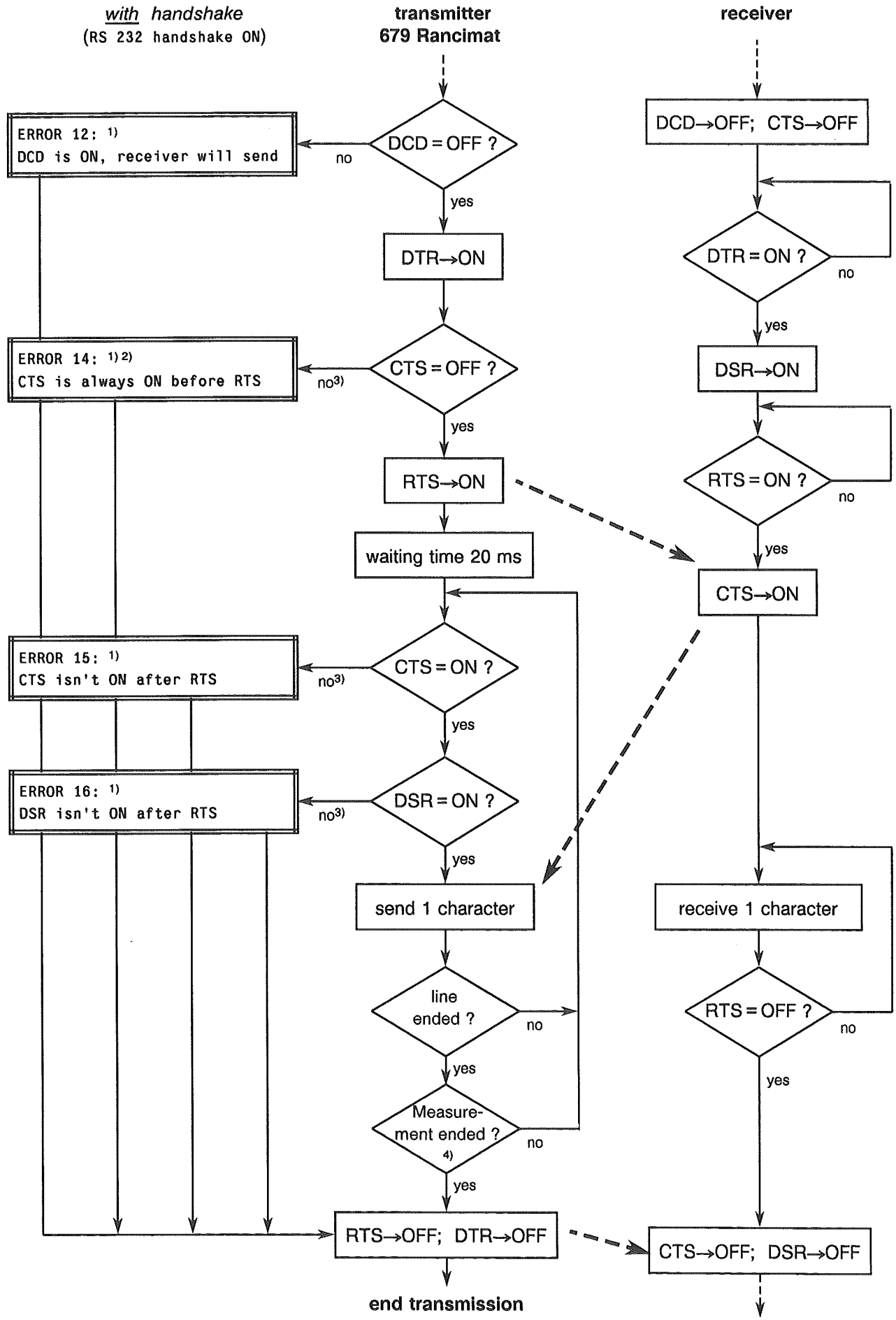
   ETX (End of Text) with CR/LF
   EOT (End of Transmission) with CR/LF

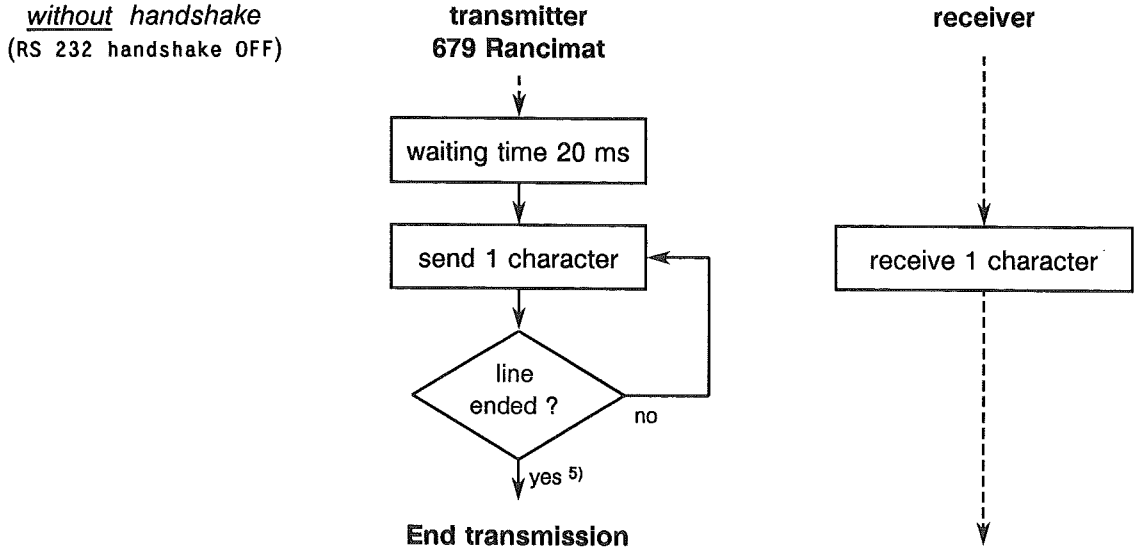
```
=======================================
Metrohm 679 RANCIMAT            METHOD 3
=======================================
DATE  87-12-07               TIME  18:52

conductivity [uS/cm]

index    ch: 1        2         3         4         5         6
-----------------------------------------------------------------
    1       0.2500    0.6250    0.1750    0.3750    0.2250    0.3000
    2       0.2500    0.6250    0.1750    0.4250    0.2250    0.3000
    3       0.2750    0.6250    0.1750    0.4750    0.2250    0.3250
    4       0.2750    0.6250    0.2000    0.5250    0.2250    0.3250
    5       0.2750    0.6500    0.2000    0.5750    0.2250    0.3250
    6       0.3000    0.6500    0.2000    0.6250    0.2250    0.3500
    .            .         .         .         .         .         .
    .            .         .         .         .         .         .
    .            .         .         .         .         .         .
  137     191.3250  172.2250  222.0250   75.1500  145.7750   91.8500
  138     194.0750  174.9250  224.8500   76.8250  146.8500   93.9000
  139     196.8500  177.6250  227.6750   78.5750  147.0000   95.9750
  140     199.6250  180.3500  230.5000   80.3500  148.1250   98.0750
    .            .         .         .         .         .         .
    .            .         .         .         .         .         .
    .            .         .         .         .         .         .
```

box head

data lines

Program structure for the data transmission





Notes:
All designations (DSR, CTS, etc.) refer to the transmitting device (679 Rancimat). For an explanation of the abbreviations, see Section 8.3.5.

1) If an error is found (ERROR 12...17), the data transmission is aborted immediately, but any measurement in progress is continued. The corresponding error message appears at the end of the measurement. To obtain the results of the recorded measurement, first acknowledge this error message by pressing the <QUIT> key and then disable the RS 232 output (RS 232 send OFF, see Section 4.5.6). A "full report" can then be requested under the key <REPORT>.

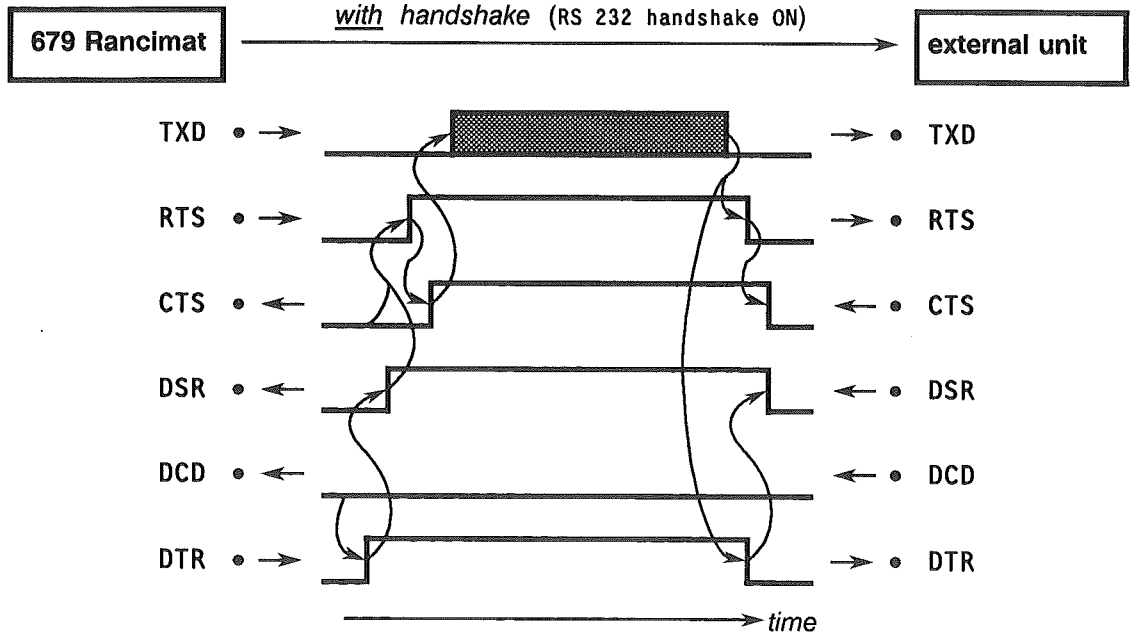
2) While a measurement is running, "ERROR 13: CTS is ON before RTS was ON" appears in place of "ERROR 14".

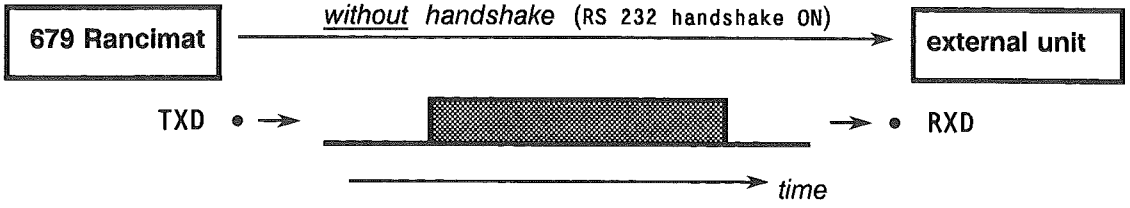
3) In the "no" case, the condition is tested further for ca. 2 s before the error message appears.

4) This condition is tested only when measurement data are transmitted.

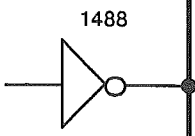
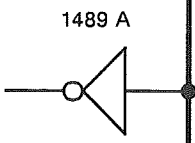
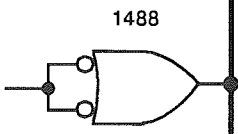
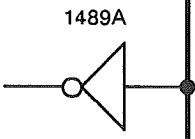
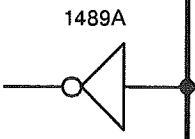
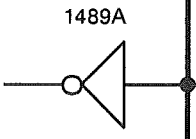
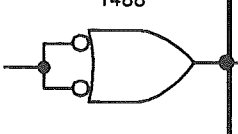
5) In the transmission of measurement data, the transmission is terminated only after completion of the measurement.

Chronological sequence of data transmission





8.3.5. Pin assignments

	3.679.0020	extern
EIA RS 232C Schnittstelle **EIA RS 232C Interface**		
Sendedaten (TXD). Erfolgt keine Datenübertragung, wird die Leitung im Zustand "EINS" gehalten Daten werden nur gesendet, wenn CTS und DSR im "EIN"-Zustand und DCD im "Aus"-Zustand sind. **Transmitted Data (TXD).** TxD is held in marking condition if there is no data transfer. A data transfer occurs only if CTS and DSR are in ON condition, and DCD in OFF condition.		E 2 Transmitted Data
Empfangsdaten (RXD) Vom Rancimat 679 werden keine Daten empfangen. **Received Data (RXD)** Data are not accepted by the 679 Rancimat.		E 3 Received Data
Sendeteil einschalten (RTS) EIN-Zustand: Rancimat 679 ist bereit, Daten zu senden. **Request to Send (RTS)** ON condition: 679 Rancimat is ready to send data.		E 4 Request to Send
Sendebereitschaft (CTS) EIN-Zustand: Gegenstation ist bereit, Daten zu empfangen. **Clear to Send (CTS)** ON condition: The connected device is ready to accept data.		E 5 Clear to Send
Betriebsbereitschaft (DSR) EIN-Zustand: Die Übertragungsleitung ist angeschlossen. **Data Set Ready (DSR)** ON condition: Communication channel is connected.		E 6 Data Set Ready
Betriebserde (GND) **Signal Ground (GND)**		E 7 Signal Ground
Empfangssignalpegel (DCD) EIN-Zustand: Der Empfangssignalpegel liegt innerhalb des Toleranzbereichs (Gegenstation ist bereit, Daten zu senden). **Data Carrier Detect (DCD)** ON condition: The received signal meets its suitability criteria (The connected device is ready to send data).		E 8 Data Communication Detector
Interface bereit (DTR) EIN-Zustand, wenn Interface sendebereit (initialisiert). **Data Terminal Ready (DTR)** ON condition as soon as the Interface is ready to send.		E 20 Data Terminal Ready

Datum/date 10.3.88 / dk/dö Metrohm	**Steuer-Ein- und Ausgänge / Control inputs and outputs** **679 Rancimat Datenausgang RS 232C** **679 Rancimat Data output RS 232C**
	3.679.0020/ 4 E 1

	3.679.0020	extern

RS 232C (Fortsetzung)
RS 232C (continued)

Schutzerde
Direkte Verbindung vom Kabelstecker zur Schutzerde des Gerätes.

Protective Ground
Direct connection from the cable plug to the protective ground of the device.

Polaritätszuordnung der Signale
- Datenleitungen (TxD)
  Spannung negativ (<–3 V): Signalzustand "EINS"
  Spannung positiv (> +3 V): Signalzustand "NULL"
- Steuer- oder Meldeleitungen (CTS, DSR, DCD, RTS, DTR)
  Spannung negativ (<–3 V): AUS-Zustand
  Spannung positiv (> +3 V): EIN-Zustand

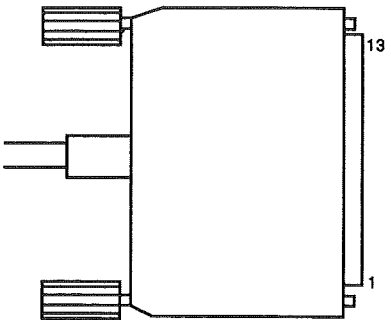
Im Uebergangsbereich von +3 V bis –3 V ist der Signalzustand undefiniert.

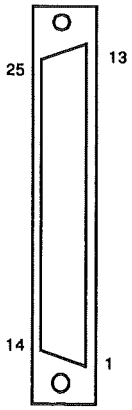
Definition of Signal States
- data interchange circuits (TxD)
  negative voltage (<–3 V): marking condition
  positive voltage (> +3 V): spacing condition
- timing and control interchange circuits (CTS, DSR, DCD, RTS, DTR)
  negative voltage (<–3 V): OFF condition
  positive voltage (> +3 V): ON condition

The function is not defined for voltages in the cross-over area between +3 V and –3 V.

Treiber Driver	1488	gemäss EIA RS 232C Spezifikation
Empfänger Receiver	1489	in conformance with the specifications of EIA standard RS 232C

Kontaktanordnung am Stecker (weibl.) für Buchse RS 232C (männl.)
Contact arrangement at the plug (female) for socket RS 232C (male)





Bestellnummern/ordering numbers:
K.210.9004 / K.210.0001

Auf Stecker-Lötseite gesehen
View of pin soldering side

Für Schäden, die durch unsachgemässes Zusammenschalten von Geräten entstehen, wird jede Haftung abgelehnt.
No liability will be accepted for any damage caused by wrong interconnections between instruments.

Datum/date
10.3.88 / dk/dö

Metrohm

Steuer-Ein- und Ausgänge / Control inputs and outputs
679 Rancimat Datenausgang RS 232C
679 Rancimat Data output RS 232C

3.679.0020/ 4 E 2

9. Scope of Delivery and Ordering Designations

9.1. 679 Rancimat

Rancimat Control Unit		**2.679.0020**
including the following accessories:		
1 ×	Connecting cable wet section – control unit; length = 5 m	6.2127.000
3 ×	Roll of thermal paper, width = 111 mm, length = 40 m	6.2237.030
1 ×	Spindle for thermal paper	6.2241.010
1 ×	Protective cover for control unit	6.2723.250
1 ×	Mains cable cable socket type CEE (22); cable plug to customer's specificiations:	
	type SEV 12 (Switzerland...)	6.2122.020
	type CEE (7), VII (Germany ...)	6.2122.040
	type NEMA/ASA (USA ...)	6.2122.070
1 ×	Instructions for use	8.679.1013
1 ×	Short instructions for use	8.679.1023
Rancimat wet section for 6 samples (220 ... 240 V / 50 Hz)		**2.679.0127**
including the following accessories:		
6 ×	Conductivity double platinum measuring cell	6.0911.120
6 ×	Measuring vessel	6.1428.020
6 ×	Reaction vessel	6.1429.030
6 ×	Foam barrier to reaction vessel 6.1429.030	6.1451.010
2 ×	Ring seal for 6.2418.0X0 air inlet tube (set of 6)	6.1454.040
6 ×	FEP tubing connection with 2 threaded nipples, length = 25 cm	6.1805.080
18 ×	Olive connector with M8 thread	6.1808.050
6 ×	Adapter M8/M6	6.1808.090
12 ×	Silicone rubber tubing, length = 18 cm	6.1816.010
6 ×	PTFE tubing, length = 8.8 cm	6.1819.050
1 ×	Vessel holder for 8 reaction vessels	6.2041.190
1 ×	Mains cable cable socket type CEE (22); cable plug to customer's specificiations:	
	type SEV 12 (Switzerland...)	6.2122.020
	type CEE (7), VII (Germany ...)	6.2122.040
	type NEMA/ASA (USA ...)	6.2122.070
2 ×	Air inlet tube for oil/fat samples (set of 12), length = 14.8 cm	6.2418.000
2 ×	Air inlet tube for PVC samples (set of 12), length = 9.8 cm	6.2418.010
1 ×	Protective cover for wet section	6.2723.260
2 ×	Dust filter, ⌀ 32 mm	6.2724.010
1 ×	Key for plastic nipple	6.2739.000
6 ×	Attachment for 6.1429.030 reaction vessel	6.2753.010
6 ×	Attachment for 6.1428.020 measuring vessel	6.2753.020
1 ×	Set of filters for molecular sieves container (set of 100)	6.2810.000
1 ×	Bottle (250 g) molecular sieve; pore size 0.3 nm	6.2811.000
Rancimat wet section for 6 samples (220 ... 240 V / 60 Hz)		**2.679.0126**
Accessories as for version 2.679.0127		
Rancimat wet section for 6 samples (100 ... 117 V / 50 Hz)		**2.679.0128**
Accessories as for version 2.679.0127		
Rancimat wet section for 6 samples (100 ... 117 V /60 Hz)		**2.679.0121**
Accessories as for version 2.679.0127		

Rancimat wet section for 3 samples (220 ... 240 V / 50 Hz) **2.679.0227**
including the following accessories:

3 ×	Conductivity double platinum measuring cell	6.0911.120
3 ×	Measuring vessel	6.1428.020
3 ×	Reaction vessel	6.1429.030
3 ×	Foam barrier to reaction vessel 6.1429.030	6.1451.010
1 ×	Ring seal for 6.2418.0X0 air inlet tube (set of 6)	6.1454.040
3 ×	FEP tubing connection with 2 threaded nipples, length = 25 cm	6.1805.080
9 ×	Olive connector with M8 thread	6.1808.050
3 ×	Adapter M8/M6	6.1808.090
6 ×	Silicone rubber tubing, length = 18 cm	6.1816.010
3 ×	PTFE tubing, length = 8.8 cm	6.1819.050
1 ×	Vessel holder for 8 reaction vessels	6.2041.190
1 ×	Mains cable	6.2122.0X0
1 ×	Air inlet tube for oil/fat samples (set of 12), length = 14.8 cm	6.2418.000
1 ×	Air inlet tube for PVC samples (set of 12), length = 9.8 cm	6.2418.010
1 ×	Protective cover for wet section	6.2723.260
2 ×	Dust filter, ⌀ 32 mm	6.2724.010
1 ×	Key for plastic nipple	6.2739.000
3 ×	Attachment for 6.1429.030 reaction vessel	6.2753.010
3 ×	Attachment for 6.1428.020 measuring vessel	6.2753.020
1 ×	Set of filters for molecular sieves container (set of 100)	6.2810.000
1 ×	Bottle (250 g) molecular sieve; pore size 0.3 nm	6.2811.000

Rancimat wet section for 3 samples (220 ... 240 V / 60 Hz) **2.679.0226**
Accessories as for version 2.679.0227

Rancimat wet section for 3 samples (100 ... 117 V / 50 Hz) **2.679.0228**
Accessories as for version 2.679.0227

Rancimat wet section for 3 samples (100 ... 117 V /60 Hz) **2.679.0221**
Accessories as for version 2.679.0227

9.2. Options

To customer's order and on payment of extra charge:

Test plug for measuring cell **3.496.8440**

Test plug RS 232C **3.496.8480**

Rancimat accessories **6.5612.000**
including the following accessories:

6 ×	Conductivity double platinum measuring cell	6.0911.120
6 ×	Measuring vessel	6.1428.020
6 ×	Reaction vessel	6.1429.030
6 ×	Foam barrier to reaction vessel 6.1429.030	6.1451.010
2 ×	Ring seal for 6.2418.0X0 air inlet tube (set of 6)	6.1454.040
6 ×	FEP tubing connection with 2 threaded nipples, length = 25 cm	6.1805.080
18 ×	Olive connector with M8 thread	6.1808.050
6 ×	Adapter M8/M6	6.1808.090
12 ×	Silicone rubber tubing, length = 18 cm	6.1816.010
6 ×	PTFE tubing, length = 8.8 cm	6.1819.050
1 ×	Vessel holder for 8 reaction vessels	6.2041.190
2 ×	Air inlet tube for oil/fat samples (set of 12), length = 14.8 cm	6.2418.000
2 ×	Air inlet tube for PVC samples (set of 12), length = 9.8 cm	6.2418.010
2 ×	Dust filter, ⌀ 32 mm	6.2724.010
6 ×	Attachment for 6.1429.030 reaction vessel	6.2753.010
6 ×	Attachment for 6.1428.020 measuring vessel	6.2753.020

Subject to modifications!

10. Warranty

The warranty regarding our products is limited to rectification free of charge in our workshops of defects that can be proved to be due to material, design or manufacturing faults which appear within 12 months from the day of delivery. Transport costs are chargeable to the purchaser.

For day and night operation, the warranty is valid for 6 months.

Glass breakage in the case of electrodes or other glass parts is not covered by the warranty. Checks which are not a result of material or manufacturing faults are also charged during the warranty period. For parts of outside manufacture insofar as these constitute an appreciable part of our instrument, the warranty stipulations of the manufacturer in question apply.

With regard to the guarantee of accuracy, the technical specifications in the Instructions for Use are authoritative.

Concerning defects in material, construction or design as well as the absence of guaranteed features, the purchaser has no rights or claims except those mentioned above.

If damage of the packaging is evident on receipt of a consignment or if the goods show signs of transport damage after unpacking, the carrier must be informed immediately and a written damage report demanded. Lack of an official damage report releases Metrohm from any liability to pay compensation.

If any instruments and parts have to be returned, the original packaging should be used if at all possible. This applies above all to instruments, electrodes, burette cylinders and PTFE pistons. Before embedment in wood shavings or similar material, the parts must be packed in a dustproof package (for instruments, use of a plastic bag is imperative). If open assemblies are enclosed in the scope of delivery that are sensitive to electromagnetic voltages (e.g. data interfaces etc.) these must be returned in the associated original protective packaging (e.g. conductive protective bag). (Exception: assemblies with built-in voltage source belong in a non-conductive protective packaging). For damage which arises as a result of non-compliance with these instructions, no warranty responsibility whatsoever will be accepted by Metrohm.

11. Literature

[1] **Analyse von Speisefetten und Speiseölen**
Metrohm Application Bulletin 141

[2] **Bestimmung der Thermostabilität von Polyvinylchlorid (PVC)**
DIN 53 381 Teil 1 Mai 1983

[3] **Bestimmung der Thermostabilität von PVC und mit ihm verwandten Copolymeren**
Metrohm Application Bulletin 205

[4] **Bestimmung der Antioxidansaktivität nach der Rancimatmethode**
Metrohm Application Bulletin 232

[5] **Bestimmung der Oxidationsstabilität von Cerealien, Keksen und Bisquits**
Metrohm Application Bulletin 237

[6] **Oxidationsstabilität von Ölen und Fetten – Rancimatmethode**
Metrohm Application Bulletin 204

[7] **Sampling and analysis of commercial fats and oils. Oil stability index (OSI)**
AOCS Cd 12b-92 (1992)

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Oxidative stability of potato chips determined by Rancimat
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JAOCS 69, 999-1002 (1992)

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JAOCS 69, 866-871 (1992)

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JAOCS 69, 525-527 (1992)

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Comparisons: Measuring oxidative stability
Inform 5, 104-109 (1994)

[17] Hill S.E., Perkins E.G.
Determination of oxidation stability of soybean oil with the oxidative stability instrument. Operation parameter effect
JAOCS 72, 741-743 (1995)

[18] Läubli M.W., Bruttel P.A.
Determination of the Oxidative Stability of Fats and Oils: Comparison between the Active Oxygen Method (AOCS Cd 12-57) and the Rancimat Method
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[19] Läubli M.W.
Bestimmung des Antioxidansaktivitäts-Indexes mit der Rancimatmethode
Lebensmittelchemie 48, 134-136 (1994)

[20] Schwarz K., Ternes W.
Verwendung von Rosmarinextrakten als natürliche Fettschutzstoffe in der Lebensmittelindustrie
Food Technology Magazin 18-21 (1993)

12. Declaration of conformities

CE EC Declaration of Conformity

The Metrohm Ltd. company, Herisau, Switzerland herby certifies, that the instrument

679 Rancimat

meets the requirements of EC Directives 89/336/EWG and 73/23/EWG.

Source of the specifications:

EN 50081-1	Electromagnetic compatibility, basic specification Emitted Interference
EN 50082-1	Electromagnetic compatibility, basic specification Interference Immunity
EN 61010	Safety requirements for electrical laboratory measurement and control equipment

Description of the instrument:

Instrument for automatic determination of oxidative and thermal stabilities

Herisau, December 4, 1995

Dr. J. Frank	Ch. Buchmann
Development Manager	Production and Quality Assurance Manager

Certificate of Conformity and System Validation

This is to certify the conformity to the standard specifications for electrical appliances and accessories, as well as to the standard specifications for security and to system validation issued by the manufacturing company.

Name of commodity:	679 Rancimat
System software:	Stored in ROMs
Name of manufacturer:	Metrohm Ltd., Herisau, Switzerland
Principal technical information:	Voltages: 100...120 V or 220...240 V
	Frequency: 50 or 60 Hz

This Metrohm instrument has been built and has undergone final type testing according to the standards:

Electromagnetic compatibility: Emission
EN55022 (class B), EN50081-1

Electromagnetic compatibility: Immunity
EN50082-1, EN60555-2, prEN50093, IEC801-2 (class 4), IEC801-3 (class 2), IEC801-4 (class 3), IEC801-5 (class 2/3)

Security specifications
IEC1010, EN61010, UL3101-1

The technical specifications are documented in the instruction manual.
The system software, stored in Read Only Memories (ROMs) has been validated in connection with standard operating procedures in respect to functionality, analytical performance, and accuracy of results.
The features of the system software are documented in the instruction manual.

Metrohm Ltd. is holder of the SQS-certificate of the quality system ISO 9001 for quality assurance in design/development, production, installation and servicing.

Herisau, December 4, 1995

Dr. J. Frank	Ch. Buchmann
Development Manager	Production and Quality Assurance Manager

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