

Operator's Manual

Veterinary Endoscope Camera System

Vetina CS5/Vetina CS5 Ultra



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- The electrical installation of the relevant room complies with the applicable national and local requirements;
- The product is used in accordance with the instructions for use.

WARNING

- **Only skilled/trained clinical professionals should operate this equipment.**
 - **It is important for the hospital or organization that employs this equipment to carry out a reasonable service/maintenance plan. Neglect of this may result in machine breakdown or personal injury.**
-

NOTE

- **If there is any inconstancy or ambiguity between the latest English version and this manual, the English version shall prevail.**
-

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Preface

Manual Purpose

This manual contains the instructions necessary to operate the product safely and in accordance with its function and intended use. Observance of this manual is a prerequisite for proper product performance and correct operation and ensures animal and operator safety.

This manual is based on the maximum configuration and therefore some contents may not apply to your product. If you have any questions, please contact the Customer Service Department or your local distributor.

This manual is an integral part of the product. It should always be kept close to the equipment so that it can be obtained conveniently when needed.

WARNING

- If you find that the contents of the multi-language manuals are NOT consistent with the device or the English manuals, refer ONLY to the corresponding English manuals.
-

Intended Audience

This manual is geared for clinical professionals who are expected to have a working knowledge of medical procedures, practices, and terminologies as required for treatment of animals.

Illustrations

All illustrations in this manual serve as examples only. They may not necessarily reflect the setup or data displayed on your equipment.

Conventions

- *Italic text* is used in this manual to quote the referenced chapters or sections.
- **Bold text** is used to indicate the screen texts and names of hard keys.
- → is used to indicate operational procedures.

Contents

1 Safety	1 - 1
1.1 Safety Information	1 - 1
1.1.1 Warnings	1 - 1
1.1.2 Cautions	1 - 2
1.1.3 Notes	1 - 4
1.2 Equipment Symbols	1 - 4
2 Product Introduction	2 - 1
2.1 Intended Purpose	2 - 1
2.2 Intended Users	2 - 1
2.3 Intended Animal Population	2 - 1
2.4 Intended Medical Conditions	2 - 1
2.5 Contraindications	2 - 1
2.6 Applied Part	2 - 1
2.7 System Components	2 - 2
2.7.1 Front View of the CCU	2 - 2
2.7.2 Back View of the CCU	2 - 2
2.7.3 Endoscope Camera Head	2 - 3
3 Equipment Preparation	3 - 1
3.1 Overview	3 - 1
3.2 Safety Information About Equipment Preparation	3 - 1
3.3 Unpacking and Checking	3 - 2
3.4 Environmental Requirements	3 - 2
3.5 Installation of the Main Unit	3 - 3
3.6 Device Connection	3 - 3
3.6.1 System Connection	3 - 3
3.6.2 Connecting External Video Recorders	3 - 5
3.6.3 Connecting the Equipotential Line	3 - 5
3.6.4 Connecting the AC Mains	3 - 6
3.6.5 Connecting USB Drive	3 - 7
3.7 Using the Touchscreen	3 - 7
3.7.1 Operation Screen Introduction	3 - 8
3.7.2 On-screen Symbols	3 - 8
3.7.3 Available Buttons	3 - 9
3.7.4 Using the On-Screen Keyboard	3 - 9
3.7.5 Locking/Unlocking the Touchscreen	3 - 10
3.7.6 Setting System Language At First Startup	3 - 10
4 Equipment Operations	4 - 1
4.1 Overview	4 - 1

4.2 Safety Information About Equipment Operations	4 - 1
4.3 Check Before Startup	4 - 2
4.4 Starting the System	4 - 2
4.5 Check Before Operation	4 - 3
4.6 Setting Interconnected Light Source	4 - 3
4.7 Selecting User Configuration	4 - 3
4.8 Performing White Balance	4 - 3
4.9 Adjusting Image Brightness	4 - 4
4.10 Adjusting Image Focus	4 - 4
4.11 Zoom In/Out	4 - 4
4.12 Taking Photos or Recording Videos	4 - 5
4.13 Error Messages	4 - 5
4.14 Removing the System from Use	4 - 7
5 Changing Settings	5 - 1
5.1 Overview	5 - 1
5.2 Setting User Configuration	5 - 1
5.3 Setting Screen Display	5 - 1
5.3.1 Adjusting Image View	5 - 1
5.4 Setting Image Mode	5 - 2
5.4.1 Performing Image Optimization	5 - 2
5.4.2 Adjusting Image Color	5 - 2
5.4.3 Setting Image Parameters for Special Departments	5 - 3
5.5 Setting Camera Head Functions	5 - 3
5.5.1 Introduction to Short-press/Long-press Functions	5 - 3
5.5.2 Setting Button Functions	5 - 4
5.6 Setting Recording Function	5 - 5
5.6.1 Setting Recording Function	5 - 5
5.6.2 Setting Freezing Time After Taking Photos	5 - 5
5.6.3 Formatting USB Drive	5 - 5
5.7 Changing System Settings	5 - 6
5.7.1 Setting General Information	5 - 6
5.7.2 Setting Device Interconnection Function	5 - 7
5.7.3 Setting Output Format	5 - 8
6 Troubleshooting	6 - 1
7 Cleaning, Disinfection, and Sterilization	7 - 1
7.1 Overview	7 - 1
7.2 Safety Information About Cleaning and Disinfection	7 - 1
7.3 Cleaning and Disinfection of the CCU	7 - 2
7.3.1 Cleaning the CCU	7 - 2
7.3.2 Disinfecting the CCU	7 - 3

7.4 Cleaning, Disinfection and Sterilization of the Camera Head	7 - 4
7.4.1 Initial Treatment at the Point of Use	7 - 4
7.4.2 Preparation Before Cleaning	7 - 4
7.4.3 Cleaning the Camera Head	7 - 5
7.4.4 Disinfecting the Camera Head	7 - 6
7.4.5 Sterilizing the Camera Head	7 - 7
7.4.6 Low Temperature Plasma Sterilization	7 - 8
7.5 Consequences Caused by Inappropriate Cleaning, Disinfection and Sterilization	7 - 9
8 Maintenance	8 - 1
8.1 Overview	8 - 1
8.2 Safety Information About Maintenance	8 - 1
8.3 Maintenance Schedule	8 - 1
8.3.1 Performing Visual Inspection	8 - 2
8.3.2 Performing Electrical Safety Tests	8 - 2
8.4 Factory Maintenance	8 - 2
8.5 Disposal	8 - 2
9 Accessories	9 - 1
A Product Specifications	A - 1
A.1 Safety Specifications	A - 1
A.2 Environmental Specifications	A - 1
A.3 Power Supply Specifications	A - 2
A.4 Physical Specifications	A - 2
A.5 Hardware Specifications	A - 2
A.6 Input/Output Interfaces	A - 3
A.7 Monitor Specifications	A - 3
A.8 Product Performance	A - 3
A.9 Operating Environment	A - 4
B EMC	B - 1
B.1 EMC	B - 1
C Abbreviations	C - 1

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1 Safety

1.1 Safety Information

WARNING

- Indicates a potential hazard or unsafe practice that, if not avoided, could result in death or serious injury.
-

CAUTION

- Indicates a potential hazard or unsafe practice that, if not avoided, could result in minor personal injury or product/property damage.
-

NOTE

- Provides application tips or other useful information to ensure that you get the most from your product.
-

1.1.1 Warnings

WARNING

- The equipment is not intended to be used within the Magnetic Resonance (MR) environment.
- Never use the system where flammable gases (such as anesthetic gases and hydrogen gas) or flammable liquids (such as ethyl alcohol) are present, otherwise an explosion may occur.
- Do not let live parts (such as various signal input and output ports) of the system or any other devices contact with an animal. If the system or other equipment fails, animals would be at risk of an electric shock.
- Do not touch the animal and live parts simultaneously.
- When using the system for body checking, avoid contact between metal parts of the accessories such as endoscope and other metal parts. Otherwise, unintended current may flow through the animal body.

- To avoid risk of electric shock, make sure the connecting parts between the endoscope to be used with the system and the camera head are insulated.
 - When energized endoscopes are used with energized endotherapy devices, animal leakage currents may be additive. It should be noted if a type CF applied part endoscope is used, in which case a type CF applied part energized endotherapy device should be used in order to minimize total animal leakage current.
 - When a defibrillator is discharged, the image displayed on the monitor may be interfered with for less than 1s.
 - Do not disconnect the power cord or turn off the equipment during the surgery.
 - Check if the equipment and accessories (such as connecting cords of instruments) are intact prior to each use. Do not use them if any damage is detected. Replace defective accessories with new ones, and contact the Customer Service Department or your local distributor for damaged equipment.
-

1.1.2 Cautions

CAUTION

- The endoscope camera system and monitor are suitable for use within the animal environment. Devices connected to the equipment must meet the requirements of the applicable IEC standards (e.g. IEC 62368-1 safety standards for information technology equipment and IEC 60601-1 safety standards for medical electrical equipment). The system configuration must meet the requirements of the IEC 60601-1 and the IEC 60601-2-18. Any personnel who connects devices to the equipment's signal input/output port is responsible for providing evidence that the safety certification of the devices has been performed in accordance with the IEC 60601-1 and the IEC 60601-2-18. If you have any questions, contact the Customer Service Department or your local distributor.
- The equipment shall only be connected to mains power with protective earth. Do not use a power socket that is not grounded.
- Do not use multiple portable socket outlets, which might cause interference, electric shock, or equipment damage.
- To avoid the interference of high frequency electrosurgery unit (ESU), do not connect the equipment and ESU to the same power socket. Besides, keep the equipment away from ESU as much as possible.
- The weight of objects stacked on the equipment should not exceed 20 kg.
- Use only endoscopes, and light source specified by Mindray Animal Medical. Using accessory or equipment that is not compatible with the equipment may cause injury to the animal, damage to the equipment or deterioration in

performance. Contact the Customer Service Department or your local distributor in case of any questions concerning equipment compatibility.

- Prior to putting the equipment into clinical operation and inspection, read this manual carefully and make sure all contents are fully understood, to ensure the correct operation of the equipment and safety of the animals and operators.
 - This equipment must be operated by skilled/trained clinical professionals.
 - The system is only supplementary in clinical examinations. The doctors shall carry out diagnosis and treatments based on the clinical manifestations of animals.
 - This manual does not contain contents relating to clinical examination technologies. Examination approach should be selected based on medical knowledge and clinical experiences.
 - Before the endoscopic surgery, prepare a backup endoscope camera system to avoid surgery interruption due to possible system failure.
 - An ESU may interfere with the image display of the monitor, resulting in disordered image tone.
 - Do not plug or unplug the system or its accessories when the power is on, otherwise it will cause system damage.
 - Do not pull, bend, or twist the connecting cords with excessive force to avoid cord or equipment damage.
 - Do not press the connectors with excessive force, or the connectors might be damaged.
 - Do not block the ventilation outlet. Otherwise the equipment may overheat, which might trigger system self-protection or cause equipment damage or fire.
 - Do not pour liquid on the equipment or let any liquid enter the interior of the equipment, or there will be risks of electric shock or equipment damage. If liquid is spilled on the equipment, disconnect the power supply, dry the equipment and contact the Customer Service Department or your local distributor.
 - Dispose of the package material as per the applicable waste control regulations. Keep the packing material out of children's reach.
 - At the end of its service life, the equipment, as well as its accessories, must be disposed of in compliance with the local or hospital's guidelines regulating the disposal of such products, to avoid contaminating or infecting the environment, other persons, or equipment.
-

1.1.3 Notes

NOTE

- **Keep this manual in the vicinity of the equipment so that it can be obtained conveniently when needed.**
- **Put the equipment in a location where you can easily view and operate the equipment.**
- **During normal use, the operator is expected to face the front of the equipment.**
- **The equipment uses a mains plug as isolation means to the mains power. Locate the equipment in a place that is convenient to operate the mains plug.**
- **The software was developed in compliance with IEC 62304.**
- **The software is intended for use by one end user on a single system.**
- **This manual describes all features and options. Your equipment may not have all of them.**
- **The software equipment copyright is solely owned by Mindray Animal Medical. No organization or individual shall resort to modifying, copying, or exchanging it or to any other infringement on it in any form or by any means without due permission.**

1.2 Equipment Symbols

Symbol	Description	Symbol	Description
	Serial number		Refer to instruction manual/ booklet
	Date of manufacture		Manufacturer
	DEFIBRILLATION-PROOF TYPE CF APPLIED PART		CE marking
	Stand-by		USB connector
	Alternating current		General warning sign

Symbol	Description	Symbol	Description
	Equipotentiality		Computer network
	Endoscope	IPX7	Protected against the effects of temporary immersion in water
	Stacking limit by number		Keep away from rain
	This way up		Fragile; handle with care
	Humidity limitation		Atmospheric pressure limitation
	Temperature limit		The following definition of the WEEE label applies to EU member states only: the use of this symbol indicates that waste electrical and electronic equipment must not be disposed of as unsorted municipal waste and must be collected separately. By ensuring that this product is disposed of correctly, you will help prevent bringing potential negative consequences to the environment and human health. For more detailed information with regard to returning and recycling this product, consult the distributor from whom you purchased the product.

The general meaning assigned to geometric shapes, safety colors and contrast colors for safety signs are as follows:

Geometric Shape	Meaning	Safety Color	Contrast Color	Graphical Symbol Color
	Prohibition	Red	White	Black
	Mandatory action	Blue	White	White
	Warning	Yellow	Black	Black

NOTE

- Some symbols listed above may not appear on your equipment.

2 Product Introduction

2.1 Intended Purpose

The Endoscope camera system, in combination with the light source, monitor and endoscope, is used for real-time display of the endoscopic or open operating field in diagnostic or surgical procedures.

NOTE

- **According to the conclusion of clinical evaluation and residual risk evaluation, for the intended animals, there is no known side effects that can occur during or after the use of the device. And there is no need for the operator to make extra preparations. Thus, no residual risk associated with using the device should be disclosed due to the risk management report.**
-

2.2 Intended Users

Generally, the user of the product shall be the medical workers who have taken training of endoscopic technique and thoroughly mastered the endoscopic operation technology.

2.3 Intended Animal Population

The attending veterinarian must decide whether the foreseen application is admissible based on the general condition of the animal.

2.4 Intended Medical Conditions

The product should be used in medical rooms which are equipped with electrical facilities in accordance with national regulations.

2.5 Contraindications

As of now, there is no contraindications directly related to this product. All the usage should follow the instruction of the responsible veterinarian according to the situation of the animal.

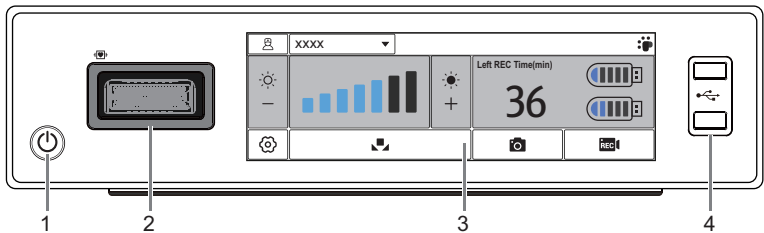
2.6 Applied Part

The applied part of the system is camera head.

2.7 System Components

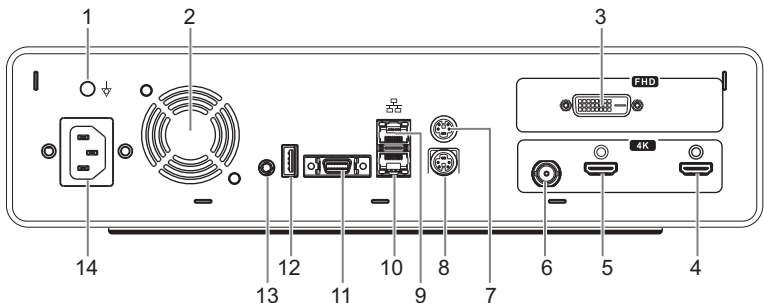
The system consists of a camera control unit (hereinafter referred to as the CCU) and a camera head.

2.7.1 Front View of the CCU



- (1) Power switch: turns on or off the CCU. Color of the power switch indicator indicates the power status of the equipment:
 - Off: AC power is not connected.
 - Orange: AC power is connected, but main unit is off.
 - Green: the main unit is on.
- (2) Camera head connector: connects a camera head.
- (3) Touchscreen: displays equipment status and changes settings.
- (4) USB (Universal Serial Bus) connectors: connects a USB drive for video storage, supporting USB 3.0 protocol. The supported storage formats include NTFS, FAT32, and exFAT.

2.7.2 Back View of the CCU



- (1) Equipotential grounding terminal: when using the equipment together with other devices, connect their equipotential grounding terminals together to eliminate potential difference.

- (2) Ventilation outlet: used for heat dissipation.
- (3) DVI (Digital Visual Interface) out: connects a high definition video device for high definition video output, such as monitor.
- (4) HDMI (High Definition Multimedia Interface) out 2: connects a 4K video device for 4K video output, such as monitor.
- (5) HDMI (High Definition Multimedia Interface) out 1: connects a 4K video device for 4K video output, such as monitor.
- (6) 3G/12G SDI (Serial Digital Interface) out: connects a high definition/4K video device for high definition/4K video output, such as monitor.
- (7) CAN (Controller Area Network) connector 2: connects external devices other than light source.
- (8) CAN (Controller Area Network) connector 1: connects external devices other than light source.
- (9) Network connector 1: supports software upgrade.
- (10) Network connector 2: reserved.
- (11) MSB (Mindray Serial Bus) connector: connects to a light source, controlling the brightness of the light source.
- (12) USB connector 3: connects a USB drive for system software upgrade, supporting USB 2.0 protocol.
- (13) External control extension connector: connects an external video recorder, and supports starting/stopping recording and taking screenshots.
- (14) AC (Alternating Current) power input: connects the AC Mains.

2.7.3 Endoscope Camera Head

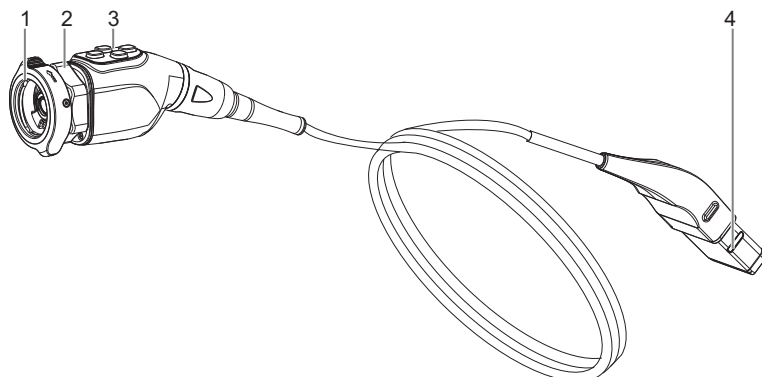
This system is compatible with the following models of camera head:

Model	Standard Cable Length	Function
Vetina CS5H	3m	Supports white light imaging.

2.7.3.1 Working Principle of Endoscope Camera Head

The camera head is used together with the CCU to support visible light imaging. It provides a 1/1.8-inch progressive scan CMOS for white light imaging, supporting 4K output display.

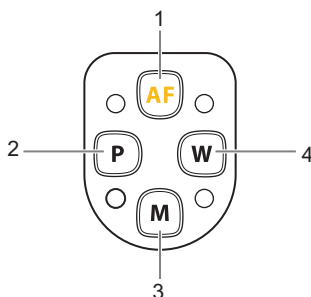
2.7.3.2 Front View of the Camera Head



- (1) Endoscope coupler: connects and secures the endoscope.
- (2) Focusing ring: rotate the ring to focus the camera head.
- (3) Camera head buttons: four functional buttons.
- (4) CCU connector: connects the CCU.

2.7.3.3 Camera Head Buttons

There are four buttons on the camera head, and three of them can be set to perform different functions. After the camera head is connected to the CCU, the button functions are displayed on the monitor. After a button is pressed, the function prompt disappears. More descriptions are shown below:



- (1) **AF**: press to perform autofocus.
- (2) **P**: short press to take photos and long press to record videos by default. This button can also be set to other functions. For details, refer to **5.5.2 Setting Button Functions**.
- (3) **M**: short press to zoom the image by default. This button can also be set to other functions. For details, refer to **5.5.2 Setting Button Functions**.

- (4) **W**: long press to perform white balance by default. This button can also be set to other functions. For details, refer to **5.5.2 Setting Button Functions**.

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3 Equipment Preparation

3.1 Overview

This chapter describes preparation and basic settings before putting the system into use.

3.2 Safety Information About Equipment Preparation

WARNING

- Do not touch the main unit with wet hands to prevent electric shock.
 - If it is not evident from the equipment specifications whether a particular combination with other devices is hazardous, for example, due to summation of leakage currents, please consult the manufacturers or else an expert in the field, to ensure the necessary safety of animals and all devices concerned will not be impaired by the proposed combination.
-

CAUTION

- The equipment should be installed by the authorized personnel.
 - Install the equipment properly and make sure it is adequately protected from potential damage caused by falling, hitting, strong vibration or other external mechanical force.
 - Make sure the equipment is horizontally installed at a fixed place to avoid possible movement and damage thus caused.
 - Before moving the system, make sure all peripheral equipment connected has been secured, in case of equipment falling and damage.
 - Magnetic and electrical fields are capable of interfering with the proper performance of the equipment. For this reason, make sure that all external devices operated in the vicinity of the equipment comply with the relevant EMC requirements. Mobile phones, X-ray equipment or MRI devices are possible sources of interference as they may emit higher levels of electromagnetic radiation.
 - Do not use the system in strong electric or magnetic fields (where a transformer presents, for example), or near high-frequency devices (such as mobile phones). Performance degradation or system failure might occur.
-

- To avoid safety risks and environment contamination, dispose of the package material as per the applicable waste control regulations. Keep the packing material out of children's reach.
 - The equipment meets the requirements of defibrillation-proof type CF applications. Devices or accessories used with the equipment should at least meet the requirements for type BF applications. The system connected with different applied parts always meets the requirements of defibrillation-proof type CF applications.
 - The equipment might be contaminated during storage and transport. Before use, verify whether the packages are intact. In case of any damage, do not apply it to animals.
 - Make sure that the operating environment of the equipment meets the specific requirements. Otherwise unexpected consequences, e.g. damage to the equipment, could result.
 - Always keep the machine dry and do not move it from a cold place to a warmer place quickly, or condensation of water droplets which may result in a short circuit will occur.
-

NOTE

- Risks might arise when the equipment is connected to other devices. Read the safety messages in the instructions for use accompanied with such devices carefully before operation.
 - Put the equipment in a location where you can easily view and operate the equipment.
 - Keep this manual in the vicinity of the equipment so that it can be obtained conveniently when needed.
 - Save the packing case and packaging materials for possible shipment or storage in the future.
-

3.3 Unpacking and Checking

Before unpacking, examine the packing case carefully for signs of damage. If any damage is detected, contact the carrier immediately. Open the package and remove the equipment and accessories carefully. Check all materials against the packing list and check for any mechanical damage. Contact the Customer Service Department or your local distributor in case of any problems.

3.4 Environmental Requirements

The operating environment of the equipment must meet the requirements specified in this manual.

The environment where the equipment is used should be reasonably free from noises, vibration, dust, as well as corrosive, flammable, and explosive substances. If the equipment is installed in a chassis, sufficient space shall be left in front and behind of the chassis to facilitate operation or maintenance. To maintain good ventilation, sufficient space, i.e. at least 2 inches (5 cm), shall be left for each side of the equipment.

When the equipment is moved from one place to another, condensation may occur as a result of temperature or humidity difference. In this case, wait until the condensation disappears before using the equipment.

3.5 Installation of the Main Unit

The system can be installed as follows:

- On a flat surface
- On a trolley

NOTE

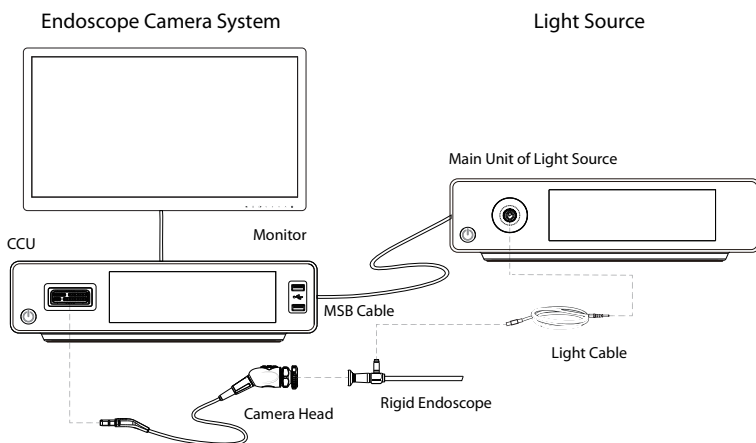
- **You are advised to install the main unit on a stable trolley rather than on the floor.**
 - **If the equipment is to be used with a trolley, there will be risks of falling or collision during movement. For more safety instructions, refer to the instructions for use accompanied with the trolley.**
 - **If the equipment is installed on a trolley, make sure the capacity of the trolley is higher than the total power consumption of all the equipment connected to the mains outlet of the trolley. If the power supply voltage is reduced due to insufficient capacity, tripping may occur, turning off the main unit and all other equipment connected to the trolley.**
-

3.6 Device Connection

Read this operator's manual carefully before using the system. Familiarize yourself with its function and operation, and observe the warnings and cautions included in the manual.

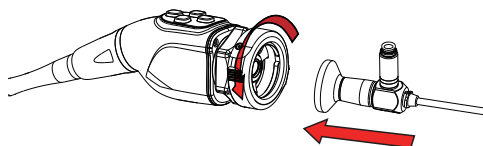
3.6.1 System Connection

The equipment can be connected with endoscopes, light sources and monitors to provide high definition images through denoise in multiple dimensions combining spatial and time domains. The connection of the modular-designed system is shown as below:



To connect devices in the diagram, follow the procedure below:

1. Connect a monitor to a correct video output connector on the back of the CCU with a video cable. Select a video cable that matches the video output connector. More than one monitors can be connected simultaneously to the CCU.
2. Connect a light source to the MSB connector on the back of the CCU with a MSB cable (System Ctrl Cable-Light Source).
3. Plug the connector of the camera head to the camera head connector on the front panel of the CCU.
4. To connect the camera head and endoscope, follow the procedure below:
 - a Rotate the endoscope coupler as indicated by the arrow on it.
 - b Align the eye piece of the endoscope with the endoscope coupler on the camera head.



- c Push the endoscope to the camera head and release the endoscope coupler.
- d Pull the endoscope slightly to check if the endoscope is secured.

To remove the endoscope, follow the procedure below:

1. Hold the camera head with one hand, and the endoscope with the other.

2. Rotate the endoscope coupler as indicated by the arrow on it. The endoscope falls off automatically.

WARNING

- **Before disconnecting the endoscope from the camera head, be sure to turn off the light of the light source. Otherwise, the brightness of light might be increased to the maximum level, causing burns or eye injuries.**
-

CAUTION

- **Use monitors recommended by Mindray Animal Medical only. Using incompatible monitors may degrade equipment performance.**
 - **Connect a monitor to the output connector of the CCU instead of through an adapter, preventing images from disappearing due to adapter malfunction during observation.**
 - **Connect the light source to the MSB connector of the CCU instead of through other connectors. Otherwise, equipment failure may result.**
 - **Turn off the CCU before connecting or disconnecting the camera head. Otherwise, the image sensor may be damaged, causing the image to disappear.**
 - **Handle the camera head gently to protect its suspended high reliability connector.**
 - **Since image signals are transmitted by laser, do not excessively bend, pull, or press the camera head, or pull the camera cable. Otherwise, the camera head might be damaged or the cable might fall off.**
-

3.6.2 Connecting External Video Recorders

You can connect a video recorder to the external control extension connector of the CCU to record videos and take screenshots. More related functions are listed below:

- Recorded videos can be saved to the external video recorder and USB drives at the same time. To set the storage location, refer to **5.6.1 Setting Recording Function**.
- After setting button functions of the camera head, you can control the recorder to record and take photos via the camera head. For detailed setting method, refer to **5.5 Setting Camera Head Functions**.

For detailed functions of the recorder, refer to the operation's manual of the recorder.

3.6.3 Connecting the Equipotential Line

An equipotential terminal is used to balance the electric potential of the protective grounding between the system and other electrical equipment. When other devices are

connected to the system, connect the equipotential line to each equipotential terminal of the devices, or an electrical shock will occur.

WARNING

- **When connecting or disconnecting the equipotential line, turn off the equipment power supply. Or an electrical shock will occur.**
-

3.6.4 Connecting the AC Mains

The equipment is powered by AC power supply. Before connecting the equipment to the AC mains, check that the voltage and frequency ratings of the power line are the same as those indicated beside the AC power input.

To use the AC power source, follow the procedure below:

1. Connect the female end of the power cord to the AC input on the back of the equipment.
2. Connect the other end of the power cord with an AC outlet.
3. When the AC mains is correctly connected, the power switch indicator is illuminated in orange.

WARNING

- **Always use the power cord delivered with the equipment.**
 - **Ensure that the equipment is supplied with continuous electric power during work. Sudden power failure may cause data loss or system failure.**
 - **If the power supply is unstable, the system might not work properly. It is recommended that an uninterrupted power supply be used.**
 - **The equipment shall only be connected to mains power with protective earth. Do not use multiple portable socket outlets, which might cause interference, electric shock or equipment damage. Do not use a power socket that is not grounded.**
 - **The equipment also can be connected to a separate power supply. Ensure that the rated output of the power supply matches the input of the equipment. The power supply and this equipment constitute an ME SYSTEM together, meeting the requirements of IEC 60601-1.**
 - **Before connecting the equipment to the AC mains, check that the voltage and frequency ratings of the power supply are the same as those indicated on the equipment's label or in this manual.**
-

3.6.5 Connecting USB Drive

Images and videos can be stored in USB drives connected to the CCU. Before recording, plug USB drives to the USB connector on the front panel. You can connect two USB drives simultaneously. The system detects the status of the USB drives automatically and displays on the touchscreen. Besides, if one USB drive is out of memory, images and videos will be stored to the other USB drive.

Select NTFS, FAT32, or exFAT USB drives from a qualified manufacturer. The CCU supports connecting hard drives with memory greater than or equal to 6 TB. You are advised to choose a USB drive with memory greater than 32 GB. The following are the recommended USB drives:

Video Quality	Recommended Manufacturer
4K quality, HD High Quality	SanDisk Z25 series SSD Samsung T7 series SSD
HD Standard Quality	SanDisk CZ600 series U disk SanDisk CZ880 series U disk

You are advised to format the USB drive before use. For details about formatting USB drives, refer to **5.6.3 Formatting USB Drive**.

You are advised to use the PotPlayer or KMPlayer to play videos stored in the USB drives.

CAUTION

- **Select USB drives from qualified manufacturers. Otherwise file corruption or system failure could result. It is not recommended that you use a card reader instead of an USB drive.**
 - **Formatting a USB drive will clear all data stored in it. Make sure a backup of data you need is made.**
-

3.7 Using the Touchscreen

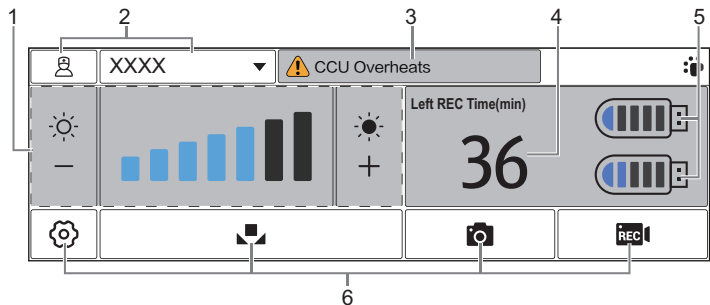
The equipment is configured with an LCD touchscreen on which you can operate and set the equipment, and view operation information.

NOTE

- **Dry the equipment immediately in case of rain or water spray.**
-

3.7.1 Operation Screen Introduction

The following figure shows the operating screen of the equipment:



- (1) Brightness setting area: displays the current brightness level. Select a button to set the brightness of the image displayed. There are 7 levels that can be adjusted.
- (2) User configuration area: displays the current user configuration. Select the User configuration button  to customize the configuration.
- (3) Error message area: displays error messages.
- (4) Left REC Time (min): indicates the estimated recording time (in minutes) the current connected USB drive supports.
- (5) USB status area: indicates the current status of the USB drive connected to the USB connector on the front panel.
NOTE: Keep observing the Left REC Time (min) value and replace the USB drive if necessary.
- (6) Button area: displays available buttons. For detailed introduction of the buttons, refer to **3.7.3 Available Buttons**.

3.7.2 On-screen Symbols

The following table lists the on-screen symbols displayed on the main screen:

Symbol	Description	Symbol	Description
	No USB drive is connected.		About 0% memory is occupied.
	About 20% memory is occupied.		About 40% memory is occupied.

Symbol	Description	Symbol	Description
	About 60% memory is occupied.		About 80% memory is occupied.
	(Yellow) The USB drive is nearly full.		The USB drive is already full.
	Identifying USB drive.		Failed to identify the USB drive.
	The touchscreen is unlocked		The touchscreen is locked

3.7.3 Available Buttons

The following table lists the available buttons displayed on the main screen:

Button	Description	Button	Description
	Setup button: select to display the setup menu.		White balance button: select to adjust the white balance.
	Camera button: select to capture images.		Record button: select to start/stop recording.
	(White) Brightness decrease button: select to decrease the brightness of the image displayed.		(White) Brightness increase button: select to increase the brightness of the image displayed.
	User configuration button: select to display the user configuration menu.		

3.7.4 Using the On-Screen Keyboard

The on-screen keyboard enables information entry:

- Enter the information by selecting one character after another.
- Select the Switch key  to switch the input method.
- Select the Space key  to add space.
- Select the Caps Lock key  to access uppercase letters.

- Select the Page turn key << or >> to turn pages.
- Select the Special Character key &% to access the page of special characters.
- Select the Backspace key <X> to delete single characters or select the Clear key ✕ to delete the entire entry.
- Select **OK** to confirm the entry and close the on-screen keyboard.

3.7.5 Locking/Unlocking the Touchscreen

The touchscreen can be automatically locked to avoid inadvertent operations. When this function is enabled, the touchscreen will be locked automatically if no operation is detected in one minute. For setting method, refer to **5.7.1.2 Setting Lock Screen Function**.

When the touchscreen is locked,  is displayed on the bottom of the touchscreen. To unlock the touchscreen, follow the procedure below:

1. Tap anywhere on the touchscreen. An unlocking bar is displayed:



2. Press  and slide it to the  position on the right. The touchscreen is unlocked.

3.7.6 Setting System Language At First Startup

When the equipment is started for the first time, the **General Setup** window is launched to help set the system language. Follow the procedure below:

1. Select a target language and press **OK**.
2. Press **Restart** in the pop-up window. After the equipment is restarted, the setting takes effect.

In subsequent use, you can switch the system language by referring to **5.7.1.4 Setting System Language**.

4 Equipment Operations

4.1 Overview

This chapter introduces the operations and settings of the system.

4.2 Safety Information About Equipment Operations

WARNING

- Before each use or after changing the viewing modes/settings, check to ensure there is a live image displayed on the monitor. You can wave your hand in front of the camera head to make sure that the image is in real-time and has the correct orientation. If the image is frozen or replayed during the surgery, animal injury may result.
 - Do not turn the system off when the endoscope is still inside the animal.
 - In case of system failure, stop the operation immediately, turn off the equipment, disconnect the power cord, and carefully withdraw the endoscope from the animal.
-

CAUTION

- Perform white balance to achieve color balance before surgery. Otherwise, the image color may be distorted.
 - Before using an ESU, make sure that the ESU is installed and connected in strict accordance with its instructions for use, and that the interference thus caused would not affect the examination and surgery. Using an ESU without such confirmation might produce electric shocks resulting in animal injury.
 - If the image displayed on the monitor is blurred, the tip of endoscope might be contaminated by blood, mucus, or tissue fragments. Withdraw the endoscope from the animal carefully and remove the blood or mucus to get better lighting and thus ensure a safe examination. Or the tip of the endoscope might overheat and burn the animal or operator.
 - Do not connect or disconnect the camera head when the CCU is powered on. Otherwise, the image sensor may be damaged.
 - Do not block the ventilation outlet of the equipment, or the equipment might overheat, causing fire or system failure.
-

- **When using medicament sprays, make sure no drops could enter the interior of the equipment from the ventilation outlet, or fire or equipment damage might result.**
 - **Do not use a humidifier near the main unit. Humidification may lead to condensation, causing equipment failure.**
 - **Keep cords connected to the ESU away from the touchscreen and monitor, or the high frequency circuit would affect the touchscreen performance and the image quality.**
-

NOTE

- **Do not press the power switch of the main unit with sharp or hard objects to avoid damaging the button.**
 - **The CCU can automatically match the surgery scene according to the surgical needs, and thus you do not need to select a surgery scene before the surgery.**
-

4.3 Check Before Startup

Check the following items before starting the equipment:

- The temperature, humidity, and atmospheric pressure meet the requirements, and installation sites are clean.
- No condensation occurs.
- Surface of the equipment and peripheral devices have no signs of distortion, damage, or contamination.
- All devices and accessories connected with the equipment are compatible.
- No rough surface, sharp edges, or protrusions exist on the parts of the endoscope or other accessories that will be put inside the animal.
- All cords are intact and well routed.
- Connectors or plugs are not loose, distorted, damaged, contaminated, or blocked.
- No irrelevant objects are on top of the equipment. The ventilation outlet is not covered by dust or other objects.
- No obstacles are in the movement range of the system or near the ventilation outlet.

4.4 Starting the System

1. Turn the monitor on.
2. Press the power switch on the front panel to turn on the CCU.

4.5 Check Before Operation

It is required to check and ensure that the equipment works properly. After turning on the equipment, check the following items:

- The system does not emit abnormal noise, smell, or excessive heat.
- Put a hand near the ventilation outlet and check that there is air flowing out.
- The touchscreen displays and functions correctly.
- Aim the tip of the endoscope to an object and check that the image quality displayed on the monitor is normal.

CAUTION

- **Do not put the system in use before the system is checked and works normally.**
 - **In case of any failure, stop and remove equipment from use. Otherwise, injury to the animal or operator or damage to the equipment might result.**
-

4.6 Setting Interconnected Light Source

After the CCU is correctly connected to the Mindray Animal Medical light source, if the light source is in auto mode, the CCU can automatically adjust the light brightness based on the current surgical field of view to ensure a clear surgical field of view and balanced light brightness.

You can turn on or off the light source by pressing the camera head button. For details about how to set the functions of camera head buttons, refer to **5.5 Setting Camera Head Functions**.

4.7 Selecting User Configuration

Through the user configuration function, you can save some customized parameters in the setup menu.

Select the drop-down list in the user configuration area on the main screen to select a saved user configuration.

To update the current user configuration, or delete a saved user configuration, refer to **5.2 Setting User Configuration**.

4.8 Performing White Balance

The white balance function is used to calibrate the color of the image displayed on the monitor.

It has be to performed:

- before starting the surgery;

- after the light source is changed; and,
- when the color of the image is anomalous.

To perform white balance, follow the procedure below:

1. Ensure that the connected light source is emitting light.
2. Point the camera head or endoscope to a white gauze or any white object, and make sure your sight is filled with white. Do not shake the camera head or the endoscope in the process.
3. Adjust the brightness to an appropriate level and avoid overexposure.
4. Long press the W button on the camera head to start white balance. You can also press the white balance button  on the main screen to start the function.
5. Check the prompt message on the monitor. If white balance is indicated to be failed, repeat the procedure.

When the white balance is successfully performed, the displayed image color becomes natural. If the white balance is not performed, the white balance parameters set last time are used by default.

The long-press function of W button on the camera head is set to **White Balance** by default. The long-press function of P or M button can also be customized to **White Balance**. For details about how to customize the button function, refer to **5.5 Setting Camera Head Functions**.

4.9 Adjusting Image Brightness



Select the brightness increase button  or brightness decrease button  on the main screen to adjust the image brightness. The brightness slider in the middle indicates the current brightness level. You can also drag the slider to the left or right to adjust the brightness.

In addition, if the short-press function of P, W, or M button on the camera head is set to **WL Brightness**, you can short press the button to adjust the brightness. For details about how to set the functions of camera head buttons, refer to **5.5 Setting Camera Head Functions**.

4.10 Adjusting Image Focus

Camera heads compatible with the CCU do not support detachable lenses. The focal length of the camera heads is 25 mm $\pm$ 20%.

You can press the AF button on the camera head to perform autofocus, or rotate the focusing ring to perform manual focus.

4.11 Zoom In/Out

In the setup menu, select **Image Zoom** to zoom in/out on the displayed image. For detailed setting method, refer to **5.3.1 Adjusting Image View**.

In addition, if the function of P, W, or M button on the camera head is set to **Image Zoom**, you can press the button to adjust the image magnification. For details about how to set the functions of camera head buttons, refer to **5.5 Setting Camera Head Functions**.

4.12 Taking Photos or Recording Videos

During surgery, you can press the buttons on the touchscreen or press the camera head buttons to take photos or record videos. The images and videos can be stored in the USB drives or an external video recorder. The specification of images and videos are as follows:

Item	Storage Format	Performance
Image	jpeg	Highest storage resolution: 4K
Video	MP4	Frame rate: 60 fps Bit width: 10bit or 8bit Encoding standard: H.265

After startup, set the storage location and video quality by referring to **5.6 Setting Recording Function**.

After setting, when you take photos or videos for the first time, a new file directory will be generated under the storage location, and images and videos recorded during this surgery will be saved to this file directory.

The name of a file directory shows the time of the corresponding surgery, and the name of a video screenshot indicates the name of the corresponding video. The name formats of file directory, video and image are as follows:

Item	Example of Name	Format Meaning
File directory	20230510_1202	year month day_hour minute
Video	Section01_0510_120212.mp4	Section No._month day_hour minute second.mp4
Image (not video screenshot)	Section00_120745.jpeg	Section00_hour minute second.jpeg
Image (video screenshot)	Section01_000402.jpeg	Section No._hour minute second.jpeg

When recording is stopped and “Saving Video” is displayed in the lower left corner of the monitor, do not disconnect the USB drives or the external video recorder.

4.13 Error Messages

Message	Possible Cause	Attemptable Solution
Light Source Disconnected.	The light source is not properly connected to the CCU.	Connect the light source to the CCU by referring to 3.6.1 System Connection .
	The light source is not turned on.	Turn on the light source.
Incompatible Light Source.	The light source connected to the CCU is not compatible.	Use the light source specified by Mindray Animal Medical.
DVR Initialization Error	The DVR module failed to initialize.	Restart the CCU. If the problem persists, contact the Customer Service Department or your local distributor. If USB storage is not required, the surgery will not be affected.
Camera Head Connection Error	The camera head is not properly connected.	Reconnect the camera head.
	The camera head is faulty.	Replace the camera head.
Camera Head Disconnected	The camera head is not properly connected.	Connect the camera head to the correct connector on the CCU.
	The camera head cable is broken.	Replace the camera head.
Incompatible Camera Head	The camera head connected to the CCU is not compatible.	Use the camera head specified by Mindray Animal Medical.
CCU Overheats	The ventilation outlet is blocked.	Clear the blockage from the ventilation outlet.
	The fan does not work normally.	Remove the system from use and use the backup CCU.
	The room temperature exceeds the limit.	Reduce the room temperature.
USB Drive Error	The USB drive is damaged.	Replace the USB drive with a new one.
USB Drive Incompatibility	The USB drive is not compatible.	Replace the USB drive with a new one.
		Select lower video quality for recording. For details, refer to 5.6.1 Setting Recording Function .

Message	Possible Cause	Attemptable Solution
USB Accidentally Ejected	The USB drive is damaged.	Replace the USB drive with a new one.
	The USB drive is not ejected normally.	Do not remove the USB drive during recording or video saving.
Insufficient USB capacity.	The USB drive connected is out of memory.	Replace the USB drive with a new one.
		Format the current USB drive. Back up data before formatting.

NOTE

- **Keep observing the error messages and take actions as instructed above. If the equipment starts to beep, you need to check the message immediately and take corrective actions.**

4.14 Removing the System from Use

To remove the system from use after the surgery or if system failure occurs, follow the procedure below:

1. Withdraw the endoscope from the animal, and turn off the light source.
2. Check the status of the Record button on the main screen. If recording is started, stop video recording.
3. Turn off the equipment by pressing the power switch.
4. Hold the camera head with one hand, and the endoscope with the other. Rotate the endoscope coupler as indicated by the arrow on it. The endoscope falls off automatically.

Perform cleaning, disinfection, sterilization, and other maintenance as required by the local or your hospital's regulation.

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5 Changing Settings

5.1 Overview

This chapter introduces the software settings of the system.

You can set the user configuration on the main screen. After selecting the Setup button  on the main screen to access the setup menu, you can also set the screen display, image mode, camera head functions, recording function, and system information.

5.2 Setting User Configuration

To add a new user configuration, follow the procedure below:

1. On the main screen, select the User configuration button  → **Save As New Config**.
2. Select the Edit button  next to **Config Name** and enter a name for the new configuration in the pop-up window.
3. Select **OK** in the pop-up window to return to the **Save As New Config** page.
4. Select **OK** to save the current configuration as the entered name.

After selecting the User configuration button , you can also select **Store** to update the current user configuration. Or you can follow the procedure below to delete a user configuration:

1. On the main screen, select the User configuration button  → **Delete Current Config**.
2. Select an user configuration as needed and then select **Delete**.

5.3 Setting Screen Display

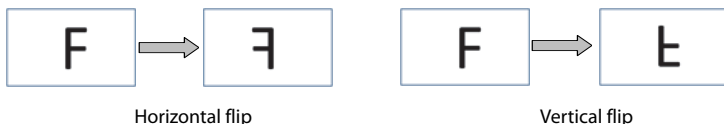
Select the Setup button  on the main screen to access the setup menu. The **Display** tab is displayed. On this tab, you can set the image view.

5.3.1 Adjusting Image View

To adjust the image view, follow the procedure below:

1. In the setup menu, select **Display** → **View Setup**.
2. Set **Image Zoom**. Press the + or - icon to adjust the magnification of the image on the monitor. The slider between the + and - icons indicates the current magnification. You can also move the slider to zoom in or out on the image.

3. Switch on or switch off **Horizontal Flip** or **Vertical Flip**. The horizontal and vertical flips are shown below:



4. Switch on or switch off **Rotate 180°**. An image that is rotated by 180° is shown below:



5. Switch on or switch off **Freeze**.
6. Switch on or switch off **Adaptive Zoom**.
 - ◆ If it is switched on, the adaptive image field function is enabled. The CCU automatically adjusts the image display mode according to the camera format.
 - ◆ If it is switched off, the adaptive image field function is disabled, and the image is centered on the monitor.

NOTE

- **The maximum magnification of images is 3.0x. To adjust the magnification threshold, refer to 5.7.1.3 Setting Image Zoom Threshold.**

5.4 Setting Image Mode

Select the Setup button  on the main screen to access the setup menu. Select the **Image** tab. On this tab, you can perform image optimization, adjust image color, and set specialist image.

5.4.1 Performing Image Optimization

To perform image optimization, follow the procedure below:

1. In the setup menu, select **Image** → **Image Opt.**
2. Switch on or switch off **Detail Enhancement**, **Color Enhancement**, and **Homogenous Brightness**.

5.4.2 Adjusting Image Color

To adjust the image color, follow the procedure below:

1. In the setup menu, select **Image** → **Color Setup**.
2. Set **Color Style**. For detailed introduction of the options, refer to **2.6 Applied Part**.

3. Select the + or - icon to set **Saturation**, **Red Gain**, or **Blue Gain**. Or select **Reset** to restore the factory defaults.

5.4.3 Setting Image Parameters for Special Departments

To set image parameters for special clinical departments, follow the procedure below:

1. In the setup menu, select **Image** → **Specialty**.
2. Switch on or switch off **De-grid Optimization** and **Anti-laser Optimization** under **Special Function**.
3. Switch on or switch off **Tone Enhancement**. After switching on it:
 - ◆ Set **Tone Enhancement Mode** to **Mode R** or **Mode G** as needed. After setting, the system enhances the image color contrast by color inversion.
 - ◆ Set **Display Mode** to **Full Screen** or **Dual Split** as needed.

5.5 Setting Camera Head Functions

Select the Setup button  on the main screen to access the setup menu. Select the **Camera Head** tab. On this tab, you can set functions of the P, W, and M buttons to performing white balance, taking photos, recording, or controlling the brightness of light.

5.5.1 Introduction to Short-press/Long-press Functions

The following table lists the short-press functions that you can set for the buttons:

Short-Press Function	Description
Capture	Short press the button to capture the image displayed on the monitor.
Image Zoom	Short press the button to zoom in or out of the image displayed on the monitor.
WL Brightness	Short press the button to increase or decrease the image brightness.
Interconnection	Short press the button to display parameters of interconnected devices on the monitor.
Tone Enhancement	Short press the button to cycle through the tone enhancement modes.
Smoke Evacuation	Short press the button to turn on or off the smoke exhaust function of the interconnected insufflator.
Image Flip	Short press the button to switch the image flip mode.
No Function	Short-press of the button will not activate any function.

The following table lists the long-press functions that you can set for the buttons:

Long-Press Function	Description
Capture	Long press the button to capture the image displayed on the monitor.
REC	Long press the button to start/stop recording video displayed on the monitor.
White Balance	Long press the button to start white balance.
Interconnection	Long press the button to display parameters of interconnected devices on the monitor.
Tone Enhancement	Long press the button to cycle through the tone enhancement modes.
Insufflator Switch	Long press the button to turn on or off the inflation function of the interconnected insufflator. Prompts of insufflation status and insufflator parameters will be displayed on the monitor.
Smoke Evacuation	Long press the button to turn on or off the smoke exhaust function of the interconnected insufflator.
Light Switch	Long press the button to stop the interconnected light source from emitting light or turn on the brightness automatic adjustment.
Image Flip	Long press the button to switch the image flip mode.
No Function	Long-press of the button will not activate any function.

5.5.2 Setting Button Functions

To set the functions of the camera head buttons, follow the procedure below:

1. In the setup menu, select **Camera Head**.
2. On the **P Key** page, set the short-press function and long-press function of the P button.
3. On the **W Key** page, set the short-press function and long-press function of the W button.
4. On the **M Key** page, set the short-press function and long-press function of the M button.
5. If the short-press function is set to **Image Zoom**, set **Image Zoom Selection** as needed.
6. If the short-press or long-press function is set to **Tone Enhancement**, set **Tone Enhancement Mode Selection** as needed.

5.6 Setting Recording Function

Select the Setup button  on the main screen to access the setup menu. Select the **REC** tab. On this tab, you can set recording or screenshot function, or format USB drives.

5.6.1 Setting Recording Function

To set the recording function, follow the procedure below:

1. In the setup menu, select **REC** → **REC Setup**.
2. Set **Storage Location**.
 - ◆ **Internal Recorder:** Videos and images are saved to USB drives by default.
 - ◆ **External Recorder:** Videos and images are saved to the external video recorder.
 - ◆ **Internal&External Recorder:** Videos and images are saved to USB drives and the external video recorder at the same time.
3. Select **Video Segment** to set the size of each video saved to USB drives.
4. Select **Video Quality** to set the quality of the videos saved to USB drives.
 - ◆ **4K HQ:** Record video at 120 Mbps.
 - ◆ **4K SQ:** Record video at 60 Mbps.
 - ◆ **HD HQ:** Record video at 40 Mbps.
 - ◆ **HD SQ:** Record video at 20 Mbps.
5. Select **Record Color Depth** to set the color depth of the video on USB drives to 8 bit or 10 bit.

5.6.2 Setting Freezing Time After Taking Photos

To set the freezing time of image after taking photos, follow the procedure below:

1. In the setup menu, select **REC** → **Photo Setting**.
2. Set **Time Of Preview** to select the length of time the thumbnail remains on the monitor after a photo is taken.

5.6.3 Formatting USB Drive

To format a USB drive, follow the procedure below:

1. In the setup menu, select **REC** → **Format**.
2. Select **Format** next to **USB(1)** or **USB(2)** to start formatting.

If no USB drive is connected or the USB drive is not compatible, **Format** is unavailable. Replace the USB drive if necessary.

CAUTION

- **Formatting a USB drive will clear all data stored in it. Make sure a backup of data you need is made.**
-

NOTE

- **Only one USB drive can be formatted at a time.**
-

5.7 Changing System Settings

Select the Setup button  on the main screen to access the setup menu. Select the **System** tab. On this tab, you can set the general information and output format.

5.7.1 Setting General Information

General system information includes logo display, lock screen function, system language, system time, and version information. To set these information, follow the operations below.

5.7.1.1 Setting Logo Display

To set the main screen display, follow the procedure below:

1. In the setup menu, select **System** → **General Setup**.
2. Switch on or switch off **Logo**.
 - ◆ If it is switched on, the manufacturer logo is displayed on the top left of the monitor.
 - ◆ If it is switched off, the manufacturer logo will not be displayed on the monitor.

5.7.1.2 Setting Lock Screen Function

To set the lock screen function, follow the procedure below:

1. In the setup menu, select **System** → **General Setup**.
2. Switch on or switch off **Screen Lock Function**.
 - ◆ If it is switched on, the lock screen function is enabled. When this function is enabled, the touchscreen will be locked automatically if no operation is detected in one minute.
 - ◆ If it is switched off, the screen will not be locked.

5.7.1.3 Setting Image Zoom Threshold

To set the image zoom threshold, follow the procedure below:

1. In the setup menu, select **System** → **General Setup**.
2. Set **Image Zoom Threshold** to 2.0x or 3.0x.

After setting, the threshold of **Image Zoom** on the **Display** tab is changed. When you zoom in on a photo, the magnification will not change when the threshold is reached.

5.7.1.4 Setting System Language

To set the system language, follow the procedure below:

1. In the setup menu, select **System** → **General Setup**.
2. Select **Setup** on the right side of **Language&Date&Time** to access the **Language&Date&Time** screen.
3. Set **Language**. Select the current language and all the languages the system currently provide are displayed. Select the target language.
4. Restart the system for the settings to take effect.

5.7.1.5 Setting System Time

To set the system time, follow the procedure below:

1. In the setup menu, select **System** → **General Setup**.
2. Select **Setup** on the right side of **Language&Date&Time** to access the **Language&Date&Time** screen.
3. Set **System Date** and **System Time**. Select the edit button  and enter the current date and time.

NOTE

- **Before using the system, check that the system time is consistent with your local time.**
-

5.7.1.6 Checking Version Information

To check the software version of the system, follow the procedure below:

1. In the setup menu, select **System** → **General Setup**.
2. The software version is displayed on the right of **Version**.

5.7.2 Setting Device Interconnection Function

To set the interconnection functions, follow the procedure below:

1. In the setup menu, select **System** → **Device Connect**.
2. Switch on or switch off **Smart Light**.
 - ◆ If it is switched on, when the white balance is started, the interconnected light source begins emitting light and quickly adjusts the brightness to a proper level. When you press any other camera head button, the light source begins emitting light as well. The light source will be illuminated slowly to minimize damage to the operator's eyes.

- ◆ If it is switched off, when the white balance is started, settings of the interconnected light source remains unchanged.
3. Switch on or switch off **Interconnection**.
 - ◆ If it is switched on, the monitor screen displays relative parameters and measurement values transmitted by interconnected devices.
 - ◆ If it is switched off, no parameters or values are displayed on the monitor screen.
 4. After **Interconnection** is switched on, select **Setup** on the right side of **Interconnection Param** to access the **Interconnection Param Setup** screen.
 5. Set the following switches to select parameters and values displayed on the monitor screen.

Menu Item	Description
Insufflator Param	If it is switched on, the monitor screen displays the pressure and flow volume values transmitted by the interconnected Mindray Animal Medical insufflator. If it is switched off, the measurement values transmitted from the interconnected Mindray Animal Medical insufflator are not displayed on the monitor screen.
Display Set Param	If it is switched on, the monitor screen displays the parameters configured on the interconnected Mindray Animal Medical devices. If it is switched off, configured parameters are not displayed on the monitor screen. Only the measurement values are displayed.

5.7.3 Setting Output Format

To set the video output format, follow the procedure below:

1. In the setup menu, select **System** → **Output Format**.
2. Set **HDMI 1**, **HDMI 2**, **SDI** and **DVI**. For detailed introduction of the connectors, refer to **2.7.2 Back View of the CCU**.
 - ◆ Set **Resolution** to select 4K or HD format for the video output from the corresponding connector.
 - ◆ Set **Color Gamut** to select video gamut parameter for the corresponding connector.
3. Select **Output Frequency** to set the video output frequency to 50Hz or 60Hz.
4. Set **Resolution** to select detailed resolution for 4K format.

6 Troubleshooting

This chapter lists the problems that are likely to occur and their possible solutions. If a problem persists after corrective actions have been taken, contact the Customer Service Department or your local distributor.

CAUTION

- **In case of any abnormality, remove the equipment from use immediately. Otherwise, injury to the animal or operator or damage to the equipment might result.**
-

Symptom	Possible Cause	Attemptable Solution
The equipment does not power up.	The equipment is not properly connected to the AC Mains.	Check the connection of the power cord. Replug the power cord and restart the equipment.
There is abnormal sound during operation.	The equipment is not horizontally placed.	Check if the equipment is properly placed on a horizontal surface.
	Objects stacked on the equipment are too heavy.	Do not stack on the equipment.
The monitor screen blurs.	The video cable is not properly connected.	Check the connection of video cable. Reconnect the cable.
	The camera head cable is not properly connected.	Check the connection of camera head cable. Reconnect the cable.
White balance fails.	The white balance button is not correctly pressed.	Press the white balance button and check if white balance is correctly performed.
There is no image displayed on the monitor.	The monitor is not turned on.	Check if the monitor is on.
	The devices in the system are not properly connected.	Check the connection between the camera head and CCU, and then the CCU and monitor. Turn off and then restart the system.
	Incorrect monitor signal source is selected.	Select a correct signal source.

Symptom	Possible Cause	Attemptable Solution
The external video recorder cannot be properly started and paused.	The recorder is not properly connected.	Check the connection between the external video recorder and CCU. Turn off and then restart the system.
The color of the displayed image deviates.	White balance is not properly performed.	Perform white balance correctly.
	The user configuration is not correctly selected.	Select the correct user configuration.
	The image setting is not appropriate.	Check the image setting.
The image displayed blurs.	The camera head is not correctly focused.	Rotate the focusing ring on the camera head to focus.
	The tip of endoscope is contaminated by blood, mucus, or tissue fragments.	Withdraw the endoscope from the animal carefully and remove the residuals.
The image displayed is too bright or dark.	The brightness and contrast of the monitor is inappropriate.	Adjust the brightness and contrast of the monitor following its instructions for use.
	The brightness setting of the CCU is inappropriate.	Adjust the brightness of the CCU by referring to 4.9 Adjusting Image Brightness .
	The light source is not properly connected.	Properly connect the light source and adjust the brightness of the light source.
	The brightness setting of the light source is inappropriate.	Set the brightness of the light source following its instructions for use.
	The light cable is broken.	Check the light cable. In case of damage, replace it with a new one.
The image is not displayed in the center.	The endoscope is not properly connected.	Disassemble the endoscope from the camera head, and reassemble them.
Image is disturbed when using an ESU.	The system is interfered by the ESU.	Keep the cable that connects the ESU away from the system as much as possible.
Video recording fails.	The USB drive is damaged.	Check the status of USB drive on the screen of the CCU. Make sure it is ready for use.
	The USB drive is out of memory.	

Symptom	Possible Cause	Attemptable Solution
There is no response when the camera head buttons are pressed.	The camera head cable is not properly connected.	Check the connection of camera head cable. Reconnect the cable.
	The settings of the camera head buttons are not appropriate.	Set the camera head buttons by referring to 5.5 Setting Camera Head Functions .

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7 Cleaning, Disinfection, and Sterilization

7.1 Overview

This chapter describes how to clean and disinfect the CCU and camera head, as well as how to sterilize the camera head.

The CCU and the camera head are not intended to come into contact with animals. Thus, they are not disinfected before leaving the factory. Clean and disinfect the camera head before the first use and after each use. Clean and disinfect the CCU as needed. In areas with severe environmental pollution or sandy winds, increase the cleaning frequency.

Do not sterilize the CCU. For sterilization of the camera head, refer to **7.4.5 Sterilizing the Camera Head**.

For the cleaning and disinfection of accessories and connected equipment, refer to their instructions for use.

7.2 Safety Information About Cleaning and Disinfection

WARNING

- **Cleaning, disinfection, and sterilization of the equipment may induce risks of infection. Follow the requirements in this chapter or the instructions of the cleaning, disinfection, and sterilization procedure of the hospital.**
 - **Mindray Animal Medical is not liable for the efficacy of the listed chemicals or methods as a means for controlling infection. For the method to control infection, consult your hospital's infection control officer or epidemiologist.**
 - **Wear appropriate protective equipment, for example eye protection and gloves, during cleaning, disinfection, or sterilization.**
-

CAUTION

- **Use only cleansers, disinfectants and sterilization methods specified in this chapter. Using unapproved substances or methods may damage the equipment and void the warranty.**
 - **Dilute and use the detergents in accordance with the instructions of their manufacturers.**
 - **Do not use mixed detergents for cleaning, disinfection or sterilization. Otherwise, damage or injury could result.**
-

- **Turn off the equipment and disconnect the power cord before cleaning. Otherwise, electric shock or damage to equipment could result.**
 - **Remove any fragments of body tissue on the equipment, if any, to avoid possible cross infection.**
 - **Never use hard or abrasive materials to wipe the equipment. It may cause damage to the surface of the equipment.**
 - **Any contact of cleansers or disinfectants with connectors or metal parts may cause corrosion. Avoid such parts during cleaning and disinfection.**
 - **Make sure there is no liquid residues at the electrical connectors of the equipment or accessories before use.**
 - **Do not pour liquid on the equipment or let any liquid enter the interior of the equipment.**
 - **If liquid is spilled on the equipment, disconnect the power supply, dry the equipment and contact the Customer Service Department or your local distributor.**
 - **Check the equipment after cleaning and disinfection. If there is any sign of aging or damage, remove it from use immediately.**
 - **Dry the equipment completely after cleaning and disinfection, especially before next use. Otherwise, there might be risks of electric shock.**
 - **Never immerse the equipment or accessories in liquids.**
-

7.3 Cleaning and Disinfection of the CCU

7.3.1 Cleaning the CCU

Before cleaning, consult the local or your hospital's regulations for cleaning of the equipment. To clean the equipment, follow this procedure:

1. Turn off the system and disconnect the power cord.
2. Disconnect the camera head from the CCU.
3. Use a lint-free cloth dampened with purified water to clean the surface of the equipment.
4. Wipe off the excess water from the surface with a dry lint-free cloth and place the equipment in a well-ventilated, cool environment to air dry.

CAUTION

- **Do not let any liquid enter the interior of the equipment.**
-

7.3.2 Disinfecting the CCU

Disinfect the equipment as required in the local or your hospital's servicing schedule. Clean the equipment before disinfection. Dilute and use the disinfectants in accordance with the instructions of use provided by their manufacturers. Use only the disinfectants recommended in this chapter for disinfection.

The following table lists the recommended disinfectants for the main unit:

Product Name	Manufacturer
Alpet® D2 Surface Sanitizing Wipes	BEST SANITIZERS INC™
CIDEX® OPA	Gilag GmbH International Advanced Sterilization products
Isopropanol, 70%	/
Metrex CaviWipes™	METERX® RESEARCH
PDI Sani-Cloth® Plus Germicidal Disposable Cloth	PDI Inc.
PDI Super Sani-Cloth® Germicidal Disposable Wipe	PDI Inc.
Sodium hypochlorite bleach, 0.5%	/
HEALTH ESSENCE Disinfecting Effervescent Tablets	Beijing ChangJiangMai Medical Science Technology Co. Ltd.
HEALTH ESSENCE Surface Disinfectant	Beijing ChangJiangMai Medical Science Technology Co. Ltd.
Health Essence Bis-QACs Disinfectant	Beijing ChangJiangMai Medical Science Technology Co. Ltd.
Dian'erkang Surface Wipes	Shanghai Likang Disinfectant Hi-Tech Co., Ltd
Dian'erkang Surface Disinfectant	Shanghai Likang Disinfectant Hi-Tech Co., Ltd
Dian'erkang Spray Disinfectant	Shanghai Likang Disinfectant Hi-Tech Co., Ltd
Ethanol, 75%	/
Clorox Dispatch® Hospital Cleaner Disinfectant Towels with Bleach	Clorox

NOTE

- **After disinfection, remove the detergent residue from the surface and dry the equipment.**
-

7.4 Cleaning, Disinfection and Sterilization of the Camera Head

After disconnecting the camera head from the CCU, follow the procedure below to reprocess the camera head:

1. Initial treatment
 2. Preparation Before Cleaning
 3. Cleaning
 4. Disinfection
 5. Sterilization
-

CAUTION

- **Before cleaning and disinfecting the camera head, apply the protection cover to the CCU connector of the camera head, and remove the cover before sterilization. Otherwise, contaminations might get inside the connector.**
-

7.4.1 Initial Treatment at the Point of Use

Immediately after surgery, remove the blood, mucus, and protein residues from the surface of the camera head with running water, or with a lint-free cloth soaked with purified water. In this way, prevent the residues from coagulating and forming stubborn stains, affecting subsequent use.

7.4.2 Preparation Before Cleaning

You are advised to use the following cleansers of which the efficacy has been tested to clean the camera head:

- Water
- Dr. Weigert neodisher® Medizym

7.4.2.1 Pretreatment

Clean all surfaces of the camera head with a lint-free cloth soaked with purified water.

7.4.2.2 Flushing

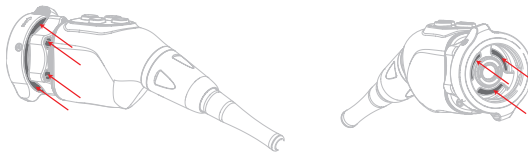
Flush the camera head with running water for 1 minute to remove contaminations from the equipment surface.

7.4.3 Cleaning the Camera Head

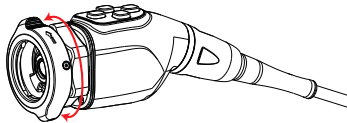
7.4.3.1 Washing

To wash the camera head, follow the procedure below:

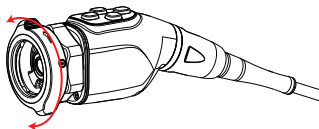
1. Fully immerse the camera head as well as its cable and connector in enzyme-containing cleanser. For requirements about immersing time, temperature, and concentration, refer to the instructions for use of the cleanser.
2. Use a syringe with a volume of at least 10 mL to aspirate the enzyme-containing cleanser and thoroughly wash the equipment parts with complex structures, such as screw threads and gaps, as shown in the following figure. Repeat this step 3 times.



3. While immersing the camera head, use a lint-free cloth or soft cleaning brush to clean all accessible surfaces for 1 to 2 minute until no residue remains.
4. In the cleanser solution, rotate the focusing ring of the camera head 3 times, as shown in the following figure:



5. In the cleanser solution, rotate the endoscope coupler of the camera head 3 times, as shown in the following figure:



7.4.3.2 Rinsing

After preliminary cleaning, follow the procedure below to rinse the camera head:

1. Thoroughly rinse the camera head with running water.
2. Wipe all accessible surfaces of the camera head with a lint-free cloth under the running water. Repeat this step 3 times.

3. Under the running water, rotate the focusing ring and endoscope coupler of the camera head 3 times by referring to the figures in **7.4.3.1 Washing**.
4. Flush the equipment parts with complex structures, such as screw threads and gaps, with a syringe with a volume of at least 10 mL. Repeat this step 3 times.

NOTE

- **For rinsing, use purified water.**
- **Do not use water for rinsing repeatedly.**

7.4.3.3 Drying

Dry the outer surfaces of the camera head with a disinfected lint-free cloth, and dry the equipment parts with complex structures by using an air gun.

7.4.4 Disinfecting the Camera Head

Disinfect the camera head as required in the local or your hospital's servicing schedule. Use the disinfectants in accordance with the instructions of use provided by their manufacturers. Use only the disinfectants recommended in this chapter for disinfection.

The following table lists the recommended disinfectants for the camera head:

Product Name	Disinfection Method
Ethanol, 75%	Wiping
Glutaraldehyde, 2% - 2.5%	Immersing

NOTE

- **In case the high-level disinfection required by your hospital or local regulations needs to be achieved, select the glutaraldehyde immersion disinfection method.**
- **Do not disinfect the camera head with ultraviolet light, long time exposure to which may cause damage to the imaging element of the camera head.**

7.4.4.1 Rinsing After Disinfection

After immersing the camera head in glutaraldehyde for disinfection, follow the procedure below to rinse the camera head:

1. After disinfection, immerse the camera head in a sterile container filled with rinsing water.
2. In the container, wipe the outer surfaces of the camera head with a sterile lint-free cloth.
3. Under the running water, rotate the focusing ring and endoscope coupler of the camera head 3 times by referring to the figures in **7.4.3.1 Washing**.

4. Repeat step 1 to step 3 three times. Change the rinsing water each time.
5. Take out the camera head and place it in another sterile container.
6. Dry the outer surfaces of the camera head with a disinfected lint-free cloth, and dry the equipment parts with complex structures by using an air gun.

NOTE

- **After cleaning and disinfection, check the equipment surface for stains. Repeat the cleaning and disinfection procedure if necessary.**

7.4.5 Sterilizing the Camera Head

Sterilize the camera head as required in the local or your hospital's servicing schedule. The camera head can withstand ethylene oxide (EO) sterilization and low temperature plasma sterilization.

WARNING

- **Use one of the recommended methods consistently on the same equipment. Using different sterilization methods may change equipment appearance.**

7.4.5.1 Packaging

Place the camera head in a proper container and double wrap the container with sterile sheet, preventing equipment contamination during storage and transportation.

Recommended specifications of the sterile sheet are as follows:

Dimension	Gram Weight	Materials
1.2m x 1.2m	45g	100% polypropylene, 5-layer SMMMS laminates

7.4.5.2 EO Sterilization

To sterilize the camera head, follow this procedure:

1. Clean and disinfect the camera head and its cable as instructed in the previous sections.
2. Place the packaged container into the sterilizer.
3. Sterilize the equipment following the instructions for use of the sterilizer. You are advised to apply the following EO sterilization parameters that have been tested:

EO Concentration	Temperature	Relative Humidity	Sterilization Time
About 760 mg/L	55°C	40% - 85%	60min

4. To ensure the EO residues remain at a level that does no harm to the human body, the sterilized equipment should go through a 12-hour resolution or longer in a well-ventilated room at 55°C before reuse.

7.4.6 Low Temperature Plasma Sterilization

Validate the sterilization procedure of the low temperature hydrogen-peroxide plasma sterilizer in accordance with the operating instructions of the sterilizer.

To perform low temperature plasma sterilization, follow the procedure below:

1. Clean and disinfect the camera head and its cable as instructed in the previous sections.
2. Place the container into the sterilizer, and ensure:
 - ◆ The container is adequately exposed in the hydrogen peroxide plasma.
 - ◆ Do not allow any object to contact the inner sides of the sterilizer.
3. Sterilize the equipment following the instructions for use of the sterilizer. You are advised to use the following low temperature hydrogen peroxide plasma sterilizer that has been tested:

Manufacturer	Product	Cycle Mode
Advanced Sterilization Products (ASP)	STERRAD™ 100NX Sterilizer with ALLClear™ Technology	Standard circulation (Full period)

After sterilization, cool the equipment down to room temperature before use. If not, the lens might fog or the camera head be damaged.

CAUTION

- **Without compromising the efficacy of sterilization, select a method that would least corrode the camera head.**
- **Make sure the camera head works normally before use. In case of any damage, remove it from use immediately, or animal or operator injury might result.**

NOTE

- **After long time of sterilization, the color of part of the camera head might fade. It is natural and will not affect the sealability or performance of the camera head.**
-

7.5 Consequences Caused by Inappropriate Cleaning, Disinfection and Sterilization

Using detergents or methods other than those recommended might cause the following consequences:

- Color change on the surface of the equipment
- Corrosion of metal parts
- Cracks or distortion of cords, connectors and the housing of the equipment
- Reduced service life of cords
- Degradation of performance
- Equipment malfunction

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8 Maintenance

8.1 Overview

The performance of the equipment might degrade over time. To ensure the normal functioning, it is required to perform periodical maintenance and service.

8.2 Safety Information About Maintenance

CAUTION

- **Follow the maintenance and testing schedule or local regulations to perform testing and maintenance. Not implementing the maintenance schedule may cause equipment failure and possible health hazards.**
 - **Installation, maintenance or upgrading of the equipment can only be conducted by service personnel trained and authorized by Mindray Animal Medical.**
 - **No modification of this equipment is allowed. All safety checks or maintenance involving any disassembly of the equipment should be performed by professional service personnel. Otherwise, undue equipment failure and possible health hazards could result.**
 - **This equipment contains no user serviceable parts. In case of any equipment failure, contact the Customer Service Department or your local distributor.**
 - **The service personnel must be properly qualified and thoroughly familiar with the operation of the equipment.**
-

NOTE

- **If needed, contact the Customer Service Department or your local distributor for circuit diagrams, component part lists, calibration instructions, or other information concerning the repair of the equipment.**
-

8.3 Maintenance Schedule

Follow the maintenance schedule or local regulations to perform the maintenance. Make sure to clean and disinfect the equipment before taking any test or maintenance.

It is recommended that comprehensive maintenance be conducted by professionals annually and if service is needed, please contact the Customer Service Department or your local distributor.

8.3.1 Performing Visual Inspection

An appearance inspection should be performed every week. In case of any damage or abnormality, remove the equipment from use immediately and contact the hospital's equipment manager or the Customer Service Department or your local distributor.

Make sure that the following items pass the inspection:

- The environment and power supply meet the requirements, and there is no condensation.
- There is not any stain on the outside of the equipment or crack or damage on the screen, and that the labels are properly affixed, intact and legible.
- The camera head and all cords are intact.
- Cords are securely connected with the equipment.
- Connectors or plugs are not loose, distorted, damaged, contaminated, or blocked.
- No irrelevant objects are on top of the equipment. The ventilation outlet is not covered by dust or other objects.
- The image is displayed normally on the monitor after the system is started.

8.3.2 Performing Electrical Safety Tests

You are advised to perform electrical safety tests annually or as needed. The test items shall be conducted as required by IEC 60601-1. Electrical safety tests shall be conducted by qualified service personnel authorized by Mindray Animal Medical.

8.4 Factory Maintenance

This menu is password-protected and only available for service personnel authorized by Mindray Animal Medical.

8.5 Disposal

At the end of its service life, the equipment, as well as the accessories, must be disposed of in compliance with the local or hospital's guidelines regulating the disposal of such products. Clean and disinfect the equipment and accessories before disposal.

9 Accessories

The accessories listed in this chapter comply with the requirements of IEC 60601-1-2 when in use with the system.

WARNING

- **Use accessories specified by Mindray Animal Medical. Using other accessories may cause damage to the system or failure to meet the claimed specifications.**
 - **The accessories listed below must be used with this equipment. Read this manual and the instructions for use of the accessories before using the equipment. Contact the Customer Service Department or your local distributor for the compatibility between the equipment and the accessories if you have any problems. Otherwise, animal injury or equipment damage might result.**
-

CAUTION

- **The accessories may not meet the performance specifications if stored or used outside the specified temperature and humidity ranges. If the performance of the accessories is degraded due to aging or environmental conditions, contact the Customer Service Department or your local distributor.**
 - **Check if the accessories and their packages are intact. Do not use them if any damage is detected.**
 - **Use the accessories before the expiry date.**
-

Power Cable
Ground Cable
12G-SDI Cable (1.5m)
12G-SDI Cable (10m)
HDMI Cable (HDMI2.0, 1.5m)
DVI Cable (1.5m)

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A Product Specifications

A.1 Safety Specifications

The device is classified, according to IEC 60601-1:

Type of protection against electrical shock	Class I equipment
Degree of protection against electrical shock	TYPE CF APPLIED PART
Protection against harmful ingress of water	Camera head: IPX7
Recommended methods of disinfection and sterilization	As recommended by the manufacturer
Degree of safety of application in the presence of flammable anesthetic mixture with air or with oxygen or nitrous oxide	The equipment is not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide
Mode of operation	Continuous operation
If the equipment protects against the effects of the discharge of a cardiac defibrillator	Yes
Installation type	Non-permanently installed equipment

A.2 Environmental Specifications

Item	Temperature (°C)	Relative Humidity (Non-condensing)	Barometric (kPa)
Operating condition	0 - 35	30% - 85%	70.0 - 106.0
Storage condition	-20 - 60	30% - 95%	70.0 - 106.0
Transportation condition	-20 - 60	30% - 95%	70.0 - 106.0

CAUTION

- **Use the equipment only in environment that meets the specific requirements. Otherwise, the equipment may not meet the performance specifications or unexpected consequences, e.g. damage to the equipment, could result. If the performance of the equipment is degraded due to aging or environmental conditions, contact the Customer Service Department or your local distributor.**
-

A.3 Power Supply Specifications

Working power supply	100-240VAC ($\pm 10\%$), 50/60 Hz (± 3 Hz)
Input power	360 VA

A.4 Physical Specifications

Dimensions (CCU)	Depth: 380 ± 5 mm Width: 350 ± 5 mm Height: 80 ± 5 mm (excluding the rubber feet)
Length (camera head, excluding the cable)	White light camera head: ≤ 131 mm
Weight	CCU: ≤ 10 kg White light camera head (excluding the cable): ≤ 190 g

A.5 Hardware Specifications

Display type (CCU)	Touchscreen
Display size (CCU)	7.8 inches
Signal output	3 4K channels and 2 HD channels
Diameter of eyepiece cup connector	$\phi 31.75, \pm 0.10$ mm

A.6 Input/Output Interfaces

Interface	Quantity	Description
USB connector	3	USB connector 1 and 2: supporting USB 3.0 protocol USB connector 3: supporting USB 2.0 protocol Fixed time synchronization pulse specified by the USB protocol
Network connector	2	RJ45 standard interface Network connector 1: reserved, supporting 1000BASE-TX protocol Network connector 2: supporting 100BASE-TX protocol Calibration protocol of TCP/IP
CAN connector	2	PS/2 interfaces, supporting CAN protocol
SDI connector	1	Used for 4K or 1080P HD video output, supporting 3G SDI and 12 G SDI protocols
HDMI connector		HDMI out 1 and 2: used for 4K video output
DVI connector	1	Used for 1080P HD video output, supporting DVI protocol
Power socket	1	Connecting the AC Mains
MSB connector	1	Supporting serial communication protocol
External control extension connector	1	Supporting level control; connecting external video recorders

A.7 Monitor Specifications

Interface type	12G-SDI or HDMI2.0 4K monitors selectable Compatible with DVI and 3G-SDI HD monitors
Resolution	3840*2160 or 4096*2160 pixels
Refresh rate	50/60 Hz

A.8 Product Performance

Image transfer pixels	3840*2160 or 4096*2160 ultra high definition
-----------------------	--

Equipment noise	≤ 55 dBA
Defibrillation recovery time	1s

A.9 Operating Environment

Hardware configuration	CPU: 500 MHz RAM: 2 Gb Flash: 4 GB
Software environment	LINUX
Processor Architecture	ARM

NOTE: The above is the minimum requirements of operating environment.

B EMC

B.1 EMC

The device complies with the EMC standard IEC 60601-1-2:2014+A1:2020.

WARNING

- **The use of unapproved accessories may diminish device performance.**
 - **Use of components, accessories, probes, and cables other than those specified may result in increased emission or decreased immunity of device.**
 - **The device needs special precautions regarding EMC and needs to be installed and put into service according to the EMC information provided below.**
 - **Use of this equipment adjacent to or stacked with other equipment should be avoided because it could result in improper operation. If such use is necessary, this equipment and the other equipment should be observed to verify that they are operating normally.**
 - **Use of accessories, transducers and cables other than those specified or provided by the manufacturer of this equipment could result in increased electromagnetic emissions or decreased electromagnetic immunity of this equipment and result in improper operation.**
 - **Portable RF communications equipment (including peripherals such as antenna cables and external antennas) should be used no closer than 30 cm (12 inches) to any part of the device, including cables specified by the manufacturer. Otherwise, degradation of the performance of this equipment could result.**
 - **Other devices may interfere with this equipment even though they meet the requirements of CISPR.**
 - **Use of portable or mobile communications devices can degrade the performance of the equipment.**
-

If the device is operated within the electromagnetic environment listed in TABLE EMC-2, EMC-3 and TABLE EMC-4, the device will remain safe and will provide the following basic performances:

- Image Display
- Running Status
- Image quality
- Accessory Identification

■ Data Storage

TABLE EMC-1

GUIDANCE AND MINDRAY ANIMAL MEDICAL DECLARATION—ELECTROMAGNETIC EMISSIONS		
The device is intended for use in the electromagnetic environment specified below. The customer or the user of device should assure that it is used in such an environment.		
EMISSIONS TEST	COMPLIANCE	ELECTROMAGNETIC ENVIROMENT – GUIDANCE
RF emissions CISPR 11	Group 1	The device 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 CISPR 11	Class A	The device is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Not applicable	
Voltage fluctuations/ Flicker emissions IEC 61000-3-3	Not applicable	

TABLE EMC-2

GUIDANCE AND MINDRAY ANIMAL MEDICAL DECLARATION—ELECTROMAGNETIC IMMUNITY			
The device is intended for use in the electromagnetic environment specified below. The customer or the user of device should assure that it is used in such an environment.			
IMMUNITY TEST	IEC 60601 TEST LEVEL	COMPLIANCE LEVEL	ELECTROMAGNETIC ENVIROMENT - GUIDANCE
Electrostatic discharge (ESD) IEC 61000-4-2	±8 kV contact ±2 kV, ±4 kV, ±8 kV, ±15 kV air	±8 kV contact ±2 kV, ±4 kV, ±8 kV, ±15 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst IEC 61000-4-4	±2 kV for power supply lines; ±1 kV for input/output lines	±2 kV for power supply lines; ±1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±0.5 kV, ±1 kV line(s) to line(s); ±0.5 kV, ±1 kV, ±2 kV line(s) to earth	±0.5 kV, ±1 kV line(s) to line(s); ±0.5 kV, ±1 kV, ±2 kV line(s) to earth	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, Short interruptions and voltage variation on power supply input voltage IEC 61000-4-11	0 % U_T ; 0.5 cycle At 0°, 45°, 90°, 135°, 180°, 225°, 270° and 315° 0 % U_T ; 1 cycle 70% U_T for 25/30 cycle at 0° 0 % U_T ; 250/300 cycle	0 % U_T ; 0.5 cycle At 0°, 45°, 90°, 135°, 180°, 225°, 270° and 315° 0 % U_T ; 1 cycle 70% U_T for 25/30 cycle at 0° 0 % U_T ; 250/300 cycle	Mains power quality should be that of a typical commercial or hospital environment. If you require continued operation during power mains interruptions, it is recommended that our product be powered from an uninterruptible power supply or a battery.
Power frequency (50/60 HZ) magnetic field IEC 61000-4-8	30 A/m	30 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
NOTE: U_T is the A.C. mains voltage prior to application of the test level.			

TABLE EMC-3

GUIDANCE AND MINDRAY ANIMAL MEDICAL DECLARATION—ELECTROMAGNETIC IMMUNITY			
The device is intended for use in the electromagnetic environment specified below. The customer or the user of device should assure that it is used in such an environment.			
IMMUNITY TEST	IEC 60601 TEST LEVEL	COMPLIANCE LEVEL	ELECTROMAGNETIC ENVIROMENT – GUIDANCE
Conducted RF IEC 61000-4-6	3 Vrms 0.15 MHz – 80 MHz 6 Vrms in ISM bands ^a between 0.15 MHz and 80 MHz	3 Vrms 0.15 MHz – 80 MHz 6 Vrms in ISM bands ^a between 0.15 MHz and 80 MHz	Portable and mobile RF communications equipment should be used no closer to any part of device, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended separation distance: $d = 1.2 \times \sqrt{P}$ $d = 2 \times \sqrt{P}$
Radiated RF IEC 61000-4-3	3 V/m 80MHz - 2.7GHz	3 V/m 80MHz - 2.7GHz	$d = 1.2 \times \sqrt{P}$ 80 MHz to 800 MHz $d = 2.3 \times \sqrt{P}$ 800 MHz to 2.7GHz Where, P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey^b, should be less than the compliance level in each frequency range^c. Interference may occur in the vicinity of equipment marked with the following symbol: 

Note 1: At 80 MHz and 800 MHz, the higher frequency range applies.

Note 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

^a: The ISM (industrial, scientific, and medical) bands between 150 kHz and 80 MHz are 6.765 MHz to 6.795 MHz; 13.553 MHz to 13.567 MHz; 26.957 MHz to 27.283 MHz; and 40.66 MHz to 40.70 MHz. The amateur radio bands between 0.15 MHz and 80 MHz are 1.8 MHz to 2.0 MHz, 3.5 MHz to 4.0 MHz, 5.3 MHz to 5.4 MHz, 7 MHz to 7.3 MHz, 10.1 MHz to 10.15 MHz, 14 MHz to 14.2 MHz, 18.07 MHz to 18.17 MHz, 21.0 MHz to 21.4 MHz, 24.89 MHz to 24.99 MHz, 28.0 MHz to 29.7 MHz and 50.0 MHz to 54.0 MHz.

^b: Field strengths from fixed transmitters, such as 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 RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the device is used exceeds the applicable RF compliance level above, the device should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the device.

^c: Over the frequency ranges 150 kHz to 80 MHz, field strengths should be less than 3V/m.

TABLE EMC-4

GUIDANCE AND MINDRAY ANIMAL MEDICAL DECLARATION—ELECTROMAGNETIC IMMUNITY

The device is intended for use in the electromagnetic environment specified below. The customer or the user of device should assure that it is used in such an environment.

IMMUNITY TEST	IEC 60601 TEST LEVEL	COMPLIANCE LEVEL	ELECTROMAGNETIC ENVIROMENT – GUIDANCE
Proximity magnetic fields IEC 61000-4-39	65 A/m 134.2 kHz Pulse modulation 2.1 kHz	65 A/m 134.2 kHz Pulse modulation 2.1 kHz	/
	7.5 A/m 13.56 MHz Pulse modulation 50 kHz	7.5 A/m 13.56 MHz Pulse modulation 50 kHz	

TABLE EMC-5- Test specifications and minimum distances

Recommended separation distances between portable and mobile RF communications equipment and the device						
The device is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the device can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the device as recommended below, according to the maximum output power of the communications equipment. Portable and mobile radio communications equipment (e.g. two-way radio, cellular/ cordless telephones and similar equipment) should be used no closer to any part of this device, including cables, than determined according to the following method:						
Test frequency (MHz)	Band(MHz)	Service	Modulation	Maximum power (W)	Distance (m)	Immunity test level (V/m)
385	380 - 390	TETRA 400	Pulse modulation 18 Hz	1.8	0.3	27
450	430 -470	GMRS 460 FRS 460	FM ± 5 kHz deviation 1 kHz sine	2	0.3	28
710	704 - 787	LTE Band 13,17	Pulse modulation 217 Hz	0.2	0.3	9
745						
780						
810	800 - 960	GSM 800/ 900, tetra 800, iDEN 820, CDMA 850, LTE Band 5	Pulse modulation 18 Hz	2	0.3	28
870						
930						

1720	1700 -1990	GSM 1800, CDMA 1900, GSM 1900, DECT, LTE Band 1, 3,4,25,UMTS	Pulse modulation 217 Hz	2	0.3	28
1845						
1970						
2450	2400 -2570	Bluetooth, WLAN, 802.11 b/g/ n, RFID 2450, LTE Band 7	Pulse modulation 217 Hz	2	0.3	28
5240	5100 -5800	WLAN, 802.11 a/n	Pulse modulation 217 Hz	0.2	0.3	9
5500						
5785						

TABLE EMC-6

RECOMMENDED SEPARATION DISTANCES BETWEEN PORTABLE AND MOBILE RF COMMUNICATION DEVICE AND THE DEVICE				
The device is intended for use in an electromagnetic environment in which radiated RF disturbance are controlled. The customer or the user of device can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communication equipment (transmitters) and device as recommended below, according to the maximum output power of the communication equipment.				
Rated Maximum Output Power of Transmitter Watts (W)	Separation Distance According to Frequency of Transmitter (m)			
	150 kHz - 80 MHz Out ISM bands $d = 1.2\sqrt{P}$	150kHz - 80MHz in ISM bands $d = 1.2\sqrt{P}$	80MHz-800MHz $d = 1.2\sqrt{P}$	800 MHz - 2.7 GHz $d = 2.3\sqrt{P}$
0.01	0.12	0.2	0.12	0.23
0.1	0.38	0.64	0.38	0.73
1	1.2	2	1.2	2.3
10	3.8	6.4	3.8	7.3
100	12	20	12	23
For transmitters at a maximum output power not listed above, the recommended separation distanced in meters (m) can be determined using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.				
Note1: At 80 MHz and 800 MHz, the higher frequency range applies.				
Note 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.				

C Abbreviations

Abbreviation	In Full
°	angle
A	ampere
ARM	Advanced RISC Machine
°C	centigrade
CAN	controller area network
cm	centimeter
CMOS	complementary metal oxide semiconductor
dBA	A-weighted decibels
DVI	digital video interface
EMC	electromagnetic compatibility
EO	ethylene oxide
ESU	electrosurgery unit
g	gram
Gb	gigabit
GB	gigabyte
GHz	gigahertz
h	hour
HF	high frequency
Hz	hertz
k	kilo-
kg	kilogram
kHz	kilohertz
kPa	kilopascal
kV	kilovolt
L	litre

Abbreviation	In Full
LED	light-emitting diode
lx	illuminance
m	meter
MHz	megahertz
min	minute
ml	milliliter
mm	millimeter
mmHg	millimeter of mercury
MR	magnetic resonance
MRI	magnetic resonance imaging
MSB	Mindray serial bus
nm	nanometer
s	second
SDI	serial digital interface
USB	universal serial bus
V	volt
VA	volt ampere
VAC	volt alternating current
Ω	ohm
μA	microampere
μm	micrometer
μV	microvolt
W	watt

