Metrohm Instructions for use

Sample Changer **676.0300**
Series 06...

Control Unit **664.0020**
Series 12...

Metrohm
Measurement in Chemistry

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Sample Changer 676.0300 Series 06 . . .

Control Unit 664.0020 Series 12 . . .

Mains connection:

Mains voltage	*U*	=	100, 117, 220, 240 V ± 10%
Mains frequency	*f*	=	50 ... 60 Hz
Power consumption	*S*	=	50 VA

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8.676.1003 Instructions for Use 676 Sample Changer

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676 Sample Changer with 664 Control Unit

Instructions for Use

1. Introduction

The **676 Sample Changer** allows series analyses in digestion tubes from the Behr, Barkey or Merck companies to be performed automatically. It is thus eminently suitable for all applications in which the sample has to be boiled or digested before the determination. The detachable sample rack holds 15 sample vessels and can be inserted directly in a suitable digestion block.

The 676 Sample Changer is normally controlled by the associated **644.0020 Control Unit**, which ensures not only coordinated sample transport, but also rational use of the required instruments and auxiliary equipment such as titrators and dispensers, valves and pumps in each particular case. To fulfill this task, the control unit has two special, built-in programs with the flow sequence of the analysis to be performed. The delay times incorporated in the analysis routine as well as the opening times of the valves can be entered directly on the control unit.

The **670 Titroprocessor** in conjunction with a **677 Drive Unit** can also be used to control the 676 Sample Changer in place of the 664 Control Unit. Special program commands in this case ensure sample transport, stirring, siphoning off and rinsing of the sample vessels.

The present Instructions for Use provide a detailed description of the above-mentioned possibilities for operation of the 676 Sample Changer. In addition, examples are used to illustrate the **determination of hydroxyl and saponification numbers** and the **COD determination** with various METROHM titrators.

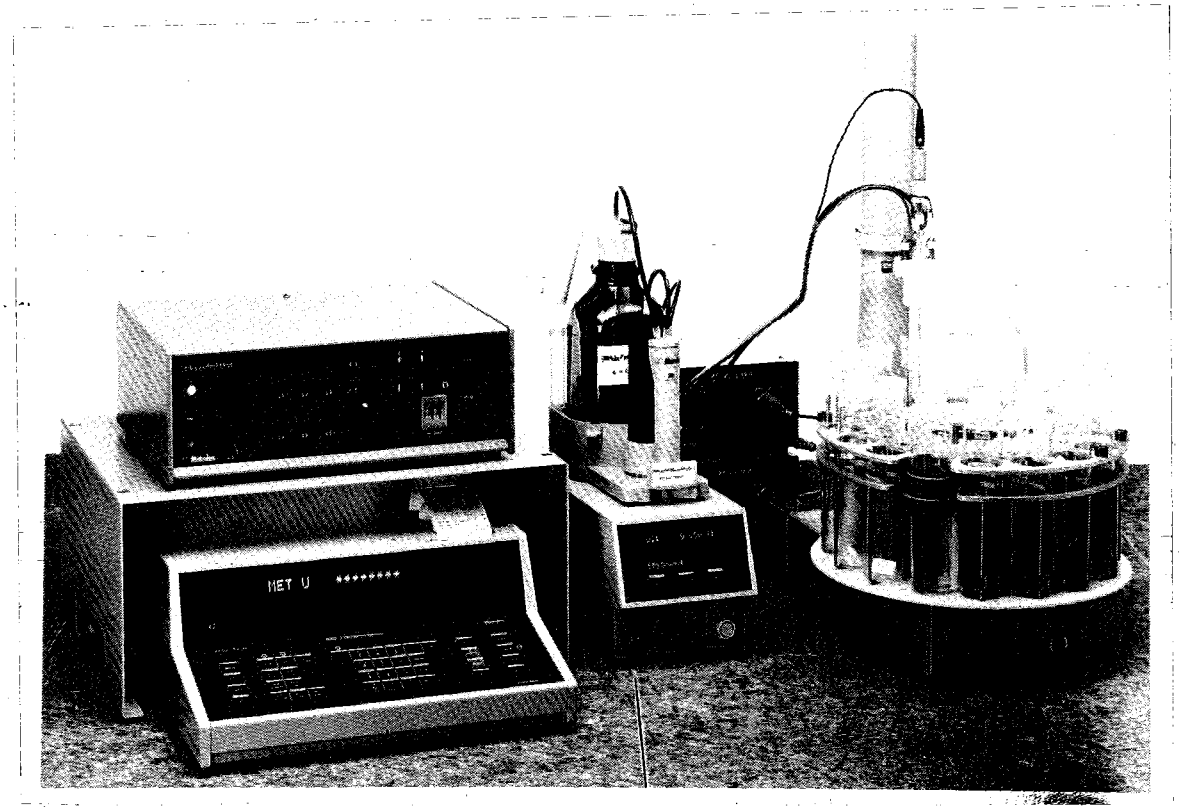


Fig. 1: 676 Sample Changer with 664 Control Unit, 686 Titroprocessor, 665 Dosimat and two 683 Pumps

2. Control elements

2.1. 676 Sample Changer

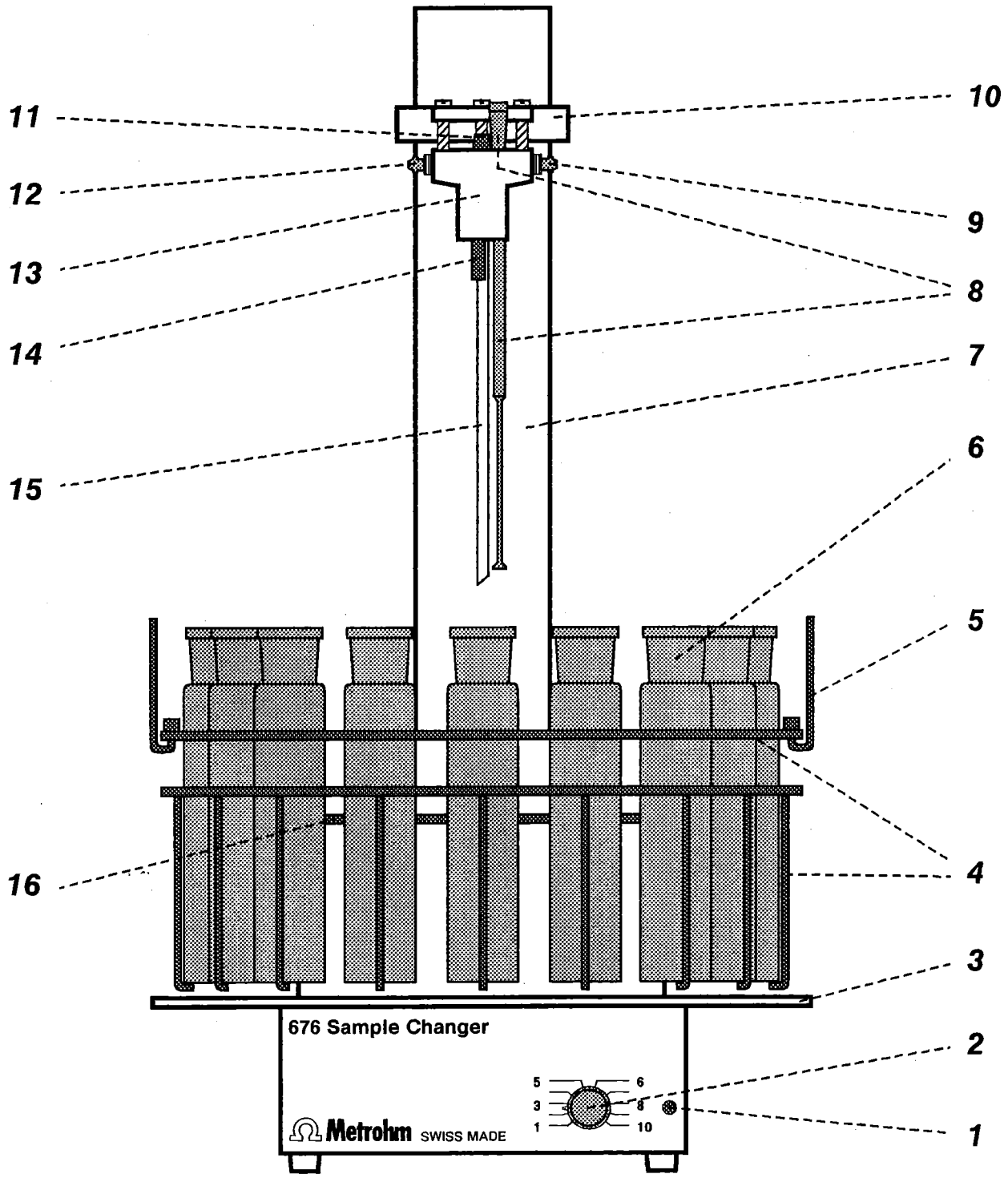


Fig. 2: Front of 676 Sample Changer

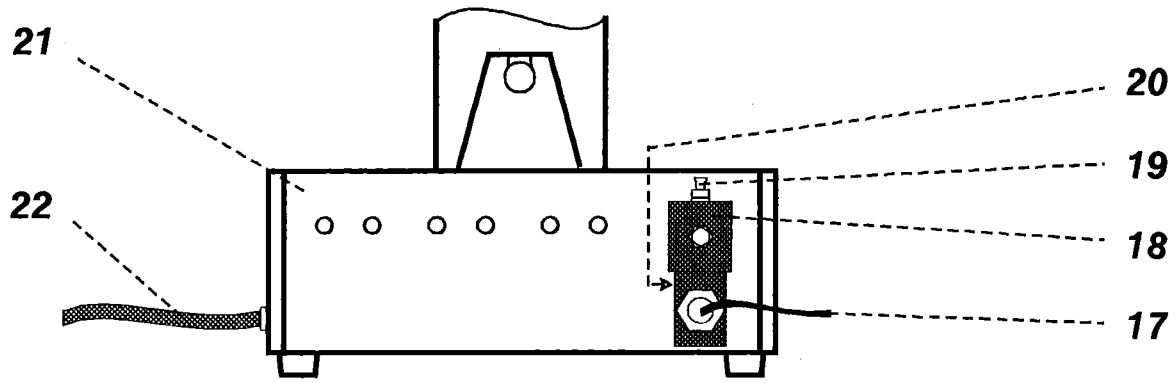


Fig. 3: Rear of 676 Sample Changer

1 ***Indicator lamp of stirrer***

2 ***Rotary regulator for control of the stirring speed***
rotational speed (stabilised):
200 ... 1900 /min

3 ***Glide surface***

4 ***6.2041.030 Sample rack***
for 15 sample vessels

5 ***4.676.0700 Holding bracket for sample rack***

6 ***Sample vessel***
- sample vessel Barkey/Behr:
  6.1452.000
- sample vessel Merck:
  6.1452.010

7 ***Lift tower***

8 ***Burette tip***
- for 6.1452.000 Sample vessels (Barkey/Behr):
  6.1543.130 Burette tip
- for 6.1452.010 Sample vessels (Merck):
  6.1543.140 Burette tip

with connection for 6.1805.110 FEP Tubing (supply of the titration solution from 665 Dosimat or 702 SET/MET Titrino)

9 ***Connection for siphoning tubing***
Connecting nipple for 6.1812.000 PTFE siphoning tubing
(connection to 683 Siphoning Pump)

10 ***Lifting arm***
with integral titration head

11 ***Nipple with O-ring***
- for mounting the 6.9902.048 pH Electrode (determination of hydroxyl and saponification numbers)
- for mounting the 6.1240.050 or 6.1240.060 Electrode Vessels (COD determination)

12 ***Connection for rinsing solution***
Connecting nipple for 6.1812.000 PTFE Tubing
(connection to 683 Rinsing Pump or 6.2726.070 Electromagnetic Valve)

13 ***Titration head***

14 ***6.2740.010 Rinse nozzle***

15 ***Siphoning tube***
- for 6.1452.000 Sample vessels (Barkey/Behr):
  6.1821.000 Siphoning tube
- for 6.1452.010 Sample vessels (Merck):
  6.1821.010 Siphoning tube

16 ***Turntable***
with holder for conditioning vessel

17 ***Connecting cable of electromagnetic valve***
Connecting cable to 664.0020 Control Unit

18 ***6.2726.070 Electromagnetic valve***

19 ***Electromagnetic valve outlet***
Connecting nipple for 6.1812.000 PTFE tubing

20 ***Electromagnetic valve inlet (not visible)***
Connecting nipple for
6.1812.000 PTFE tubing

21 ***Valve panel for 4 valves***

22 ***Connecting cable to 664.0020 Control Unit***
integral

2.2. 664.0020 Control Unit

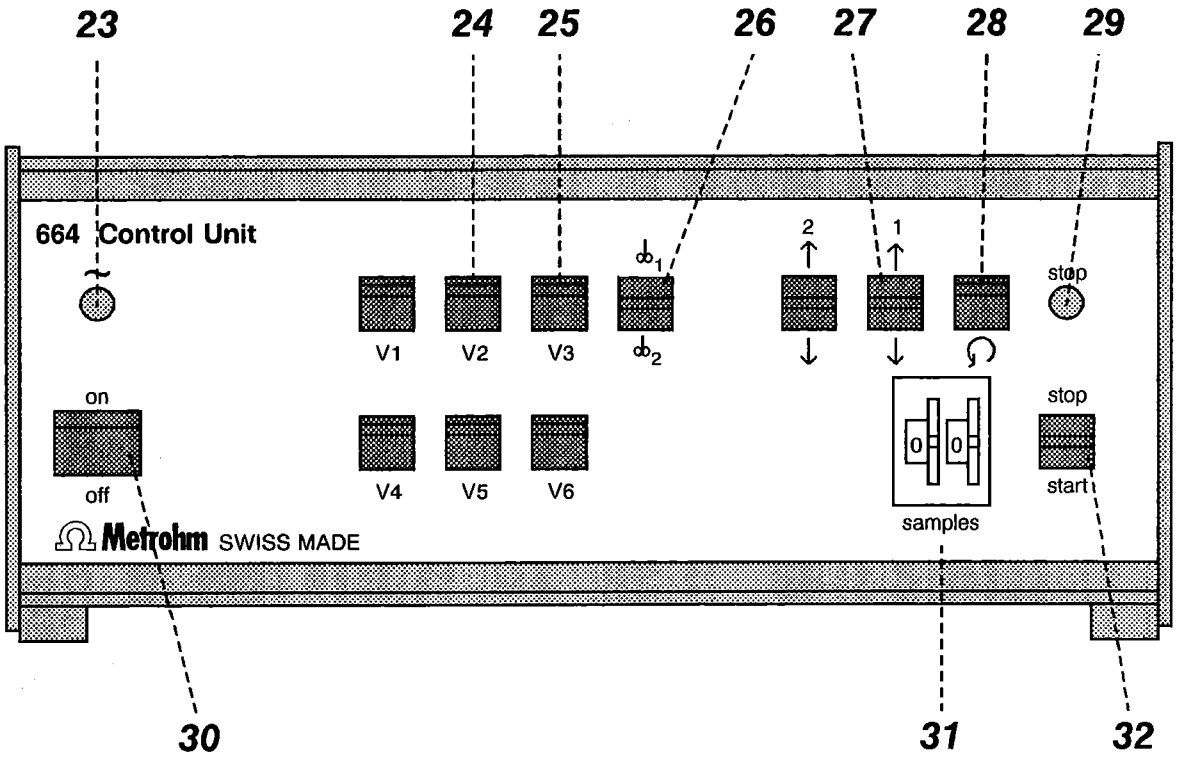


Fig. 4: **Front of 664.0020 Control Unit**
(the parts not marked have no function)

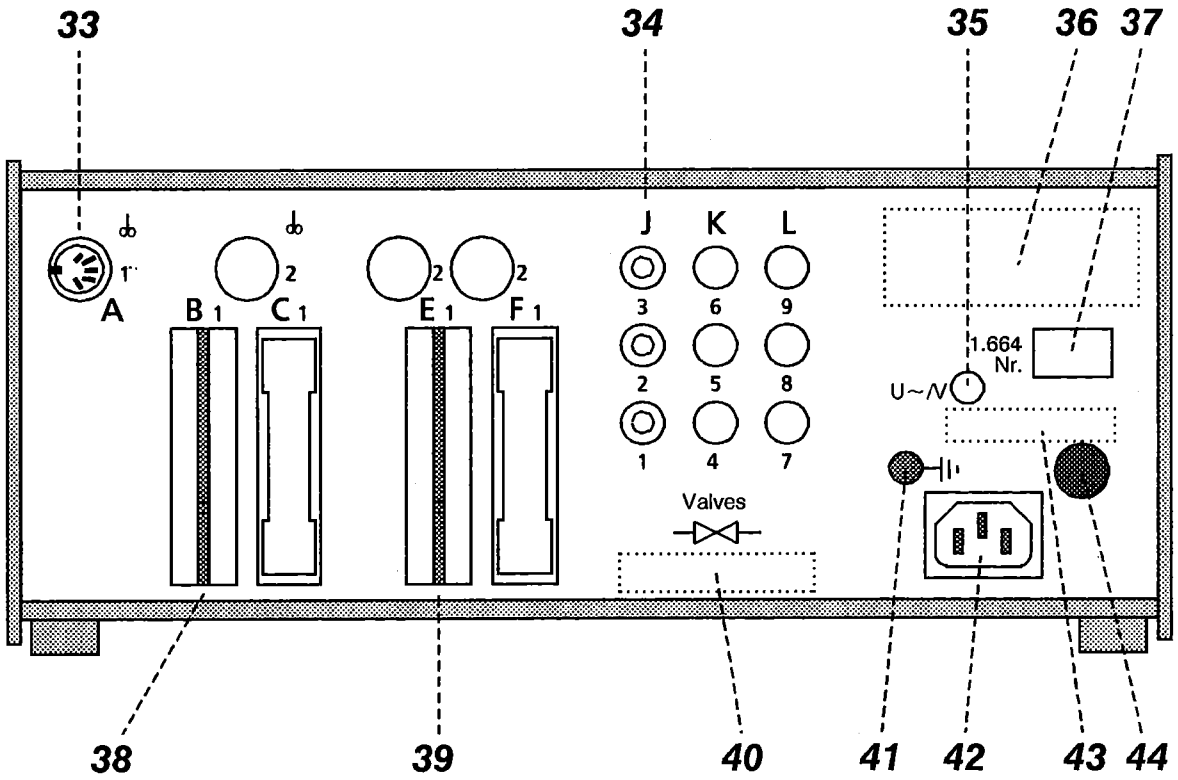


Fig. 5: **Rear of 664.0020 Control Unit**
(the parts not marked have no function)

23 ***Power on lamp***
lights up when instrument switched on

24 ***Manual operation Siphoning***
Pressing this key *down* switches on the 683 Siphoning Pump (this must be attached to connection ***34***-2).

25 ***Manual operation Rinsing***
Pressing this key *down* triggers the rinsing operation (683 Rinsing pump is switched on or electromagnetic valve ***18*** is opened). For this, the 683 Rinsing Pump or electromagnetic valve ***18*** must be attached to connection ***34***-3.

26 ***Manual operation of the stirrer***
Pressing this key *up* switches on the magnetic stirrer at the sample changer (indicator lamp ***1*** lights up). The stirring speed can be set at the rotary regulator ***2***.

27 ***Manual operation of the lifting arm***
By pressing this key *up*, lifting arm ***10*** is *raised*.

By pressing this key *down*, lifting arm ***10*** is *lowered*.

28 ***Manual operation of the sample transport***
By pressing this key *down*, operation of the turntable ***16*** is started.

If the sample vessels need to be moved only by 1 position, the key must be pressed only briefly (ca. 1 s).

29 ***Stop lamp***
lights up when the analysis program has been executed or stopped manually.

30 ***Mains switch***
On/off switching of the instrument

When instrument is in operation, the power-on lamp ***23*** is lit up

31 ***Thumbwheel switch to set the number of samples***
must be set to 00

32 ***Control key***
for starting and stopping the analysis program

By pressing the key *down*, the set analysis program is *started*.

By pressing the key *up*, the set analysis program is immediately *stopped* (an ongoing titration is first run to completion).

33 ***Connecting socket for stirrer***

34 ***Plug socket J with connecting sockets for siphoning pump (V2) and rinsing pump or electromagnetic valve (V3)***

35 ***Display of the set mains voltage***
Setting of the voltage, see *section 3.4*

36 ***Important note:***
"In case of service note the instructions inside this panel"

37 ***Instrument designation***
Instrument number, model number, serial number

38 ***3.540.2111 PCB Connector for connection of the 676 Sample Changer***

39 ***3.540.1640 PCB Connector for connection of peripheral units (e.g. 682, 686, 702)***

40 ***Important note:***
"ATTENTION:
For continued protection replace only with the same type and rating of fuse!"

41 ***Earth socket***
Earthing, see *section 3.4*

42 ***Mains socket***
Mains connection, see *section 3.4*

43 ***Fuse and power consumption data***

44 ***Fusible cutout***
Changing the fuse, see *section 3.4*

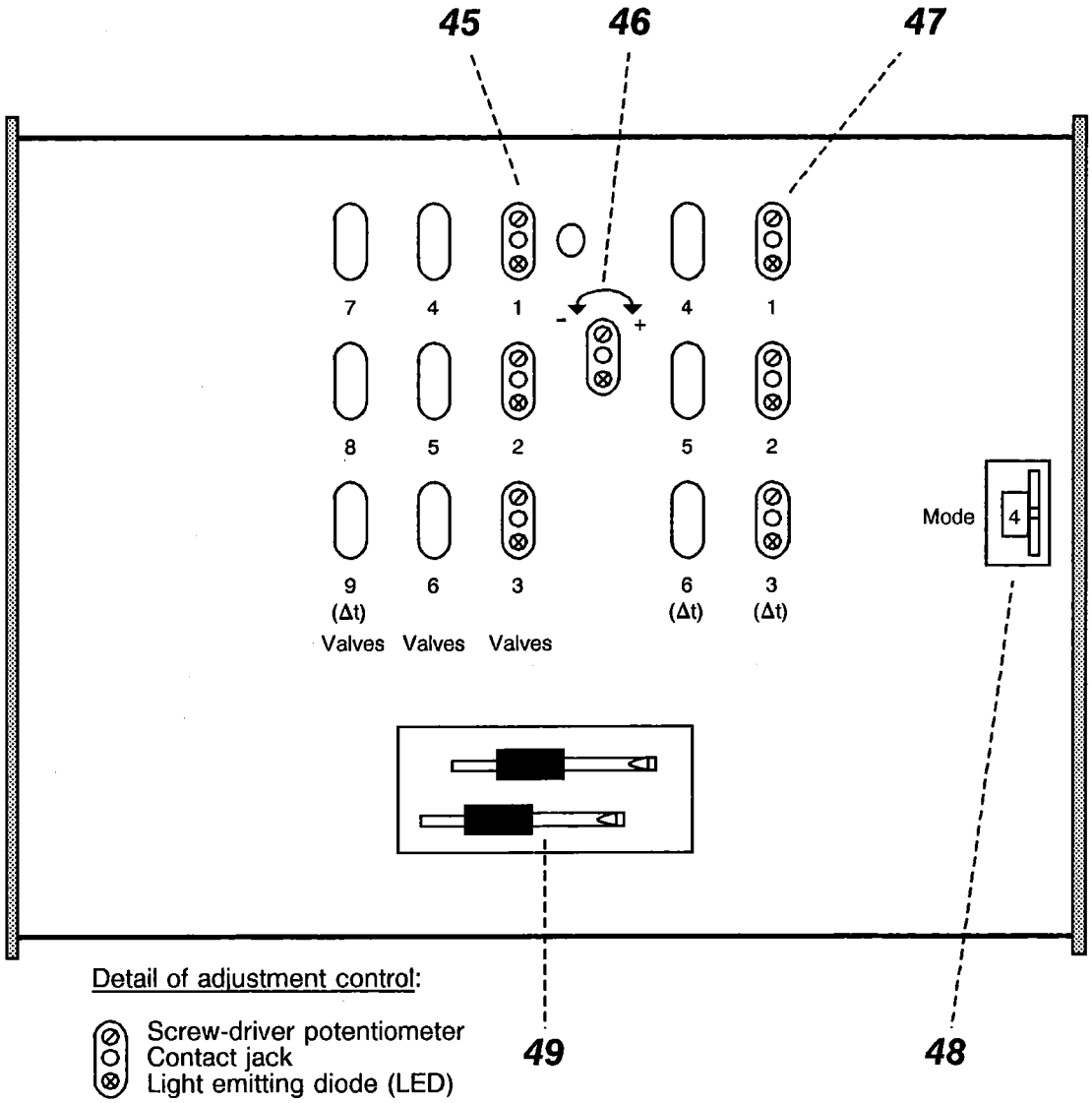


Fig. 6: **Top view of 664.0020 Control Unit with top panel removed**
(the parts not marked have no function)

45 ***Adjustment controls***
for valve opening times V1, V2, V3

(procedure see *section 3.6.2*)

46 ***Designation of direction of rotation of potentiometer***

47 ***Adjustment controls***
for delay times Δt1, Δt2, Δt3

(procedure see *section 3.6.2*)

48 ***Selector switch for analysis program 4 or 5***

49 ***Screw drivers / contatct pins***

3. Installation

3.1. Setting up the instruments

3.1.1. Packing

The 676 Sample Changer and 664 Control Unit are supplied together with the separately packed accessories in special packaging which provides exceptionally good protection. This comprises shock-absorbing foam liners in blue plastic film foamed to match the individual shape. The instruments themselves are packed in a dust-tight, evacuated polyethylene bag. It is essential that you store all these special packagings in a safe place as they and they alone assure indemnified transport of the instruments.

3.1.2. Check

On receipt of the goods, immediately check that the shipment is complete and is free from damage (compare with delivery note and accessories list in *section 8*). If transport damage is found, see instructions in *section 9* "Warranty".

3.1.3. Location

Set up the 676 Sample Changer and the 664 Control Unit at a place in the laboratory suitable for operation which is free from vibration, protected against any corrosive atmosphere and contamination by chemicals. For perfect functioning, the sample changer needs a horizontal surface. If none is available, the sample changer must be levelled with the aid of shims (check horizontal positioning with a level).

3.2. Equipping the titration head at the 676 Sample Changer

3.2.1. Equipping for the determination of hydroxyl and saponification numbers

Titration head ***13*** is adjusted in the factory for either Barkey/Behr or Merck sample vessels in accordance with your ordering instructions. The additional accessories required for each type of vessel (see *section 8.3.2*) are mounted in the titration head as follows (*see Figs. 2 and 7*):

1▸ Carefully (slowly) raise lifting arm ***10*** with permanently mounted titration head ***13*** by hand (*the 664 Control Unit must not be switched on!*).

2▸ Screw rinse nozzle ***14*** (6.2740.010) from below into opening ***54*** of the titration head.

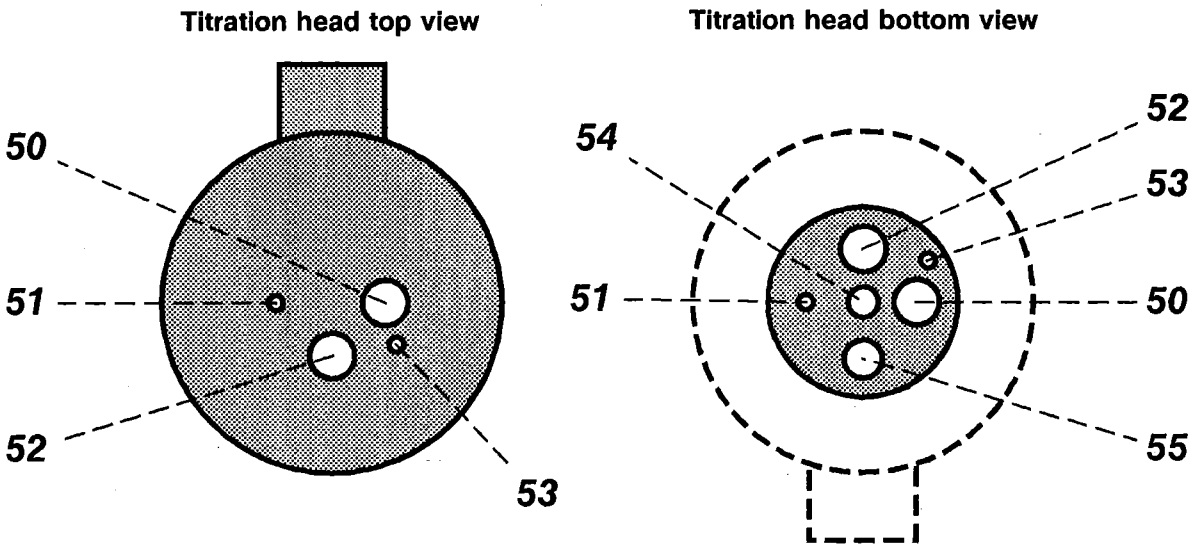
3▸ Screw siphoning tube ***15*** (6.1821.000 for Barkey/Behr vessels; 6.1821.010 for Merck vessels) from below into opening **55** of the titration head so that the tip of the bevelled tube faces outward (towards the edge of the vessel).

4▸ Insert burette tip ***8*** (6.1543.130) from above into opening ***50*** of the titration head until the lower end is ca. 1 cm above the end of siphoning tube ***15***.

5▸ Screw 6.1805.110 FEP Tubing to burette tip ***8*** (connection to 665 Dosimat).

6▸ Insert 6.9902.048 pH Microelectrode from above into opening ***52*** of the titration head until the lower end is ca. 1 cm above the end of siphoning tube ***15***.

6▸ Fasten 6.9902.048 pH Microelectrode tightly with nipple ***11*** and fit with 6.2104.030 Electrode Cable (or 6.2104.060 when 670 Titroprocessor used).



Determination of hydroxyl and saponification number

50	6.1543.1X0 Burette tip
51	–
52	6.9902.048 pH Microelectrode
53	–
54	6.2740.010 Rinse nozzle
55	6.1821.0X0 Siphoning tube

COD determination

50	6.1543.1X0 Burette tip
51	6.1248.0X0 Gold rod electrode
52	6.1240.0X0 Electrolyte vessel with 6.0724.140 Reference system
53	–
54	6.2740.010 Rinse nozzle
55	6.1821.0X Siphoning tube

Fig. 7: Equipping the titration head

3.2.2. Equipping for the COD determination

Titration head ***13*** is adjusted in the factory for either Barkey/Behr or Merck sample vessels in accordance with your ordering instructions. The additional accessories required for each type of vessel (see *section 8.3.3*) are mounted in the titration head as follows (*see Figs 2 and 8*):

1▸ Carefully (slowly) raise lifting arm ***10*** with permanently mounted titration head ***13*** by hand (*the 664 Control Unit must not be switched on!*).

2▸ Screw rinse nozzle ***14*** (6.2740.010) from below into opening ***54*** of the titration head.

3▸ Screw siphoning tube ***15*** (6.1821.000 for Barkey/Behr vessels; 6.1821.010 for Merck vessels) from below into opening ***55*** of the titration head so that the tip of the bevelled tube faces outward (towards the edge of the vessel).

4▸ Insert 6.1248.0X0 Gold rod electrode (6.1248.060 for Barkey/Behr vessels; 6.1248.070 for Merck vessels) from above into opening ***51*** of the titration head until the lower end is ca. 1 cm above the stop and fit with 6.2120.030 Electrode cable.

5▸ Insert burette tip ***8*** (6.1543.130) from above into opening ***50*** of the titration head until the lower end is ca. 1 cm above the end of siphoning tube ***15***.

6▸ Screw 6.1805.110 FEP Tubing to burette tip ***8*** (connection to 665 Dosimat or 702 SET/MET Titrino).

7▸ Fill 6.1240.0X0 Electrolyte Vessel (6.1240.050 for Barkey/Behr vessels; 6.1240.060 for Merck vessels) with $c(KNO_3)$ = sat. (6.2310.000 Electrolyte Solution), insert into opening ***52*** from above until the bottom end is ca. 2 cm above the end of siphoning tube ***15*** and then fasten tightly with nipple ***11***.

8▸ Mount 6.0724.140 Reference System on 6.1240.0X0 Electrolyte Vessel and fit with 6.2106.060 Cable.

3.3. Tubing connections

3.3.1. Tubing connections for rinsing with 683 Pump

For rinsing of the sample vessels, use of a 683 Pump as shown in scheme **A** in *Fig. 8* is recommended. The following connections must be made in such a case:

1. Connect connecting nipple ***12*** of the 676 Sample Changer (see *Fig. 2*) with the aid of the 6.1812.000 PTFE Tubing to connecting nipple ***10*** of the 683 Pump (see Instructions for Use of 683 Pump) (procedure, see *section 3.3.4*).
2. Attach 6.1812.000 PTFE Tubing to connecting nipple ***6*** of the 683 Pump (see Instructions for Use of 683 Pump) and insert in rinsing agent supply bottle (procedure, see *section 3.3.4*).

3.3.2. Tubing connections for rinsing with air pump and electromagnetic valve

The sample vessels can also be rinsed as shown in scheme **B** in *Fig. 8* with the aid of a 6.2817.000 Air Pump and a 6.2726.070 Electromagnetic Valve. In this case, the supply bottle must be kept constantly under pressure by the air pump. When the electromagnetic valve opens, rinsing agent is delivered. For this type of rinsing, the following connections must be made:

1. Connect connecting nipple ***12*** of the 676 Sample Changer (see *Fig. 2*) with the aid of the 6.1812.000 PTFE Tubing to connecting nipple ***19*** of the electromagnetic valve ***18*** (see *Fig. 3*) (procedure, see *section 3.3.4*).
2. Attach 6.1812.000 PTFE Tubing to connecting nipple ***20*** of electromagnetic valve ***18*** (see *Fig. 3*) and insert in a compression-proof rinsing agent supply bottle (procedure, see *section 3.3.4*)
3. Connect 6.2817.000 Air Pump with the aid of the appropriate connecting tubing to the rinsing agent supply bottle.

3.3.3. Tubing connections for siphoning with the 683 Pump

For siphoning off of the sample vessel contents in accordance with scheme **C** in *Fig. 8*, the following connections must be made:

1. Connect connecting nipple ***9*** of the 676 Sample Changer (see *Fig. 2*) with the aid of the 6.1812.000 PTFE Tubing to connecting nipple ***6*** of the 683 Pump (see Instructions for Use of 683 Pump) (procedure, see *section 3.3.4*).
2. Attach 6.1812.000 PTFE Tubing to connecting nipple ***10*** of the 683 Pump (see Instructions for Use of 683 Pump) and insert in waste container (procedure, see *section 3.3.4*).

Note: ***No solids*** *can be siphoned off with the 683 Pump. These could damage the pump.*

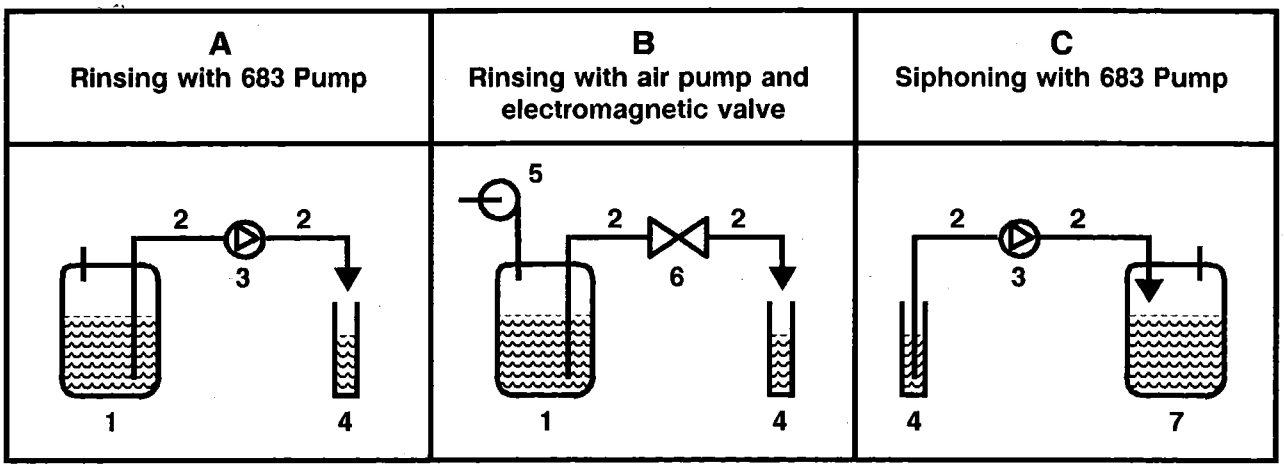


Fig. 8: Rinsing and siphoning the sample vessels

1 Supply bottle
2 6.1812.000 PTFE Tubing
3 683 Pump
4 Sample vessel
5 6.2817.000 Air pumpe
6 6.2726.070 Electromagnetic valve V3
7 Waste container

3.3.4. Fastening the 6.1812.000 PTFE Tubing

To fasten the 6.1812.000 PTFE Tubing to the appropriate connecting nipples, a suitable procedure is as follows:

1. Place the screw cap over the tubing end to be fastened.
2. Enlarge tubing using a pencil (or a similar object).
3. Grip tubing with fine abrasive paper and push over the connecting nipple.
4. Tighten screw cap firmly by hand (use no tools!)

3.3.5. Fastening tubing and cables

It is advisable to bind together all tubing as well as all electrode cables attached to titration head ***13*** using the optional 6.1815.010 Spiral Band.

3.4. Mains connection and switching on the 664.0020 Control Unit

3.4.1. Setting the voltage

Before switching on the 664 Control Unit for the first time, check whether the mains voltage set on the instrument (visible in display ***36***) matches the available mains voltage. If this is not the case, you have to change the voltage as follows:

1. Disconnect mains cable and all other cables plugged into the control unit.
2. Unscrew instrument rear panel and take off.
3. Turn voltage selector switch with a screwdriver to the desired position.
4. Replace instrument rear panel and screw on.
5. Take out fuse ***44*** and compare its specifications with the data ***43*** on the rear panel.
   Replace fuse if necessary.

   220 ... 240 V: 0.25 A (slow-blow)
   110 ... 117 V: 0.5 A (slow-blow)
6. Reconnect cables.

3.4.2. Mains cable

The requested mains cable supplied with the instrument:

- 6.2122.020 mit Stecker SEV 12 (Switzerland ...)
- 6.2122.040 mit Stecker CEE(7), VII (Germany ...)
- 6.2122.070 mit Stecker NEMA 5-15 (USA ...)

is three-core and fitted with a connector with an earthing pin. If a different connector has to be mounted, the yellow/green lead (IEC standard) must be connected to the protective earth (Class 1 instrument). If no socket with earthing is available, you have to connect the instrument to a perfect earthing conductor via its earth socket ***41*** (⏚).

3.4.3. Mains connection

Plug the mains cable into connection socket ***42*** of the 664 Control Unit.

3.4.4. Switching on the instrument

Switch on the 664 Control Unit with mains switch ***30***.
When the power-on lamp ***23*** is lit up, the instrument is switched on.

3.5. Electrical interconnections

3.5.1. Interconnection with the 686 or 682 Titroprocessor

The 686 and 682 Titroprocessors can be used to determine not only the hydroxyl and saponification number, but also the COD.

Fig. 9 shows the interconnections with the 686 or 682 Titroprocessor for determination of the hydroxyl and saponification numbers. For the COD determination with the 686 Titroprocessor, a gold rod and reference electrode have to be attached in place of the pH electrode. Rinsing with a 683 Pump is also shown in *Fig. 9* (for rinsing with an air pump and electromagnetic valve, see *Fig. 10*).

You will find examples of the programming of the 686/682 Titroprocessor in *section 5*.

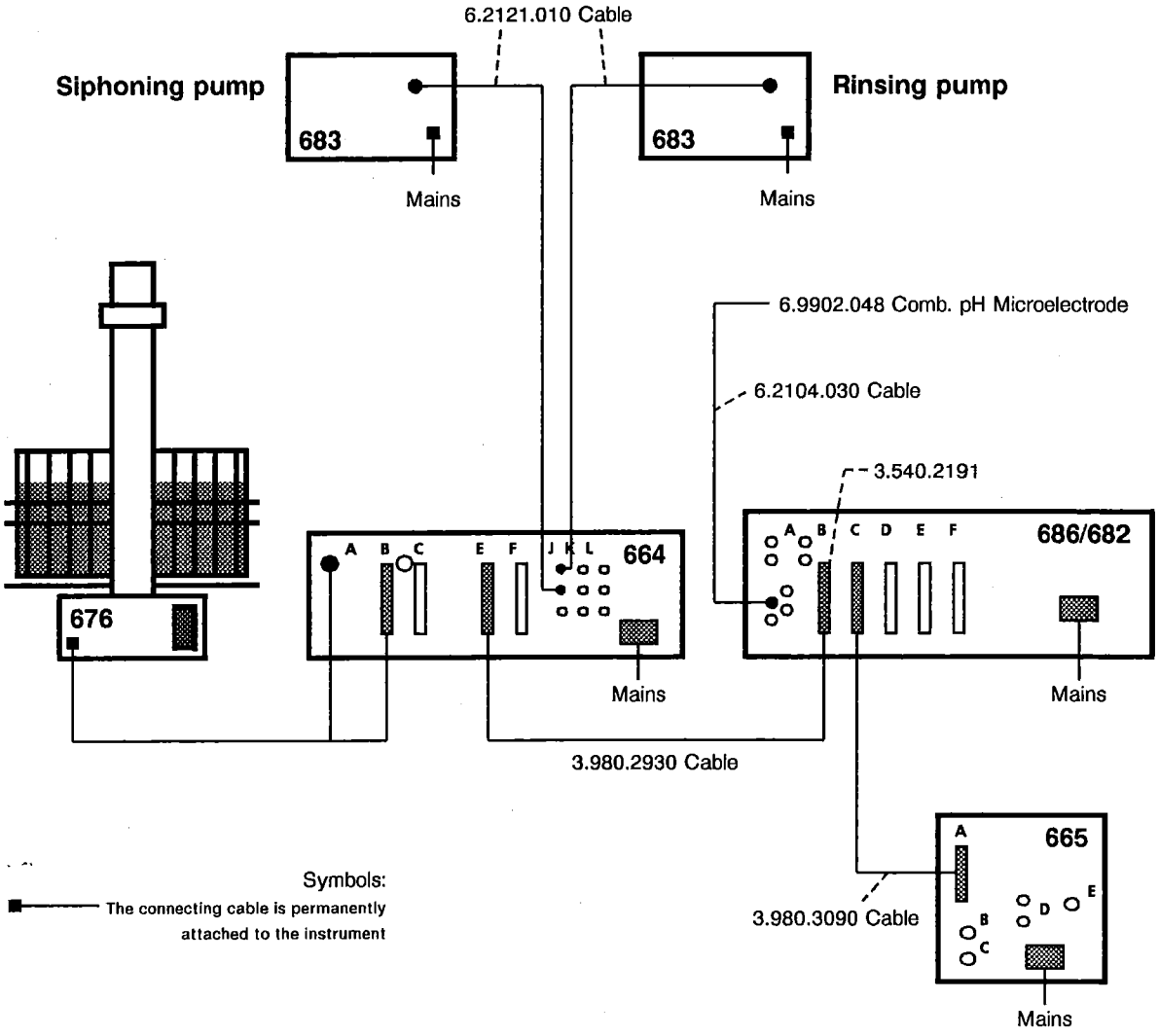


Fig. 9: Interconnection with 686/682 Titroprocessor and 665 Dosimat for the determination of hydroxyl and saponification numbers

664 Control Unit: Mode 4 or mode 5
- V2: Siphoning off of the sample vessel contents with 683 Siphoning Pump
- V3: Addition of the rinsing solution with 683 Rinsing Pump

686/682 Titroprocessor: The 3.540.2191 Sample Changer Interface must be inserted in connector B.

3.5.2. Interconnection with the 702 SET/MET Titrino

Interconnection with the 702 SET/MET Titrino is especially suitable for COD determinations (see *Fig. 10*). *Fig. 10* shows rinsing using an air pump and electromagnetic valve (for rinsing with a 683 Pump, see *Fig. 9*).

You will find an example of the programming of the 702 SET/MET Titrino in *section 5.3.4.*

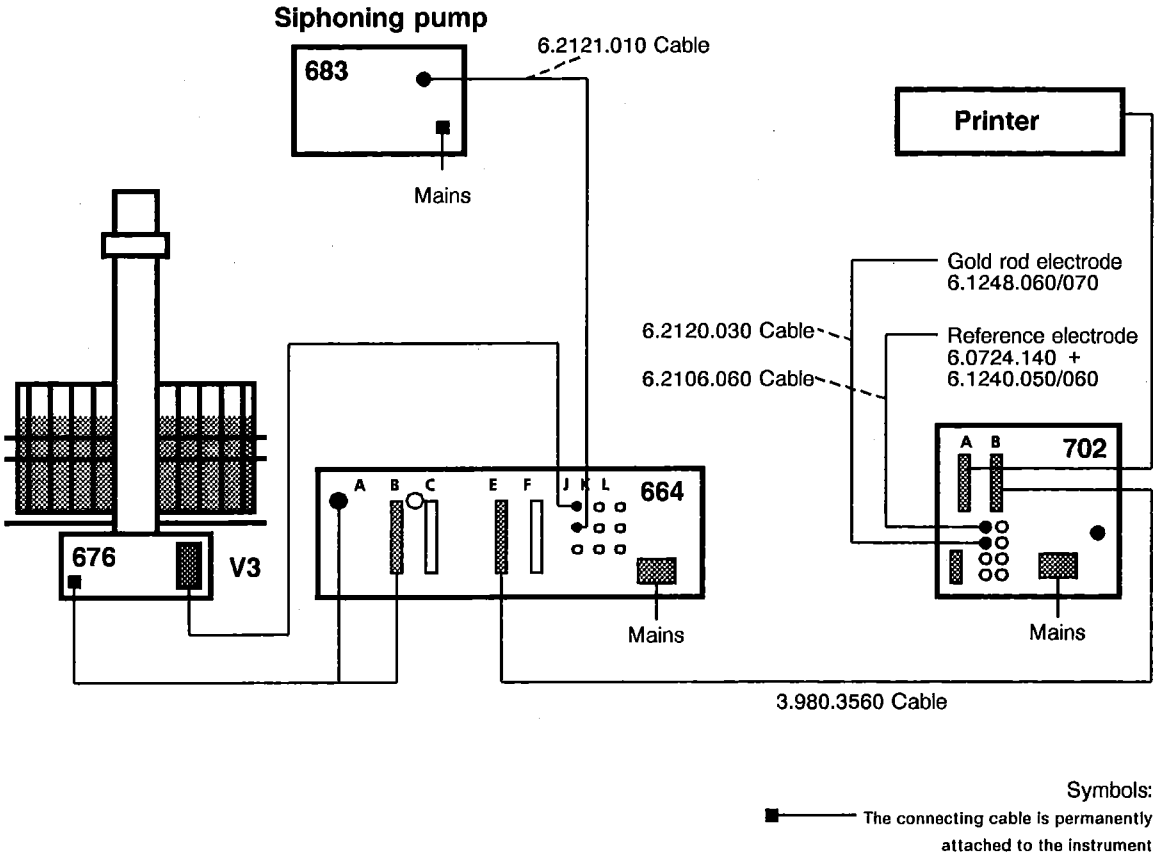


Fig. 10: Interconnection with the 702 SET/MET Titrino for the COD determination

664 Control Unit: Mode 4 or Mode 5
- V2: Siphoning off of the sample vessel contents with 683 Siphoning Pump
- V3: Addition of the rinsing solution with the aid of Air Pump and Magnetic valve

702 SET/MET Titrino: Mode MET

3.5.3. Interconnection with the 670 Titroprocessor

The 670 Titroprocessor can be used to determine not only the hydroxyl and saponification number, but also the COD.

Fig. 11 shows the interconnections for the determination of hydroxyl and saponification numbers. Here, a 677 Drive Unit is needed in place of the 664 Control Unit. For the COD determination, a gold rod and reference electrode have to be attached in place of the pH electrode (for connection of the gold electrode, the 6.2103.080 Adapter is also needed). *Fig. 11* shows rinsing with a 683 Pump (for rinsing with an air pump and electromagnetic valve, see *Fig. 10*).

You will find an example of the programming of the 670 Titroprocessor in *section 5.3.3.*

Note: – *For operation of the 676 Sample Changer with the 670 Titroprocessor, an additional wire must be soldered into the connector leading to the 677 Drive Unit. For this, the connector leading to the 677(A) has to be opened and a wire soldered between connections e5 and e17.*

– *If the lifting arm starts to sink slowly during operation of its own accord, this can be rectified by a service engineer as follows:*

1. *Open 677 Drive Unit.*
2. *Measure voltage between e14 and e19 at output A of 677 Drive Unit.*
3. *Turn screw of R50 resistor to left until the measured voltage is 40 ... 100 mV.*

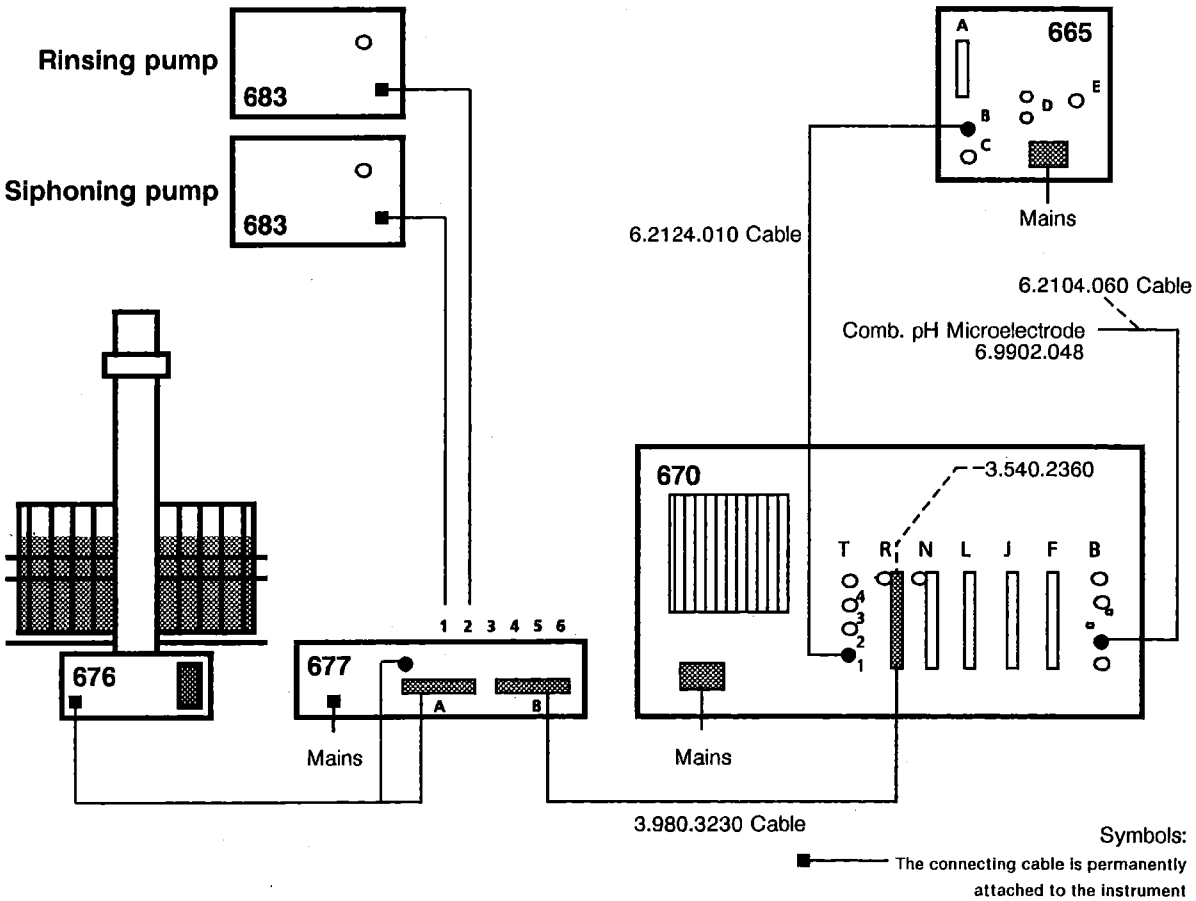


Fig. 11: Interconnection with the 670 Titroprocessor for the determination of hydroxyl and saponification numbers

Titroprocessor 670: The 3.540.2360 Sample Changer Interface must be inserted in connector R.

Drive Unit 677: Connection 1: Siphoning pump
Connection 2: Rinsing pump

3.6. Settings at 664.0020 Control Unit

3.6.1. Program selection

Before the start of an analysis, the desired program must be set on the 664 Control Unit:

1▸ Switch on control unit (see *section 3.4*).

2▸ Loosen cover of the control unit by turning the fastening screw anti-clockwise and then remove. The adjustment controls of the 664 Control Unit are now accessible (see *Fig. 6*).

3▸ Switch in desired program by turning the selector switch ***48***. Possible selections are the two programs **Mode 4** and **Mode 5** (see *Table 1*), which are distinguished only in the manner in which the sample vessels are rinsed (with Mode 4, rinsing is performed once, with Mode 5 twice).

4▸ Screw on cover of control unit.

	Mode 4	**Mode 5**
Function	Titration with 686, 682 or 702	Titration with 686, 682 or 702
Program sequence	1) Shift sample 2) Stirrer on 3) Lower lift 4) Stirrer off 5) Raise lift (Δt2) 6) Stirrer on 7) Titration 8) Lower lift completely 9) Stirrer off 10) Open valve V2 11) Delay time (Δt1) 12) Close valve V2 13) Rinsing with valve V3 (2 × V3 = max. 30s) 14) Siphoning with valve V2 (2 × V2 = max. 30s) 15) Raise lift completely 16) Delay time (Δt3)	1) Shift sample 2) Stirrer on 3) Lower lift 4) Stirrer off 5) Raise lift (Δt2) 6) Stirrer on 7) Titration 8) Lower lift completely 9) Stirrer off 10) Open valve V2 11) Delay time (Δt1) 12) Close valve V2 13) Rinsing with valve V3 (2 × V3 = max. 30s) 14) Siphoning with valve V2 (2 × V2 = max. 30s) 15) Rinsing with valve V3 (2 × V3 = max. 30s) 16) Siphoning with valve V2 (2 × V2 = max. 30s) 17) Raise lift completely 18) Delay time (Δt3)
664 Control Unit settings	V1: 0...15 s not programmed V2: 0...15 s Siphoning during 2 × V2 = max. 30s V3: 0...15 s Rinsing during 2 × V3 = max. 30s Δt1: 0...5 min Delay time (siphoning off the sample) Δt2: 0...15 s Raising the lift to the working position Δt3: 0...15 s Delay time	V1: 0...15 s not programmed V2: 0...15 s Siphoning during 2 × V2 = max. 30s V3: 0...15 s Rinsing during 2 × V3 = max. 30s Δt1: 0...5 min Delay time (siphoning off the sample) Δt2: 0...15 s Raising the lift to the working position Δt3: 0...15 s Delay time
Interconnections	686: *Fig. 9* 682: *Fig. 9* 702: *Fig. 10*	686: *Fig. 9* 682: *Fig. 9* 702: *Fig. 10*
Setting the delay and valve opening times	V1: not programmed V2: 3 s V3: 2 s Δt1: 15 s Δt2: 1-1.5 s Δt3: 4-5 s	V1: not programmed V2: 3 s V3: 2 s Δt1: 15 s Δt2: 1-1.5 s Δt3: 4-5 s

Table 1: Overview of the programs of 664.0020 Control Unit

3.6.2. Setting the delay and valve opening times

The delay and valve opening times are set in the factory to the values shown in *Table 1*. These values have been optimized for the two programs *Mode 4* and *Mode 5*, but if you wish to change these times proceed as follows:

1▸ Switch on control unit (see *section 3.4*).

2▸ Loosen cover of the control unit by turning the fastening screw anti-clockwise and then remove.
The adjustment controls ***45*** and ***47*** of the 664 Control Unit are now accessible (see *Fig. 6*).

3▸ Set valve opening times V2 and V3 (***45***) by turning the potentiometer screws with screwdriver ***49***.

Turning in a clockwise direction increases the time interval, turning in an anti-clockwise direction decreases it.

If the adjustment range of the potentiometers is exceeded, when the time is decreased a jump to infinite time occurs, whereas at the other end of the scale the time interval no longer increases despite further rotation in a clockwise direction.

The maximum time interval for the valve opening times is 15 s. To determine the current setting of the valve opening time, either briefly press the appropriate valve switches V2 (***24***) and V3 (***25***) or briefly plug the contact pin ***49*** into the appropriate contact socket of the adjustment controls ***45***. This lights up the LED for a period corresponding to the set opening time.

4▸ Set delay times Δt1, Δt2, Δt3 (***47***) by turning the potentiometer screws with screwdriver ***49***:

Turning in a clockwise direction increases the time interval, turning in an anti-clockwise direction decreases it.

If the adjustment range of the potentiometers is exceeded, when the time is decreased a jump to infinite time occurs, whereas at the other end of the scale the time interval no longer increases despite further rotation in a clockwise direction.

The maximum time interval for delay times Δt2 and Δt3 is 15 s. To ascertain the current valve opening time, the contact pin ***49*** is plugged briefly into the appropriate contact socket of the adjustment controls ***47***. This lights up the LED for a period corresponding to the set opening time.

In the case of delay time Δt1, the adjustable time interval is 0...5 min (= 20 × 0...15 s). To ascertain the set time interval, plug in the contact pin and measure the on-period of the flashing LED (contact pin remains plugged in). This on-period is 1/20 of the set interval. In other words, should an interval of, e.g. 3 min be set, the on-period is regulated to 3 × 60 s / 20 = 9 s.

Note: *The control key may not be switched to "start" until the manually initiated functions are complete and no LEDs are lit up!*

5▸ Screw on cover of the control unit.

3.7. Filling the tubing

The operational procedure of the 676 Sample Changer with the 664 Control Unit is described. If the 676 Sample Changer is controlled by the 670 Titroprocessor, the corresponding program commands must be entered as described in the 670 Instructions for Use (see also section 3.5.3).

To fill the 6.1812.000 PTFE Tubing fastened to connecting nipple ***12*** with rinsing solution, first ensure that the 664 Control Unit is switched on (see *section 3.4*) and connected to the peripherals (see *section 3.5*), then proceed as follows:

1. Pull glass vessel detector (contact bridge in the titration position facing lift tower ***7***) by hand in the direction of rotation and hold.
2. Press key ***27*** (↑) on 664 Control Unit *up* until the lifting arm ***10*** is right in the top rest position.
3. Press key ***28*** on 664 Control Unit *down*. As soon as the turntable ***16*** starts to rotate, the glass vessel detector can be released.
4. While the turntable ***16*** is rotating, place a sample vessel (6.1821.000 Barkey/Behr or 6.1821.010 Merck) in the holder for the conditioning vessel permanently mounted on the turntable ***16***. The turntable continues to turn until the conditioning vessel is positioned exactly under the titration head ***13***.
5. Press *down* and hold key ***27*** (↓) on 664 Control Unit until the lifting arm ***10*** is right in the bottom rest position.
6. Press *down* and hold switch ***25*** (V3) on 664 Control Unit until only rinsing agent flows out of the rinse nozzle ***14***.

The 6.1805.110 FEP Tubing attached to the burette tip ***8*** must then be filled with titrant. The procedure is described in the appropriate *665 Dosimat or 702 SET/MET Titrino Instructions for Use.*

3.8. Setting the stirring speed

The stirring speed of the magnetic stirrer built into the 676 Sample Changer is set at rotary regulator ***2*** to ca. "3".

If necessary, the stirring speed can be increased or decreased by turning switch ***2***.

3.9. Conditioning

The operational procedure of the 676 Sample Changer with the 664 Control Unit is described. If the 676 Sample Changer is controlled by the 670 Titroprocessor, the corresponding program commands must be entered as described in the 670 Instructions for Use (see also section 3.5.3).

When not in use, the electrodes mounted in the titration head must always be immersed in a conditioning solution appropriate to the type of electrodes used.

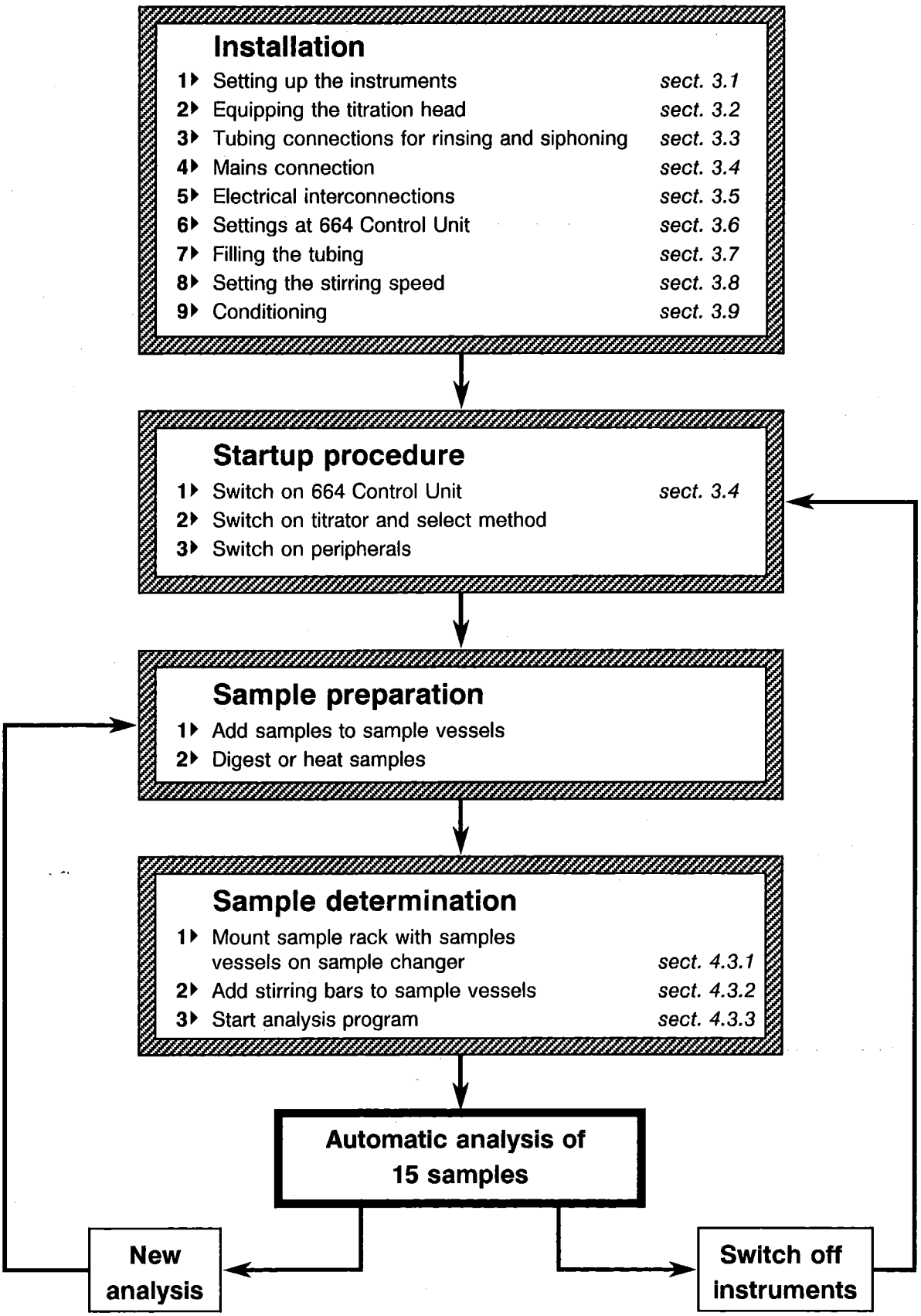
- Determination of hydroxyl and saponification numbers: $c(KCl) = 3$ mol/L (6.2308.020 electrolyte solution)
- COD detgermination: $c(KNO_3) =$ sat. (6.2310.000 electrolyte solution)

For positioning of the conditioning solution, proceed as follows:

1. A sample vessel (6.1821.000 Barkey/Behr or 6.1821.010 Merck) is filled with 100 mL conditioning solution (*see above*).
2. Press key ***27*** (↑) on 664 Control Unit *up* until the lifting arm ***10*** is right in the top rest position.
3. Press key ***28*** on 664 Control Unit *down*. The turntable ***16*** starts to rotate.
4. While the turntable ***16*** rotates, remove the sample vessel used to fill the tubing from the holder.
5. Place sample vessel with conditioning solution in the permanently mounted holder on the turntable ***16***. The turntable continues to rotate until the conditioning vessel is positioned exactly under the titration head ***13***.
6. Press *down* and hold key ***27*** (↓) on 664 Control Unit until the lifting arm ***10*** is right in the bottom rest position.

4. Operation

4.1. Operation scheme



4.2. Manual operation

The operational procedure with the 676 Sample Changer and the 664 Control Unit is described. If the 676 Sample Changer is controlled by the 670 Titroprocessor, the appropriate program commands must be entered as described in the 670 Instructions for Use (see also section 3.5.3).

4.2.1. Manual operation rinsing

The rinsing operation is initiated by pressing key ***25*** (V3) *down*. Depending on the type of rinsing selected (see *section 3.3*), either the 683 Rinsing Pump is switched on or the 6.2726.070 Electromagnetic Valve opened. The rinsing time is given by the set valve opening time V3 (see *section 3.6*).

4.2.2. Manual operation siphoning

The siphoning operation is initiated by pressing key ***24*** (V2) *down*. This switches on the 683 Siphoning Pump. The siphoning time is given by the set valve opening time V2 (see *section 3.6*).

4.2.3. Manual operation of the magnetic stirrer

By pressing the stirrer key ***26*** *up*, the magnetic stirrer built into the 676 Sample Changer is switched on.

The stirring speed (200 ... 1900/min) can be set at rotary regulator ***2***.

To switch the stirrer off, the stirrer key ***26*** is switched to the middle position.

4.2.4. Manual operation of the lifting arm

By pressing key ***27*** (↑) *up*, the lifting arm ***10*** is *raised*.

By pressing key ***27*** (↓) *down*, the lifting arm ***10*** is *lowered*.

Note: *If there is no vessel in the titration position, for manual operation of the lifting arm the glass vessel detector (contact bridge at the titration position facing lift tower **7**) must be moved by hand in the direction of rotation and held.*

*The lifting arm **10** can be moved with key **27** only when the turntable **16** is in the correct position (the glass vessel or the glass vessel holder must be directly under the titration head). It may thus be necessary to first move the turntable by hand into the correct position.*

4.2.5. Manual operation of the sample transport

By pressing key ***28*** down, movement of the turntable ***16*** is started. It rotates until the next sample vessel has reached the titration position.

Note: *If there is no vessel at the titration position, for manual operation of the sample transport lifting arm the glass vessel detector (contact bridge at the titration position facing lift tower **7**) must be moved by hand in the direction of rotation and held.*

*The turntable **16** can be moved with key **28** only when the lifting arm **10** is in the top rest position.*

4.3. Notes on operation of the 676 Sample Changer

The operational procedure with the 676 Sample Changer and the 664 Control Unit is described. If the 676 Sample Changer is controlled by the 670 Titroprocessor, the appropriate program commands must be entered as described in the 670 Instructions for Use (see also section 3.5.3).

4.3.1. Sample rack

The sample rack ***4*** can hold 15 sample vessels of the Barkey/Behr type (6.1452.000) or Merck type (6.1452.010). The two holding brackets **5** are used to transport the sample rack (see *Fig. 2*).

The sample rack together with samples vessels can be directly inserted in the heating and cooling block of the digestion apparatus *csb-therm X* of the *Barkey Labor Technik* company. With other digestion apparatus, the sample vessels must be positioned individually in the sample holder ***4*** after digestion/heating.

4.3.2. Stirring bars

Before the start of the analysis program, a stirring bar must be added to every sample vessel:

for Barkey/Behr sample vessels:	6.1906.010 Stirring Bars (triangular cross-section)
for Merck sample vessels:	6.1906.020 Stirring Bars (oval)

4.3.3. Check on the electrolyte vessel

In COD determinations, before every start of the analysis program a check must be made to see if there is sufficient electrolyte solution in the 6.1240.0X0 Electrolyte Vessel. If need be, this vessel must be topped up with electrolyte solution (see *section 3.2.2*).

4.3.4. Start of the analysis program

Before the start of the analysis program, the sample counter ***31*** must be set to "00".

The set analysis program (see *section 3.6.1*) is started by pressing the control key ***32*** *down*.

The analysis program is then performed for all samples on the sample rack. After the last sample, the titration head is lowered into the conditioning beaker.

4.3.5. Manual stop of the analysis program

By pressing the control key ***32*** *up*, the current function is immediately terminated. An exception is the ongoing titration (incl. stirrer), which is allowed to run to completion before being stopped.

4.3.6. Conditioning solution

When not in use, the electrodes mounted in the titration head must always be immersed in a conditioning solution appropriate to the type of electrodes used.

- Determination of hydroxyl and saponification numbers: $c(KCl) = 3$ mol/L (6.2308.020 electrolyte solution)
- COD determination: $c(KNO_3)$ = sat. (6.2310.000 electrolyte solution)

On completion of the analysis program (that is, after max. 15 samples), the titration head together with the electrodes is automatically lowered into the vessel with conditioning solution (for first-time positioning of the conditioning solution, see *section 3.9*).

4.3.7. Siphoning off with 683 Pump

Note: *The waste container must be* ***emptied*** *from time to time.*

No solids *can be siphoned off with the 683 Pump. These could damage the pump.*

5. Application examples

5.1. Determination of the hydroxyl number

5.1.1. Analysis procedure

The analysis procedure depends on the nature of the samples.

Detailed instructions are described in *METROHM Application Bulletin 141* (for edible oils and fats) and *METROHM Application Bulletin 200* (for plastics).

5.1.2. Titration with the 686 or 682 Titroprocessor

The 686 and 682 Titroprocessors allow the automatic performance and evaluation of titrations. For operation and programming of the instruments, see the appropriate Instructions for Use.

Example: Determination of the hydroxyl number in edible oils and edible fats

- Sample preparation: see *Appl. Bull. 141*
- Titrant: c(KOH) = 0.5 mol/L
- Calculation:

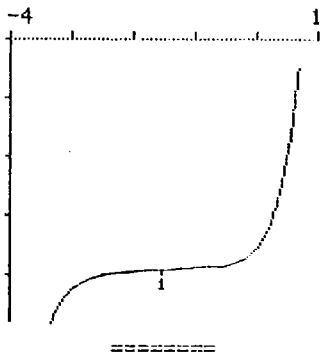
$$\text{Hydroxyl number (mg/g KOH)} = \frac{28.05 \cdot (B - A)}{E}$$

A = mL KOH for the sample
B = mL KOH for the blank value
E = sample weight in g

- Instrument parameters, formulae and curve:

```
GET U    ********  #     3
electr. input  1
titr.rate    1.00 ml/min
anticip.        5
stop V      24.00 ml
start V     15.00 ml
temp.        20.0 °C
EP crit.        8
         ========

date 89-06-19 time 15:15
GET U    ********  #     3
Id.#1        2305
Id.#2         1.1
C00=        7.908 g
U(init)        92 mV
           V/ml       U/mV
EP1      21.856       -152
RS1         1.631
stop V reached
         ========

GET U    ********  #     3
F1=(C01-EP1)*C02/C00+C03
;3;
C01=       22.062
C02=        28.05
C34=          .90
         ========
```

```
date 89-06-19 time 15:15
GET U    ********  #     3
2.0ml/div    ΔU=100mV/div
start V  15.000 ml
```




```
         ========
```

5.2. Determination of the saponification number

5.2.1. Analysis procedure

The analysis procedure depends on the nature of the samples.

Detailed instructions for edible oils and edible fats are described in *METROHM Application Bulletin 141*.

5.2.2. Titration with the 686 or 682 Titroprocessor

The 686 and 682 Titroprocessors allow the automatic performance and evaluation of titrations. For operation and programming of the instruments, see the appropriate Instructions for Use.

Example: Determination of the hydroxyl number in edible oils and edible fats

- Sample preparation: see *Appl. Bull. 141*
- Titrant: c(HCl) = 0.5 mol/L
- Calculation:

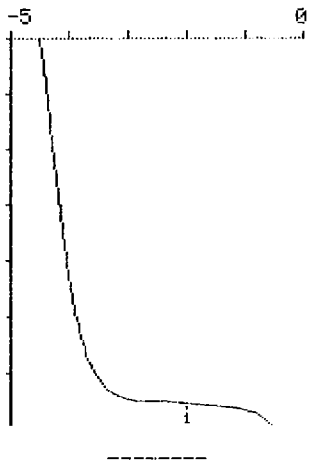
$$\text{Saponification number (mg/g KOH)} = \frac{28.05 \cdot (B - A)}{E}$$

A = mL HCl for the sample
B = mL HCl for the blank value
E = sample weight in g

- Instrument parameters, formulae and curve:

```
GET U    ********  #     0
electr. input  1
titr.rate     .50 ml/min
anticip.        5
stop V      14.00 ml
temp.        20.0 °C
EP crit.        8
         ========

date 89-06-15 time 07:36
GET U    ********  #     0
Id.#1       2305
Id.#2        1.1
C00=        2.013 g
U(init)      -450 mV
           V/ml       U/mV
EP1      13.132        -199
RS1        292.53
         ========

GET U    ********  #     0
F1=(C01-EP1)*C02/C00;2;
C01=       34.125
C02=        28.05
         ========
```

```
date 89-06-15 time 07:36
GET U    ********  #     0
2.0ml/div    ΔU=100mV/div
start V    0.000 ml
```



5.3. COD determination

5.3.1. Analysis procedure

The analysis procedure for COD determinations is specified in *DIN 38409 Part 41*.

Detailed instructions can be found in *METROHM Application Bulletin 212*.

5.3.2. COD determination with the 686 Titroprocessor

The 686 and 682 Titroprocessors allow the automatic performance and evaluation of titrations. For operation and programming of the instruments, see the appropriate Instructions for Use.

- Sample preparation: see *DIN 38409 Part 41* and *Appl. Bull. 212*
- Titrant: $(NH_4)_2Fe(SO_4)_2$
- Instrument parameters

```
MET U   ********  #   16
electr. input  1
vol.step      .08 ml
drift          70 mV/min
stop V      25.00 ml
stop EP#        1
temp.        25.0 °C
EP crit.U      40 mV
        ========

date 87-12-09 time 16:04
MET U   ********  #   16
C00=           10 ml
U(init)      -381 mV
          V/ml       U/mV
EP1       2.186       -270
RS1         616   ppm
stop EP# reached
        ========

MET U   ********  #    0
F1=(C30-EP1)*C01*C02/C00
;0;ppm
        ========
```

- Calculation: COD value (mg/L = ppm) = `(C30-EP1)*C01*C02/C00`

  `C01`: Concentration of the titrant in mol/L

  `C02`: Equivalence factor $f = 8000$

  `C00`: Volume in mL of the water sample used in the investigation

  `C30`: Volume in mL of the titrant needed for the blank sample (twice dist. water)

  `EP1`: Volume in mL of the titrant needed for the analysis sample (calculated automatically)

5.3.3. COD determination with the 670 Titroprocessor

The 670 Titroprocessor allows the automatic performance and evaluation of titrations as well as control of the 676 Sample Changer. For the operation and programming of the instrument, refer to the appropriate Instructions for Use.

- Sample preparation: see *DIN 38409 Part 41* and *Appl. Bull. 212*
- Titrant: $(NH_4)_2Fe(SO_4)_2$

- Program page:

```
   COD Determination with 676 Sample Changer          METHOD     PAGE 3A
                                                      OPERATION SEQUENCE

   OPERATIONS/PARAMETERS                    OPERATIONS/PARAMETERS
 1 OMOVE1;                                 9c   M.VALUE            OFF
 2 STIR 1;                                 10 WPOS 1;
 3 WPOS 1;                                 11 OSTIR1;
 4 OSTIR1;                                 12 CTR 11;              20.0 s
 5 RDIR 1;                                 13 OCTR11;              100  ms
 5a   t.MOVE            1.0 s              14 CTR 12;              6.0 s
 6 STIR 1;              3  s               15 OCTR12;              100  ms
 7 MEAS 1;                                 16 CTR 11;              7.0 s
 7a   QUANTITY    U                       17 OCTR11;              100  ms
 7b   DRIFT /min        35  mV             18 CTR 12;              5.0 s
 7c   M.DELAY           22  s              19 OCTR12;              100  ms
 8 MONT 1;                                 20 CTR 11;              10.0 s
 8a   V.MONOT           80  uL             21 OCTR11;              100  ms
 8b   DOS.RATE          MAX.               22 RPOS 1;              5  s
 9 TSTOP ;                                 23 SHIFT1;
 9a   N.EPs             1                  24 CMOVE1;
 9b   VOLUME            12.000 mL          25 BEEP  ;END   ;
```

- Calculations:

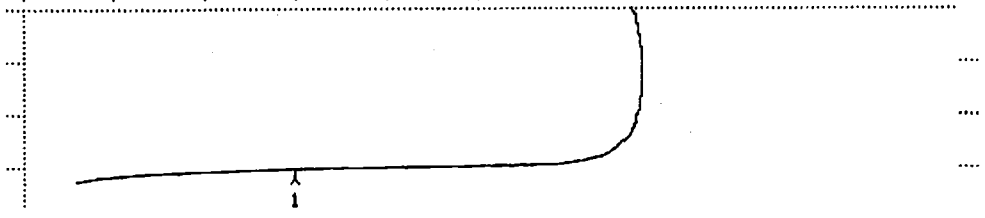
```
   COD Determination with 676 Sample Changer          METHOD     PAGE 6
                                                      CALC.STATEMENTS
   a                b                                      c    d
   RES.QUANTITY     R#, I#, Cx FORMULA                     DPL  RES.UNIT
 1 COD              R1=(CA-E1)*D1*C1/S0                      0    mg/l

   COD Determination with 676 Sample Changer          METHOD     PAGE 7
                                                      ASSIGNMENTS
   a              b                      a                  b
   C#  CALC.VAR   COMMENT                Cx  COM.VAR        COMMENT
 1 C1  8000.00    aequiv. factor   21    CA  9.54100 E- 3   Blank value
```

- Results:

```
COD Determination with 676 Sample Changer              METHOD
                                                  S0 SIZE(m,V)   20.0000 mL
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
TITR          EP V/mL       EP M.VAL      TEST M.VAL    FIN.V/mL    pK or HNP
  #1  U
      E1        3.035         478.3 mV                    3.280
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
CALCULATIONS
COD              =   312          mg/l

DATE  91-04-16        TIME 12:33                RUN #  5
================================================================================
```

- Curve example:

```
COD Determination                                      METHOD

V.BEGIN=   0  mL        V.DIV=   1.000 mL        U/mV              TITR #   1

300     360     420     480     540     600     660     720     780     840     900
|       |       |       |       |       |       |       |       |       |       |
```




```
FIN.VOLUME=  3.280 mL
DATE  91-04-16        TIME 12:33                RUN #  5          0022
================================================================================
```

5.3.4. COD determination with the 702 SET/MET Titrino

The 702 SET/MET Titrino allows the automatic performance and evaluation of titrations. For the operation and programming of the instrument, refer to the appropriate Instructions for Use.

- Sample preparation: see *DIN 38409 Part 41* and *Appl. Bull. 212*
- Titrant: $(NH_4)_2Fe(SO_4)_2$
- Instrument parameters

```
date 91-04-02      time 14:43          1
MET  U            ********
parameters
>titration parameters
  V step                0.08 ml
  titr.rate             max. ml/min
  signal drift            70 mV/min
  equilibr.time           22 s
  start V:               OFF
  pause                    0 s
  meas.input:              1
  temperature           25.0 °C
>stop conditions
  stop V:               abs.
  stop V                  25 ml
  stop U                 OFF mV
  stop EP                  1
  filling rate          max. ml/min
>statistics
  status:                OFF
>evaluation
  EPC                     40 mV
  EP recognition:        all
  fix EP1 at U           OFF mV
>preselections
  req.ident:             OFF
  req,smpl size:         OFF


date 91-04-02      time 14:43          1
U(init)         21 mV  MET U   ********
smpl size       10 ml
id#2             5
EP1          2.493 ml             427 mV
RS1            199 ppm
         ============


date 91-04-02      time 14:43          1
MET  U            ********
>calculations
RS1=(C30-EP1)*C01*C02/C00;0;ppm
```

- Calculation: COD value (mg/L = ppm) = `(C30-EP1)*C01*C02/C00`

  `C01`: Concentration of the titrant in mol/L

  `C02`: Equivalence factor $f = 8000$

  `C00`: Volume in mL of the water sample used in the investigation

  `C30`: Volume in mL of the titrant needed for the blank sample (twice dist. water)

  `EP1`: Volume in mL of the titrant needed for the analysis sample (calculated automatically)

6. Technical specifications

6.1. 676 Sample Changer

- **Capacity** — max. 15 sample vessels (+ 1 vessel for conditioning)

- **Drive mechanism**
  1 DC motor for raising and lowering the movable lifting arm with titration head
  1 DC motor for rotating the turntable
  1 DC motor for electromagnetic stirrer

- **Power supply** — from 664.0020 Control Unit

- **Materials**

Housing	light alloy, multicoat stove-enamel
Glide surface	polyethylene terephthalate (PETP)
Turntable	light alloy, polyvinyl chloride (PVC)
Lift tower	polyvinyl chloride (PVC)
Lifting arm	light alloy, multicoat stove-enamel
Titration head	polytetrafluorethylene (PTFE)
Sample rack	light alloy, clear anodised

- **Dimensions**

Width	335 mm
Height	615 mm
Depth	490 mm

- **Weight** (incl. standard acc.) — 9.5 kg

- **Sample vessels**

	6.1452.000	*6.1452.010*
Application	for digestion block Barkey or Behr	for digestion block Merck
Material	borosilicate glass 3.3	borosilicate glass 3.3
Final volume	170 mL	230 mL
Diameter	40.8 mm	40.8 mm
Height	200 mm	260 mm
Weight	112 g	90 g

6.2. 664.0020 Control Unit

- **Housing** — injection-moulded light alloy with several coats of stove enamel; top cover removable for easy access to valve and time settings

- **Number of samples** — 15 (sample counter must be set to "00")

- **Analysis programs**
  - *Number* — 2 standard programs (Mode 4 + Mode 5), selected on thumbwheel switch under top cover
  - *Program steps* — total 1024 (128 per program)
  - *Program memory* — "Erasable Programmable Read Only Memory" (EPROM)

- **Functions**
  - *Manual* — open valves 1...3
stir
raise and lower lifting arm
transport samples
start and stop program
  - *Automatic* — the samples inserted into the sample rack are processed according to the program chosen

- **Time settings**
  - *Delay times* — 1×0...5 min ; 2×0...15 s
  - *Valve opening times* — 3×0...15 s

- **Ambient temperature**
  - *Nominal operating range* — +5 ... +40 °C
  - *Storage, transport* — –10 ... +70 °C

- **Mains connection**
  - *Mains voltage* — $U_{\sim}$ = 100, 117, 220, 240 V ± 10 %, switchable
  - *Mains frequency* — f = 50...60 Hz
  - *Power consumption* — ca. 50 VA, depending on extent of expansions
  - *Fuse* — Ø = 5 mm, length L = 20 mm
100 and 117 V: 0.5 A (slow-blow)
220 and 240 V: 0.25 A (slow-blow)

- **Safety specifications** — in accordance with IEC Publication 348 (class 1 instrument)

- **Dimensions**
  - *Width* — 350 mm
  - *Height* — 130 mm
  - *Depth* — 280 mm

- **Weight** (incl. standard acc.) — 5 kg

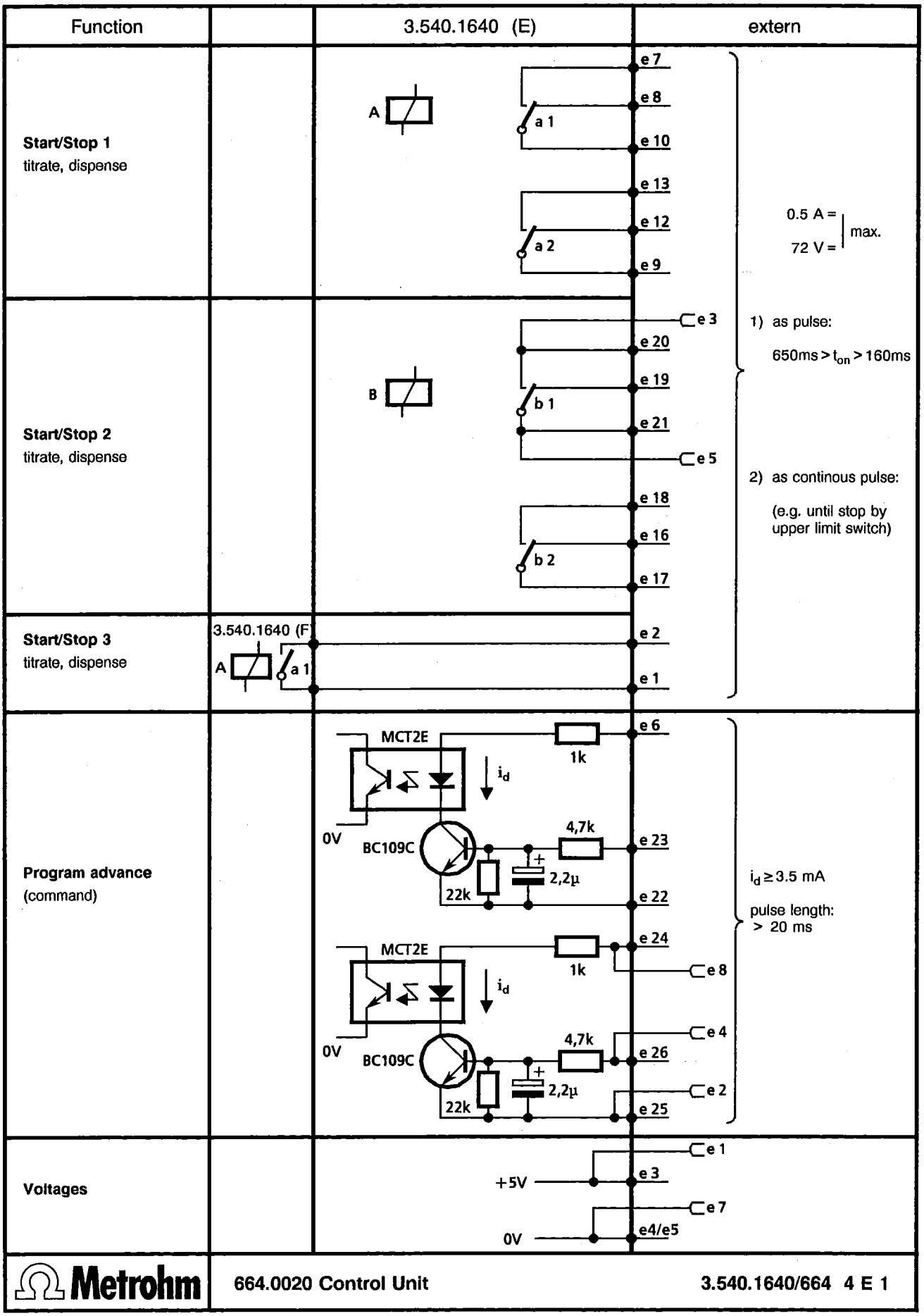
6.3. 6.2726.070 Electromagnetic Valve

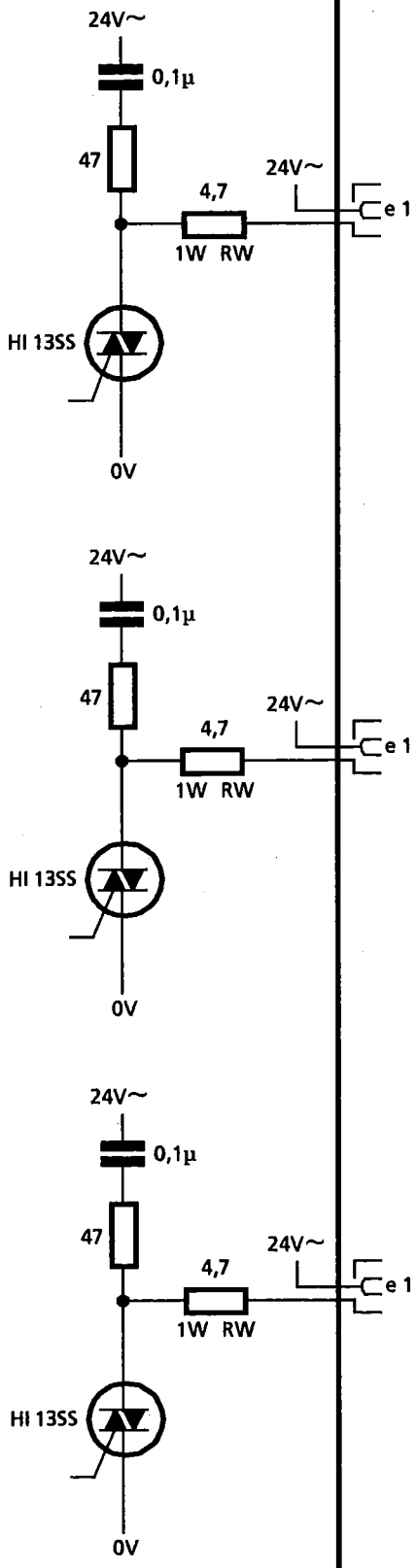
- **Application** — rinsing valve for aqueous sulutions (not suitable for acetone or similar solvents)
- **Material** — polytetrafluorethylene (PTFE) polyvinylidene fluoride (PVDF)
- **Bore** — 3 mm
- **Metering error** — ca. 5 %
- **Temperature range** — 0... + 100°C
- **Power supply** — 24 V AC (from 664.0020 Control Unit)
- **Power consumption** — 8 VA
- **Dimensions**
  - *Width* — 37 mm
  - *Height* — 95 mm
  - *Depth* — 106 mm
- **Weight** — 250 g

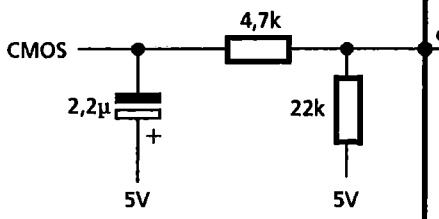
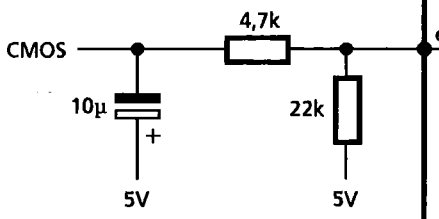
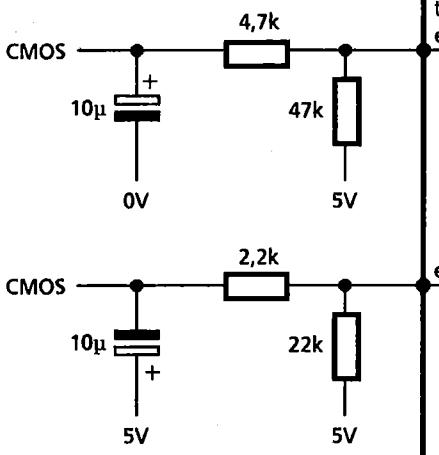
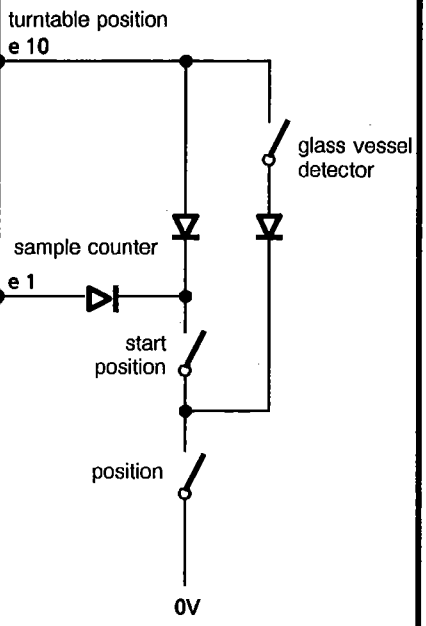
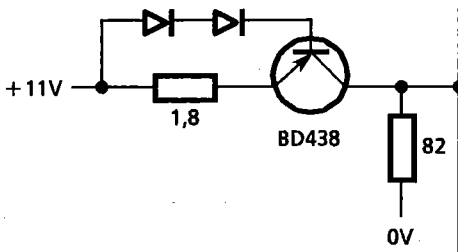
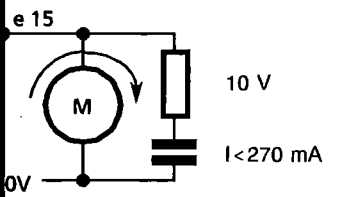
6.4. 6.2817.000 Air Pump

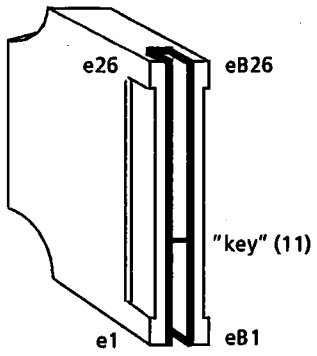
- **Function principle** — membrane
- **Pump capacity**
  - *Delivery rate* — ca. 2 ... 6 L/min, adjustable
  - *Pressure head* — ca. 1 ... 5 m water column (0.1 ... 0.5 bar), adjustable
- **Materials**
  - *Membrane* — ethylene polypropylene elastomer (EPDM)
  - *Housing* — aluminium
  - *Tube nipple* — aluminium
  - *Inner tube* — polyvinylchloride (PVC)
- **Ambient temperature**
  - *Nominal operating range* — +5 ... +40 °C
  - *Storage, transport* — –10 ... +70 °C
- **Mains connection**
  - *Mains voltage* — $U_{\sim}$ = 220 ... 240 V (other voltages on request)
  - *Mains frequency* — f = 50...60 Hz
  - *Power consumption* — 13 VA
- **Dimensions**
  - *Width* — 190 mm
  - *Height* — 110 mm
  - *Depth* — 120 mm
- **Weight** — 2.2 kg

6.5. Control inputs and outputs

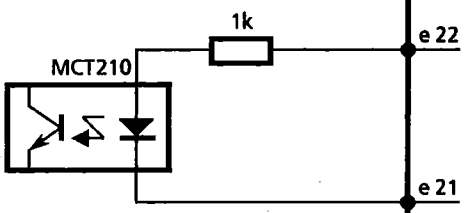
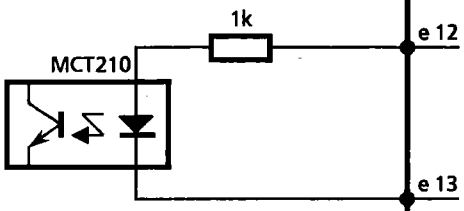
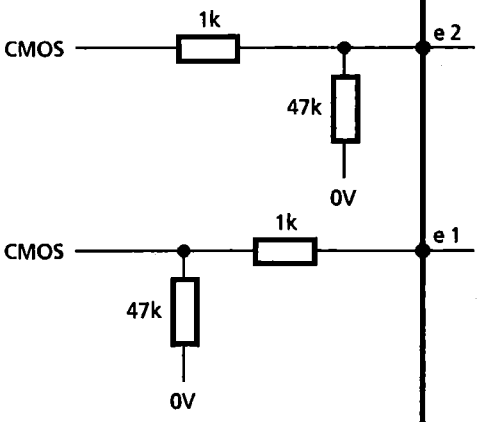
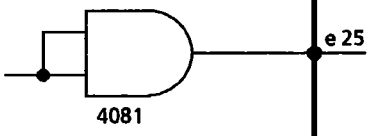
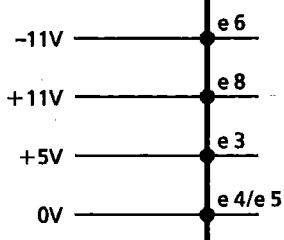


Function	3.540.1620 (J)	extern
Valves 1...3 output		U = 24 V~ maximum load of the 24 V~ supply voltage: I_{max} = 1.5 A
Metrohm	664.0020 Control Unit	3.540.1640/664 4 E 4

Function	3.540.2111 (B)	extern
Top end switch at electrode lift L = stop raising		 is closed when upper position is reached
Bottom end switch at electrode lift L = stop lowering		 is closed when lower position is reached
Glass vessel detector and position switch at turntable L = turntable in position and start position or glass vessel detector L = turntable in position and start position		
Motor for turntable		
Voltages		
Metrohm	**664.0020 Control Unit**	**3.540.2111/664 4 E 5**

Function	3.540.2111 (B)	extern
Motor for lifting arm	≤ ± 10V positive feedback e 14 e 26 e 19 M + I ≤ 320 mA 0V	
Non-occupied pins	e6, e7, e9, e16, e17, e18, e22, e25 eB1 ... eB26	
Contact location at the plug  ordering number: 3.540.8440		

Any liability for damages due to wrong interconnections between instrumentation is refused.

Function	3.540.2420 (C)	extern
Start program		start (pulse)
Stop program		stop (pulse)
Program selection with Mode 8 : flag 0 / flag 1 / program segment L / L / 800–87F (Mode 0) L / H / 900–97F (Mode 2) H / L / A00–A7F (Mode 4) H / H / B00–B7F (Mode 6) with Mode 9: flag 0 / flag 1 / program segment L / L / 880–8FF (Mode 1) L / H / 980–9FF (Mode 3) H / L / A80–AFF (Mode 5) H / H / B80–BFF (Mode 7)		flag 1 flag 0
Busy		busy = L
Voltages		
Metrohm	664.0020 Control Unit	3.540.2420/664 4 E 7

7. Scope of delivery and ordering designations

7.1. 676 Sample Changer

676.0300 Sample Changer **2.676.0300**

including the following acessories:

1 × Sample rack for 15 reaction vessels from Behr, Barkey or Merck incl. 2 holding brackets 6.2041.030

1 × Tubing connection of FEP (tetrafluoroethylene hexafluoropropylene copolymer) with 2 screw nipples with M6 thread, protected against light and buckling i.d. = 1.5 mm, length *L* = 80 cm 6.1805.110

1 × Rinse nozzle with M6 thread 6.2740.010

1 × PTFE/PVDF Electromagnetic valve (mounted at the instrument) 6.2726.070

2 × Connecting cable 664 Control Unit – 683 Pump, length *L* = 1 m 6.2121.010

1 × Instructions for Use (english) 8.676.1003

7.2. 664.0020 Control Unit

664.0020 Control Unit **2.664.0020**

for 676 Sample Changer,
with 3 adjustable valve opening times and 3 delay times,
including the following accessories:

1 × Plastic dust cover 6.2723.140

1 × Mains cable (to customer specification)

cable socket	cable plug	
type IEC 320/C 13	type SEV 12 (Suisse ...)	6.2122.020
type IEC 320/C 13	type CEE (7), VII (Germany ...)	6.2122.040
type CEE (22), V	type NEMA 5–15 (USA ...)	6.2122.070

7.3. Options

7.3.1. Reaction vessels

Reaction vessel appropriate for Barkey or Behr digestion block 6.1452.000

Reaction vessel appropriate for Merck digestion block 6.1452.010

7.3.2. Accessories for the determination of hydroxyl and saponification numbers

For reaction vessels from Barkey or Behr

1 × Combined pH microelectrode with plug-in head; lower, tapered part of length *L* = 220 mm, Ø 6 mm 6.9902.048

1 × Cable with F plug, length *L* = 2 m, for 6.9902.048 pH electrode 6.2104.030
(for use with the 670 Titroprocessor, the 6.2104.060 Cable is needed instead)

1 × 250 mL elektrolyte solution *c*(KCl) = 3 mol/L, for 6.9902.048 pH electrode ... 6.2308.020

1 × Burette tip, length *L* = 280 mm 6.1543.130

1 × Siphoning tube, length *L* = 178 mm 6.1821.000

15 × Stirrer bars, length *L* = 25 mm, triangular cross-section 6.1906.010

1 × Spiral band for holding cables and tubing together Ø = 7 mm, length *L* = 50 cm 6.1815.010

Subject to modifications!

For reaction vessels from Merck

1	×	Combined pH microelectrode with plug-in head; lower, tapered part of length L = 220 mm, Ø 6 mm	6.9902.048
1	×	Cable with F plug, length L = 2 m, for 6.9902.048 pH electrode *(for use with the 670 Titroprocessor, the 6.2104.060 Cable is needed instead)*	6.2104.030
1	×	250 mL Electrolyte solution c(KCl) = 3 mol/L, for 6.9902.048 pH electrode	6.2308.020
1	×	Burette tip, length L = 312 mm	6.1543.140
1	×	Siphoning tube, length L = 238 mm	6.1821.010
15	×	Stirrer bars, oval, 13 mm × 26 mm	6.1906.020
1	×	Spiral band for holding cables and tubing together, Ø = 7 mm, length L = 50 cm	6.1815.010
1	×	Set of spacers (2 pieces) for conversion of the standard version of the 676 Sample Changer to Merck reaction vessels (conversion in the factory)	6.2049.000

7.3.3. Accessories for the COD determination

For reaction vessels from Barkey or Behr

1	×	Reference system Ag/AgCl	6.0724.140
1	×	Cable with 2 B plugs, length L = 2 m; for reference system	6.2106.060
1	×	Electrolyte vessel	6.1240.050
1	×	250 mL Electrolyte solution KNO_3 saturated, for reference system	6.2310.000
1	×	Gold rod electrode *(for use with the 670 Titroprocessor, an additional 6.2103.080 Adaptor is needed)*	6.1248.060
1	×	Cable for gold rod electrode; with F plug	6.2120.030
1	×	Burette tip, length L = 280 mm	6.1543.130
1	×	Siphoning tube, length L = 178 mm	6.1821.000
15	×	Stirrer bars, length L = 25 mm, triangular cross-section	6.1906.010
1	×	Spiral band for holding cables and tubing together, Ø = 7 mm, length L = 50 cm	6.1815.010

For reaction vessels from Merck

1	×	Reference system Ag/AgCl	6.0724.140
1	×	Cable with 2 B plugs, length L = 2 m; for reference system	6.2106.060
1	×	Electrolyte vessel	6.1240.060
1	×	250 mL electrolyte solution KNO_3 saturated, for reference system	6.2310.000
1	×	Gold rod electrode *(for use with the 670 Titroprocessor, an additional 6.2103.080 Adaptor is needed)*	6.1248.070
1	×	Cable for gold rod electrode; with F plug	6.2120.030
1	×	Burette tip, length L = 312 mm	6.1543.140
1	×	Siphoning tube, length L = 238 mm	6.1821.010
15	×	Stirrer bars, oval, 13 mm × 26 mm	6.1906.020
1	×	Spiral band for holding cables and tubing together, Ø = 7 mm, length L = 50 cm	6.1815.010
1	×	Set of spacers (2 pieces) for conversion of the standard version of the 676 Sample Changer to Merck reaction vessels (conversion in the factory)	6.2049.000

7.3.4. Accessories for 676 Sample Changer

Holding brackets for 6.2041.030 Sample rack	4.676.0700
PTFE Tubing, Ø = 4/6 mm, length L = 400 cm	6.1812.000
PTFE/PVDF Electromagnetic valve (not suited for acetone and similar solvents)	6.2726.070
PVDF Reducing valve for 6.2726.070 Electromagnetic valve	6.2726.040
PTFE/PVDF Electromagnetic valve (with reducing valve, not suited for acetone and similar solvents)	6.2726.080
PTFE Electromagnetic valve (specially suited for acetone and similar solvents)	6.2726.000

7.3.5. Accessories for 664.0020 Control Unit

Contact pin for 664 Control Unit 6.2812.000
Connecting cable 664 Control Unit – 682/686/678 ..... 3.980.2930
Connecting cable 664 Control Unit – 682/686/678 + 586 ..... 3.980.2990
Connecting cable 664 Control Unit – 682/686/678 + 671 ..... 3.980.3030
Connecting cable 664 Control Unit – 702 ..... 3.980.3560

7.3.6. Auxiliairy instruments

686 Titroprocessor **2.686.0100**
Potentiometric titrator for titrations with automatic endpoint recognition as well as titrations to a preset endpoint

Sample changer interface for 686 Titroprocessor 3.540.2191
Connecting cable 686 Titroprocessor – 665 Dosimat 3.980.3090
Connecting cable 686 Titroprocessor – 664 Control Unit 3.980.2930

665 Dosimat **2.665.0010**
for the precise dispensing of reagents

Exchange Unit with 1 L reagent bottle of brown glass, micro outlet valve, burette volume 10 mL 6.3012.213
Exchange Unit with 1 L reagent bottle of brown glass, micro outlet valve, burette volume 20 mL 6.3012.223

702 SET/MET Titrino **2.702.0010**
Compact potentiometric Titrator for endpoint and monotonic titrations

Connecting cable 702 SET/MET Titrino – 664 Control Unit 3.980.3560
Exchange Unit with 1 L reagent bottle of brown glass, micro outlet valve, burette volume 10 mL 6.3012.213
Exchange Unit with 1 L reagent bottle of brown glass, micro outlet valve, burette volume 20 mL 6.3012.223
Printer and printer cable ..... *on request*

670 Titroprocessor **2.670.0020**
Potentiometric titrator for dynamic, monotonic, endpoint and pH stat titrations

Sample changer interface for 670 Titroprocessor 3.540.2360
Connecting cable 670 Titroprocessor – 665 Dosimat 6.2124.010
Connecting cable 670 Titroprocessor – 677 Drive Unit 3.980.3230

677 Drive Unit **2.677.0020**
for control of 676 Sample Changer, stirrer, 683 Pumps, valves

683 Diaphragm Pump
Liquid pump with PTFE diaphragm, PTFE-coated valve plates, sealing rings and housing of PVDF (polyvinylidene fluoride);

for 220 V supply **2.683.0024**
for 110 V supply **2.683.0025**
for 240 V supply **2.683.0026**

For siphoning off the titrated solution and rinsing of the reaction vessel and internal fittings, two 683 Diaphragm Pumps are needed.

615 Power Distributor
with built-in interference suppression filter

with 6 sockets according to SEV (Switzerland) **2.615.0010**
with 5 sockets according to VDE (Germany) **2.615.0020**

Digestion block, cooling block
These are available from the manufacturers of the digestion units, i.e. from Barkey, Behr or Merck.

8. 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 orderer.

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.

oncerning defects in material, construction or design as well as the absence of guaranteed features, the orderer 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.

9. Index