IKA

designed for scientists

IKA MATRIX ORBITAL
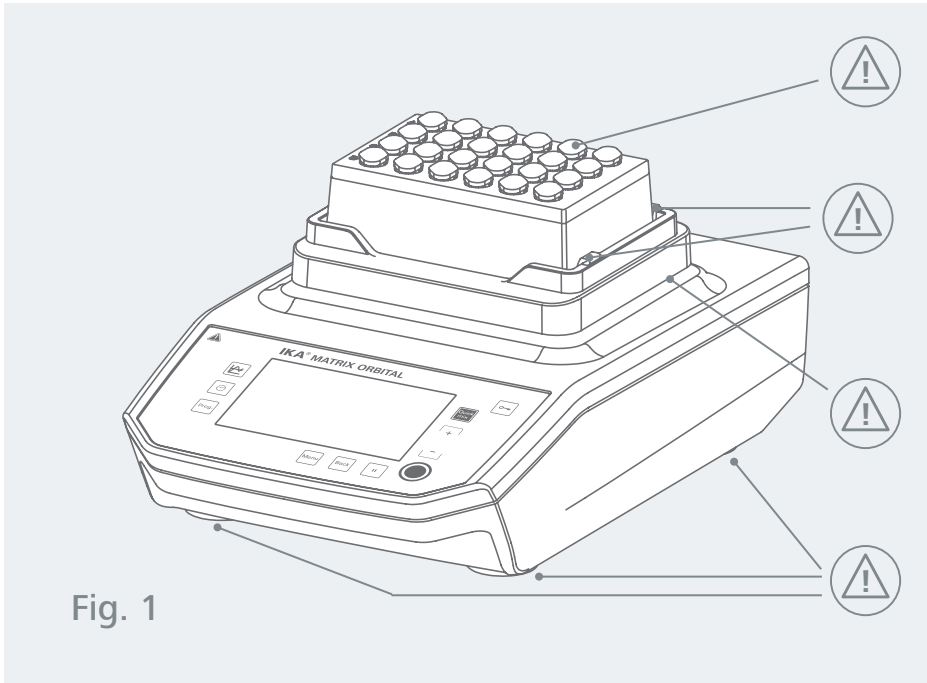
ENGLISH

Fig. 1

EU Declaration of conformity

We declare under our sole responsibility that this product corresponds to the directives 2014/35/EU, 2006/42/EC, 2014/30/EU and 2011/65/EU and conforms with the following standards or normative documents: EN 61010-1, EN 61010-2-051, EN 61326-1, EN 60529 and EN ISO 12100.

A copy of the complete EU Declaration of conformity can be requested at sales@ika.com.

Explication of warning symbols

/// Warning symbols

Danger!   Indicates an (extremely) hazardous situation, which, if not avoided, will result in death, serious injury.

Warning!   Indicates a hazardous situation, which, if not avoided, can result in death, serious injury.

Caution!   Indicates a potentially hazardous situation, which, if not avoided, can result in injury.

Notice!   Indicates practices which, if not avoided, can result in equipment damage.

/// General Symbols

A——   Position number

Correct/Result!
Shows the correct execution or the result of an action step.

Wrong!
Shows the incorrect execution of an action step.

Note!
Displays action steps that require particular attention to detail.

Safety instructions

/// General information

› **Read the operating instructions completely before starting up and follow the safety instructions.**
› Keep the operating instructions in a place where it can be accessed by everyone.
› Ensure that only trained staff work with the device.
› Follow the safety instructions, guidelines, occupational health and safety and accident prevention regulations.
› The device must only be used in a technically perfect condition.

/// Device setup

⊗ **Danger!**
› Please pay attention to the dangerous parts of the equipment in Fig. 1.

⊗ **Danger!**
› Do not use the device in explosive atmospheres, it is not EX-protected.
› With substances capable of forming an explosive mixture, appropriate safety measures must be applied, e.g. working under a fume hood.
› To avoid body injury and property damage, observe the relevant safety and accident prevention measures when processing hazardous materials.

⊗ **Caution!**
› Set up the device in a spacious area on an even, stable, clean, non-slip, dry and fireproof surface.
› The feet of the device must be clean and undamaged.
› Overfilling with liquid may cause the medium to splash out. For this reason, only closed test tubes should be used.
› Check the device and accessories for damage before each use. Do not use damaged components.
› All screw connections must be properly tightened

/// Work with the device

› The device must only be used in a technically perfect condition.

⊗ **Danger!**
› You must not touch any moving parts (danger of crushing, impacts and cuts, Fig. 1 points of danger shown)
› Wear your personal protective equipment in accordance with the hazard category of the media to be processed. There may be a risk from:
    - splashing and evaporation of liquids,
    - release of toxic or combustible gases,
    - body parts, hair, clothing and jewelry getting caught.
› Reduce the speed if:
    - the device is not running smoothly.
› The device may heat up when in use.

⊗ **Danger!**
› Only process media that will not react dangerously to the extra energy produced through processing. This also applies to any extra energy produced in other ways, e.g. through light irradiation.

⚠ **Warning!**
› Beware of the risk of:
  - glass breakage as a result of mechanical shaking power.

⚠ **Notice!**
› Covers or parts that can be removed from the device without tools must later be refitted to ensure safe operation. This will prevent the infiltration of foreign objects and liquids.

/// Accessories

› Protect the device and accessories from bumping and impacting.
› Check the device and accessories beforehand for damage each time when you use them. Do not use damaged components.
› Safe operation is only guaranteed with the accessories described in the "Accessories" section.
› Place the vessels securely on the shaking table or the selected insert.
› Ensure accessory parts are secured carefully as otherwise the sample containers can be damaged or ejected.
› Place a single sample vessel in the centre. When using several sample vessels, ensure that they are distributed evenly.
› Incorrectly secured accessory parts/sample vessels can be damaged or ejected. The securing of the sample vessels and the securing of the inserts must be checked at regular intervals, particularly before each recommissioning.
› Disconnect the power cord before attaching or replacing accessories.

/// Power supply / switching off the device

⚠ **Notice!**
› The specified settings on the rating plate must coincide with the actual mains supply.
› The device can only be disconnected from the mains supply by pulling out the mains plug or the connector plug.
› The device must only be operated with the original power supply unit.
› The outlet for the mains plug must be easily accessible.
› Socket must be earthed
› After an interruption to the power supply, the device does not start up again automatically (factory settings).
› The device is maintenance-free and must not be opened.

/// Maintenance

› Follow the cleaning instructions.
› Even in case of repairs, the device may only be opened by trained staff. Before opening, you should disconnect from the mains. Energised parts inside may also continue to be live for some time after the mains plug is removed.
› Only use original IKA spare parts!

/// Disposal instructions

› The device, accessories and packaging must be disposed of in accordance with local and national regulations.

Intended use

/// Use

The MATRIX ORBITAL shaker is used to mix liquids. These can be shaken in sample vessels or sample plates, perhaps also using different inserts.

/// Range of use

Indoor environments similar to that of a laboratory in research, education, commerce or industry.

The safety of the user cannot be guaranteed:
› if the device is operated with accessories that are not supplied or recommended by the manufacturer.
› if the device is operated improperly or contrary to the manufacture's specifications.
› if the device or the printed circuit board are modified by third parties.

Useful information

The device can be used with a wide range of applications in combination with different vessels.

⚠ **Note!**
› As the motor gives off heat, the mounting plate may heat up.
› Vibrations caused by the device can cause laboratory structures and equipment to vibrate. For this reason you should pay special care to ensure a stable mounting plate and make sure vessels cannot slip, to make sure that unwanted vibrations are not caused in the surroundings and the walls of the device. The feet of the device and the mounting plate should be cleaned before each start-up.

Unpacking

/// Scope of delivery

› Please unpack the device carefully;
› Any damage should be notified immediately to the shipping agent (post office, railway network or logistics company).
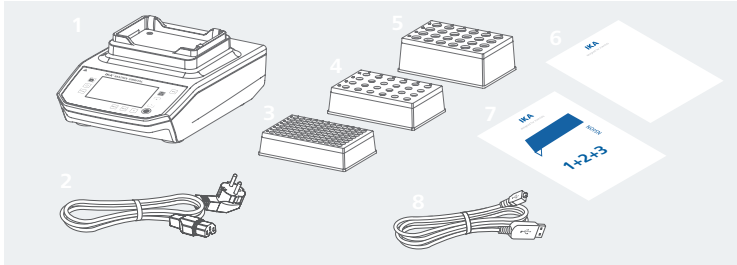
1	IKA Matrix Orbital	**5**	IKA 1.5/2.0 ml - Vessel insert (24x1.5 ml or 2.0 ml)
2	Mains cable	**6**	User guide
3	IKA PCR 96 - Vessel insert (96x0,2 ml)	**7**	Warranty card
4	IKA 0.5ml - Vessel insert (24x0,5 ml)	**8**	USB cable

/// Device Setup
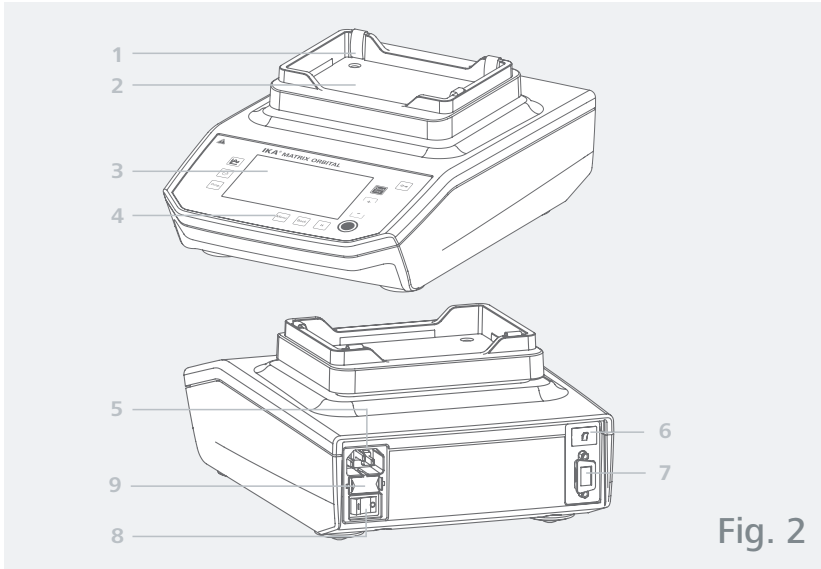
Fig. 2

1	Spring fastening	**6**	USB interface
2	Shaking table	**7**	RS 232 interface
3	Display	**8**	Power switch (ON/OFF)
4	Operator panel	**9**	Fuse holder
5	Mains connection		

Assembly

/// Connection to the power supply
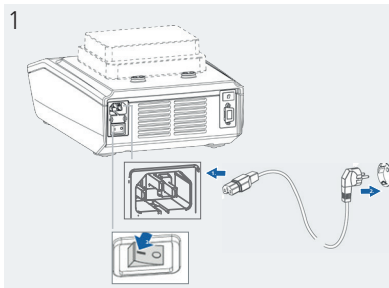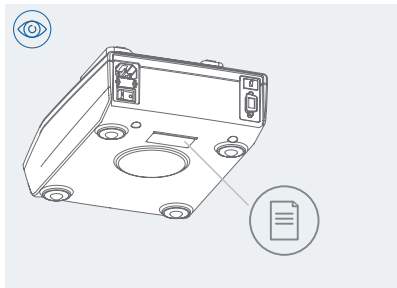
/// Mount the inserts/sample plates

› IKA 0.5ml - Vessel insert (24x0.5 ml)
› IKA 1.5/2.0ml - Vessel insert (24x1.5 ml or 2.0 ml)
› IKA PCR 96 - Vessel insert (96x0.2 ml)

› Deepwell plates (DWP)
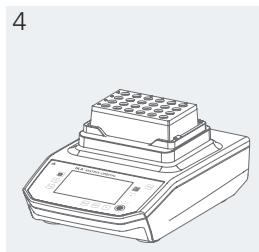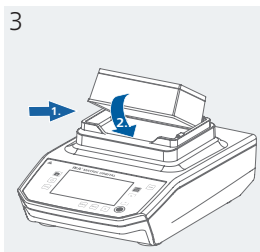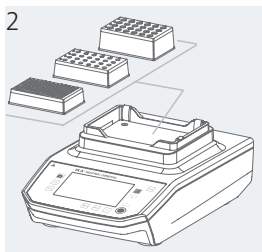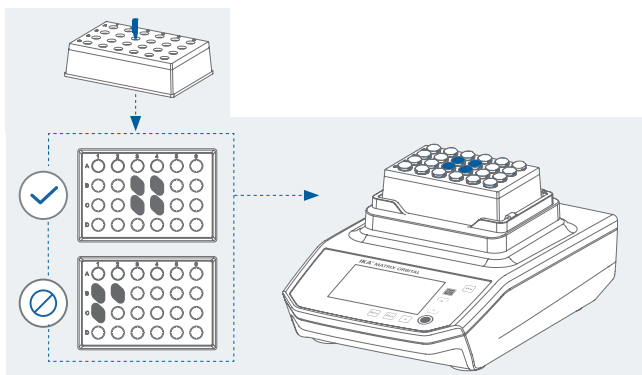› Microtiter plates (MTP)

/// Mount the sample vessels

Operator panel and display

/// Explanation of the control elements
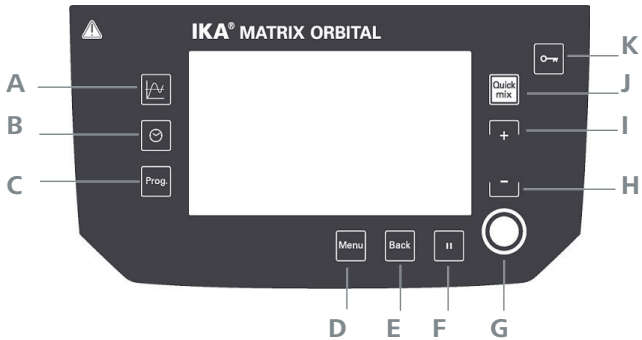
Pos.	Designation	Function
A	Graph key	Speed/time diagram
B	Timer key	Editing/activating the timer
C	Program key	Program management
D	Menu key	› press 1x: Back to main menü › press 2x: Back to working display
E	Back key	Returns to previous menu level
F	Pause key	› Stops the mix and timer function › Restart work procedure: Press the pause button again. Caution: With an active program function, the pause button cannot be selected.
G	Start/Stop/Enter key	› Start/stop mixing at set speed › Input button in the menu
H	(+) key	› Increases the motor speed in the main screen › Menu navigation in the submenu
I	(-) key	› Reduces the motor speed in the main screen › Menu navigation in the submenu
J	Quick Mix key	As long as the button is pressed, the mixing process is active with the set speed.
K	Lock key	Lock / Unlock the keys

/// Explanation of symbols on the working screen
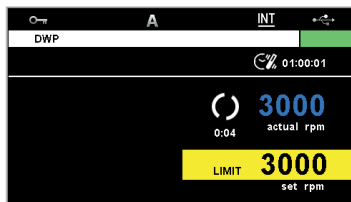
Symbol	Designation	Function
◯	Shaking	The shaking function is activated
PC	PC control	The shaker is connected to a computer and is controlled by it
PR	Program control	The shaker is controlled by a program ("Programs" chapter)
INT	Intermittent Mode	The shaker is in intermittent mode
⟜	USB	The shaker communicates via a USB cable
⟜	Key lock	Key lock is activated
A B C	Operating mode	The operating mode is displayed: A, B or C
	Timer	Timer mode Max. start value that can be selected "99hh:59mm:59ss"
	Counter	Counter mode. The counter can only count up to the maximum value "99hh:59mm:59ss". When this value is reached, the device runs again and the counter stops
0:04	Time	Current time interval

Menu navigation and structure

/// Menu navigation

› Press "Menu" button (D).
› Select a menu item by pressing the "(+)" button (I) or the "(-)" button (H).
› Confirm the menu item by pressing the "◯" button (G).
› In the menu item press the "(+)" button (I) or the "(-)" button (H) to select the desired menu options and to edit/activate/deactivate the values or settings.
› Confirm the settings by pressing the "◯" button (G).
› Press the "Back" button (E), to leave/cancel the setting or to return to the previous menu.
› Press the "Menu" button (D) to go straight back to the work screen.

/// Menu structure

Mixing
- Intermittent Mode
  - Activate........ .... –
  - CW time....... .... 00:10 (mm:ss)
  - Stop time...... .... 00:10 (mm:ss)
  - CCW time..... .... 00:00 (mm:ss)
- Attachment
  - DWP............. .... –
  - MTP............. .... –
  - Inserts........... .... Activated

Timer — Time/Counterr
- Hours........... .... 00 (hh)
- Minutes........ .... 00 (mm)
- Seconds........ .... 00 (ss)

Mode
- A........................ .... Activated
- B........................ .... –
- C........................ .... –

Graph — Axis scaling
- X- Axis.......... .... 5 Minutes
- Y- Axis — Automatic............................ Activated
  - Manual   Maximum....... 3000
                    Minimum....... 0

Program — Start.................... .... –
- Edit
  - Edit
    - Speed.................................... –
    - Time (hh:mm:ss).................... –
    - Mixing directien.................... –
  - Insert........... .... –
  - Delete.......... .... –
  - Save.............. .... –
- Delete................. .... –
- Rename............... .... –

Safety — Password............. .... No Password (000)

Settings
- Language
  - English......... .... Activated
  - German........ .... –
  - ....   –
- Display
  - Background — Black..................................... Activated
                 White..................................... –
  - Firmware update information   Activated
- Sound — Key tone....... .... Activated
- Factorys settings.... .... –
- Information — Software — Version xxx............................... –
  - Firmware update information   –

/// Menu details

Mixing

Intermittent mode:
In the menu you can select/carry out various settings for the direction of rotation and the mixing process:
1. Tick (✓): Intermittent mode option activated
2. CW time: set
3. Stop time: set
4. CCW time: set

Symbolic combination	Graph representation	Description
CW	CW / t / CWW	**Factory setting: CW continuos mode mode**
CW	CW / t / CWW	<ins>**CW & Stop activated:**</ins> **CW run time & stop time can be set separately**
CCW	CW / t / CWW	<ins>**CCW & Stop activated:**</ins> **CCW run time & stop time can be set separately**
CW/CCW	CW / t / CWW	<ins>**CW- STOP - CCW activated**</ins> **CW/CCW/STOP time can be set separately.**

Accessories:
Selection of the insert types/sample containers (the max. speed limit is preset).

Timer

Setting hours, minutes and seconds.

	Timer (max. 99hh:59mm:59ss)
	Counter starts at 00hh:00mm:00ss (max. 99hh:59mm:59ss)
	When the maximum value is reached, the device runs again and the counter stops.

Modes

A	After switching on/mains power interruption, the functions do not restart automatically.
B	After switching on/mains power interruption, the functions restart automatically, depending on previous settings.
C	Setpoints (set in A or B) cannot be changed. After switching on/mains power interruption, the functions restart automatically, depending on previous settings.

Graph

Axis scaling

X-axis scaling	5; 10; 20; 30; 60; 90; 120 selectable in minutes
Y-axis scaling	Manual (through input of the min. / max. speed limit in rpm) or automatic.

Program

5 user-defined speed (rpm) time profiles can be created in the "Programs" menu. After a program has been selected, the following menu options are available.

Start:
Start the selected program by pressing the "OK" button.

Edit:
Change the program parameters of the selected program (edit, insert, delete or save). When you have edited the program time for at least one segment, an edit symbol ⊠ appears for the relevant program.

Delete:
Delete all program parameters of the selected program using the navigation buttons +/- and the ○ button (G), "Delete" menu option. The edit symbol ⊠ disappears.

Rename:
Rename the selected program with the navigation buttons +/- and ○ button (G).

Safety

Password:
In the "Password" menu, the menu settings can be locked by a 3-digit password.

Settings

Languages:
Select the desired language.

Display:
Change the background colour and brightness of the working screen.

Sound:
Activate/deactivate the button sound.

Factory settings:
Select the "Factory settings" option by turning and pressing the rotary/push knob. The system requests confirmation to restore the factory settings. Pressing the "OK" button resets all the system settings to the original standard values set at dispatch from the factory (see "Menu structure").

Information:
Overview of the most important system settings of the device.

Operation

/// Switching on

After switching on via the main switch (Fig. 2, (8)), the device type, device designation, user-defined device name and the firmware version are shown in the display.

**Firmware Update Tool**
After the start screen, the information start screen for the Firmware Update Tool appears. You can use the tool to update the software of your IKA device to the latest version. Firmware updates contain new functions or optimisations of previous functions. You can download the Firmware Update Tool at www.ika.de/fut.
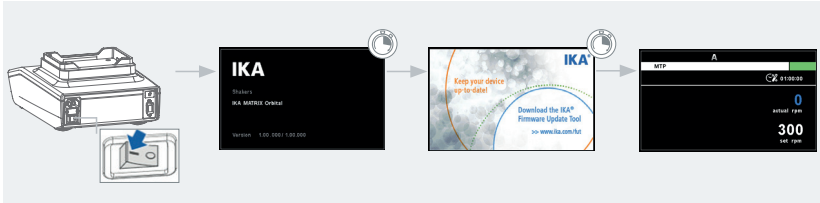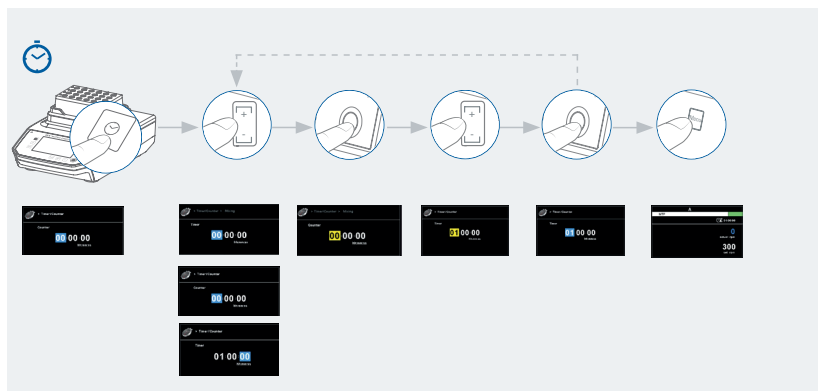

/// Select inserts/sample plates

/// Set speed
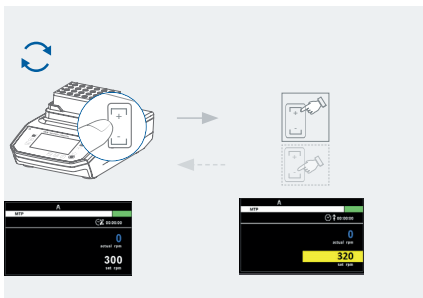
/// Setting the timer

Interfaces and outputs

The device can be operated by computer via an RS 232 or USB port using labworldsoft® laboratory software.
The device software can also be updated with a PC via the RS 232 or USB port.
Note: Please comply with the system requirements together with the operating instructions and help section included with the software.

/// USB interface

The Universal Serial Bus (USB) is a serial bus for connecting the device to the PC. Equipped with USB devices can be connected to a PC during operation (hot plugging). Connected devices and their properties are automatically recognized. The USB port can also be used to update firmware.

/// USB device drivers

First, download the latest driver for IKA devices with USB port from:
http://www.ika.com/ika/lws/download/usb-driver.zip
Install the driver by running the setup file. Then connect the IKA device through the USB data cable to the PC.
The data communication is via a virtual COM port.

/// RS 232 interface

Configuration
› The functions of the interface connections between the device and the automation system are chosen from the signals specified in EIA standard RS 232 in accordance with DIN 66 020 Part 1.
› For the electrical characteristics of the interface and the allocation of signal status, standard RS 232 applies in accordance with DIN 66 259 Part 1.
› Transmission procedure: asynchronous character transmission in start-stop mode.
› Type of transmission: full duplex.
› Character format: character representation in accordance with data format in DIN 66 022 for start-stop mode. 1 start bit; 7 character bits; 1 parity bit (even); 1 stop bit.

› Transmission speed: 9600 bit/s.
› Data flow control: none
› Access procedure: data transfer from the device to the computer takes place only at the computer's request.

## /// Command syntax and format

The following applies to the command set:
› Commands are generally sent from the computer (Master) to the device (Slave).
› The device sends only at the computer's request. Even fault indications cannot be sent spontaneously from the device to the computer (automation system).
› Commands are transmitted in capital letters.
› Commands and parameters including successive parameters are separated by at least one space (Code: hex 0x20).
› Each individual command (incl. parameters and data) and each response are terminated with Blank CR LF (Code: hex 0x0d hex 0x0A) and have a maximum length of 80 characters.
› The decimal separator in a number is a dot (Code: hex 0x2E).

The above details correspond as far as possible to the recommendations of the NAMUR working party (NAMUR recommendations for the design of electrical plug connections for analogue and digital signal transmission on individual items of laboratory control equipment, rev. 1.1).
The NAMUR commands and the additional specific IKA commands commissioning serve only as low level commands for communication between the device and the PC. With a suitable terminal or communications program these commands can be transmitted directly to the device. The IKA software package, Labworldsoft®, provides a convenient tool for controlling device and collecting data under MS Windows, and includes graphical entry features, for motor speed ramps for example.

Commands	Function
IN_NAME	Read device name.
IN_PV_4	Read the actual speed (rpm)
IN_SP_4	Display actual speed
OUT_SP_4	Setting the speed
START_4	Start the motor
STOP_4	Stop the motor
IN_VERSION	Read Software version
IN_SOFTWARE_ID	Read software ID and version
IN_IAP_ID	Displays IAP ID
IN_PCB_ID	Displays PCB ID
IN_FLASH_SIZE	Displays controller flash size

/// Connection between the device and external devices

PC 1.1 Cable: This cable is required to connect RS 232 port to a PC.
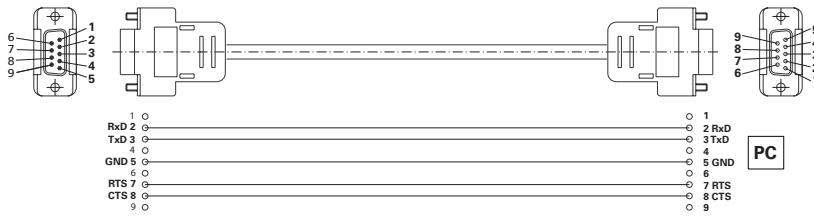
USB 2.0 Cable (A – B): This cable is required to connect USB port to a PC.

USB 2.0 B   USB 2.0 A
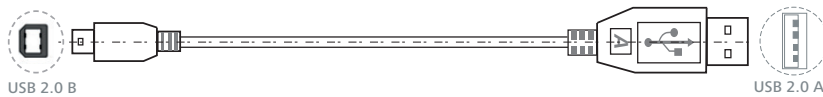
Maintenance and cleaning

The device is maintenance-free. It is only subject to the natural wear and tear of components and their statistical failure rate.

/// Cleaning

For cleaning disconnect the mains plug!
Only use IKA-approved cleaning agents when cleaning your IKA devices.
They are: water (containing detergent) und isopropanol

› Wear protective gloves during cleaning the device.
› Electrical device may not be placed in the cleansing agent for the purpose of cleaning.
› Do not allow moisture to get into the device when cleaning.
› Before using another than the recommended method for cleaning or decontamination, the user must ascertain with IKA that this method does not destroy the device.

/// Spare parts order

When ordering spare parts, please give:
› machine type,
› serial number, see type plate,
› item and designation of the spare part see **www.ika.com,**
› software version.
.

/// Repair

Please send in device for repair only after it has been cleaned and is free from any materials which may constitute a health hazard.
For repair, please request the "**Safety declaration (Decontamination Certificate)**" from IKA or use the download printout of it from IKA website: **www.ika.com**.
If you require servicing, return the device in its original packaging. Storage packaging is not sufficient. Please also use suitable transport packaging.

Error codes

The fault is shown by an error message on the display if the error occurs. Proceed as follows in such case:
› Switch the device off.
› Carry out corrective measures.
› Restart the device.

Err. 1
Watchdog Error 1

Causes	› PC does not transmit any data within the set watchdog time
	› Connection to PC interrupted
Effect	› Motor switched off
Solutions	› Change watchdog time
	› Transmit data from PC within set watchdog time (OUT_WDx@m)
	› Check cable and plug

Err. 2
Watchdog Error 2

Causes	› PC sendet innerhalb der gesetzten Watchdogzeit keine Daten
	› Connection to PC interrupted
Effect	› Motor switched off
Solutions	› Change watchdog time
	› Transmit data from PC within set watchdog time (OUT_WDx@m)
	› Check cable and plug

Err. 3
Device internal temperature

Causes	› Device internal temperature too high
Effect	› Motor off
Solutions	Turn off the device and let it cool down

Err. 48
Motor load

Causes	› Overload / overload protection triggered
Effect	› Motor off
Solutions	› Reduce the speed setting or the load.

If the action described fails to resolve the fault or another error code is displayed then take one of the following steps:
› Contact the service department
› Send the device for repair, including a short description of the fault.

Warranty

In accordance with IKA warranty conditions, the warranty period is 24 months. For claims under the warranty please contact your local dealer. You may also send the machine direct to our factory, enclosing the delivery invoice and giving reasons for the claim. You will be liable for freight costs. The warranty does not cover worn out parts, nor does it apply to faults resulting from improper use, insufficient care or maintenance not carried out in accordance with the instructions in this operating manual.

Accessories

For further accessiores see **www.ika.com**.

Technical data

	Unit	Value
General data		
Nominal voltage	**VAC**	100 … 240 ±10%
Input	**Hz**	50 / 60
Fuse		T4A 250V (2x)
Power input max.	**W**	80
Dimensions (W × D × H)	**mm**	200 x 320 x 120
Weight	**kg**	7,2
Protection class according to DIN EN 60529		IP 21
Permissible ambient temperature	**°C**	+5 … +40
Permissible relative humidity	**%**	80
Operation at a terrestrial altitude	**m**	2000
Mix function		
Type of movement		orbital
Direction of movement		Standard: CW Programmable: CW/CCW
Shaker diameter	**mm**	3
Speed min.	**rpm**	0
Speed min. (adjustable)	**rpm**	300
Speed max.	**rpm**	3000
Speed deviation	**rpm**	±30
Operating mode		timer and continuous operation
Max. load.	**kg**	0,3
Permissible ON time	**%**	100
Working with sample plates		Yes, microtitre, deep well and PCR plates
Number of sample plates	**Stck**	1
Working with sample vessels		yes, 0,5ml / 1,5ml / 2,0 ml vessels
Number of sample vessels	**Stck**	24 (in sample vessel holder)
User interface		
Display		TFT-Display 4,3" (10,9 cm)
Operation		Capacitative buttons
Timer		1 s … 99 h 59 m 59 s
Counter		1 s … 99 h 59 m 59 s (∞)
Programming		Interval and program mode
Remote		Labworld Soft
Software Update		IKA Firmware Update Tool
Interfaces		
RS 232		9-pol Sub-D (back side)
USB		Typ B (front side)

Subject to technical changes!

IKA

designed for scientists

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