CEREC Radio Device

Operating Instructions
# Table of contents

1 General data ........................................................................................................... 4  
1.1 Dear Customer,............................................................................................ 4  
1.2 Contact information...................................................................................... 4  
1.3 General information about this operating manual........................................ 5  
1.4 Structure of the document............................................................................ 5  
  1.4.1 Identification of the danger levels .................................................. 5  
  1.4.2 Formats and symbols used............................................................ 5  
2 Safety instructions .................................................................................................. 7  
2.1 Important information for the user................................................................ 7  
2.2 FCC and IC declarations.............................................................................. 8  
2.3 EC Declaration of Conformity ...................................................................... 10  
3 Product description ................................................................................................. 11  
3.1 Main components of the product.................................................................. 11  
  3.1.1 Controls.......................................................................................... 11  
  3.1.2 LED displays.................................................................................. 12  
4 Technical data ........................................................................................................ 13  
5 System description ................................................................................................. 14  
  5.1 CEREC system ........................................................................................ 14  
  5.2 System components .................................................................................... 14  
  5.3 Main function................................................................................................ 16  
  5.4 Network unit............................................................................................... 16  
6 Networking.............................................................................................................. 18  
  6.1 CEREC Radio Device network overview .................................................... 18  
  6.2 Creating a network....................................................................................... 18  
    6.2.1 Creation ......................................................................................... 18  
    6.2.2 Isolated network unit................................................................. 19  
    6.2.3 Permanent network....................................................................... 19  
    6.2.4 Installation.................................................................................... 19  
    6.2.5 Maximum size................................................................................ 19  
  6.3 Network creation failures ............................................................................. 19  
    6.3.1 Isolated network unit................................................................. 19  
    6.3.2 Multiple networks created .......................................................... 19
# Table of contents

6.4 Extending the network ................................................................. 21
   6.4.1 Adding a new network unit .................................................. 21
   6.4.2 Reducing the network ......................................................... 21
6.5 Resetting to factory defaults ....................................................... 21
6.6 Network unit states ................................................................. 22
   6.6.1 State definitions ............................................................... 22
   6.6.2 Transitions between states ................................................ 23
6.7 Radio characteristics .............................................................. 24
   6.7.1 Frequency spectrum .......................................................... 24
   6.7.2 Channel control ............................................................... 24
   6.7.3 Channel switching ............................................................ 24
7 Data transmission ........................................................................... 25
   7.1 Stationary data transmission .................................................. 25
   7.2 Network routing ................................................................. 26
   7.3 Multiple streams ............................................................... 27
   7.4 Simultaneous access ......................................................... 28
   7.5 Interrupted transmission ................................................... 29
   7.6 Increasing the range ............................................................ 30
8 Disposal ...................................................................................... 31
1 General data

1.1 Dear Customer,

Thank you for purchasing your CEREC Radio Device from Sirona. This CEREC Radio Device allows you to set up a wireless network for communication between acquisition units and milling units.

The CEREC Radio Device (REF 65 43 891 D3492) is a powerful, wireless 100 Base-T Ethernet transmission system, by means of which periphery devices can establish a wireless network, or which can access it via a cable network. The CEREC Radio Device works on the 2.4 GHz ISM frequency band and complies with FCC, IC, and EU regulations.

The CEREC Radio Device can be installed with ease and does not require any special drivers. It can be used with most computers and operating systems.

This equipment manual contains the technical data for the Radio Device and operating instructions.

Should problems arise during the course of installation, or when in operation, which cannot be resolved using the information in this equipment manual, please refer to your local dealer’s customer service department or to Sirona (see “Contact information”).

Improper use and handling can create hazards and cause damage. Please therefore read and follow these operating instructions carefully. Always keep them within easy reach.

Also pay attention to the safety instructions to prevent personal injury and material damage.

Your
CEREC Team

1.2 Contact information

Customer service center

For technical questions, use the contact form on the internet at the following address:
http://srvcontact.sirona.com

Customer service
Sirona Dental Systems Trading (Shanghai) Co., Ltd

Manufacturer's address
Sirona Dental Systems GmbH
Fabrikstrasse 31
64625 Bensheim
Germany

Tel.: +49 (0) 6251/16-0
Fax: +49 (0) 6251/16-2591
e-Mail: contact@dentsplysirona.com
www.dentsplysirona.com
1.3 General information about this operating manual

Observe the Operating Instructions

Please familiarize yourself with the unit by reading through these Operating Instructions before putting it into operation. It is essential that you comply with the specified warning and safety information.

Always keep the operating instructions handy in case you or another user require(s) information at a later point in time. Save the operating instructions on the PC or print them out.

If you sell the unit, make sure that the operating instructions are included with it either as a hard copy or on an electronic storage device so that the new owner can familiarize himself with its functions and the specified warning and safety information.

Online portal for technical documents

We have set up an online portal for the Technical Documents at http://www.dentsplysirona.com/manuals. There, you can download these operating instructions and further documents. Please complete the online form if you would like a hard copy of a particular document. We will then be happy to send you a printed copy free of charge.

Help

If you require additional help despite having thoroughly studied the Operating Instructions, please contact your dental depot.

1.4 Structure of the document

1.4.1 Identification of the danger levels

To prevent personal injury and material damage, please observe the warning and safety information provided in these operating instructions. Such information is highlighted as follows:

- **DANGER**
  An imminent danger that could result in serious bodily injury or death.

- **WARNING**
  A possibly dangerous situation that could result in serious bodily injury or death.

- **CAUTION**
  A possibly dangerous situation that could result in slight bodily injury.

- **NOTICE**
  A possibly harmful situation which could lead to damage of the product or an object in its environment.

- **IMPORTANT**
  Application instructions and other important information.

Tip: Information for simplifying work.

1.4.2 Formats and symbols used

The formats and symbols used in this document have the following meaning:
<table>
<thead>
<tr>
<th>✓ Prerequisite</th>
<th>Prompts you to do something.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. First action step</td>
<td></td>
</tr>
<tr>
<td>2. Second action step</td>
<td></td>
</tr>
<tr>
<td>or</td>
<td></td>
</tr>
<tr>
<td>➢ Alternative action</td>
<td></td>
</tr>
<tr>
<td>% Result</td>
<td></td>
</tr>
<tr>
<td>➢ Individual action step</td>
<td></td>
</tr>
</tbody>
</table>

See "Formats and symbols used [→ 5]"

Identifies a reference to another text passage and specifies its page number.

● List

Designates a list.

“Command / menu item”

Indicates commands, menu items or quotations.
2 Safety instructions

2.1 Important information for the user

The CEREC Radio Device does not require any maintenance or special care. Observe the following safety instructions:

Safety instructions

Do not operate the unit in the vicinity of strong electromagnetic fields.

Observe the operating temperature range specified in the section “Technical data [→ 13]”. Prevent overheating!

Protect the unit against moisture and dust.

Clean the unit using only a soft cloth and a mild cleaning agent. Do not use any water or liquid cleaning agents.

Do not insert any objects in the openings of the unit, unless this is explicitly instructed in this document. This could damage the unit.

Do not open the CEREC Radio Device! It does not contain any parts that could be serviced, replaced, or repaired by customers or by any unauthorized maintenance personnel.

Opening the unit can cause damage to the electrical components. In this case, proper functioning of the unit can no longer be guaranteed!
2.2 FCC and IC declarations

Compliance statement
This device complies with part 15 of the FCC Rules and to Industry Canada’s license-exempt RSSs.

Operation is subject to the following two conditions:
(1) this device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation.

Le présent appareil est conforme aux CNR d’Industrie Canada applicables aux appareils radio exemts de licence. L’exploitation est autorisée aux deux conditions suivantes :
(1) l’appareil ne doit pas produire de brouillage, et
(2) l’utilisateur de l’appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d’en compromettre le fonctionnement.

Warning
Changes or modifications not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.

This in particular is applicable for the antenna which has been delivered with the CEREC Radio Device.

RF Exposure
To comply with FCC RF exposure requirements for mobile transmitting devices, this transmitter should only be used or installed at locations where there is at least 20cm separation distance between the antenna and all persons.
Information to the User

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with Industry Canada ICES-003: CAN ICES-3 (B)/NMB-3(B).
# 2.3 EC Declaration of Conformity

## EC Declaration of Conformity

### Technical Documentation No: GC 116/3

<table>
<thead>
<tr>
<th>Manufacturer:</th>
<th>Sirona Dental Systems GmbH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address:</td>
<td>Fabrikstraße 31</td>
</tr>
<tr>
<td></td>
<td>64825 Bensheim</td>
</tr>
<tr>
<td></td>
<td>Germany</td>
</tr>
</tbody>
</table>

### Names of Radio Equipment:

<table>
<thead>
<tr>
<th>Product Identification:</th>
<th>CEREC Radio Device</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Ref. number)</td>
<td>6543601</td>
</tr>
<tr>
<td>(Type number)</td>
<td>D3492</td>
</tr>
<tr>
<td>(Batch/serial number)</td>
<td>10900 - 19999</td>
</tr>
</tbody>
</table>

This declaration of conformity is issued under the sole responsibility of the manufacturer.

We declare the compliance of the device concerned with the requirements of the Council Directive Radio Equipment Directive (RED) 2014/53/EU and in accordance with the German Funkanlagengesetz (FuAG).

Any modification to the product, not authorized by us, will invalidate this declaration.

The following (parts/clauses of) standards have been applied:

- IEC/EN62368-1:2014
- EN 300 440 V2.1.1
- EN 301 489-1 V2.2.0
- EN 301 489-3 V2.1.1

The Notified Body TÜV Rheinland LGA Products GmbH 0197 performed an EU-type examination and issued the EU-type examination certificate: RT 00125777

Bensheim: 2018-01-22

Place and date

(Signature) [Signature]

(Printed Name) Dr. F. Thiel

Vice President

(The declaration certifies the compliance with the Directive. Conditions of guarantee and liability are dealt within our General Conditions of Sale.)
3 Product description

3.1 Main components of the product

3.1.1 Controls

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Ethernet</td>
<td>RJ45 port for Ethernet 100 Base-T with red and green LED</td>
</tr>
<tr>
<td>B</td>
<td>DC input</td>
<td>Micro-USB connector for 5 VDC power supply</td>
</tr>
<tr>
<td>C</td>
<td>Reset button</td>
<td>Opening for pressing the reset button. Use a pointed object to press the button.</td>
</tr>
</tbody>
</table>
### 3.1.2 LED displays

Two LEDs indicate the condition of the unit. Each LED may have the following states:

- Off
- Slowly flashing
- Quickly flashing
- On

The table below shows the possible unit states:

<table>
<thead>
<tr>
<th>State</th>
<th>LED color Orange</th>
<th>LED color Green</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Booting</td>
<td>Off</td>
<td>Off</td>
<td>Both LEDs are not yet ready for operation.</td>
</tr>
<tr>
<td>Networking</td>
<td>Slowly</td>
<td>Slowly</td>
<td>This state usually only occurs when a new network is set up.</td>
</tr>
<tr>
<td>Isolated</td>
<td>Quickly</td>
<td>Slowly</td>
<td>No network could be created.</td>
</tr>
<tr>
<td>Separated</td>
<td>On</td>
<td>Slowly</td>
<td>No network devices are in range.</td>
</tr>
<tr>
<td>Connected</td>
<td>Off</td>
<td>On</td>
<td>The unit is working properly and is ready for data transmission.</td>
</tr>
<tr>
<td>Transfer</td>
<td>Off</td>
<td>Quickly</td>
<td>Quick flashing indicates data transfer in process.</td>
</tr>
<tr>
<td>Error</td>
<td>Quickly</td>
<td>Quickly</td>
<td>A serious error has occurred. A restart and possibly a firmware update are required to resolve this.</td>
</tr>
</tbody>
</table>
# Technical data

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions</td>
<td>Approx. 104 x 75 x 24 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>Approx. 100 g</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>0 to 40°C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-25 to 80°C</td>
</tr>
<tr>
<td>Power supply</td>
<td>5 VDC (max. 1.4 W)</td>
</tr>
<tr>
<td>Data interface</td>
<td>100 Base-T Ethernet</td>
</tr>
<tr>
<td>Frequency band</td>
<td>2402 to 2480 MHz</td>
</tr>
<tr>
<td>Transmitted power</td>
<td>Max. 10 mW (+10 dBm)</td>
</tr>
<tr>
<td>Standards</td>
<td>EN 60950-1:2006 + A12:2011</td>
</tr>
<tr>
<td></td>
<td>EN 301489-1/-3</td>
</tr>
<tr>
<td></td>
<td>EN 300440-02 V 1.4.1</td>
</tr>
<tr>
<td></td>
<td>AS/NZS 4268:2008</td>
</tr>
<tr>
<td></td>
<td>FCC: 47 CFR Part 15</td>
</tr>
<tr>
<td></td>
<td>RSS-210</td>
</tr>
<tr>
<td>Conformity</td>
<td>R&amp;TTE, FCC, and IC</td>
</tr>
<tr>
<td>Modulation</td>
<td>GFSK</td>
</tr>
<tr>
<td>Multiplexing</td>
<td>Not available</td>
</tr>
<tr>
<td>Wireless data rate</td>
<td>1 Mbit/s</td>
</tr>
<tr>
<td>Usable data rate</td>
<td>Up to 300 Kbit/s</td>
</tr>
<tr>
<td>Antennae</td>
<td>Two omnidirectional antennae, integrated SMA connector with reversed polarity, vertical polarization, quarter-wave dipole, 2 dBi amplification. One antenna is used for the transmission (Tx) and one for reception (Rx).</td>
</tr>
<tr>
<td>Range</td>
<td>Line of sight; up to 60 m inside buildings; up to 300 m in open fields.</td>
</tr>
<tr>
<td>Controls</td>
<td>Pushbutton on the rear</td>
</tr>
<tr>
<td></td>
<td>Two LEDs</td>
</tr>
<tr>
<td>Housing</td>
<td>Plastic housing:</td>
</tr>
<tr>
<td>Installation</td>
<td>Installed on table or wall</td>
</tr>
<tr>
<td>Accessories</td>
<td>AC/DC adapter model FW7662/05</td>
</tr>
<tr>
<td></td>
<td>Input 100 to 240 VAC / 50 to 60 Hz / 150 mA</td>
</tr>
<tr>
<td></td>
<td>Output 5 VDC / 1.1 A</td>
</tr>
</tbody>
</table>
5 System description

This section explains the context of the CEREC Radio Device by describing the main function and identifying the system components.

5.1 CEREC system

The CEREC system consists of a mobile acquisition unit and a stationary milling unit.

The acquisition unit generates the restoration data which is transmitted to the milling unit.

The acquisition unit establishes a TCP/IP connection with the milling unit for the data transmission.

An Ethernet infrastructure is required for this.

This can be implemented by standard, wired LAN infrastructure, a WLAN, or the CEREC Radio Device system as described in this document.

5.2 System components

The identifiable components and their role in the CEREC system are presented below:

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
<th>Role</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acquisition unit</td>
<td>The PC platform used for recording the dental data.</td>
<td>Data source. Initiates the transmission to a milling unit.</td>
<td></td>
</tr>
<tr>
<td>Network unit</td>
<td>A wireless transmitter/receiver with an Ethernet connector. The Ethernet socket is equipped with LEDs which indicate the unit's status.</td>
<td>Wireless node in the network.</td>
<td></td>
</tr>
<tr>
<td>Mobile network unit</td>
<td>A network unit which is installed inside an acquisition unit.</td>
<td>The network unit for the acquisition unit.</td>
<td></td>
</tr>
<tr>
<td>Stationary network unit</td>
<td>A network unit which is either attached to the milling unit directly or connected to a LAN.</td>
<td>Wireless end-point for the data communication to the milling unit.</td>
<td></td>
</tr>
<tr>
<td>Milling unit</td>
<td>Receives the data and processes it to mill a restoration.</td>
<td>Data receiver</td>
<td></td>
</tr>
</tbody>
</table>
### 5 System description
5.2 System components

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
<th>Role</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator</td>
<td>A person possessing technical knowledge (either by experience, practice, or training) of the functional details of the network.</td>
<td>Performs all infrastructural changes to the network based on their technical knowledge.</td>
<td><img src="image" alt="Operator Icon" /></td>
</tr>
<tr>
<td>Dentist</td>
<td>User who does not possess any technical knowledge about the working of the network.</td>
<td>Uses the network to transmit data.</td>
<td><img src="image" alt="Dentist Icon" /></td>
</tr>
</tbody>
</table>
5.3 Main function

The objective of the CEREC Radio Device is to obtain a reliable, wireless data connection between a stationary milling unit and a mobile acquisition unit. The wireless network that is created can then be used to transmit time-dependent data.

For the acquisition units and milling units there is no difference between the CEREC Radio Device and a local wired network (LAN); the connection is completely transparent.

5.4 Network unit

The CEREC Radio Device enables the setting up of a range of wireless network units that together create a wireless network. The number of network units in one network is limited to three. These network units implement a proprietary Sirona protocol specially developed to comply with time-dependent transmission requirements for CEREC Radio Device applications.

The basic functionality of a network unit is to convert incoming Ethernet data into a number of packages for wireless data transmission and to forward these to one or more neighboring network units (and vice versa). This functionality is comparable to an Ethernet network switch. As such, this network can be used as a wireless network (WLAN) and is completely transparent for Ethernet communication.

Using this functionality, a link between two network units can support the data communication between an acquisition unit and milling unit.
A network unit can have three different roles:

- Directly connected to a milling unit using a network cable and powered by the supplied mains adapter.
- Built into an acquisition unit where it is directly connected to the integrated PC via a network cable and powered via the USB 3.0 connection of the PC.
- Connected to LAN infrastructure, i.e. to a hub or switch and powered through the mains adapter.

A schematic representation of a network unit is shown below.

As can be seen in the image, the network unit has four connection points:

- **Antenna**
  The network unit has two antennas that are screwed on during production. These antennas must not be removed or replaced with different antennas.

- **Micro-B USB**
  For power the network unit has a standard Micro-B USB port. A standard 5V power adapter supplied in the package can be plugged into this port. However, any standard USB 3.0 connection can be used to power the network unit. The network unit integrated in the CEREC mobile acquisition unit is powered through this port.

- **RJ-45**
  The network unit has an RJ45 interface to which the standard network cable (CAT5) can be connected. The network unit can be connected to any other Ethernet communication device through this interface. To establish a connection with the LAN infrastructure, you can alternatively connect it to an Ethernet connection component such as a hub or switch.
6 Networking

This section describes the network function of the CEREC Radio Device. Below you will find a list of the sections:

- CEREC Radio Device network overview
- Creating a network
- Network creation failures
- Extending the network
- Reset to factory defaults
- Network unit states
- Radio characteristics

6.1 CEREC Radio Device network overview

The network units in the CEREC Radio Device network create a so-called peer-to-peer mesh network. This means that there is not a master or slave as with Bluetooth, nor a central controlling access point for the control as with WLANs.

As such there is no distinction between a network unit connected to a milling unit, one that is built into an acquisition unit, or one that is connected to LAN infrastructure: any network unit belonging to the same network (see “Creating a network [\rightarrow 18]”) can communicate with all other network units in this network that are in range. This is also applicable when they are out of range of all other network units, making establishing network connections very flexible.

The wireless network operates in the 2.4GHz band which is available worldwide for license-free operation. It therefore needs to be able to communicate with other wireless networks such as WLAN or Bluetooth networks. The network accomplishes this by avoiding congested channels wherever possible. However, the network is not completely immune to interferences caused by other wireless technologies. The result of these interferences can be a reduced range and drops in performance. The network technology therefore offers several easy mechanisms with which a network can be extended to achieve better coverage (see “Extending the network [\rightarrow 21]”).

The network can also easily be extended and the coverage increased, using LAN cables or even an existing LAN infrastructure (see “Increasing the range [\rightarrow 30]”).

6.2 Creating a network

Network units that come out of the box have never been part of a network. To allow for several networks of different owners to operate side-by-side or in the same area, new network units must first create a network. This is described in the following section.

6.2.1 Creation

To create a new network with a number of new network units the following steps must be completed:

1. Bring all network units together in one room.
2. Power-up all network units within one minute.
3. Wait approximately one minute after the last network unit was powered-up.
4. Check that all the network units are connected, indicated by the green LED (see “LED displays [→ 12]”).

When completed, all network units will belong to a single network, which can be operated as an independent network, and can communicate with each other. The network created in this way is unique worldwide. See “Network creation failures [→ 19]” should a problem arise.

6.2.2 Isolated network unit

A unique network is only created when two or more network units are present. In case of an isolated network unit, no network is created until another network unit is within range.

6.2.3 Permanent network

When a network unit has been added to a network, the network ID is stored permanently. When network units are switched off and back on again, they re-establish a connection with the network.

6.2.4 Installation

After the network has been set up, the network units can be switched off and placed at their designated locations (to connect them to the milling units, for example).

Since the network creation is permanent, the network units remain part of the network even after switching off and switching back on again. This applies even if they are placed outside of range of other network units, for example in case of an isolated milling unit in a separate room.

6.2.5 Maximum size

A network can comprise up to three network units. Larger networks are not possible.

6.3 Network creation failures

The following section describes potential issues which could arise when creating a new network and offers solutions for each scenario.

6.3.1 Isolated network unit

When a single network unit is powered-up too late, it may not be part of the network. This can be identified if the LED does not turn green.

This situation is the same as when a new network unit is added to an existing network. This is described in “Extending the network [→ 21]”.

6.3.2 Multiple networks created

When more than one network unit is powered-up too late, these network units could form their own network.
Initially this will not be clear because all network units will indicate that connections to other network units have been established with a green LED (see “LED displays [→ 12]”).

One way of checking this is to connect a PC with a fixed IP address to each network unit and try to ping the PCs from another PC. Another way is to switch-off all but one network unit. Then complete the following steps for each additional network unit:

1. Switch a network unit on.
2. Wait until the orange LED goes out.
3. The LED lights up green and the network unit belongs to the network.
4. Go to the next network unit.

If a network unit is not connected, the orange LED lights up constantly. When this occurs the network unit must be reset to factory defaults (see “Resetting to factory defaults [→ 21]”) and then added to the network by switching one of the other network units off and back on again (see “Extending the network [→ 21]”).
6.4 Extending the network

Additional new network units can be added to an existing network. This section explains how this is done.

6.4.1 Adding a new network unit

New network units can be added to an existing network. However, to prevent any network unit from becoming part of the network, the user must complete four simple but specific steps:

1. Place the new network units next to a network unit belonging to the network.
2. Switch-on the new network units.
3. Within one minute, switch the existing network unit off and then back on again.
4. After one minute the new network units will become part of the network.

6.4.2 Reducing the network

In some cases it may be necessary to remove one or more network units from an existing network.

Sequence:

1. One network unit is switched-off.
2. After approximately 5 seconds, the other network units detect the lost connection.

The network units themselves cannot distinguish between a network unit that is switched off and is to be removed from the network and a situation in which the network unit is moved outside the network’s range. The removed network unit will still occupy an entry in the network information administration. Normally this does not affect the performance of the network at all.

However, since the number of network units in the network information administration is limited, this can be a problem if network units are removed a number of times.

To clear the list of detected network units the network units can be switched off and on again.

6.5 Resetting to factory defaults

A network unit that was previously part of a network can be removed from this network.

➢ This is completed by holding the reset button for five seconds.

♀ This will reset the network unit to factory defaults.
### 6.6 Network unit states

The proper behavior of a network unit can be identified by its state. This section describes the possible states that can be identified for a network unit. To provide feedback on the proper operation of the network unit to the user, these states are also mapped onto LED indications.

#### 6.6.1 State definitions

The following states can be identified for a network unit:

<table>
<thead>
<tr>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Booting</td>
<td>The firmware starts the network device.</td>
</tr>
<tr>
<td>Networking</td>
<td>The network unit was not previously part of a network and is trying to detect other network units to create a new network.</td>
</tr>
<tr>
<td>Isolated</td>
<td>The network unit was not previously part of a network. No other network units found.</td>
</tr>
<tr>
<td>Separated</td>
<td>Part of a network, but not in range of other network units.</td>
</tr>
<tr>
<td>Connected</td>
<td>Connected to one or more network units.</td>
</tr>
<tr>
<td>Transfer</td>
<td>Transfer of Ethernet packets from the wireless network to the LAN and vice versa.</td>
</tr>
<tr>
<td>Error</td>
<td>Hardware error</td>
</tr>
</tbody>
</table>
6.6.2 Transitions between states
The transitions between these states are given in the following figure:

![Diagram showing the transitions between states]

These transitions are described in the table below:

<table>
<thead>
<tr>
<th>State</th>
<th>Next state</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial state</td>
<td>Booting</td>
<td>The booting program starts after a restart or after switch-on.</td>
</tr>
<tr>
<td>Booting</td>
<td>Networking</td>
<td>A network setup timer of one minute is started. During this time, other</td>
</tr>
<tr>
<td></td>
<td></td>
<td>network units are searched for. When the other units are also in the</td>
</tr>
<tr>
<td>Networking</td>
<td>Isolated</td>
<td>No other network units were found within one minute.</td>
</tr>
<tr>
<td>Networking</td>
<td>Separated</td>
<td>The network unit starts searching for other network units of the same</td>
</tr>
<tr>
<td>Separated</td>
<td>Connected</td>
<td>At least one other network unit was found in the same network.</td>
</tr>
<tr>
<td>Connected</td>
<td>Error</td>
<td>Any</td>
</tr>
</tbody>
</table>

Table:**
### 6.7 Radio characteristics

This chapter describes some technical details about the radio which might be required for more advanced setups when the system must operate and coexist in an environment with several wireless systems.

#### 6.7.1 Frequency spectrum

The CEREC Radio Device network units each receive a 2 MHz channel, assigned to them in the 2.4 GHz band. The WLAN channels in this band are illustrated in the figure below.

![Frequency Spectrum](image)

#### 6.7.2 Channel control

Each network unit uses a specific channel on which it can receive data.

#### 6.7.3 Channel switching

In order to avoid interference by other wireless devices, each network unit continuously monitors the radio signals in the entire frequency band. The unit can decide to switch to another (better) frequency channel in case its data transmission suffers too much from interference in its own frequency channel.
7 Data transmission

To further explain the functionality of the CEREC Radio Device, this section describes how data is transmitted in various cases:

- Stationary data transmission
- Network routing
- Multiple streams
- Simultaneous access
- Interrupted transmission

7.1 Stationary data transmission

The mobile network unit stays connected to the same stationary network unit during data transmission.

Requirements:

- The acquisition unit is in range of the stationary network unit.
- The stationary network unit is connected to a milling unit.
- The acquisition unit wants to start transmitting data to the milling unit.

Sequence:

1. The acquisition unit sends a packet to the connected mobile network unit.
2. The mobile network unit forwards the packet to the stationary network unit.
3. The stationary network unit forwards the packet to its connected milling unit.
4. The milling unit receives the packet.
5. The milling unit sends an acknowledgement.
6. This acknowledgement is received and forwarded by the connected stationary network unit.
7. The mobile network unit forwards the acknowledgement to the acquisition unit.

IMPORTANT

The data that is contained in the packet and was transmitted by the acquisition unit or milling unit is not important for the transfer.
7.2 Network routing

The mobile network unit has connections to several stationary network units that each are connected to a milling unit. Therefore the mobile network unit has to determine which stationary network unit to use.

Requirements:
- The acquisition unit is in range of two stationary network units A and B.
- Each stationary network unit is connected to a milling unit.
- An acquisition unit wants to start transmitting data to a milling unit C.

Sequence:
1. The acquisition unit sends the first data to the connected mobile network unit.
2. The mobile network unit forwards the data to both stationary network units.
3. Both stationary network units forward the data to their connected milling unit.
4. Only milling unit C will process the data.
5. Milling unit C sends the confirmation.
6. The confirmation is received and forwarded by the connected stationary network unit B.
7. The mobile network unit forwards the data to the acquisition unit.
8. The steps are repeated until the mobile network unit is certain that the link to stationary network unit B should be used.
9. After this, the data is only transmitted to stationary network unit B.
7.3 Multiple streams

The mobile network unit has connections to several stationary network units that each are connected to a milling unit. The acquisition unit sends data to all milling units.

Requirements:
- The acquisition unit is in range of two stationary network units A and B.
- Each stationary network unit is connected to a milling unit.
- An acquisition unit is transmitting data to a milling unit D using stationary network unit A.

Sequence:
1. At one point in time, while the transmission to milling unit D is still ongoing, the acquisition unit starts a transmission to milling unit C using another stationary network unit B.
2. Because the mobile network unit in the acquisition unit now has to support two data streams, the effective data rate available for both data streams will be lower.
3. When one of the two data streams is stopped, the effective data rate for the remaining data stream will again be at its maximal level.

IMPORTANT

There is only a practical limit to the number of data streams, because at a certain number the effective data rate will no longer be acceptable.
7.4 Simultaneous access

Several acquisition units are transmitting their data via the same stationary network unit.

For the acquisition units the effective data rate is lower than compared to a situation where the stationary network unit was not used together with other acquisition units. Note that the milling units and their network unit could be connected via a switch.
7.5 **Interrupted transmission**

The acquisition unit is removed from the range of the stationary network unit and no alternative connection to the milling unit is available.

**Sequence:**

The acquisition unit is removed from the range of the stationary network unit.

After a while, both the mobile network unit and stationary network units will detect that no packets are exchanged anymore.

The mobile network unit will try but fail to reconnect with other network units.
### 7.6 Increasing the range

If the distance between the acquisition unit and the stationary network unit of the milling unit is too long to establish a direct connection, there is the possibility to extend the range by using two additional network units which have to be paired as a separate network.

The example below shows network units 1 and 2, which form one network, and network units 3 and 4, which form a second, separate network.

<table>
<thead>
<tr>
<th>IMPORTANT</th>
</tr>
</thead>
<tbody>
<tr>
<td>The two network units connected by a LAN cable have to be placed at a distance from each other of at least one meter to prevent radio disturbances.</td>
</tr>
</tbody>
</table>
8 Disposal

In accordance with Directive 2012/19/EU and national disposal regulations regarding old electrical and electronic devices, please be advised that such items must be disposed of in a special way within the European Union (EU). These regulations require the environmentally friendly recycling/disposal of old electrical and electronic devices. Such items must not be disposed of as domestic refuse. This has been expressed using the icon of the “crossed out trash can”.

Disposal procedure

We feel responsible for our products from the first idea to their disposal. For this reason, we give you an option to return our old electronic and electrical devices.

If you wish to dispose of your devices, please proceed as follows:

In Germany

To initiate return of the electrical device, please send a disposal request to enretec GmbH. You have the following options here:

- Use the “Returning an electrical device” button under the “eom” menu item on the enretec GmbH homepage (www.enretec.de).
- Alternatively, you can also contact enretec GmbH directly.

enretec GmbH
Kanalstraße 17
16727 Velten
Tel.: +49 3304 3919-500
E-mail: eom@enretec.de

In accordance with the national disposal regulations regarding old electrical and electronic devices (ElektroG), as the manufacturer, we assume the costs for disposing of the electrical and electronic devices in question. Disassembly, transport and packaging costs shall be borne by the owner/operator.

Prior to disassembly/disposal of the product, it must be fully prepared (cleaned/disinfected/sterilized).

If your unit is not permanently installed, it will be collected from the practice. If it is permanently installed, it will be picked up curbside at your address by appointment.

Other countries

For country-specific information on disposal, contact your local dental dealers.
We reserve the right to make any alterations which may be required due to technical improvements.