VARIOMAG™
Magnetic Stirrer

Operating Manual
50108226 Issue 02.2007

MINI 07 • MINI 20
MICRO 07 • MICRO 20
COMPACT 07 • COMPACT 20
MAXI 07 • MAXI 20 • MAXI 40

Analyze • Detect • Measure • Control™

Thermo SCIENTIFIC

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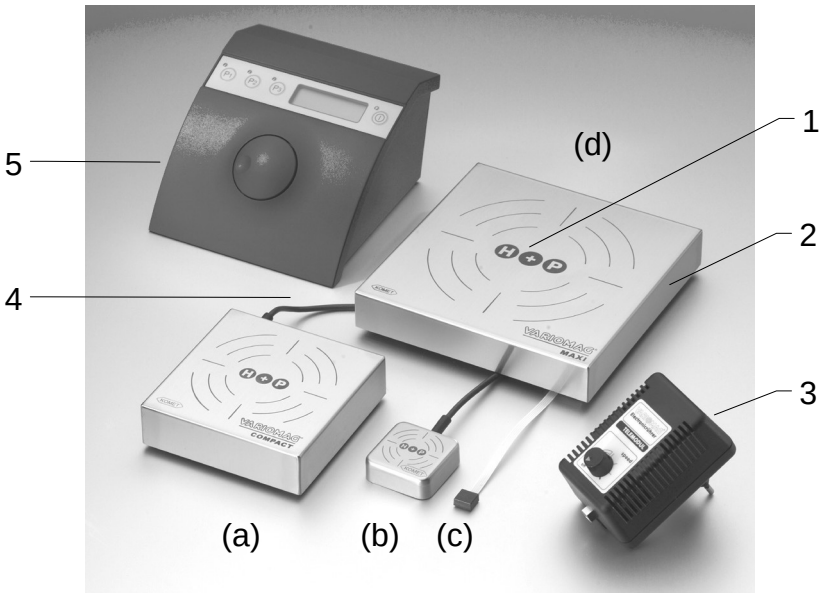
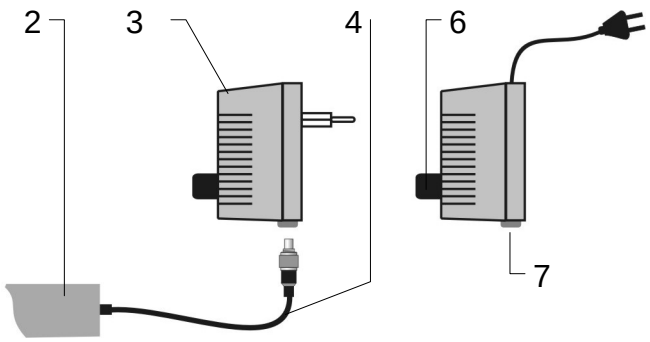
Assembly drawings



1 Stirring point
2 Stirring drive
a) COMPACT
b) MICRO
c) MINI
d) MAXI
3 TELEMODUL control unit
4 Control cable
5 TELEMODUL 20 C / 40 C control unit

Figure 1: MINI, MICRO, COMPACT and MAXI stirring systems with TELEMODUL and TELEMODUL 20 C / 40 C control units



2 Stirring drive
3 TELEMODUL control unit
4 Control cable
6 Rotation speed control button
7 Magnetic stirrer outlet

Figure 2: TELEMODUL control unit as plug-in control unit (left) or with mains cable (right)

5 TELEMODUL 20 C / 40 C control unit
8 Adjusting wheel
9 Program keys
10 Display
11 START/STOP key
12 Power supply unit connecting cable
13 Power supply unit
14 Mains cable

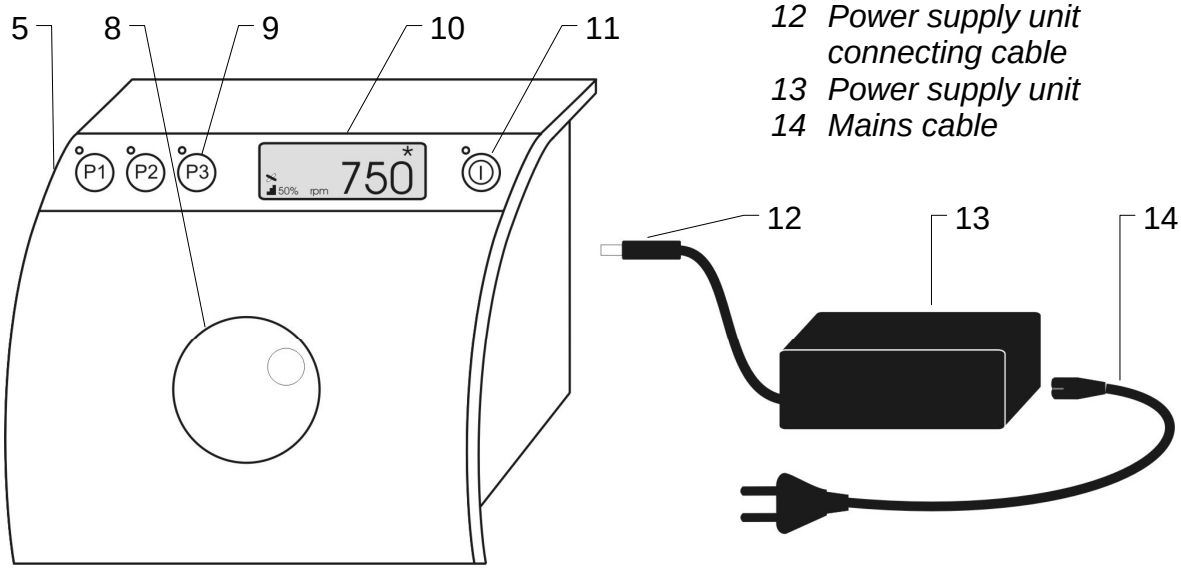
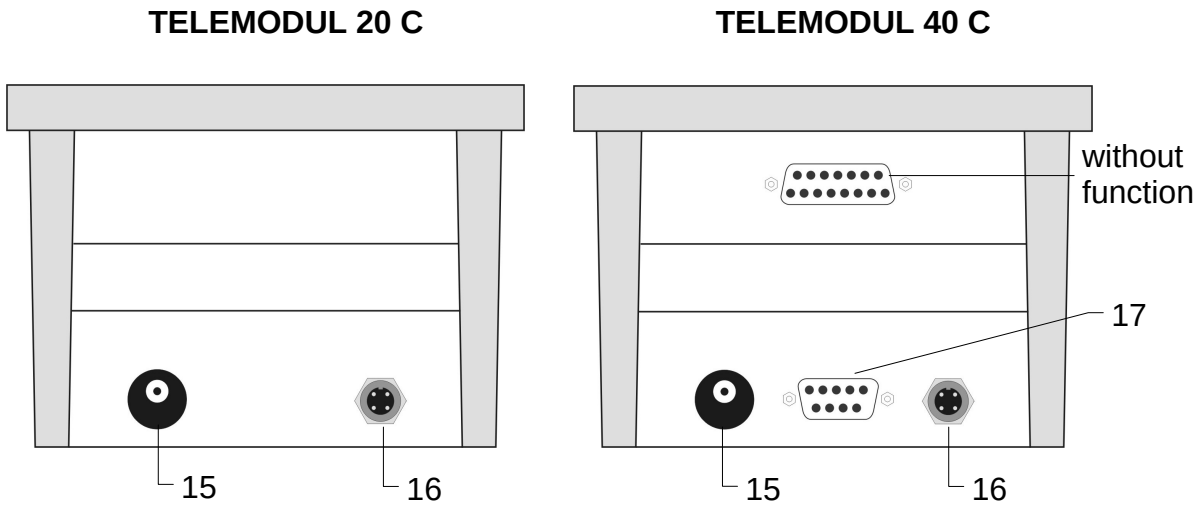


Figure 3: Control unit TELEMODUL 20 C / 40 C with power supply unit



15 Power supply unit intake
16 Magnetic stirrer outlet
17 RS 232C port

Figure 4: Control unit TELEMODUL 20 C (left) and TELEMODUL 40 C (right), back view

User considerations

Correct use

The remote-controlled single magnetic stirring systems MINI, MICRO, COMPACT and MAXI are designed for stirring or vertical mixing of liquids. The MICRO, COMPACT and MAXI stirring drives are ideally suited for submerged operation. The single magnetic stirring systems can be employed for chemical, microbiological, pharmaceutical or medical purposes.

The stirrers are suited to operation in the following areas:

- On the laboratory bench
- In incubators and gas incubators with or without air humidification
- In cold chambers
- MICRO, COMPACT and MAXI: In water bath
- In laminar flow equipment
- In safety laboratories and sterile rooms
- In measuring equipment (e. g. photospectrometers)

Incorrect use

The magnetic stirring systems MINI, MICRO, COMPACT and MAXI must not be operated in hazardous locations.

Do not stir or shake flammable liquids with a low boiling point.

The magnetic stirring system MINI must not be operated in a water bath.

Do not heat liquids in pressure sealed vessels (e.g. storage flasks, Erlenmeyer flasks).

Pictographs

You will find the following pictographs in this operating manual:

DANGER
This sign refers to dangerous voltages.

DANGER
This sign refers to hazardous situations.
Hazards to human life are indicated by "LIFE HAZARD".

CAUTION
This sign indicates danger to equipment and machinery.

INFORMATION
This sign indicates easier working practices.

♦ Indicates an operating step.

⇨ Indicates alternatives.

1 Safety considerations

For your own safety, you should observe the following safety warning signs.

The warning signs indicate potential sources of danger.
They also inform on how correct action can avert danger. You will find these warning signs wherever there is a risk of dangerous situations.

DANGER

Supply voltage and supply frequency must be within the range specified for the control unit (3, 5).
The control unit (3, 5) must only be connected to a grounded socket.

DANGER

Magnetism.
Magnetic or metallic parts (e.g. data carriers, pacemakers, watches) can be affected by magnetic fields.
Keep such parts away from the stirring drive (2) and the magnetic stirring bars.

CAUTION

The equipment must not be operated in hazardous locations.

CAUTION

Permissible ambient conditions:
Cf. Technical specifications.
Avoid extreme temperature changes.
The control unit (3, 5) must not be run in humid rooms, or set up in water splash zones!

CAUTION

Connect only the appropriate power supply unit to the TELEMODUL 20 C (cf. Technical specifications, control units).
Connect only the appropriate power supply unit to the TELEMODUL 40 C (cf. Technical specifications, control units).
Connection to another power supply unit may cause damage to the control unit.

CAUTION

Before connecting the stirring drives (2) to the TELEMODUL 20 C / 40 C control unit (5), please note the connection options as listed in Table 1.
Do not connect a single MINI, MICRO or COMPACT stirring drive to the TELEMODUL 40 C control unit. This may result in overload and damage the stirring drives.
You may connect only stirring drives of the same type to the benchtop distributors, and you may only connect them in pairs.

CAUTION

Do not place hot stirring vessels on top of the magnetic stirrer (2). Maximum temperature: +56°C (except MICRO: max. +100°C).

CAUTION

TELEMODUL 20 C / 40 C:
If you selected the shake mode (vertical mixing):
Select the minimum speed setting and then increase it slowly. Depending on the magnetic stirring bar used, you may be able to perform vertical stirring only at lower speeds.

CAUTION

In case of repair, the equipment must only be opened by an authorized service agent.

CAUTION

Do not allow AlNiCo5 type magnetic stirring bars to remain in an alternating magnetic field if they cannot rotate freely. Do not subject the magnetic stirring bar to a strong inverse magnetic field. This may result in destruction of the magnetic stirring bar.

INFORMATION

In the case of circular and triangular magnetic stirring bars, the length must not exceed 50 mm. The length of the magnetic stirring bars should not exceed 80 % of the vessel diameter.
Do not use cylindrical stirring bars with a center ring, or elliptical stirring bars with a round cross-section.

INFORMATION

Some magnetic stirring bars (especially triangular bars) may have a critical resonance frequency at lower rotation speeds. This may cause the magnetic stirring bar to wander away from the turning center and carry out periodic oscillations. Avoid this rotation speed setting when the problem occurs. Quickly travel through this problem range when adjusting the rotation speed.

2 Equipment description

Figures 1 to 4 show the components together with their position numbers.

Every magnetic stirring system MINI, MICRO, COMPACT and MAXI is equipped with one stirring point (1). The drive is inside the housing of the stirring drive (2), which is completely watertight. This prevents germs from penetrating into the inside of the stirring drive (2). The stirring drive (2) is cleared for use in safety laboratories and sterile rooms. The drive is constructed without the use of moving parts and therefore totally wear-free.

The stirring drive (2) gets its power either from the TELEMODUL control unit (3; Figure 2) or the TELEMODUL 20 C / 40 C control unit (5; Figure 3).

On the budget-priced equipment incorporating the TELEMODUL control unit (3), the rotation speed can be preselected continuously. This is done using the rotation speed control button (6). The TELEMODUL control unit (3) can be of the plug-in type, or be fitted with a mains cable.

The TELEMODUL 20 C / 40 C (5) is available in two models, 20 C and 40 C. These two models differ with regard to maximum speed and to stirring power (for details see the technical specifications). The TELEMODUL 40 C control unit is additionally equipped with a RS 232C port. The RS 232C interface can be used to remote-control the control unit from a PC.

The TELEMODUL 20 C / 40 C (5) interface is menu-driven. The display (10) shows the selected speed (rpm) and gives an overview over the functions selected.
You may preset speed and stirring power as well as change the stirring mode. The adjusting wheel (8) is used for selecting the appropriate menu and for adjusting the desired value. The three program keys (9) can be individually defined.

After the startup time (soft start) the stirring bar turns or mixes at the selected speed.

The TELEMODUL 20 C / 40 C (5) can be equipped with a four-way or eight-way benchtop distributor (accessory), allowing you to control 2, 4, 6 or 8 stirring drives simultaneously.

Stirring vessels and magnetic stirring bars do not fall within the scope of delivery.

3 Function

The magnetic stirring systems MINI, MICRO, COMPACT and MAXI are used for chemical, microbiological, biotechnical or medical purposes, e.g.:

- Growing microorganisms (e.g. aerating and growing bacteria cultures),
- Dissolving nutrient media and solids,
- To prevent the settling of suspended matter,
- Titration,
- Integration in measurement equipment facilitating concurrent measurement and stirring.

The **MINI** stirring system is designed for very small vessels such as cuvettes. It is extremely small and flat, has a highly flexible flat-strip cable, and is suitable for integration in measurement equipment.

The powerful and handy **MICRO** stirring system with its completely sealed stainless steel body can be used for extended temperature ranges. This stirring system can be attached to analyzers, experimental set-ups, or stands. For this purpose it is fitted with an M4 thread at the bottom of the device.

The **COMPACT** and **MAXI** stirring systems are particularly suited for routine laboratory tasks and larger stirring quantities. Thanks to their robust stainless steel bodies they can also be used in water baths.

Liquids may be stirred in vessels of various shapes (e.g. cuvettes, conical (Erlenmeyer) flasks, beakers and test tubes). As the rotation speed can be variably adjusted, liquids can be both moved gently as well as vigorously mixed.

When the stirring vessel is placed on the stirring point (1), an electromagnetic field will move the magnetic stirring bar.

When using the TELEMODUL 20 C / 40 C (5), you have a choice of stirring or vertically mixing the liquid. During stirring operation, the liquid will rotate in the vessel. During vertical mixing (shake mode), the current inside the vessel will be directed upwards and downwards. The liquid will not rotate. The rotation or shaking frequency can be adjusted continuously. The speed display shows the current rotating or oscillating speed of the magnetic stirring bars. All magnetic stirring bars will be moving at the same frequency.

4 Startup procedure

4.1 Connecting the device

DANGER

Supply voltage and supply frequency must be within the range specified for the control unit (3, 5). The control unit (3, 5) must only be connected to a grounded socket.

DANGER

Magnetism.
Magnetic or metallic parts (e.g. data carriers, pacemakers, watches) can be affected by magnetic fields.
Keep such parts away from the magnetic stirrer (2) and the magnetic stirring bars.

CAUTION

The equipment must not be operated in hazardous locations.

CAUTION

Permissible ambient conditions:
Cf. Technical specifications.
Avoid extreme temperature changes.
The control unit (3, 5) must not be run in humid rooms, or set up in water splash zones!

⇨ **TELEMODUL control unit (3):**

- Turn the rotation speed control button (6) to position OFF.
- Connect the control cable (4) of the stirring drive (2) to the output socket (7) of the control unit (3). Tighten the knurled screw.
- Plug the mains plug into a properly installed mains outlet.
- If an absolutely germ-free environment is called for, the control unit (3) should be located outside the sterile zone.

⇨ **Control unit TELEMODUL 20 C / 40 C (5):**

CAUTION

Connect only the appropriate power supply unit to the TELEMODUL 20 C (cf. Technical specifications, control units).
Connect only the appropriate power supply unit to the TELEMODUL 40 C (cf. Technical specifications, control units).
Connection to another power supply unit may cause damage to the control unit.

- Connect the mains cable (14) with the power supply unit (13).
- Plug the power supply unit connecting cable (12) into the power supply unit intake (15) of the TELEMODUL 20 C / 40 C (5).

You can connect a stirring drive (2) directly to the control unit TELEMODUL 20 C / 40 C (5) (standard version).
When using the four-way or eight-way benchtop distributor (Figure 5), you can control 2, 4, 6 or 8 identical stirring drives (2) (i.e. the stirring drives should be connected in pairs). This is particularly important when combining the powerful TELEMODUL 40 C control unit with the smaller MINI, MICRO or COMPACT stirring drives. All stirring drives (2) stir at the same speed and are completely synchronized.

CAUTION

Before connecting the stirring drives (2) to the TELEMODUL 20 C / 40 C control unit (5), please note the connection options as listed in Table 1.
Do not connect a single MINI, MICRO or COMPACT stirring drive to the TELEMODUL 40 C control unit. This may result in overload and damage the stirring drives.
You may connect only stirring drives of the same type to the benchtop distributors, and you may only connect them in pairs.

Number or stirring drives **minimum / maximum**	Telemodul 20 C			Telemodul 40 C		
	1 outlet	Benchtop distributor four-way	Benchtop distributor eight-way	1 outlet	Benchtop distributor four-way	Benchtop distributor eight-way
MINI	✕	$^2/_4$	$^2/_8$	–	$^2/_4$	$^2/_8$
MICRO	✕	$^2/_4$	0	–	$^2/_4$	$^2/_8$
COMPACT	✕	$^2/_4$	0	–	$^2/_4$	$^2/_8$
MAXI	✕	0	0	✕	$^2/_4$	0

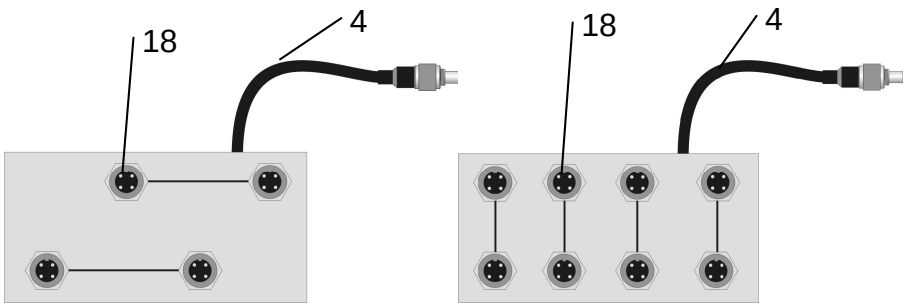
✕ = standard – = not permitted 0 = too weak

Table 1: Possible connections of stirring drives (2) to control units TELEMODUL 20 C or 40 C (5)

⇨ **Connecting the single stirring system (standard version):**

- Connect the control cable (4) of the stirring drive (2) to the output socket (16) of the control unit (5). Tighten the knurled screw.
- Connect the mains plug (14) into the mains socket.
- If an absolutely germ-free environment is called for, the control unit (5) should be located outside the sterile zone.

⇨ **Connecting the benchtop distributor:**



4 Control cable
18 Magnetic stirrer outlet

Figure 5: Four-way (left) and eight-way (right) benchtop distributor

- output sockets (18) of the benchtop distributor that are connected by a line (see Figure 5).
- Connect the mains plug (14) into the mains socket.
- If Place the benchtop distributor behind the control unit (5).
- Connect the control cable (4) of the benchtop distributor to the output socket (16) of the control unit (5). Tighten the knurled screw.
- Connect the control cable of the stirring drives (2), always in pairs, with the an absolutely germ-free environment is called for, the control unit (5) should be located outside the sterile zone.

4.2 Stirring vessels

You should use stirring vessels which are circular in shape, and made of glass, nonmagnetic metal or plastic. Wall thicknesses should be of an even thinness. For the MINI you may also use cuvettes.
Flat-bottomed glass vessels (not concave) and smooth surfaces improve the running quality of the magnetic stirring bars. When stirring larger volumes of liquid, you should use stirring vessels having a relatively small diameter with a thin bottom.

4.3 Magnetic stirring bars

We recommend using PTFE coated magnetic stirring bars supplied by **THERMO SCIENTIFIC.** The bars are made from AlNiCo5 magnets or high performance rare-earth permanent magnets. The following sizes are suitable:

Thermo Scientific recommends the following magnetic stirring bars:

Type	Size (mm)	Material	Order No.
KOMET 15	(Ø x L) 9 x 15	SmCo	50087924
KOMET 30	(Ø x L) 12 x 30		50087930
KOMET 50	(Ø x L) 21 x 50		50087909

Table 2: Magnetic stirring bars

INFORMATION

Some magnetic stirring bars (especially triangular bars) may have a critical resonance frequency at lower rotation speeds. This may cause the magnetic stirring bar to wander away from the turning center and carry out periodic oscillations. Avoid this rotation speed setting when the problem occurs. Quickly travel through this problem range when adjusting the rotation speed.

INFORMATION

In the case of circular and triangular magnetic stirring bars, the length must not exceed 50 mm. The length of the magnetic stirring bars must not exceed 80 % of the vessel diameter. Do not use cylindrical stirring bars with a center ring, or elliptical stirring bars with a round cross-section.

Thermo Scientific has developed a new magnetic stirring bar **KOMET** (Figure 6). It contains a high-quality super-strong samarium-cobalt magnet. KOMET shows a strong magnetic force. The stronger attraction to the magnetic alternating field provides the stirring bar with very efficient stirring properties. Even if there are greater distances (e.g. in high measuring cylinders) the stirring force will be maintained.
The stability of the stirring bar will not be impaired if the vessel has a curved bottom. The strong magnetic coupling in samarium-cobalt magnets will also increase friction. The standard design of the KOMET magnetic stirring bar is therefore unsuitable for stirring liquids containing particulate matter (such as mud) or for stirring in vessels with a rough interior surface. Some of the KOMET stirring bars are specially fitted with a wear-resistant glide ring for use under excruciating circumstances, such as when stirring vessels feature rough plastic or stainless-steel bottoms or if the media to be stirred contain solids (Figure**Fehler! Verweisquelle konnte nicht gefunden werden.**7).

Any risk of demagnetisation by external magnetic fields is completely eliminated. All KOMET series stirring bars can be readily recognized by their two conical ends.

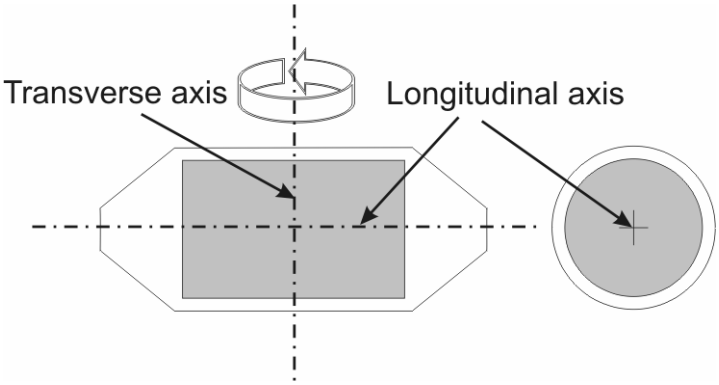


Figure 6: ***KOMET*** *stirring bar.*
Side view (left) and cross-section through central portion (right).

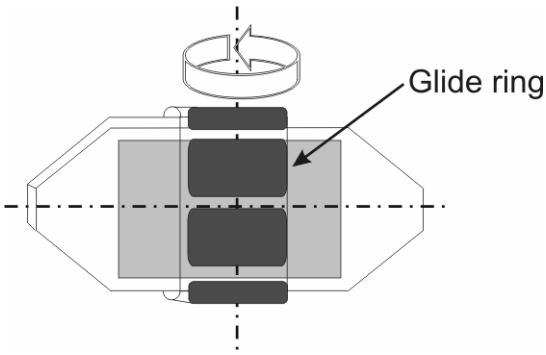


Figure 7: ***KOMET*** *stirring bar with glide ring*

5 Short operating manual for TELEMODUL 20 C / 40 C

⇨ **Selecting a language, resetting the default settings, accessing device type / version:**

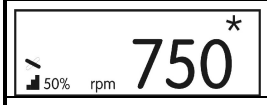
	Press the adjusting wheel (8) ☞: Selection is confirmed	
Press and release the P1 and P2 keys together:		
	◊ Back Language ..... Reset	
Turn the adjusting wheel (8) ↙ : Marker moves downward ↘: Marker moves upward	Back ◊ Language → Reset	◊ Back ⊕ English Spanish German French
	Back Language ..... ◊ Reset	Factory setup Factory defaults are restored: Language: English Startup time: 1x Power: 50 % Mode: Stirring Interval: OFF Stirring time: 00:10:00 Pause time: 00:00:30 P1: speed 200 rpm P2: speed 400 rpm P3: speed 600 rpm
Press and release the P1 and P3 keys together: Shows device type and version.		

Table 3: Selecting a language, resetting the default settings, accessing device type / version

◇	The selection marker indicates the selected function.
⊕	The circle-plus sign indicates the currently active function.
↓	The down arrow indicates that the list is continued below.
↑	The up arrow indicates that the list is continued above.
→	The right arrow indicates that this selection will open another menu.
🕒	Time: hours : minutes : seconds
Back in menu	Move marker to *Back* and press adjusting wheel, or press program key.

Selecting a progam:

750 rpm 50%	Press the adjusting wheel (8) ☞: Selection is confirmed										
Turn the adjusting wheel (8): Select speed	◇ back Stirrer →	back	◇ back	back ◇ Startup time Power Mode →	Startup time 1x / 2x / 4x Select by turning the adjusting wheel						
Turn the adjusting wheel (8) ↘: Marker moves downward ↗: Marker moves upward				back Startup time Power ◇ Mode →	Power 20 C: 25 % / 50 % / 75 % / 100 % 40 C: 10 % / 20 % / ... / 100 % Select by turning the adjust.wheel						
				back Startup time Power ◇ Mode →	◇ back ⊕ Stirrer → Shake						
					back ◇ ⊕ Stirrer → Shake	◇ back Interval Stirring time Pause time					
						back ◇ Interval Stirring time Pause time	Interval ◇ ON OFF				
						back Interval ◇ Stirring time Pause time	Stirring time 00:00:30 ◷ Select time by turning the adjusting wheel				
						back Interval Stirring time ◇ Pause time	Pause time 00:00:15 ◷ Select time by turning the adjusting wheel				
						back ⊕ Stirrer → ◇ Shake		back Stirrer → ◇ ⊕ Shake			

Table 4: Selecting a progam

6 Stirring operation

CAUTION

Do not place hot stirring vessels on top of the magnetic stirrer (2).
Maximum temperature: +56°C (except MICRO: max. +100°C).

For MINI and MICRO, please observe the correct orientation of the stirring drive (2) (Figure 9)

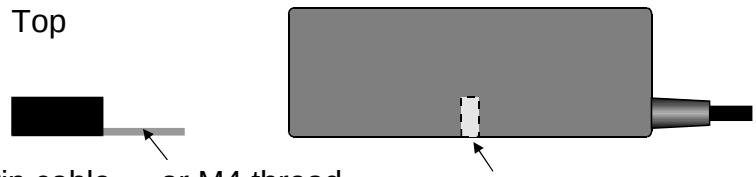


Figure 9: Correct orientation of the stirring drives MINI (left) and MICRO (right)

6.1 Recommended rotation speed ranges

We recommend the following rotation speed ranges for various applications:

Application	Rotation speed range
Microbiological and biotechnical applications:	(rpm)
Aeration of bacteria cultures Growth of bacteria cultures Dissolving nutrient media	200-350 300-450 350-500
Routine laboratory work:	
Prevent aeration of suspended matter Titration Dissolving solids	150-250 250-400 350-700

Table 5: Recommended rotation speed ranges

CAUTION

TELEMODUL 20 C / 40 C:
If you selected the shake mode (vertical mixing):
Select the minimum speed setting and then increase it slowly.
Depending on the magnetic stirring bar used, you may be able to perform vertical stirring only at lower speeds.

6.2 Stirring using the TELEMODUL control unit

- Fill stirring vessels no more than half full (upper rotation speed range) or three-quarters full (lower rotation speed range).
- Place a magnetic stirring bar into every stirring vessel.
- Turn the rotation speed control button (6) to position OFF (see also Figure 2).
- Center the stirring vessel onto the marked stirring point (1).

- ♦ Turn the rotation speed control (6) clockwise until a slow speed is attained. The magnetic stirring bar moves to the center of rotation.
- ♦ Select the desired speed using the rotation speed control (6).

6.3 Stirring using the TELEMODUL 20 C / 40 C

INFORMATION

Please observe the tables of the short operating manual (chapter 5) for operating the TELEMODUL 20 C / 40 C.

6.3.1 Selecting the language

The TELEMODUL 20 C / 40 C control unit can display messages in either of four different languages: German, English, French and Spanish. The factory default display language is *English*.

- ♦ Turn the control unit (5) off using the START/STOP key (11) (Figure 3).
- ♦ Press program keys P1 and P2 (9) concurrently.
- ♦ Release both program keys (9) simultaneously.

The display (10) shows the language selection menu (Table 3).

- ♦ Select Language by turning the adjusting wheel (8).
- ♦ Confirm your selection by pressing the adjusting wheel (8).

The display now shows the languages that can be selected (Table 3).

- ♦ Select a language by turning the adjusting wheel (8).
- ♦ Confirm your selection by pressing the adjusting wheel (8).

The display returns to the language selection menu. The selection marker is at the Back position.

- ♦ Exit the menu by pressing the adjusting wheel (8).

The display (10) returns to the stirring display (Figure 10).

6.3.2 Selecting a progam

The three program keys labelled P1, P2 and P3 (9) can be programmed with individual settings. Programs can be selected only if the stirrer has been turned off. When the stirrer is turned on, the last program selected will be active. Speed, stirring power, and stirring mode settings are stored as a part of the currently active program.

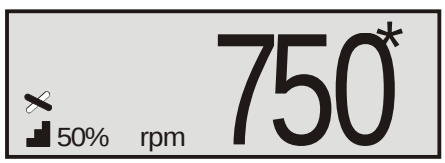


Figure 10: Stirring display

 : The stirring bar symbol turns when the stirrer is active. How the symbol turns indicates the selected stirring mode.

- Stirrer: Symbol continuously turns in the same direction
- Interval: Symbol alternates between turning clockwise and turning counterclockwise
- Shake: Symbol rocks back and forth

 : The stair symbol indicates reduced stirring power. The power is adjustable:
For the TELEMODUL 20 C in 4 increments between 25 % and 100 %.
For the TELEMODUL 40 C in 10 increments between 10 % and 100 %.

 : The asterisk symbol remains visible on the display until the set speed (rpm) has been reached (soft start).

Three program keys (9) are available for storing repeated combinations of parameters. Changes to the parameters are stored as a part of the currently active program. The speed can always be adjusted by simply turning the adjusting wheel (8).

- ♦ Press one of the program keys P1, P2 or P3 (9).

Programs can be selected only if the control unit has been turned off with the START/STOP key (11). All other settings can be adjusted while the unit is turned on.

The adjusting wheel (8) serves two purposes: selecting a menu and adjusting values.

- ♦ Press the adjusting wheel (8).

The display shows the main menu (Table 4)

- ♦ Select a function by turning the adjusting wheel (8).
- ♦ The selection marker ◇ indicates the selected function.
- ♦ Confirm your selection by pressing the adjusting wheel (8).

The display will show the appropriate selection menu (Table 4). Repeat the process until you have reached the desired settings menu.

- ♦ Use the adjusting wheel (8) to make the desired adjustment (e.g. to the stirring power).
- ♦ Confirm your setting by pressing the adjusting wheel (8).

The display will return to the previous menu. The marker will point to ***back***.

- ♦ Select another menu.
- ♦ or
- ♦ Confirm all settings by again pressing the adjusting wheel (8). Repeat until the stirring display (Figure 10) reappears.
- ♦ alternatively:
- ♦ Press the program key (9) for which you made the settings. The settings are stored, and the stirring display (Figure 10) reappears.

6.3.3 Stirring

- ♦ Fill stirring vessels no more than half full (upper rotation speed range) or three-quarters full (lower rotation speed range).
- ♦ Place a magnetic stirring bar into every stirring vessel.
- ♦ Place the stirring vessel on the stirring point (1) of the magnetic stirrer.
- ♦ Select a program key (9).
- ♦ Start the stirrer using the START/STOP key (11).
- ♦ Set the desired speed using the adjusting wheel (8).

The magnetic stirrer has a soft start feature that first centers the magnetic stirring bars within the vessels and then slowly accelerates them to the desired speed. As long as the asterisk symbol is still shown in the display (10), the selected speed has not been reached yet.

6.3.4 Power adaptation

Cf. Table 4, *Power* menu.

Select

- **Higher** power for larger quantities, higher speeds, viscous media, and connection with several stirring drives via the bench-top terminal block (see also Table 1).
- **Lower** power for smaller quantities, lower speeds, media of watery consistency, or if heating the area where the stirrer is placed or heat emanation (e.g. in incubators) are undesirable.

♦ Select the required stirring power in the *Power* menu.

While doing so, observe the stirring movement: The power setting is correct when the stirring bar turns evenly and without jerking.

6.3.5 Mixing vertically (Shake)

CAUTION

If you selected the shake mode (vertical mixing):
Select the minimum speed setting and then increase it slowly.
Depending on the magnetic stirring bar used, you may be able to perform vertical stirring only at lower speeds.

Cf. Table 4, *Shake* menu.

To avoid vigorous stirring movements, change the stirring mode to Shake. This will keep the magnetic stirring bar from spinning, rocking it gently back and forth only. This helps avoid excessive shear forces.

♦ Select vertical mixing on the *Shake* menu.
♦ Select the minimum speed setting and then increase it only slowly.

6.3.6 Interval operation

Cf. Table 4, *Interval* menu.

Even during continuous operation (e.g. overnight) it may be a good idea to interrupt the stirring at regular intervals. After each pause, the stirring bars are being recentered. This ensures that no stirring point is rendered inoperative for a longer period of time if a stirring bar migrates away from the turning center.

♦ Select the *Interval* submenu
♦ Select Interval ON.
♦ Select the desired stirring time (e.g. 30 s).
♦ Select the desired pause time (e.g. 10 s).

The rotation speed is reduced at the end of every stirring period, and the stirring is stopped. After every pause the stirrer is restarted. The direction of rotation is reversed, the magnetic stirring bars are recentered and the rotation speed is slowly increased again.

6.3.7 Selecting the startup time

Cf. Table 4, *Startup time* menu.

If you intend to stir large quantities of liquid or highly viscous media, it may be necessary to slowly accelerate the stirring bar to the selected speed. To do so, you may adjust the soft-start feature to double or quadruple the startup time.

- Select the *Startup time* menu.
- Select the desired startup time (1x, 2x, 4x).

6.3.8 Terminating the stirring process

- Turn off the stirrer using the START/STOP key (11).

The control unit (5) switches now to standby.
In order to switch it off completely, you have to pull the mains plug.

6.4 Tips on stirring

⇨ **If rotation of the magnetic stirring bar is uneven or jerky:**

Reaction between the alternating magnetic field and the magnetic stirring bar is too strong.

- Increase the rotation speed, or
- Use a smaller magnetic stirring bar, or
- Increase the gap between the vessel and the stirring drive (2).
  You can do this by placing a glass plate or a nonmagnetic metal plate between vessel and stirring drive (2), or
- Reduce the stirring power of the TELEMODUL 20 C / 40 C.

⇨ **If the magnetic stirring bar cannot be centered, or constantly wanders off center:**

Reaction between the alternating magnetic field and the magnetic stirring bar is too weak, or the base of the stirring vessel is concave or too thick.

- Move the stirring vessel a little back and forth and recenter it on the stirring point (1).
- Reduce the rotation speed, or
- Use a longer magnetic stirring bar or one with a larger diameter (e.g. the elliptical or SmCo magnetic stirring bar), or
- Use a smaller stirring vessel with a thin-walled, flat base, or
- Reduce the filling level in the stirring vessel, or
- Increase the stirring power of the TELEMODUL 20 C / 40 C.

⇨ **If the stirring action is too weak:**

- Use the magnetic stirring bar KOMET.
- Use a longer magnetic stirring bar or one with a larger diameter, or a stirring vessel of smaller diameter.

7 Remote operation

The TELEMODUL 40 C control unit is additionally equipped with a RS 232C port (17). The RS 232C interface can be used to remote-control the control unit from a PC.

- ♦ Connect a PC to the RS 232C port (17) at the rear of the TELEMODUL 40 C control unit (5).

In order to send commands and data to the TELEMODUL 40 C control unit (5) using the RS 232C port (17), you need to start a terminal emulation program.
Serial port settings and commands are listed in Table 6.

RS 232C port settings	
Bits per second (bps)	9600
Data bits	8
Parity	None
Stop bits	1
Protocol	None

Commands[1]	
VER↵	(same as VERSION)
VERSION↵	Shows the date the current software was compiled.
GETTYPE↵	Shows device type information.
STIRRER□[n]↵	Stirrer OFF: [n]=0 ON: [n]=1 Corresponds to the START/STOP key of the control unit
SETRPM□[speed]↵	Entering the desired speed in rpm. Speeds below 100 rpm are not supported.
GETRPM↵	Shows the set stirrer speed in rpm.
RESTARTRPM↵	Stirrer is started at the lowest speed, which is then increased to the set speed using the automatic start-up characteristics.
SETPOWER□[power]↵	Sets stirring power in % (Partition: 20 C – 4 increments, 40 C – 10 increments)
GETPOWER↵	Shows the set stirring power in %.

Table 6: RS 232C remote control commands for the TELEMODUL 40 C

[1] □ = Space,
↵ = Enter or Carriage Return (CR) + Line Feed (LF)

Examples:

To turn on the stirrer:

*Table 6 shows:*STIRRER□[n] ↵STIRRER□[n] ↵
ON: [n]=1n]=1

Enter: STIRRER □1↵

To reduce the stirring power to 50 %:

Table 6 shows: SETPOWER□[power]↵
stirring power in %

Enter: SETPOWER □50↵

As soon as the control unit (5) senses a signal on the RS 232C interface (17), it will automatically go into remote operation mode.

⇨ **Terminate remote operation mode:**

- ♦ Disconnect the power supply unit (13) of the TELEMODUL 40 C from mains.

On reconnecting the power supply unit (13) you can once again operate the TELEMODUL 40 C manually.

8 Maintenance and cleaning

The stirring drive (2) is maintenance-free.

The magnetic drive inside the housing is embedded in synthetic resin and watertight. This prevents germs from being carried over to the inside or the outside. The stainless steel surface is largely resistent to acids and alkalis.

The standing surface is coated with a protective film. You may leave this on the stirring drive (5), or strip it off.

Clean the surfaces of the magnetic stirrer (2) at regular intervals. You can wash it down with water or a disinfectant solution. For this purpose the magnetic stirrer (2) may be totally immersed in water.
Wipe the surface of the control unit (5) using a damp cloth. Do not use caustic liquids.

CAUTION

In case of repair, the equipment must only be opened by an authorized service agent.

In case of necessity to repair the equipment, it should be returned to an authorized servicing agent. The equipment must be clean and free from harmful substances.

To avoid transport damages during the shipment, please send the equipment correctly packed in the original packing.

Please always enclose the filled out return delivery note.

If necessary ask for the return delivery note at **Thermo** (address: see inside of the cover sheet).

When ordering spares, please state equipment type and serial number.

You can obtain further technical documents (e.g. circuit diagrams, board data) for your engineers by contacting the address on the inside of the cover sheet.

9 Troubleshooting

Rotation of the magnetic stirring bar is always irregular:

It is unavoidable that magnetic stirring bars will age with time, for example through sterilization, use at excessive temperatures, or mechanical stress (such as when you drop it). This may adversely affect the magnetic properties of the stirring bar.

CAUTION

Do not allow AlNiCo5 type magnetic stirring bars to remain in an alternating magnetic field if they cannot rotate freely. Do not subject the magnetic stirring bar to a strong inverse magnetic field. This may result in destruction of the magnetic stirring bar.

- Remove and replace the magnetic stirring bar with a new one.

Or:

- Use the KOMET series of super-strong magnetic stirring bars offered by **Thermo Scientific** (see chapter 4.3). They are made from high-performance Samarium-Cobalt magnets. Any risk of demagnetisation by external magnetic fields is completely eliminated.

TELEMODUL only: The rotation speed control button (6) slips:

- Tighten screw on rotation speed control button (6).

10 Technical specifications

Order numbers, Stirring drives with control unit TELEMODUL

TELEMODUL	MINI 07	MICRO 07	COMPACT 07	MAXI 07
Version **DE**	50088130	50088162	50088152	50088143
Version **AU**	-	50088155	50094111	-
Version **GB**	50088132	50088151	50088153	50088145
Version **JP**	50088126	50088149	50088154	50088146
Version **US**	50088118	50088150	50088142	50088147

Table 7: Order numbers, stirring systems with control unit TELEMODUL

Order numbers, Stirring drives with control unit TELEMODUL 20 C:

-	MINI 20	MICRO 20	COMPACT 20	MAXI 20
TELEMODUL 20 C	50088120	50088148	50088133	50088135

Table 8: Order numbers, stirring systems with control unit TELEMODUL 20 C

Order numbers, Stirring drives with control unit TELEMODUL 40 C:

-	-	-	-	MAXI 40
TELEMODUL 40 C	-	-	-	50088122
-	**MINI 04.40**	**MICRO 04.40**	**COMPACT 04.40**	**MAXI 04.40**
TELEMODUL 40 C	50088116 4 stirring drives with distributor	50088111 4 stirring drives with distributor	50088117 4 stirring drives with distributor	50088113 4 stirring drives with distributor
-	-	**MICRO 08.40**	**COMPACT 08.40**	-
TELEMODUL 40 C	-	50088070 8 stirring drives with distributor	50088067 8 stirring drives with distributor	-

Table 9: Order numbers, stirring systems with control unit TELEMODUL 40 C

Order numbers, Stirring drives without control unit:

-	MINI	MICRO	COMPACT	MAXI
without control unit	50088140	50088139	50088137	50088127

Table 10: Order numbers, stirring systems without control unit

Technical specification:stirring drives

Type		MINI	MICRO	COMPACT	MAXI
Dimensions (W x D x H)	mm	12x12x5	48x48x16	120x120x35	180x180x35
Weight	g	15	200	1,000	2,300
Connector thread		-	M 4	-	-
Maximum centring hole size (optional)	mm	-	8	20	on request
Stirring volume					
Minimum	ml	0.1	1	1	250
Maximum with					
TELEMODUL	ml	5	800	1,000	2,000
TELEMODUL 20 C	ml	5	1,000	1,500	4,000
TELEMODUL 40 C	ml	-	-	-	5,000
Stirring power with					
TELEMODUL	W	0.1	3	5	6
TELEMODUL 20 C	W	0.05/0.1/0.15/0.2	2/4/6/8	3/6/9/12	4.5/9/13.5/18
TELEMODUL 40 C	W	-	-	-	3 - 36
Rotation speed range for					
TELEMODUL	rpm	130 to 1,000			
TELEMODUL 20 C		130 to 1,400			
TELEMODUL 40 C		100 to 2,000			
Duty cycle		100 %			
Speed regulation for alternating loads		none			
Operating voltage for					
TELEMODUL	VDC	12	12	12	12
TELEMODUL 20 C		20	20	20	20
TELEMODUL 40 C		-	-	-	36
Construction:					
Control line	mm	1,000	2,000	2,000	2,000
Housing material		plastic	stainless steel	stainless steel	stainless steel
Colour		black	polished	polished	polished
Submersion		no	yes	yes	yes
Equipment plug		C	C	C	C
Input voltage	VDC	≤ 20	≤ 20	≤ 20	≤ 36
Permissible operation conditions:					
Air, 100 % humidity	°C	-10 to +56	-10 to +100	-10 to +56	-10 to +56
Air, dry	°C		-10 to +120		
Water bath	°C	no	0 to +95	0 to +50	0 to +50
Ice bath		no	yes	yes	yes
Coolant		on request	yes	on request	on request
Disinfection		yes	yes	yes	yes

Type		MINI	MICRO	COMPACT	MAXI
Permissible storage conditions:					
Temperature	°C	-40 to +70	-40 to +120	-40 to +70	-40 to +70
Humidity	%	10 - 95	10 - 100	10 - 100	10 - 100
Barometric pressure	hPa	500 - 1,060	500 - 1,060	500 - 1,060	500 - 1,060
Protective system (according to DIN 40050)		IP 67	IP 68	IP 68	IP 68
Expansion levels, accessories		Benchtop distributor, four-way and eight-way; extension cable for stirring drive			

Subject to technical alterations

Table 11: Technical specifications for stirring drives

Control units

Type		TELEMODUL	TELEMODUL 20 C	TELEMODUL 40 C
Order No. Control unit		50087966 (DE) 50087967 (AU) 50087968 (GB) 50087969 (JP) 80087970 (US)	50094707	50094705
Order No. Control unit with power supply unit		-	50090773	50090774
Order No. Power supply unit		-	50093506	50094706
Dimensions (W x D x H)	mm	63x96x50	155x165x95	
Weight	g	400	600	700
Nominal power	VA	7	20	40
Setting range as a percentage of the nominal power	%	100	25 / 50 / 75 / 100 (4 increments)	10 - 100 (10 increments)
Rotation speed range	rpm	130 to 1,000	130 to 1,400	100 to 2,000
Speed constancy	%	± 3	± 1	± 1
Stirring times			5 sec to 60 min	5 sec to 60 min
Pause times			5 sec to 60 min	5 sec to 60 min
Output voltage	VDC	12	20	36
Operating voltage	VDC		24	48
Input voltage Frequency	VAC/Hz	DE: 230/50-60 AU: 240/50-60 GB: 230/50-60 JP: 100/50-60 US: 115/50-60		
Input voltage Frequency (of included power supply unit)			100-240 VAC 50-60 Hz	100-240 VAC 50-60 Hz
Mark of conformity Protective system (acc. to DIN 40050)		Protection class 2 IP 20 VDE tested	IP 30 -	IP 30 -
Permissible operating conditions		+10 °C to +40 °C at 30 % to 75 % relative humidity 700 bis 1060 hPa barometric pressure		
Permissible storage conditions		-40 °C to +70 °C, at max.80 % relative humidity, 500 to 1060 hPa barometric pressure		

Subject to technical alterations

Table 12: Technical specifications for control units

11 Warranty

VARIOMAG magnetic stirrers have a modular construction and offer the greatest possible degree of trouble-free operation, thanks to their maintenance-free stirring and magnetic drives.

If despite our strict quality controls a system component should ever fail to work perfectly, it can be repaired or replaced by our after-sales service without difficulty. Please retain your invoice, which will be needed when presenting any warranty claims.

Two years full warranty on all system components!