

STORZ

KARL STORZ — ENDOSKOPE

en **Instructions for use**
C-MAC Monitor
8404ZX



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1 General information

1.1 Read the instructions for use

If the instructions for use are not followed, patients, users, and third parties may be injured or the product may be damaged.

- ▶ Read the instructions for use carefully and follow all the safety notes and warnings.
- ▶ Read the reprocessing instructions carefully and follow all the safety notes and warnings. The reprocessing instructions can be downloaded from www.karlstorz.com/ifu by entering the item number.
- ▶ Keep the instructions for use and reprocessing instructions in a safe place.

1.2 Read the instructions for use of compatible products

If the instructions for use of compatible products are not followed, patients, users, and third parties may be injured or the product may be damaged.

- ▶ Read the instructions for use of the compatible products carefully and follow all the safety notes and warnings.
- ▶ Read the reprocessing instructions of the compatible products carefully and follow all the safety notes and warnings.

1.3 Scope

This instruction manual is valid for:

Product name	Item number
C-MAC Monitor	8404ZX

1.4 General signs and symbols

The signs and symbols used in this document have the following meaning:

Practical tip

-  This sign refers to useful and important information.

Actions to be performed

Action to be carried out by several steps:

- ✓ Prerequisite that must be met before carrying out an action.
- 1. Step 1
 - ⇒ Interim result of an action
- 2. Step 2
 - ⇒ Result of a completed action

Actions in safety notes or in the case of a single step:

- ▶ Step 1

Lists

- 1. Numbered list
- Unnumbered list, 1st level

– Unnumbered list, 2nd level

1.5 Description of warning messages

To prevent any injury to persons or damage to property, the warnings and safety notes in the instructions for use must be observed. The warnings use the following levels of danger:

▲ WARNING

WARNING

Designates a possible imminent risk. If this is not avoided, it could lead to death or serious injuries.

▲ CAUTION

CAUTION

Designates a possible imminent risk. If this is not avoided, it could lead to minor injuries.

NOTICE

NOTICE

Designates a possibly harmful situation. If this is not avoided, the products could be damaged.

2 Normal use

2.1 Intended use

C-MAC Monitors

C-MAC Monitors are intended for visualization as well as storage and playback of videos and images of an endoscopic procedure. C-MAC Monitors do not have body contact with the patient.

2.2 Indications

No specific medical indication.

2.3 Contraindications

All medical devices under evaluation are contraindicated for use in fetuses/feti.

The medical devices must not be used for interventions in direct contact with the CNS (central nervous system) and central circulatory system.

Furthermore, there are no contraindications directly associated with the use of the medical devices.

2.4 Clinical benefits

The products permit endotracheal intubation and visualization of the upper airways.

2.5 Residual risks

No residual risks directly related to the product were identified.

2.6 Patient population

There are no restrictions in terms of patient groups for this product.

2.7 Target user populations

The medical device may only be used by doctors and medical assistants with a relevant specialist qualification.

3 Safety and warning

⚠ WARNING

Danger due to non-observance of warnings and safety notes

This chapter contains warnings and safety notes structured according to hazards and risks.

- ▶ 1. Carefully read and observe all warnings and safety notes.
- ▶ 2. Follow the instructions.

3.1 Serious incidents

A 'serious incident' includes incidents which, directly or indirectly, had, could have had or could have any of the following consequences:

- Death of a patient, user, or another person
- Temporary or permanent serious deterioration in the medical condition of a patient, user, or another person
- A serious threat to public health
- ▶ The manufacturer and appropriate authority must be notified of all serious incidents.

3.2 Correct handling and product testing

If the product is not handled correctly, patients, users, and third parties may be injured.

- ▶ Only persons with the necessary medical qualification and who are acquainted with the application of the product may work with it.
- ▶ Check that the product is suitable for the procedure prior to use.
- ▶ Check the product for the following properties, for example, before and after every use:
 - Functionality
 - Damage
 - Changes to the surface
 - In the case of several components: completeness and correct assembly
- ▶ Do not continue to use damaged products.
- ▶ Dispose of the product properly.
- ▶ Do not leave broken-off components inside the patient.
- ▶ Do not overload the product with mechanical stress.
- ▶ Do not bend bent products back to their original position.

3.3 Unsterile product

The product is not sterile when delivered. The use of non-sterile products poses a risk of infection for patients, users, and third parties.

- ▶ Reprocess the product in line with the reprocessing instructions before initial use and every subsequent use.

3.4 Combination with other components

The use of unauthorized devices and components or unauthorized changes to the product can result in injuries.

Additional devices connected to electrical medical equipment must comply with the relevant IEC or ISO standards. Furthermore, all configurations must comply with the requirements for medical electrical systems (see IEC 60601-1-1 or clause 16 of the 3rd edition of IEC 60601-1).

- ▶ Only combine the product with devices and components that the manufacturer has approved for combined use, see chapter *Possible combinations*.
- ▶ Comply with national and local regulations.
- ▶ Observe the instruction manuals and interface specifications of the devices and components used in combination.
- ▶ Only use devices and components that have standardized interfaces and do not breach the normal use of the product.
- ▶ Only make changes to the product if these changes are approved by KARL STORZ.

3.5 Modifications to the product

Modifications to the product reduce the safety of the product. Patients, users, and third parties may be injured as a result.

- ▶ Do not modify the product.

3.6 Opened product

If the product is opened, it presents a risk of life-threatening electrical shock.

- ▶ Do not open the product.
- ▶ Arrange for service work to be carried out by authorized personnel only.

3.7 Damage due to ingress of liquid in electrical components

In the case of electrical products, individual components or the product itself may be live. Liquid ingress into an electrical product may result in a short circuit or an unintentional transfer of current. The product is damaged as a result and patients, users and third parties may be injured.

- ▶ Do not store liquids near the product or on the product.
- ▶ If liquid has entered the product, pull out the plug and allow the product to dry completely.

3.8 Patient leakage current

If several products supplied with energy are used simultaneously, the patient leakage currents of the product can accumulate. Excessively high leakage current levels may result in the patient becoming injured.

- ▶ Only use products of the same type together, particularly if CF products are required.

 If the product is connected to a type BF generator, the product will also correspond to type BF.

3.9 Electromagnetic interference

Medical electrical products are subject to special precautions regarding electromagnetic compatibility and must be installed and commissioned according to the tables on electromagnetic compatibility. If other products (e.g., for MRT, CT, diathermy, electrocautery, or RFID) emit electromagnetic radiation, the function of the product may be impaired. High-frequency communication equipment can affect medical electrical products and impair their performance.

- ▶ Do not use the product in the vicinity of a magnetic resonance tomograph (MRT).
- ▶ Do not use the product next to or together with other devices. If such use is required, monitor the product and the other devices, and follow the relevant instructions for use in the event of malfunctions.

- ▶ Portable RF communications equipment including peripheral devices (e.g., antenna cables and external antennas) should be used no closer than 30 cm from the product, including cables specified by the manufacturer.
- ▶ During installation and operation of the product, please take note of the information on electromagnetic compatibility, see chapter *Electromagnetic compatibility*.
- ▶ In case of uncertainties, seek expert advice from KARL STORZ.

The use of accessories and cables other than those specified in the instructions for use may result in increased emissions or decreased immunity of the product. When using other accessories and cables, the operator is responsible for checking compliance with IEC 60601-1-2 for this particular product.

- ▶ To prevent increased electromagnetic emissions or reduced electromagnetic immunity of the product, only use accessories, transducers, and cables recommended or supplied by the manufacturer.

3.10 National guidelines on airway management

Failure to observe the national guidelines on airway management may put the patient at risk.

- ▶ National guidelines on airway management must be observed in addition to the documentation accompanying the product.

4 Product description

4.1 Product overview

⚠ CAUTION

Forceful insertion of sharp objects! Product damage!

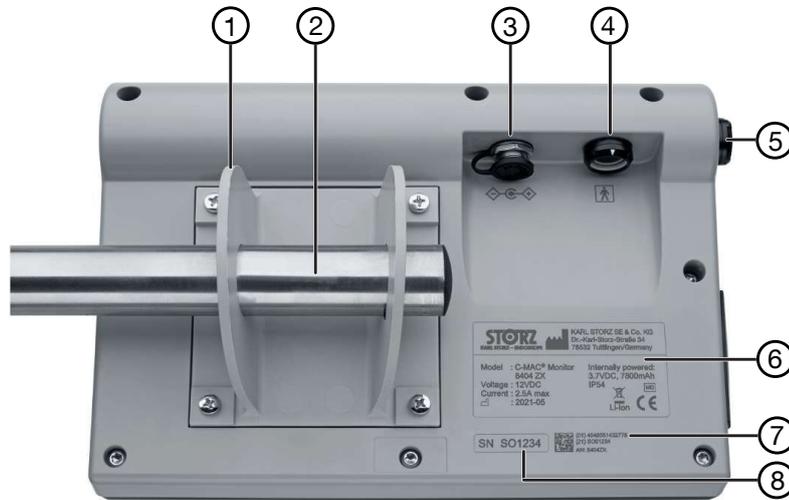
If sharp objects are inserted into the microphone opening, the product may be damaged and leak.

- ▶ Do not insert any objects into the microphone opening.



C-MAC Monitor 8404ZXK, front

- | | | | |
|---|---------------------------|---|---------------------------|
| 1 | 8" IPS display | 6 | Integrated microphone |
| 2 | Slot for SD card | 7 | USB plug |
| 3 | On/Off button | 8 | HDMI port |
| 4 | Operational readiness LED | 9 | Connection for video unit |
| 5 | Battery charge state LED | | |



C-MAC Monitor 8404ZXK, back

- | | | | |
|---|---------------------------|---|---------------------------|
| 1 | VESA 75 Quick Clip | 5 | Connection for video unit |
| 2 | Holding arm | 6 | Type plate |
| 3 | Power supply connection | 7 | Data Matrix Code |
| 4 | Connection for video unit | 8 | Serial number |

4.2 Possible combinations

The product can be combined with the following components:

Video units for anesthesia

Item	Order no.
C-MAC connecting cable	8403X
C-MAC S Imager	8402XS
C-MAC S Imager	8403XS
C-MAC S Imager	8403XSI
C-MAC S Pediatric Imager	8403XSP
C-MAC S Video Laryngoscope MILLER #0	051110-10
C-MAC S Video Laryngoscope MILLER #1	051111-10
C-MAC S Video Laryngoscope MAC #3	051113-10
C-MAC S Video Laryngoscope MAC #4	051114-10
C-MAC S Video Laryngoscope D-BLADE	051116-10
Electronic Module	8402X
C-MAC Video Laryngoscope MAC #3	8401AX
C-MAC Video Laryngoscope MAC #4	8401BX
C-MAC Video Laryngoscope D-BLADE	8401HX
C-MAC Video Laryngoscope MAC #3	8401AXC

Item	Order no.
C-MAC Video Laryngoscope MAC #4	8401BXC
C-MAC Video Laryngoscope MIL #0, alu. handle	8401DXC
C-MAC Video Laryngoscope MIL #1, alu. handle	8401GXC
C-MAC Video Laryngoscope D-BLADE Ped.	8401HXP
C-MAC Video Laryngoscope MAC #2	8401KXC
C-MAC Video Laryngoscope MAC #3	8403AX
C-MAC Video Laryngoscope MAC #4	8403BX
C-MAC Video laryngoscope MAC #3	8403AXC
C-MAC Video laryngoscope MAC #4	8403BXC
C-MAC Video Laryngoscope MIL #0	8403DXC
C-MAC Video laryngoscope MAC #0	8403EXC
C-MAC Video Laryngoscope MIL #1	8403GXC
C-MAC Video laryngoscope D-BLADE	8403HX
C-MAC Video laryngoscope D-BLADE, Ped.	8403HXP
C-MAC Video Laryngoscope MAC #2	8403KXC
C-MAC Video Laryngoscope MIL #2	8403MXC
C-MAC Video Laryngoscope MIL #3	8403NXC
C-MAC Video Laryngoscope MAC #3	8404AX
C-MAC Video Laryngoscope MAC #4	8404BX
C-MAC Video Laryngoscope D-BLADE	8404HX
C-MAC Video Laryngoscope MAC #3	8404AXC
C-MAC Video Laryngoscope MAC #4	8404BXC
C-MAC Video Laryngoscope MIL #0	8404DXC
C-MAC Video Laryngoscope MAC #0	8404EXC
C-MAC Video Laryngoscope MIL #1	8404GXC
C-MAC Video Laryngoscope D-BLADE, Ped.	8404HXP
C-MAC Video Laryngoscope MAC #2	8404KXC
C-MAC Video Laryngoscope MIL #2	8404MXC
C-MAC Video Laryngoscope MIL #3	8404NXC
C-MAC VS	10331BX
Flex. Intubation Videoscope	11301ABX
Flex. Intubation Videoscope	11301BNX
Flex. Intubation Videoscope	11302BDX
Flex. Intubation Videoscope	11303BNX

Item	Order no.
Flex. Intubation Videoscope	11304BCX
FIVE S 3.5x65	091361-06
FIVE S 5.3x65	0915612-06

Video units for ENT

Item	Order no.
CMOS Video Rhino-Laryngoscope SSU	091330-06
CMOS Video Esophagoscope SSU	091370-06
CMOS Video Rhino-Laryngoscope	11101CM
CMOS Video Rhino-Laryngoscope	11102CM
CMOS Video Otoscope	121200
Video Esophagoscope	13303E

Video units for urology

Item	Order no.
C-View Video Cystoscope	11272V
C-View Video Cystoscope	11272VU
C-View Video Cystoscope	11272VE
C-View Video Cystoscope	11272VUE
Video-uretero-renoscope FLEX-X ^{C1}	091271-06
Video-uretero-renoscope FLEX-X ^{C1}	091279-06

Video units for imaging

Item	Order no.
C-CAM	20290132
H1 Camera head	TH130

4.3 Technical specifications

C-MAC Monitor 8404ZX

Designation	Value
Power supply	
Degree of protection acc. to IEC 60259*	IP 54
Electrical protection class	II
Input voltage	12 V
Maximum current consumption	2.5 A
Battery	Lithium-ion, 3.7 V, 7,800 mAh

Designation	Value
Housing	
Dimensions (L x H x W)	231 mm x 160 mm x 60 mm
Weight	1,250 g
Screen	
Colors	Color TFT LCD monitor
Panel	IPS
Screen size	8"
Angle of view (diagonal)	89°
Resolution	1,200 x 1,920 pixels
Interfaces	
External monitor	HDMI Resolution of 1,920 x 1,200 pixels (Full HD) at a frame rate of 30 fps
Memory device	USB
Audio	No socket for audio and microphone

* The IP degree of protection can only be ensured if the connection sockets are sealed using the designated rubber seals.

Charger (ET27-30-0006091)

Designation	Value
Power supply	100–240 V ~, 50–60 Hz, 600–300 mA
Output current	Max. 2.5 A
Output voltage/ power output:	12 V / up to 30 W
Power connection:	Power adaptor for EU/UK/USA/AUS/JP/IEC
Degree of protection acc. to IEC 60259	IP 40
Cable length	2 m
Dimensions of wall power supply	87 mm x 52 mm x 33 mm (without power adaptor)
Weight	Approx. 130 g

SD card

Designation	Value
Data rate	At least 80 MB/s
Compatibility	Compatible with SDHC SD cards (class 10 or higher), FAT32 formatted, memory capacity up to 32 GB

USB stick

Designation	Value
Compatibility	Compatible with USB 2.0, FAT32 formatted, memory capacity up to 32 GB

VESA 75 Stand Holder (8401YCA)

Designation	Value
Diameter	25 mm

Open-source software

This product contains free software which falls under the terms of the General Public License (GPL) and Lesser General Public License (LGPL). The free software used and the corresponding licenses are shown in the **License information** menu, see chapter *Password-protected settings* [p. 29]. The source code for this software is available via Technical Support, which can be contacted via the German KARL STORZ website (www.karlstorz.com).

4.4 Ambient conditions

Storage/transport conditions	
Temperature	-10°C ... +50°C (14°F ... 122°F)
Relative humidity (non-condensing)	5–85%
Air pressure	700–1,080 hPa

Operating conditions	
Ambient temperature	0°C ... 40°C (32°F ... 104°F)
Relative humidity (non-condensing)	30–70%
Air pressure	700–1,080 hPa
Average product life cycle	5 years

4.5 Symbols employed

4.5.1 Symbols on the packaging

Symbol	Meaning
	Manufacturer
	Medical device
	Article no.
	Serial number
	Number of products in the product packaging
	Unique Device Identifier
	Consult the printed or electronic instructions for use
	Fragile, handle with care
	Keep dry
	Temperature limit
	Humidity limit
	Air pressure limit
	Federal (USA) law restricts this device to sale by or on the order of a physician.
	CE marking With this marking, the manufacturer declares the conformity of the product with the applicable EU directives. A code number after the CE mark indicates the responsible notified body. The EU directives relevant to the product can be found in the EU Declaration of Conformity, which can be requested from KARL STORZ.

4.5.2 Symbols on the product

Symbol	Meaning
	Follow the instructions for use. The color may differ on the product. The symbol is black/white on the packaging label.
	Power socket
	Applied part type BF
	Serial number
	NRTL certification mark for the USA and Canada With this mark, the manufacturer declares compliance with the certification requirements.

4.5.3 Symbols on the type plate

Symbol	Meaning
	Manufacturer
	Separate collection of electrical and electronic devices. Do not dispose of in household refuse.
	CE marking With this marking, the manufacturer declares the conformity of the product with the applicable EU directives. A code number after the CE mark indicates the responsible notified body. The EU directives relevant to the product can be found in the EU Declaration of Conformity, which can be requested from KARL STORZ.
	Medical device
	Data matrix code (example display) Product information, e.g., UDI

5 Preparation

5.1 Unpacking the product

1. Carefully remove the product and accessories from the packaging.
2. Check the delivery for missing items and possible damage.
3. In the case of damage, hidden defects, and short deliveries, document their nature and extent and contact the manufacturer or supplier immediately.
4. Keep packaging for further transport.

5.2 Assembling the product

Attaching the monitor to the stand

To attach the monitor to a stand, use VESA 75 Quick Clip stand holder 8401YCA and, as an option, clamp 8401YB, Accessories.

1. Attach the stand holder to the back of the monitor using 4 screws.



2. Press together the holder and slide the holding arm through the holder.
3. Release the holder in the desired position.
⇒ The monitor is secured in place on the holding arm.

5.3 Connecting the power supply

The C-MAC Monitor can be powered using either a connected power supply unit or the integrated lithium-ion battery.

1. Before each use, ensure that the power supply to the monitor for the planned procedure is provided either by the battery or by a connected power supply unit.
2. If power is supplied by the battery, check the battery charge state on the status bar (Monitor status bar) and charge the battery if necessary.

Battery charging time and life

The battery can be used for approx. 2 hours when fully charged and will last for approx. 4–5 hours on standby mode. The battery life may be shorter depending on the components and functions used.

Recharge the battery:

- After each use of the device
- Whenever the charge state falls below 50%

The discharged battery is fully charged after approx. 3 hours when the device is switched off. If the battery is charged while the device is switched on, this will increase the charging time.

5.3.1 Connecting the power supply unit

NOTICE

Damage due to incompatible charger

The product may be damaged if an incompatible charger is used.

- ▶ Only use chargers supplied by KARL STORZ.

1. Insert the connector for the power supply unit into the socket on the monitor.



2. Secure the connector using the swivel nut.
3. Plug the power supply unit into the wall socket, holding onto the plug housing, not the cable itself.
 - ⇒ The monitor is connected to the power supply.
 - ⇒ The green indicator on the power supply unit lights up.
 - ⇒ The orange status LED lights up.
 - ⇒ The battery charges.

5.3.2 Disconnecting the power supply unit

- ▶ Pull on the plug housing to disconnect the power supply unit. Never pull directly on the cable.

5.3.3 Replacing the power supply unit adaptor

The power supply unit can be adapted to country-specific power sockets by using exchangeable adaptors.

1. Press the button on the power supply unit to change the adaptor.
 - ⇒ This releases the adaptor, which can then be pushed out.



2. Insert the new adaptor into the guide and push it towards the cable until it clicks audibly into place.

Country-specific configuration

The power supply unit has exchangeable adaptors which enable it to be adapted to suit the respective power sockets.



5.4 Connecting a video unit

Two KARL STORZ video units can be connected to the monitor, either when the monitor is switched off or during operation. Video units from other manufacturers cannot be connected, see chapter *Possible combinations* [p. 12].

1. Connect the video unit to one of the two connections.



Connection at rear



Connection on the left of the housing

⇒ The video unit that is connected first is recognized as the primary video unit.

5.5 Connecting the external monitor

- ✓ The external monitor supports a resolution of 1,920 x 1,080 pixels (Full HD) at a frame rate of 30 fps.
- ✓ The HDMI cable has a maximum length of 1.80 m. Active HDMI repeaters are required for longer cables.



- ▶ Connect the external monitor to the HDMI port on the C-MAC Monitor.

6 Operation

6.1 Switching the product on/off

6.1.1 Switching on the monitor

⚠ WARNING

Hot surfaces! Risk of burns!

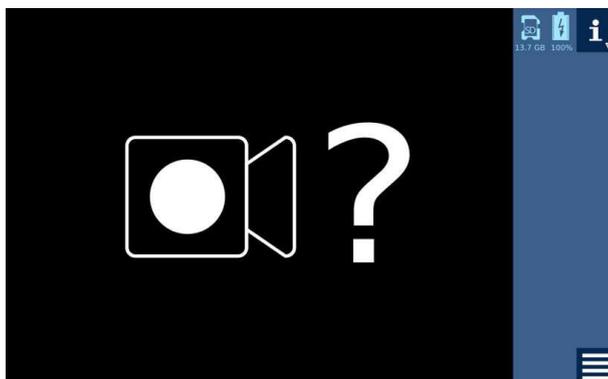
- ▶ If the surfaces get hot, switch off the product.

- ✓ The battery is charged or the power supply unit is connected, see chapter *Connecting the power supply* [p. 19].

1. Press the **On/Off** button to switch the monitor on.



- ⇒ The operational readiness status LED lights up green.
- ⇒ The symbol on the **On/Off** button lights up blue.
- ⇒ The monitor is switched on.
- ⇒ The start screen is displayed:
If a video unit is connected, the video image is transmitted to the monitor.
If a video unit is not connected, an image of a camera and a question mark is displayed on the monitor.



6.1.2 Switching off the monitor

1. To switch off the monitor, hold down the **On/Off** button until the bar on the status bar has been completely filled in.



- ⇒ The operational readiness LED goes out.
- ⇒ The monitor is switched off.

6.2 Switching the monitor to standby mode

Standby mode enables the monitor to be quickly ready for operation again in the event of brief interruptions.

- ▶ To switch the monitor to standby mode manually, press the **On/Off** button briefly.
 - ⇒ The operational readiness LED flashes.
 - ⇒ The monitor switches to standby mode. After 5 minutes in standby mode, the monitor switches off.

Automatic standby mode

The monitor switches to standby mode automatically after 20 minutes of inactivity. Depending on which video unit is connected, this time may be longer.

The monitor does not switch to standby mode if it is connected to a flexible endoscope and is connected to the power supply.

If the monitor is connected to a flexible endoscope but is not connected to the power supply, the following values apply:

Flexible Endoscope	Standby mode after [min]
10331BX	45
11301ABX	45
11301BNX	45
11302BDX	45
11303BNX	45
11304BCX	45
091361-01	45
0915612-01	45
11102CM	20
091330-01	20
091370-01	20
13303E	20
11272V	90
11272VE	90
11272VU	90

Flexible Endoscope	Standby mode after [min]
11272VUE	90
091271-01	90
091279-01	90

6.3 Using storage media

6.3.1 Inserting the SD card

- ✓ The storage medium is formatted with FAT32 and only has one partition.
 - ✓ The monitor is switched off.
1. Insert the SD card into the monitor in the correct position.



⇒ The information area displays the available memory capacity.

- ⓘ The C-MAC Monitor is compatible with SDHC SD cards (class 10 or higher), FAT32 formatted, data rate of at least 80 MB/s, storage capacity of up to 32 GB. Correct operation is not guaranteed if other memory cards are used.

NOTICE

Data transmission fault

If the SD card or connecting cable is removed during image/video capture, this can result in data loss.

- ▶ Ensure that the SD card and connecting cable are connected to the device during capture.

6.3.2 Inserting the USB stick

- ✓ The storage medium is formatted with FAT32 and only has one partition.

1. Insert the USB stick into the USB port on the side of the monitor.



⇒ The information area displays the available memory capacity.

6.4 User interface

6.4.1 Start screen layout

The user interface of the C-MAC Monitor is subdivided into the following areas:



Start screen with video unit connected

- | | | | |
|---|----------------------|---|----------------------------|
| 1 | Information bar | 5 | Access to information area |
| 2 | Image and video area | 6 | Video unit functions |
| 3 | Menu bar | 7 | Access to function space |
| 4 | Status bar | | |

Information bar

The information bar displays the active functions of the video unit (e.g., video recording and image position) and also notifies you when the battery needs charging, see chapter *Icons and functions on the user interface* [p. 30].

Image and video area

The image and video area displays the field of view of the connected video units, see chapter *Images and videos* [p. 36].

Menu bar

The menu bar contains the following areas:

- **Status bar**
The status bar provides information on the memory capacity of the connected storage media and the charge state of the battery, see chapter *Icons and functions on the user interface* [p. 30].
- **Information area**
The i icon is used to open the information area. This area stores the system information for the monitor and the connected video unit, see chapter *Information area* [p. 28].

- **Video unit functions**
Depending on the video unit that is connected, this area displays various functions for operating the video unit, see chapter *Icons and functions on the user interface* [p. 30].
- **Function space**
This contains the settings for the monitor and the accessories that are being used, see chapter *Function space* [p. 28].

6.4.2 Information area

The information area provides the following details:

- Item number, firmware version, and, depending on the connected accessories, the number of cycles and the operating time of the connected video unit
- Memory capacity and remaining storage space on the SD card being used
- Memory capacity and remaining storage space on the USB stick being used
- Battery charge state
- Firmware version of the C-MAC Monitor

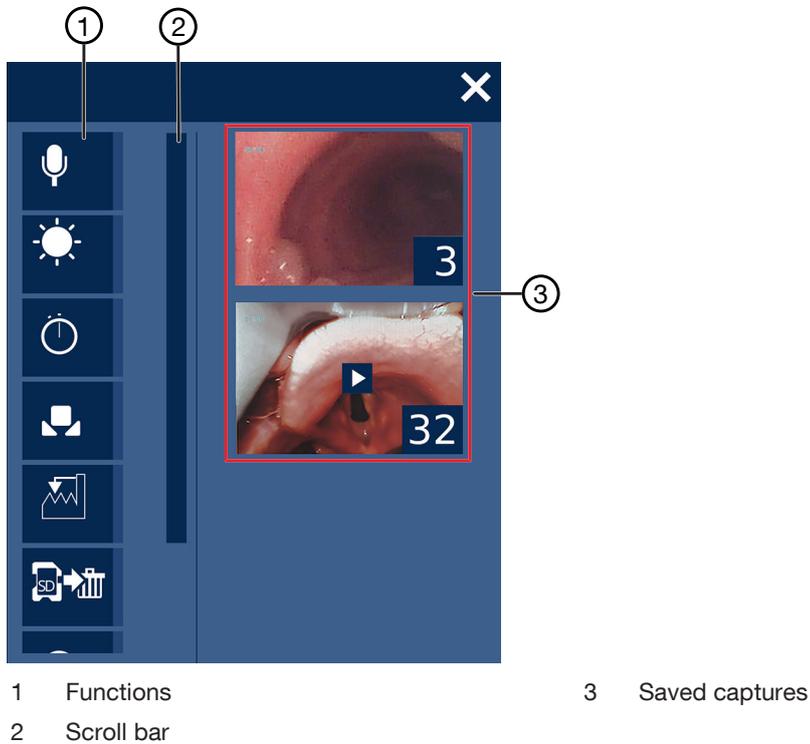


The icons for the connected storage media and the battery charge state are also displayed on the status bar on the user interface, see chapter *Icons and functions on the user interface* [p. 30].

6.4.3 Function space

The function space contains all the settings for the C-MAC Monitor and the connected accessories. Certain functions are only displayed if a video unit has been connected or a storage medium has been inserted.

1. Tap the **function space** button at the bottom right of the touch screen.
 - ⇒ The main menu appears:



Depending on which accessories are connected and which functions are enabled, certain functions are not available and are therefore not displayed, see chapter *Icons and functions on the user interface* [p. 30] and see chapter *Password-protected settings* [p. 29].

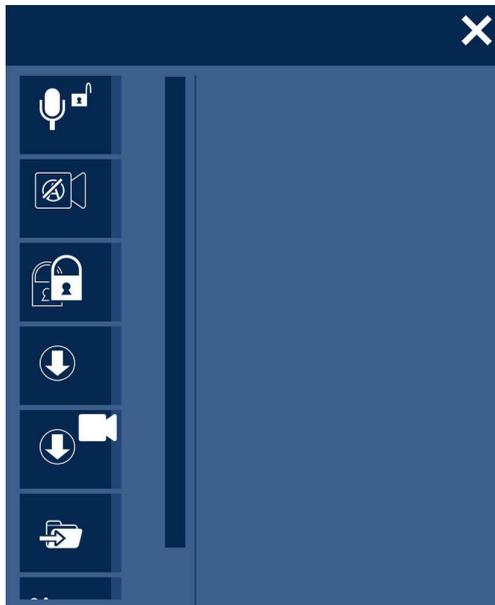
6.4.4 Password-protected settings

A default password is set when the product is delivered, see chapter *Access and security concept* [p. 44].

1. Enter the password.
⇒ The following dialog appears:



2. Tap the checkmark to confirm the entry.
⇒ The menus of the password-protected area appear:



Depending on which accessories are connected and which functions are enabled, certain functions are not available and are therefore not displayed, see chapter *Icons and functions on the user interface* [p. 30].

6.4.5 Icons and functions on the user interface

Functions on the start screen

Icon	Meaning
	Module information Calls up all the necessary information on the system and the connected accessories.
	Function space Selects video unit functions or changes the product settings.
	Video recording Starts or stops a video recording, see chapter <i>Capturing stills and recording videos</i> [p. 39]. This function is only available if an SD card has been inserted.
	Switch video unit The video unit connected at the side of the housing is the primary source. This function is only available if two video units are connected.
	Switch video unit The video unit connected at the back of the device is the primary source. This function is only available if two video units are connected.
	Image capture Captures and saves images. The Freeze function is not enabled, see chapter <i>Capturing stills and recording videos</i> [p. 39].

Icon	Meaning
	This function is only available if an SD card has been inserted.
	Image capture with freeze Freezes the live image, see chapter <i>Capturing stills and recording videos</i> [p. 39]. This button is only available if an SD card has been inserted and the Freeze function has been enabled.
	Image capture with freeze Freezes the live image, see chapter <i>Capturing stills and recording videos</i> [p. 39]. The operating buttons on the video unit are locked. This button is only available if an SD card has been inserted and the Freeze function has been enabled.
	Freeze Freezes the live image, see chapter <i>Capturing stills and recording videos</i> [p. 39]. This function is only available if an SD card has not been inserted and the Freeze function has been enabled.
	Full screen Displays the live image of the primary video unit, see chapter <i>Selecting the viewing mode</i> [p. 36]. This function is only available if the picture-in-picture or side-by-side viewing mode has been activated.
	Picture-in-picture (PiP) The live image of the secondary video unit is shown at the bottom left of the live image of the primary video unit, see chapter <i>Selecting the viewing mode</i> [p. 36]. This function is only available if two video units are connected.
	Side-by-side If two video units are connected, the live images of both video units are shown next to each other. The image on the left displays the live image of the primary video unit, see chapter <i>Selecting the viewing mode</i> [p. 36]. This function is only available if two video units are connected.
	Show and hide menu bar In the 16:10 screen format, the menu bar can be shown or hidden, see chapter <i>Selecting the viewing mode</i> [p. 36].

Functions in the function space

Icon	Description
	Microphone Switches on or mutes the microphone. Default setting: The microphone is muted and must be activated manually.
	Screen settings

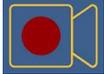
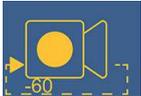
Icon	Description
	The Screen settings menu displays and adjusts the hue, saturation, contrast, and brightness settings of the monitor, see chapter <i>Screen settings</i> [p. 38].
	Brightness Adjusts the brightness of the monitor.
	Hue Adjusts the hue of the monitor.
	Saturation Adjusts the saturation of the monitor.
	Contrast Adjusts the contrast of the monitor.
 	Timer Activates or deactivates the timer.
 	Image position The displayed live image is in its original position or has been rotated by 180°.
 	Still image (freeze) Enables or locks the Freeze function.
 	Operation via video unit Enables or locks the operating buttons on the video unit. Only available if a video unit with a button lock function is connected.
	White balance Performs the white balance, see chapter <i>Performing white balance</i> [p. 42].
	Factory settings Resets the primary video unit to the factory settings.
	SD card to USB stick Transfers the content of the SD card to a USB stick, see chapter <i>Copying data from an SD card to a USB stick</i> [p. 43]. Only available if an SD card and USB stick have been inserted.
	Clear SD card Deletes the content of the SD card. Only available if an SD card has been inserted.

Icon	Description
	Date and time Sets the date and time.
	Password-protected settings Calls up the protected system settings.
	Confirm
	Cancel
	Select
	Play
	Pause
	Stop
	Increase value
	Decrease value

Functions in the password-protected area

Icon	Description
	Sound recordings Enables or disables the microphone for sound recordings.
	Automatic video recording Enables or disables automatic video recording. If the function is enabled, video recording starts automatically as soon as a video unit is connected.
	Retrospective video recording Activates retrospective video recording 60 seconds before the start of the video recording, see chapter <i>Activating retrospective video recording</i> [p. 40].
	Change password Changes the password for the protected area, see chapter <i>Access and security concept</i> [p. 44].
	Firmware update Updates the firmware of the C-MAC Monitor. This function is only available if an SD card with update files has been inserted and the power supply is sufficient, see chapter <i>Updating the firmware</i> [p. 46].
	Firmware update for video unit Updates the firmware of the connected video unit. This function is only available if an SD card with update files has been inserted, a video unit is connected, and the power supply is sufficient, see chapter <i>Updating the firmware</i> [p. 46].
	Exports the system log (log files) to the inserted SD card.
	License information Calls up the license information for the product and the software source code.

Information icons

Icon	Meaning
	Image capture An image has been captured.
	Video recording The video recording has started.
	Operation via video unit Video recording using the buttons on the video unit is disabled.
	Sound recordings The video recording also records sound.
	Retrospective video recording Retrospective video recording of max. 60 seconds is activated. The recording has no sound.
	Retrospective video recording with sound Retrospective video recording of max. 60 seconds is activated. The recording also records sound.
	Freeze The Freeze function has been enabled; the live image is frozen.
	Image position The live image has been rotated by 180°.
	No memory card No memory card has been recognized.
	Memory card present The inserted memory card has been recognized.
	Low memory capacity Less than 300 MB of memory capacity is available.
	Critical memory capacity Flashing red: Less than 100 MB of memory capacity is available.
	Memory stick connected. Only shown if a USB stick has been recognized.
	Version and firmware version of the connected video units
	Firmware version of the monitor
	Battery charge state

Icon	Meaning
	Low charge state; below 20%
	Critical charge state; below 10% The red bar flashes.
	Critical charge state: operating time of approx. 10 minutes
	The battery is charging.
	Replace battery: The maximum battery capacity is less than 50% of the original maximum capacity

6.5 Images and videos

6.5.1 Selecting the viewing mode

If two video units are connected, live images can be shown in the **full screen**, **picture-in-picture**, and **side-by-side** viewing modes.

If the viewing mode settings are changed, this can alter the image display and image position.

1. Before each use, check whether a live image or a saved image is being displayed.
2. Before each use, check whether the correct image position has been selected.

6.5.1.1 Full screen display

If only one video unit is connected, the live image fills the entire screen. If two video units are connected, the live image of the primary video unit is shown in full screen.

1. To change the primary video unit, tap the **Switch video unit** button.



2. To switch the view, tap the **Side-by-side** or **Picture-in-picture** button.

6.5.1.2 Picture-in-picture display

In the **picture-in-picture** viewing mode, the minimized live image of the secondary video unit is shown in the bottom-left corner of the image of the primary video unit.

1. To change the primary video unit, tap the **Switch video unit** button.



2. To switch the view, tap the **Side-by-side** or **Full screen** button.

6.5.1.3 Side-by-side display

The live images of both video units are shown next to each other. The image on the left displays the live image of the primary video unit, while the image on the right is the live image of the secondary video unit. The menu bar is positioned at the bottom of the screen.

1. To change the primary video unit, tap the **Switch video unit** button.

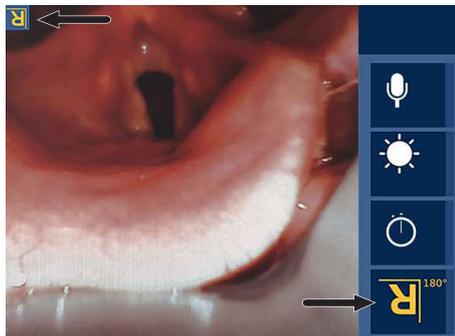


2. To switch the view, tap the **Picture-in-picture** or **Full screen** button.

6.5.1.4 Changing the image position

The displayed live image can be rotated by 180° and saved.

1. Tap the **Image position** button in the function space.
 - ⇒ The live image is rotated by 180°.
 - ⇒ The Image position icon appears on the information bar.
 - ⇒ The **Image position** button changes in the function space:



6.5.2 Screen settings

The screen's display quality may be affected by bright light (e.g., sunlight).

The hue, saturation, contrast, and brightness of the primary video can be adjusted to optimize the display quality.

1. Call up the **Screen settings** menu.

⇒ The function area appears at the bottom of the screen:



2. Tap the **Brightness** button to adjust the brightness of the screen.
3. Use the **Plus** or **Minus** buttons or the slider to adjust the screen's brightness to the lighting conditions.
⇒ The selected value appears on the LED display.
4. Adjust the values for **Contrast**, **Saturation**, and **Hue** in the same way.

Recommended settings for accessories

Item	Brightness [%]	Contrast [%]	Saturation [%]	Hue [%]
8402X	40	35	40	50
8401AX, 8401AXC, 8401BX, 8401BXC, 8401DXC, 8401GXC, 8401HX, 8401HXP, 8401KXC	40	35	40	50
8402XS	15	45	30	50
8403AX, 8403AXC, 8403BX, 8403BXC, 8403HX	33	25	28	50
8403DXC, 8403EXC, 8403GXC, 8403HXP, 8403KXC, 8403MXC	47	45	54	50
8404AX, 8404AXC, 8404BX, 8404BXC, 8404HX	50	50	50	50
8404DXC, 8404EXC, 8404GXC, 8404KXC, 8404MXC, 8404HXP	50	50	50	50
8403XS, 8403XSI	50	50	47	50
8403XSP	40	54	53	50

Item	Brightness [%]	Contrast [%]	Saturation [%]	Hue [%]
10331BX	52	45	30	50
11102CM	52	45	30	50
11272V, 11272VE, 11272VU, 11272VUE	40	34	25	50
11301ABX	52	45	30	30
11301BNX	40	40	35	50
11302BDX	52	45	30	50
11303BNX	52	45	30	50
11304BCX	52	45	30	50
13303E	52	45	30	50
091361-01	52	40	30	50
0915612-01	52	40	30	50
091330-01	52	40	30	50
091370-01	52	40	30	50
091271-01	52	40	30	50
091279-01	52	40	30	50
C-CAM	50	37	48	50
TH130	50	50	50	50

6.5.3 Capturing stills and recording videos

Stills and video sequences of the current procedure can be captured and saved to an SD card.

6.5.3.1 Recording videos

- ✓ A video unit has been connected.
 - ✓ An SD card with sufficient memory capacity has been inserted.
1. Tap the **Video recording** button to start the recording.
 - ⇒ Video recording will start.
 - ⇒ The **Video recording** icon appears on the information bar.
 - ⇒ The **Video recording** button switches to recording mode.



⇒ The video recording is saved to the SD card.

2. To stop the video recording, tap the **Video recording** button again.

6.5.3.2 Capturing an image

A still of a live image or a current video recording can be created and saved if an SD card has been inserted.

- ✓ An SD card with sufficient memory capacity has been inserted.

- ▶ Tap the **Image capture** button.



- ⇒ The **Image capture** icon appears on the information bar briefly.
- ⇒ The still is saved to the memory card.

6.5.3.3 Freeze with SD card inserted

If a memory card has been inserted, the **Freeze** icon is added to the **Image capture** icon on the start screen.

- ✓ A video unit with a freeze function has been connected.
- ✓ The **Freeze** function has been enabled in the function space.

1. Tap the **Image capture with freeze** button.

- ⇒ The image is frozen.
- ⇒ The **Freeze** icon appears on the information bar:



- ⇒ The frozen image is saved to the memory card.

2. To return to the live image display, tap the **Image capture with freeze** button again.

6.5.3.4 Freeze without SD card inserted

- ✓ A video unit with a freeze function has been connected.
- ✓ The **Freeze** function has been enabled in the function space.

1. Tap the **Freeze** button.

- ⇒ The image is frozen.
- ⇒ The **Freeze** icon appears on the information bar:



2. To return to the live image display, tap the **Freeze** button again.

6.5.3.5 Activating retrospective video recording

Using the **Retrospective video recording** function, the monitor adds video sequences to a video recording that it has buffered prior to the start of the video recording in a circular buffer with a memory capacity of 60 seconds. Once the memory capacity has been reached, the video sequences in the circular buffer are overwritten by new ones.

1. In the password-protected area, open the **Video recording** menu by tapping the **Video recording** button.
2. Tap the **Retrospective video recording** button.

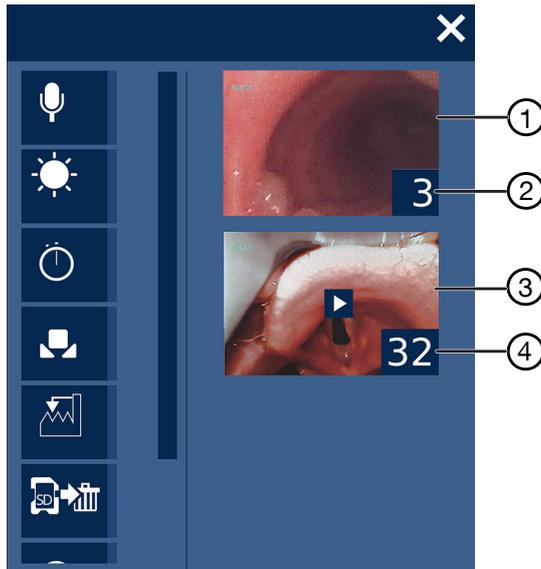


- ⇒ Retrospective video recording is activated. The recording has no sound.

- To activate retrospective video recording with sound, switch on the microphone in the function space.
⇒ The retrospective video recording then records sound.

6.5.4 Viewing and deleting captures

Captures can be viewed and deleted in the image and video area of the function space. The most recently created stills and videos are displayed in a preview.



- | | | | |
|---|------------------------|---|------------------------|
| 1 | Last saved image | 3 | Last saved video |
| 2 | Number of saved images | 4 | Number of saved videos |

6.5.4.1 Viewing a capture

- To view the saved images, tap the last saved image.
⇒ The area containing the saved images is displayed:



- Tap a capture.
⇒ The capture is displayed.

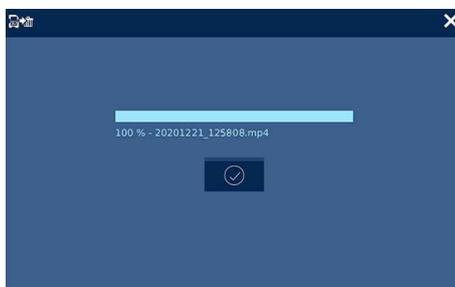
6.5.4.2 Deleting a capture

- Tap a capture to mark it for deletion.

2. Hold down the **Delete** button until the button has been completely filled in:



- ⇒ A progress bar shows the status of the deletion process.
- ⇒ Once the deletion process is complete, a confirmation window appears:



3. Confirm that you wish to delete the capture.

6.5.5 Performing white balance

To adapt the live image to the current lighting conditions, white balance can be performed.

1. Hold the connected video unit in front of a white, non-reflective object (e.g., white gauze).
2. Hold down the **White balance** button in the function space until the icon is filled in and flashes briefly.



- ⇒ After approx. 2 s, the icon will flash briefly. The white balance is complete.

6.5.6 Activating the timer

The timer measures the time required for an application, precisely to the second. As soon as a video recording is started, the timer starts automatically. However, it can also be started manually.

6.5.6.1 Starting the timer

1. Activate the timer using the **Timer** button.



- ⇒ The timer is shown at the top left.
- 2. Start a video recording or tap the timer that appears.
- ⇒ The timer starts.

6.5.6.2 Stopping the timer

The timer stops and is set to 00:00 if the monitor goes into standby mode or is switched off. The recorded time is shown on saved images and videos.

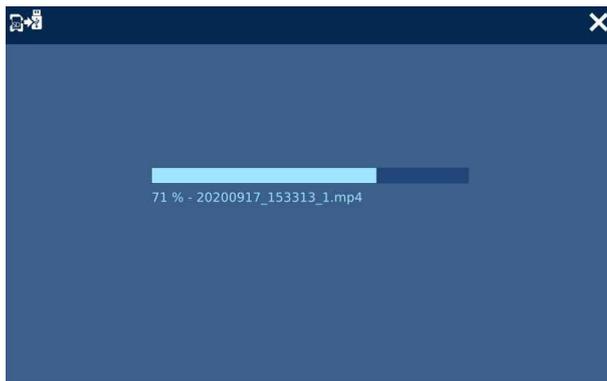
6.5.6.3 Resetting the timer

- ▶ Tap the timer to reset it to 00:00.
- ⇒ The timer starts to count again from 00:00 without interruption.

6.6 Copying data from an SD card to a USB stick

The USB port serves exclusively to transfer data from the SD card to the USB stick. Data cannot be saved directly to a connected USB stick.

- ✓ The storage medium is formatted with FAT32 and only has one partition.
 - ✓ The USB stick has sufficient memory capacity to hold the data saved on the SD memory card.
1. Connect the USB stick to the monitor.
 2. Select the **Copy data to USB stick** function in the function space.
- ⇒ The video data is copied from the SD card to the USB stick.
 - ⇒ A progress bar shows the status of the copying process:



- ⓘ When transferring the data from an SD card to a USB stick, the data is copied from the SD card and not deleted. The data on the SD card can only be deleted manually on the C-MAC Monitor or on a PC.

6.7 Setting the date and time

1. Call up the **Date and time** menu.

⇒ The following dialog appears:



2. Enter the current date in the format *DD:MM:YYYY*.
 3. Enter the current time in the format *hh:mm*.
 4. Tap **del** to correct any mistakes.
 5. Tap the checkmark to confirm the entry.
- ⇒ The settings are saved.

6.8 Access and security concept

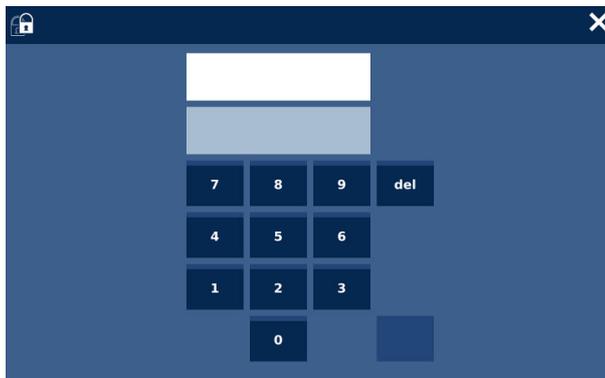
Certain settings are password-protected to prevent the product and the sensitive areas of the menu from being accessed by unauthorized parties.

The default password when the product is delivered is: *0000*.

KARL STORZ recommends that you change the password and store it in a safe place. If you lose the password, you will have to contact KARL STORZ Service.

1. To change the password, go to the **Password-protected settings** area and call up the **Change password** menu.

⇒ The following dialog appears:



2. Enter a numerical password of between 4 and 8 digits in the top input field.

3. Enter the new password again in the bottom input field.



4. Tap the checkmark to confirm the entry.
⇒ The password is changed.

7 Maintenance, servicing, repairs, and disposal

7.1 Updating the firmware

The firmware of the C-MAC Monitor and the firmware of the connected video unit can be updated via the password-protected area.

- ✓ An SD card with update files has been inserted.
 - ✓ If the video unit firmware is to be updated, a video unit is connected to the side connection.
 - ✓ The battery is charged or the power supply unit is connected, see chapter *Connecting the power supply* [p. 19].
1. Tap the **Firmware update for monitor** button to update the C-MAC Monitor firmware.



2. Tap the **Firmware update for video unit** button to update the video unit firmware.



⇒ The firmware is updated.

The **Firmware update for video unit** button is only visible if there is an update file on the SD card that matches the connected video unit.

7.2 Replacing the battery

The battery's capacity decreases over time. KARL STORZ recommends replacing the battery after 2 years.

The battery may only be replaced by persons authorized by KARL STORZ.

7.3 Maintenance

Maintenance work may only be carried out by KARL STORZ or a company authorized by KARL STORZ.

Interval	Maintenance work	To be performed by
annually	Safety inspection	KARL STORZ Service technicians

7.4 Safety inspection in accordance with IEC 62353

▲ WARNING

Risk of injury due to product degradation!

Patients, users and third parties may be injured as a result of product and accessory degradation.

- ▶ Shut down the product.
- ▶ Have the deficiencies repaired by persons authorized by KARL STORZ.

Regardless of the national accident prevention regulations and testing intervals for medical devices, for this device safety checks must be performed as repeat inspections according to IEC 62353 and recorded by a qualified electrician at least once a year. Detailed specifications regarding the scope and execution of the safety inspection can be found in the service manual.

7.4.1 Visual inspection

1. Check the product and accessories for any mechanical damage.

2. Check labels for readability.

7.4.2 Electric measurements

 Limit values for electrical measurements can be found in the current IEC 62353.

1. Measure the protective ground resistance.
2. Measure the earth leakage current.
3. Measure the touch current.
4. Measure the patient leakage current.

7.5 Repairing the product

Repair work may only be performed by KARL STORZ or by a company authorized by KARL STORZ. The interventions described in this instruction manual are exempt from this rule.

- ▶ Please contact your local KARL STORZ subsidiary or authorized dealer (see the list of subsidiaries).

Contaminated devices may not be shipped. To prevent contact infections and airborne infections, products must first be decontaminated. KARL STORZ reserves the right to send back contaminated products.

7.6 Disposing of the product

The product meets the requirements of the Directive on Waste Electrical and Electronic Equipment (WEEE).

Within the scope of application of this directive, KARL STORZ SE & Co. KG is responsible for the proper disposal of this product.

1. The product must be disposed of in accordance with the applicable national laws and regulations at a suitable collection point for the reprocessing of electrical and electronic equipment.
2. Contact KARL STORZ SE & Co. KG, a KARL STORZ branch or an authorized dealer to find out the address of the collection point in your area.

8 Accessories and spare parts

8.1 Accessories

Item	Order no.
Rolling Stand for C-MAC Monitor	8404YA
Crossbar, 50 cm x Ø 25 mm	8401YAA
Crossbar, 70 cm x Ø 25 mm	8401YAB
Clamp, VESA 75	8401YB
Protective Bag, blue, for C-MAC system	8404YD
TROLL-E Airway Mobile Stand	20020085
C-MAC TROLL-E Mobile Stand	20020086
COR Airway Mobile Stand	UG914
COR C-MAC Mobile Stand	UG915

8.2 Spare parts

Item	Order no.
Power supply unit, for C-MAC® Monitor 8404ZX	ET27-30-0006091
VESA 75 Quick Clip, with 4 clamping screws, for mounting C-MAC to holding arms up to diameter 25 mm	8401YCA

Exchangeable adaptors for charger

Item	Order no.
Adaptor for EUROPE	ET27-30-0004697
Adaptor for UK	ET27-30-0004698
Adaptor for USA/Japan	ET27-30-0004699
Adaptor for Australia	ET27-30-0004700
IEC connection (ROW)	ET27-30-0004701
Adaptor cable for USA/Japan	ET27-30-0004370

9 Electromagnetic compatibility

9.1 General notes on the operating environment

The product is suitable for use in professional healthcare settings. Professional healthcare facilities include physician offices, dental offices, limited care facilities, freestanding surgical centers, freestanding birth centers, multiple treatment facilities, hospitals (emergency rooms, patient rooms, intensive care, surgical rooms, outside the HF-shielded room of an ME system for MRT).

- i** The emission characteristics of this product make it suitable for use in industrial areas as well as in hospitals (CISPR 11 Class A) and other professional healthcare environments. If it is used in a residential environment (for which CISPR 11 Class B is normally required), the product may not offer sufficient protection for radio transmission operation. The user might need to take mitigation measures, such as relocating or re-orienting the product.

⚠ WARNING

Electromagnetic interferences! Malfunction!

Use of this product adjacent to or stacked with other equipment could result in improper operation.

- ▶ This situation should be avoided.
- ▶ If such use is necessary: Verify that this equipment and the other equipment are operating normally.

9.2 Table 1 – Compliance level for immunity tests

Guidelines and manufacturer's declaration – electromagnetic immunity

The product is intended for use in the electromagnetic environment specified below. The user of the product should make sure that it is used in such an environment.

Immunity tests	EN/IEC 60601 test level	Compliance level	Electromagnetic environment – guidelines
Electrostatic discharge (ESD) acc. to IEC 61000-4-2	± 8 kV contact discharge ± 15 kV air discharge	± 8 kV contact discharge ± 15 kV air discharge	Floors should be made of wood, concrete, or covered with ceramic tiles. If floors are covered with synthetic material, the relative humidity must be at least 30%.
Electrical fast transients/bursts acc. to IEC 61000-4-4	± 2 kV for power lines ± 1 kV for input and output lines 100 kHz repetition	± 2 kV for power lines ± 1 kV for input and output lines 100 kHz repetition	The power supply quality should be that of a typical commercial or hospital environment.
Surges acc. to IEC 61000-4-5	±1 kV voltage outer conductor – outer conductor ±2 kV voltage outer conductor – ground	±1 kV voltage outer conductor – outer conductor ±2 kV voltage outer conductor – ground	The power supply quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions, and voltage variations acc. to IEC 61000-4-11	<u>Voltage dip:</u> Dip to 0% for 1 cycle at 0° phase angle Dip to 70% for 25/30 cycles at 0° phase angle	<u>Voltage dip:</u> Dip to 0% for 1 cycle at 0° phase angle Dip to 70% for 25/30 cycles at 0° phase angle	The power supply quality should be that of a typical commercial or hospital environment. If the user of the product requires continued operation in

Immunity tests	EN/IEC 60601 test level	Compliance level	Electromagnetic environment – guidelines
	Dropout to 0% for 0.5 cycles @ 0°, 45°, 90°, 135°, 180°, 225°, 270°, and 315° phase angles <u>Voltage interruption:</u> 100% for 250/300 cycles	Dropout to 0% for 0.5 cycles @ 0°, 45°, 90°, 135°, 180°, 225°, 270°, and 315° phase angles <u>Voltage interruption:</u> 100% for 250/300 cycles	the event of interruptions to the power supply network, it is recommended that the product be operated with an uninterruptible power supply or a battery.
Magnetic field at the power frequency (50/60 Hz) acc. to IEC 61000-4-8	30 A/m at 50 Hz / 60 Hz	30 A/m at 50 Hz / 60 Hz	If image distortion occurs, it may be necessary to install the product further from sources of electromagnetic fields or to install magnetic shielding. Before the product is installed, the electromagnetic field should be measured to ensure that it is sufficiently low.
Immunity test acc. to IEC 61000-4-3 for radiated, radio-frequency electromagnetic fields	3 V/m 80 MHz to 2.7 GHz * Refer to Table 2 for wireless proximity RF field test levels	3 V/m 80 MHz to 2.7 GHz	
Immunity to conducted disturbances, induced by radio-frequency fields acc. to IEC 61000-4-6	3 V _{rms} on 150 kHz to 80 MHz 1 kHz 80% AM modulation 6 V _{rms} in ISM band	3 V _{rms} on 150 kHz to 80 MHz 1 kHz 80% AM modulation 6 V _{rms} in ISM band	

9.3 Table 2 – Test levels for near fields from HF wireless communications equipment

Test frequency MHz	Frequency band MHz	Radio service	Modulation	Immunity test level V/m	Compliance level V/m
385	380 – 390	TETRA 400	Pulse modulation 18 Hz	27	27
450	430 – 470	GMRS 460, FRS 460	FM ± 5 kHz deviation 1 kHz sine wave	28	28
710	704 – 787	LTE band 13 and 17	Pulse modulation 217 Hz	9	9
745					
780					

Test frequency MHz	Frequency band MHz	Radio service	Modulation	Immunity test level V/m	Compliance level V/m
810	800 – 960	GSM 800/900, TETRA 800, iDEN 820, CDMA 850, LTE band 5	Pulse modulation 18 Hz	28	28
870					
930					
1720	1700 – 1990	GSM 1800, CDMA 1900, GSM 1900, DECT, LTE band 1, 3, 4, 25, UMTS	Pulse modulation 217 Hz	28	28
1845					
1970					
2450	2400 – 2570	Bluetooth, WLAN 802.11 b/g/n, RFID 2450, LTE Band 7	Pulse modulation 217 Hz	28	28
5240	5100 – 5800	WLAN 802.11 a/n	Pulse modulation 217 Hz	9	9
5500					
5785					

9.4 Table 3 – Test levels for radiated and conducted immunity tests

Guidelines and manufacturer's declaration – electromagnetic immunity

The product is intended for use in the electromagnetic environment specified below. The user of the product should make sure that it is used in such an environment.

Immunity tests	EN/IEC 60601-1-2 test level	Compliance level	Electromagnetic environment – guidelines
Conducted RF disturbances acc. to IEC 61000-4-6	3 V _{rms} 150 kHz to 80 MHz	3 V _{rms}	Portable and mobile HF communications equipment should be used no closer to any part of the product, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended safety distances: $d = 1.2 \sqrt{P}$ Where P is the rated power of the transmitter in watts [W] according to the information provided by the
Radiated RF disturbances acc. to IEC 61000-4-3	3 V/m 80 MHz to 2.7 GHz 6 V for ISM frequency bands	3 V/m	

Immunity tests	EN/IEC 60601-1-2 test level	Compliance level	Electromagnetic environment – guidelines
			<p>transmitter manufacturer and d is the recommended separation distance in meters [m].</p> <p>Field strengths from fixed HF transmitters as determined by an electromagnetic site survey ^a should be less than the compliance level in each frequency range ^b.</p> <p>$d = 1.2 \sqrt{P}$ 80 MHz to 800 MHz</p> <p>$d = 2.3 \sqrt{P}$ 800 MHz to 2.7 GHz</p> <p>Interferences may occur in the vicinity of equipment marked with the following symbol:</p> 
<p>Note: At 80 MHz and 800 MHz, the higher frequency range applies.</p> <p>Note: These guidelines may not apply in all situations. The propagation of electromagnetic waves is affected by absorptions and reflections of buildings, objects, and people.</p> <p>^a The field strength of stationary transmitters, e.g., base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast, and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed transmitters, an electromagnetic site survey should be considered. If the measured field strength at the location where the device is used exceeds the above compliance levels, the device should be monitored to ensure proper function. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the device.</p> <p>^b Over the frequency range from 150 kHz to 80 MHz, field strengths should be less than 3 V/m.</p>			

9.5 Table 4 – Emission class and group

Guidelines and manufacturer’s declaration – electromagnetic emissions

The product is intended for use in such an environment as specified below. The customer or user of the product should ensure that it is used in such an environment.

Interference emission measurements	Compliance	Electromagnetic environment – guidelines
RF emissions acc. to CISPR 11	Group 1	The product uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions acc. to CISPR 11	Class A	The product is suitable for use in all establishments other than domestic and those directly connected to the
Harmonic emissions acc. to IEC 61000-3-2	N/A	

Interference emission measurements	Compliance	Electromagnetic environment – guidelines
Voltage fluctuations/flicker emissions acc. to IEC 61000-3-3	N/A	public low voltage power supply network that supplies buildings used for domestic purposes.

9.6 Table 5 – Recommended separation distances between portable and mobile HF communications equipment and the product

The product is intended for use in an electromagnetic environment in which HF disturbances are controlled. The customer or user of the product can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile HF communications equipment (transmitters) and the product as recommended below, according to the output energy of the communications equipment.

Rated power of the transmitter [W]	Separation distance d [m] according to the transmitter frequency		
	150 kHz to 80 MHz $d = 1.2 \sqrt{P}$	80 MHz to 800 MHz $d = 1.2 \sqrt{P}$	800 MHz to 2.5 GHz $d = 2.3 \sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.2	1.2	2.3
10	3.8	3.8	7.3
100	12	12	23

For transmitters whose maximum rated power is not listed in the table above, the recommended separation distance d in meters (m) can be estimated using the equation from the respective column, whereby P is the maximum rated power of the transmitter in watts (W) according to the transmitter manufacturer.

Note: At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

Note: These guidelines may not apply in all situations. The propagation of electromagnetic waves is affected by absorptions and reflections of buildings, objects, and people.

10 Errors and messages

10.1 Fault correction

Fault	Possible causes	Actions
Complete failure of the device. Status display may be lit	<ul style="list-style-type: none"> – Power supply failure – Loose connection between power supply plug and socket on device – System error 	<ul style="list-style-type: none"> – Check the power supply. – Push the power supply plug firmly into the socket on the device. – Carry out a restart.
No picture, screen dark	<ul style="list-style-type: none"> – Battery empty – Video unit not fully inserted – Video unit electronics defective – Screen defective 	<ul style="list-style-type: none"> – Connect the product to the power supply. – Push in the video unit's connector as far as it will go. – Send the product to KARL STORZ for repair.
The touch screen does not react.	<ul style="list-style-type: none"> – Screen defective – System error 	<ul style="list-style-type: none"> – Restart the system. – Send the product to KARL STORZ for repair.
Cloudy image, stripes, streaks, or similar	<ul style="list-style-type: none"> – Video unit's telescope is dirty – Video unit's contacts are dirty 	<ul style="list-style-type: none"> – Clean the video unit's telescope with a cotton swab and alcohol solution or special cleaning paste. – Clean the video unit's contacts.
Color distortions	<ul style="list-style-type: none"> – White balance not carried out correctly – Hue set incorrectly – Screen or video unit defective 	<ul style="list-style-type: none"> – Carry out new white balance. – Correct the color settings, see chapter <i>Screen settings</i> [p. 38]. – Reset the video unit to the factory defaults. – Send the product to KARL STORZ for repair.
The color rendering varies.	<ul style="list-style-type: none"> – Video unit's connecting cable defective 	<ul style="list-style-type: none"> – Replace the video unit's connecting cable.
The image cannot be saved. The icon is not displayed in the menu bar.	<ul style="list-style-type: none"> – No memory card inserted – Memory card full – Memory card is not recognized – System error 	<ul style="list-style-type: none"> – Insert a memory card. – Change the memory card. – Insert the memory card while the C-MAC Monitor is switched off and then turn the monitor on again. – Carry out a restart to ensure that the SD card is recognized. – Format the memory card on the PC with FAT32.

The saved video stream cannot be played back on the PC monitor.	<ul style="list-style-type: none"> – No MPEG-4 codec installed 	<ul style="list-style-type: none"> – Install an MPEG-4 codec on the PC.
Unable to write to the SD card.	<ul style="list-style-type: none"> – SD card is formatted incorrectly – SD card is write-protected 	<ul style="list-style-type: none"> – Format the SD card on the PC with FAT32. – The SD card must have only one partition. – Remove the write protection on the SD card.
Unable to write to the USB stick.	<ul style="list-style-type: none"> – USB stick is formatted incorrectly 	<ul style="list-style-type: none"> – Format the USB stick on the PC with FAT32. – The USB stick must have only one partition.
The battery charge state LED flashes when the power supply unit is connected.	<ul style="list-style-type: none"> – Battery cannot be charged 	<ul style="list-style-type: none"> – Remove the power supply unit. – Allow the monitor to cool down. – Reconnect the power supply unit. – If the status LED continues flashing, send the product to KARL STORZ for repair.
The battery charge state LED lights up green, but the display in the status bar does not show 100%.	<ul style="list-style-type: none"> – The monitor is new. It has not yet been charged 5 times. 	<ul style="list-style-type: none"> – Once the monitor has been charged 5 times at most, the % display will match the battery charge state LED. The battery is completely charged when the LED lights up green.
Color distortion	White balance not carried out correctly	<ul style="list-style-type: none"> ▶ Repeat white balance adjustment
	Screen or video unit defective	<ul style="list-style-type: none"> ▶ Send product to KARL STORZ for repair
	Incorrect color setting on the monitor	<ul style="list-style-type: none"> ▶ Set the color on the monitor
		<ul style="list-style-type: none"> ▶ Reset the video unit to the factory defaults

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