

HELIODENTPLUS

Service Manual

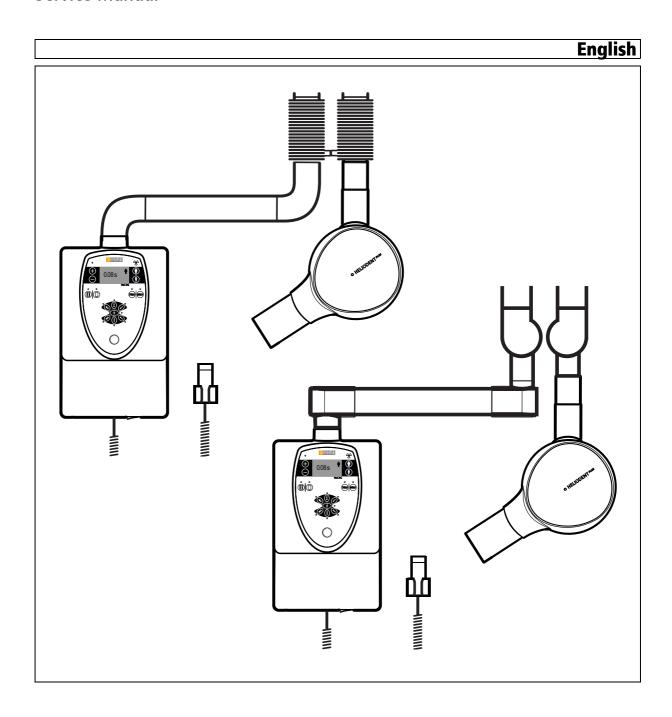


Table of contents

| 1 | Gene | eral information | 7 |
|---|--------|---|-------------|
| | 1.1 | 1.1.1 Identification of the danger levels | 7 7 7 |
| | 1.2 | | , 8 |
| | 1.2 | · | 9 |
| | _ | • | |
| | 1.4 | Changing the device configuration | |
| | | 1.4.1 Changing the cone length | |
| | 1.5 | Measures when exchanging spare parts | |
| | 1.5 | 1.5.1 Safety-related tests | |
| | 1.6 | Demo mode | 3 |
| | 1.7 | List of software versions | |
| | 1.8 | Round and angular support arm system 1 | |
| | 1.9 | The most important subassemblies | 5 |
| | 1.10 | Labeling1 | |
| | 1.11 | Removing covers | |
| | | 1.11.1 Wall module | |
| | | 1.11.2 Remote control and remote timer | |
| | | 1.11.3 X-ray tube unit | 1 |
| | 1.12 | Overview of PC boards | 2 |
| | | 1.12.1 Generator board DX1 | 2 |
| | | 1.12.2 Control board DX4 | 3 |
| | 1.13 | Required items | |
| | | 1.13.1 Additional documents | |
| | | 1.13.2 Tools and auxiliary materials2 | 4 |
| 2 | List o | of messages | 5 |
| | 2.1 | Error messages | 5 |
| | | 2.1.1 General | |
| | | 2.1.2 Structure | |
| | | 2.1.3 List of error messages 2 | R |

| 3 | Trouk | pleshooting2 | | | | | |
|---|-------|---|--|--|--|--|--|
| | 3.1 | Error message: NONE | | | | | |
| | 3.2 | Error message: E5 01 02 / E5 01 14 / E5 01 12 | | | | | |
| | 3.3 | Error message: E5 01 22 | | | | | |
| | 3.4 | Error message: E6 01 23 | | | | | |
| | 3.5 | Error message: E7 01 01 | | | | | |
| | 3.6 | Error message: E7 04 51 - Door contact error | | | | | |
| 4 | Maint | Maintenance | | | | | |
| | 4.1 | Checking the shielding | | | | | |
| | | 4.1.1 Test | | | | | |
| | | 4.1.2 Positions | | | | | |
| | 4.2 | Checking the protective ground connections | | | | | |
| | | 4.2.1 Test | | | | | |
| | | 4.2.2 Positions | | | | | |
| | 4.3 | Checking exposure time and high voltage kV | | | | | |
| | 4.4 | Checking the deadman function | | | | | |
| | 4.5 | Checking the release button | | | | | |
| | | 4.5.1 General | | | | | |
| | | 4.5.2 Release button on PC board DX1 (coiled cable) | | | | | |
| | | 4.5.3 Release button on PC board DX4 (coiled cable) | | | | | |
| | | 4.5.4 Release button on front panel on PC board DX4 | | | | | |
| | 4.6 | Checking the front panel | | | | | |
| | | 4.6.1 Visual check | | | | | |
| | 4.7 | • | | | | | |
| | 4.7 | Checking and adjusting the support arm | | | | | |
| | | 4.7.2 Angular support arm system | | | | | |
| | | 4.7.2.1 Checking and adjusting the angular scissor arm | | | | | |
| | | 4.7.2.2 Checking and adjusting the angular scissor arm is parallel | | | | | |
| | 4.8 | Checking the X-ray tube assembly joint | | | | | |
| | 4.9 | Checking the ceiling model | | | | | |
| | 4.10 | Checking HELIODENT PLUS on the mobile stand | | | | | |
| | 4.11 | Checking the tube current | | | | | |
| | 4.12 | Checking the protective ground wires | | | | | |
| | 4.13 | Checking the unit leakage current | | | | | |
| | 4 14 | Checking insulation resistance on the power supply cord of the mobile stand | | | | | |

| 5 | Serv | ice routin | es | 65 |
|---|------|------------|---------------------|----|
| | 5.1 | Operat | ion | 65 |
| | 5.2 | Overvi | ew | 66 |
| | 5.3 | Service | e routines (list) | 67 |
| | | 5.3.1 | Service routine S01 | 67 |
| | | 5.3.2 | Service routine S02 | 67 |
| | | 5.3.3 | Service routine S03 | 67 |
| | | 5.3.4 | Service routine S04 | 67 |
| | | 5.3.5 | Service routine S05 | 68 |
| | | 5.3.6 | Service routine S06 | 68 |
| | | 5.3.7 | Service routine S07 | 69 |
| | | 5.3.8 | Service routine S08 | 69 |
| | | 5.3.9 | Service routine S09 | 69 |
| | | 5.3.10 | Service routine S10 | 70 |
| | | 5.3.11 | Service routine S11 | 70 |
| | | 5.3.12 | Service routine S12 | 70 |
| | | 5.3.13 | Service routine S13 | 71 |
| | | 5.3.14 | Service routine S14 | 71 |
| | | 5.3.15 | Service routine S15 | 72 |
| | | 5.3.16 | Service routine S16 | 73 |
| | | 5.3.17 | Service routine S17 | 73 |
| | | 5.3.18 | Service routine S18 | 74 |
| | | 5.3.19 | Service routine S19 | 74 |
| | | 5.3.20 | Service routine S20 | 75 |
| | | 5.3.21 | Service routine S21 | 75 |
| | | 5.3.22 | Service routine S22 | 75 |
| | | 5.3.23 | Service routine S23 | 76 |
| | | 5.3.24 | Service routine S24 | 76 |
| | | 5.3.25 | Service routine S25 | 76 |
| | | 5.3.26 | Service routine S26 | 77 |
| | | 5.3.27 | Service routine S27 | 77 |
| | | 5.3.28 | S28 service routine | 78 |
| | | 5.3.29 | Service routine S29 | 78 |

| 6 | Repa | air | | 79 |
|---|------|---------|--|----|
| | 6.1 | Safety- | -related tests | 79 |
| | 6.2 | Replac | sing X-ray tube assembly H1 | 79 |
| | 6.3 | Replac | sing PC board DX1 | 85 |
| | | 6.3.1 | Removing a defective board DX1 | 85 |
| | | 6.3.2 | Installing the new board DX1 | 86 |
| | | 6.3.3 | Connection in the control panel for cable L2 | 87 |
| | | 6.3.4 | Connecting the power cable | 87 |
| | | 6.3.5 | Attach the EMC additional plate for the wall adapter to the power supply | 88 |
| | 6.4 | Replac | sing PC board DX4 | 89 |
| | 6.5 | Replac | sing the power supply cord for the mobile stand | 90 |

1 General information

1 1 Structure of the document

1.1.1 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.

MARNING

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 on making work easier.

1.1.2 Formats and symbols used

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

| ✓ Prerequisite | Prompts you to do something. |
|---------------------------------------|---|
| 1. First action step | |
| 2. Second action step | |
| or | |
| Alternative action | |
| ∜ Result | |
| ➤ Individual action step | |
| See "Formats and symbols used [→ 7]" | 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. |

General safety information

WARNING

Radiation protection

The valid radiation protection regulations and measures must be observed. The statutory radiation protection equipment must be used.

In case of malfunctions, cancel the exposure immediately by letting go of the exposure release button.

CAUTION

Electrical components of the unit can be destroyed.

Prior to opening the unit

- > Please comply with the usual precautionary measures for handling printed circuit boards (ESD).
- Make sure you touch a ground point to discharge yourself prior to touching the components.
- Use an ESD wrist band and connect it to the protective ground wire.



/!\ CAUTION

Gaps appear between the internal hinges when moving the angular support arm.

Fingers may be crushed in these gaps.

> Ensure that you never place your fingers in the gaps between the hinges, neither during operation nor for cleaning purposes.

NOTICE

Operational reliability

Installation and servicing may be performed only be personnel specifically authorized by Sirona.



WARNING

Shock hazard

People can be injured or electrical components of the unit destroyed.

It is essential that you switch off the unit PRIOR to beginning the installation or servicing.



/ WARNING

Modifications to the product

Modifications which may affect the safety of the operators or third parties are prohibited by law!



No additional components on the support arm system

It is not permissible to fix additional components to the support arm system.

1.3 Operation notes

Nominal line voltage

Nominal voltage: 120V, 200V– 240V

Permissible fluctuation: ± 10%

Rated current: At 120 V: 10 A

At 200 – 240 V: 6 – 5 A

Nominal frequency: 50/60 Hz

Internal line impedance: At 120 V 0.3 ohms

At 200 - 240 V 0.8 ohms

Remote control

The unit may be equipped with a remote control to be used inside the treatment room or outside of the X-ray room.

The release button with coiled cable can/must be removed from the remote control and connected directly to the unit for testing.

Keep in mind that the disconnected cable may be the cause of defects.

Switch-on procedure

Cooling period

Software version

NOTICE

Do not press any buttons when switching on the unit!

> Switch the unit on.

♦ It will execute an electronic self-testing routine.

The operational readiness indicator must be lit up.

The cooling period between two exposures is maintained by an automatic exposure blocking function according to the pulse/pause ratio.

The DX4 board determines the software version.

You can find the software version with the following steps:

- Start service routine "2."
- A label next to the main switch includes an imprint of the software version.

Disturbance of electronic equipment caused by cell phones

Disposal

To ensure safe operation of medical electrical equipment, the use of mobile wireless phones in practice or hospital environments is prohibited.



General

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 environmental friendly usage/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" since March 24, 2006, amongst other methods.

Please observe the disposal regulations applicable in your country.

Removing covers

Measurements

X-ray tube unit

The X-ray tube assembly contains a tube which can implode, lead lining, and mineral oil.

Observe the section on "Removing covers".

Observe the following when taking measurements:

- Always switch the unit off before connecting a measuring instrument.
- Select the correct current/voltage type and adjust the measuring range to match the expected readings.
- Perform continuity tests only on units which are switched off.
- If several exposures with radiation must be taken to check a measurement, make sure that the prescribed cool-down intervals are observed.
 - They are maintained by an automatic exposure blocking function (see Operating Instructions).
- Observe the radiation protection guidelines before releasing the radiation.

1.4 Changing the device configuration

1.4.1 Changing the cone length

Explanation

If the cone length is changed, this change must be registered with service routine S06 [\rightarrow 68].

1.4.2 Using and changing a diaphragm

Explanation

If a diaphragm needs to be used, this change must be registered with service routine S07 [\rightarrow 69].

If a diaphragm is replaced or removed, this change must also be registered with service routine S07 [\rightarrow 69].

1.5 Measures when exchanging spare parts

Spare parts

The article numbers for ordering spare parts can be found in the spare parts list, Order No. 62 34 111

NOTICE

The diagrams contained in the spare parts list provide a useful guide when replacing parts.

Preparation

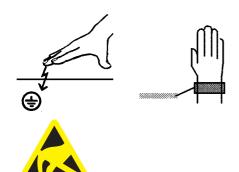
> Always switch the unit off before replacing parts.

Replacement

The following must be observed when replacing individual subassemblies:

 The unit must be disconnected from the power supply before replacing any parts near the power supply, the power switch, or the power supply board.

Disconnect the unit from the junction box of the building installation.



- Always wear an ESD wrist band to protect sensitive components on printed circuit boards (ESD) and attach it to a ground conductor (green/yellow).
- Always check the unit after replacing PC boards DX1 and DX4 or the X-ray tube assembly.
- For safety reasons, the support arm must be secured with the safety belt when replacing the X-ray tube assembly.

1.5.1 Safety-related tests

A protective conductor test and a leakage current test must be performed prior to the installation or the hand-over of the unit as well as after repair work.

See Sections "Protective conductor test [\rightarrow 61]" and "Leakage current test."

1.6 Demo mode



- 1. Set service routine "26" to "On".
- 2. Switch the unit off.
- 3. Open the protective cover of the wall module.
- 4. Attach cables V (blue) and W (pink) on terminal strip X500.
- 5. Close the protective cover of the wall module.
- 6. Switch the unit back on.
 - ♦ The message "E1 11 88" appears on the display.
- **7.** Acknowledge this message by pressing any key (not a release button).
- ♥ The demo mode is now activated.
- When a release button is activated, **no X-ray radiation** will be generated.

Deactivation

- ✓ The unit is in "demo mode".
- 1. Set service routine "26" to "Off".
- 2. Switch the unit off.
- 3. Open the protective cover of the wall module.
- **4.** Attach cable **V** (blue) to terminal strip **X500.1**.
- 5. Attach cable W (pink) on terminal strip X500.2.
- 6. Close the protective cover of the wall module.
- 7. Switch the unit back on.
- ♦ The demo mode was deactivated.
- When a release button is activated, **X-ray radiation** will be generated.

1.7 List of software versions

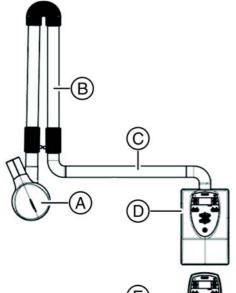
| Software | Remarks | |
|-----------|---------------------------------|--|
| V02.04.00 | 1. Series release | |
| V02.05.00 | from serial no. 3001 | |
| V02.07.00 | from serial no. 20001 | |
| V02.08.00 | new S28 and S29 service routine | |

1.8 Round and angular support arm system

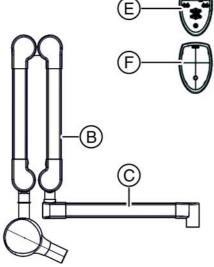
The HELIODENT Plus is available with a round and angular support arm system.

In the images which do not exclusively demonstrate the angular support arm system, the round support arm system is shown.

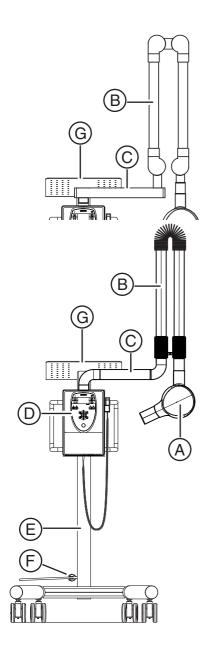
1.9 The most important subassemblies



| Position | Designation | | |
|----------|---------------------------|--|--|
| Α | X-ray tube unit | | |
| В | Scissor arm | | |
| С | Support arm | | |
| D | Wall module | | |
| | Board DX1 | | |
| | Front panel | | |
| | Control board DX4 | | |
| Е | Remote Timer (Optional) | | |
| | Front panel | | |
| | Control board DX4 | | |
| F | Remote control (optional) | | |



| Position | Designation | |
|----------|---|--|
| Α | X-ray tube assembly on overhead support | |
| В | LEDview on overhead support | |



| Position | Designation |
|----------|--------------------|
| Α | X-ray tube unit |
| В | Scissor arm |
| С | 410 mm support arm |
| D | Wall module |
| | Board DX1 |
| | Front panel |
| | Control board DX4 |
| E | Mobile stand |
| F | Power supply cord |
| G | Tray |

1.10 Labeling 17 (32) 18 12 40 16 10 (12) 11 20 (50) (53 42 (51) [14]

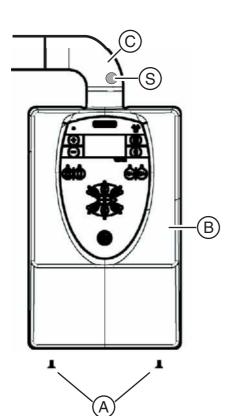
| Item | Designation | Info |
|------|--|--------------------------|
| 10 | ID label of X-ray tube assembly | attached inside the cone |
| 11 | ID label of wall adapter | |
| 12 | ID label of scissor arm | |
| 14 | "Follow the operating instructions" label | |
| 15 | ID label of round cone extension | transp. / white print |
| 16 | ID label of square cone extension | transp. / white print |
| 17 | ID label of radiation field limiter 2x3 | |
| 18 | ID label of radiation field limiter 3x4 | |
| 20 | Warning label for HELIODENT PLUS | yellow / black print |
| 21 | Warning label for X-ray unit | Affixed on site |
| 32 | ID label of LEDview | |
| 40 | DHHS label about Regulations 21CFR (45x27) | transp. / white print |
| 42 | DHHS label UL-CSA | white / black print |
| 50 | Chinese label for HELIODENT PLUS | |
| 51 | Chinese label for HELIODENT PLUS (ID) | |
| 53 | Chinese label for CCIB | |

1.11 Removing covers

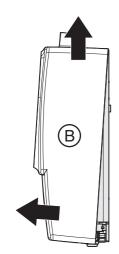
1.11.1 Wall module

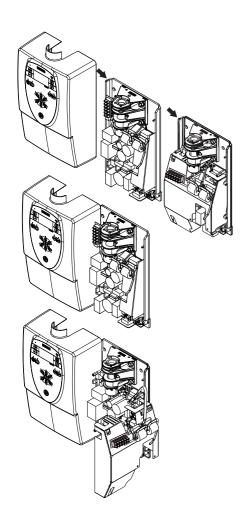
Removing the cover

- 1. Turn the unit off.
- 2. Unlock the housing shell **(C)** of the support arm above the wall module by pinching the housing shells together at position **(S)**.
- 3. Remove the housing shell (C) from the support arm.
- **4.** Unscrew and remove the fastening screws **(A)** from the underside.



- 5. Pull the protective cover (B) slightly away from the wall and lift it up.
- ♦ You can now remove the protective cover.

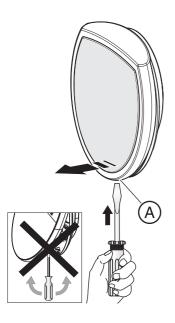




Hanging up the cover

➤ Hang the cover on the side of the wall adapter plate so that it is securely positioned (see illustration). To do this from serial no. 27 000 onwards, the EMC plate must be removed beforehand.

1.11.2 Remote control and remote timer

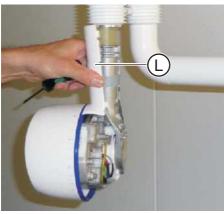


➤ Detach the housing of the remote control or the Remote Timer by carefully inserting the tip of a screwdriver in opening A and pressing against the catch. **Do not pry with or turn the screwdriver!**

1.11.3 X-ray tube unit



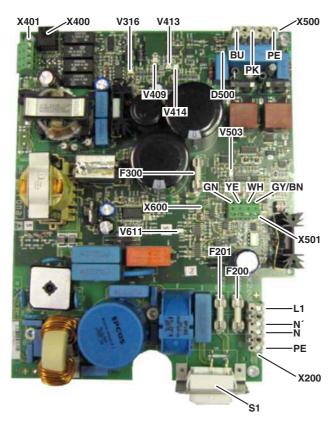
1. Unscrew and remove the cover (A).

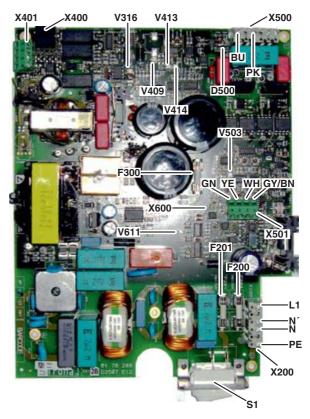


2. Remove the arm cover (L).

1.12 Overview of PC boards

1.12.1 Generator board DX1





| S1 | Power switch | F200 / F201 | Fuse for PFC (10A 250V slow-blow, order no.: 10 77 460) |
|------|--|----------------|--|
| F300 | Fuse for switched-mode power supply (1A 250V quick-blow, order no.: 10 77 304) | V316 | LED, supply voltage +15V - LED lights up when +15 V supply voltage is present. |
| X400 | Direct contact with control board DX4 [\rightarrow 23] / cable L2 or L6 . | X401 | Release and safety circuit only for installation options 1, 2, 4, 6, and 6.1 |
| V409 | LED, setpoint generation - LED lights up during an X-ray exposure. | V413 | LED, basic heating - LED lights up when basic heating is correct LED lights up during an X-ray exposure. |
| V414 | LED, kV controller - LED lights up during an X-ray exposure if the kV controller is functioning correctly. | V503 | LED, kVactual cable - LED lights up if the kVactual cable is incorrectly connected. |
| D500 | Glow lamp, output stage - The glow lamp lights up during an X-ray exposure. The high-voltage transformer is activated. | X600 | Measuring points for the tube current measurement (see section "Checking the tube current [\rightarrow 60]"). |
| V611 | LED, release - LED lights up when the release button is pressed. | | |

1.12.2 Control board DX4



| (A) | Protective circuit (door contact) | (B) | Release button |
|------|--|---------------|---|
| (C) | EMC shielding | V108 | LED, +3.3 V for LCD |
| V200 | LED, Debugging | V201 | LED, status indicator - LED flashes with 100% unit function. |
| H200 | Acoustic signal - Acoustic signal sounds during an X-ray exposure. | X108, X109 | Connection to membrane keyboard |
| X103 | Direct contact with generator board DX1 [→ 22] / cable L2 (installation options 1, 2, 4, 6 and 6.1) | X105, X106 | Direct contact with generator board DX1 [→ 22] as remote control / cable L6 (installation options 3, 5, 7 and 8) |
| V600 | LED, +8V input voltage | V602 | LED, +3.3 V controller voltage |
| X100 | Remote timer connection outside the X-ray | S1 | Changeover switch, internal/external trigger |
| | room | S2 | Changeover switch, safety circuit ON/OFF |

1.13 Required items

1.13.1 Additional documents

Spare parts list

- Order No.: 62 34 111

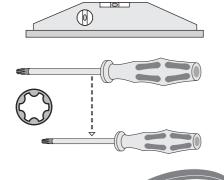
Wiring diagrams

- Order No.: 62 15 086

1.13.2 Tools and auxiliary materials

- Allen key / size 13:
- Spirit level





Side cutting pliers



adhesive tape



- 2x multimeter or one of each of the following measuring instruments:
 - 1x voltmeter
 - 1x ammeter



- Test unit for device leakage current measurement:
 For measurements, Sirona recommends an automatic tester (example illustration) which complies with standard IEC 62353.

 If you do not use an automatic tester, please pay attention to the specifications in the standard IEC 62353.
- Power source for protective ground wire test Technical data:
 - No-load voltage max. 6V
 - Short-circuit current at least 5A max. 25A

2 List of messages

2.1 Error messages

2.1.1 General

Explanation

The error messages appear on the display of the control electronics.

Recognition

Error messages can be recognized by a six-digit error code (**Ex yy zz**) beginning with a large **E**.

The structure of the error messages is explained in the section entitled "Structure [\rightarrow 25]".

Handling error messages

As a general rule, error messages are acknowledged via all buttons except for the release button.

If trouble-free operation is possible after the error is acknowledged, then no further action is necessary.

If error messages reoccur or occur frequently or trouble-free operation is not possible, identify the error as described in the section "List of error messages [\rightarrow 26]" and take appropriate action to eliminate the corresponding error or fault.

2.1.2 Structure

Explanation

The codes provide you with error type, error location and troubleshooting information. Plain text error output follows.

Configuration

The error codes are structured according to the following pattern: **Ex yy zz** Explanation of abbreviations:

Ex - Error type

"Remedy" classification for the user. The x character provides a foundation for making quick decisions as to how serious the error is and how to handle the error.

yy - Locality

Describes the impacted functionality.

This functionality can be:

- Subassembly
- Subsystem
- Logical functional unit

zz - Identification

Describes a further specification of the error via a consecutive number with error identification.

2.1.3 List of error messages

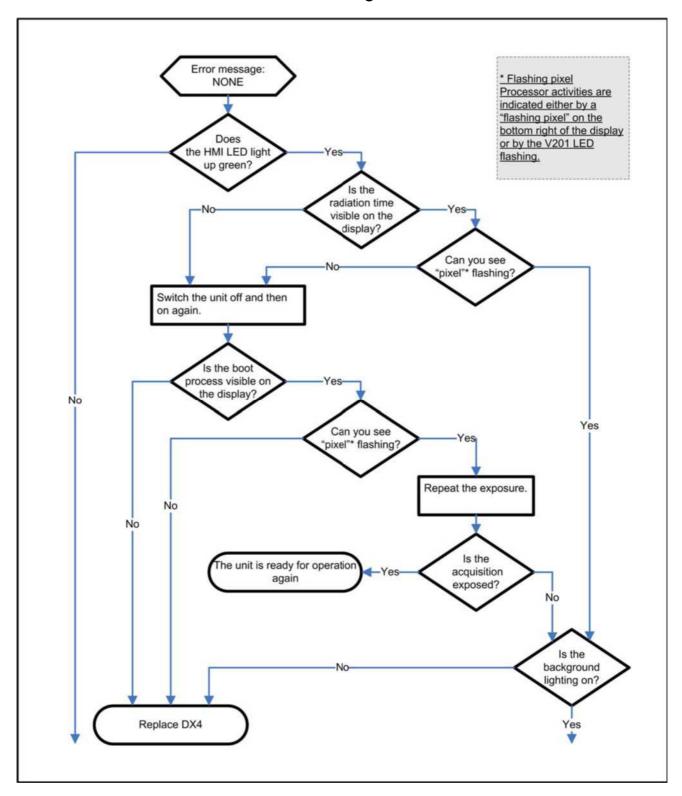
| Error code | Description | Actions required |
|----------------------|--|---|
| None | Release does not result in any reaction/ exposure | See Section "Error message NONE [→ 29] |
| E1 11 88 | Demo mode ACTIVE | Acknowledge the error message with any key. |
| | | For "normal operation" - change service routine 26 [→ 77] |
| E1 04 03 | | Acknowledge the error message with any key. |
| | | If the error message reappears, DX4 must be replaced. |
| E1 04 04 | Error programming the values. | Acknowledge the error message with any key. |
| | | If the error message reappears, DX4 must be replaced. |
| E1 04 60 | Error of serial port | Replace DX4. |
| E3 04 30 | Power-up error | Switch unit OFF and ON again |
| | Release button was actuated during power-on | If the error message reappears, remove the release button. |
| | | If there are no more error messages, use a new release button. |
| | | If the error message persists, check the cable between DX1 and DX4. DX4 may need to be replaced |
| E3 04 31 | Error keys | Switch unit OFF and ON again |
| | A front panel key was actuated during power-on | If the error reoccurs, perform a key test with Service routine S22 [→ 75]. |
| | | Key defective? Replace front panel |
| E5 01 02 E5 01 12 | No target values are generated DX4 buzzer sounds, no exposure | Check the cable between DX1 and DX4 (B4). Replace the entire cable if necessary. |
| | DA4 buzzer sourius, no exposure | If the error message reappears, DX1 must |
| E5 01 14 | | be replaced. |
| E5 01 32 | | |
| E5 01 42 | D | Devise DV4 |
| E5 01 02 | Buzzer sounds | Replace DX1 |
| E5 01 12 | No exposure | |
| E5 01 14 | | |
| E5 01 32 | | |
| E5 01 02 | Buzzer sounds | See Section ""Error message E5 01 02 / E5 01 12 / E5 |
| E5 01 12 | No exposure | 01 14 [→ 32]" |
| E5 01 14 | | |

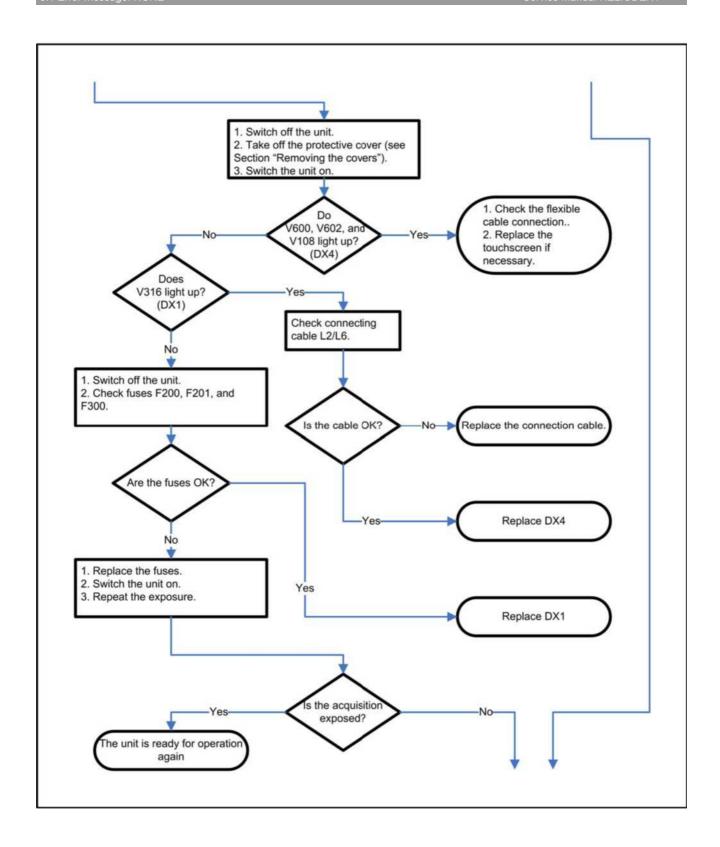
| Error code | Description | Actions required |
|------------|--|--|
| E5 01 02 | Buzzer sounds | Replace DX1 |
| E5 01 14 | no exposure temporarily | |
| E7 01 51 | | |
| E5 01 22 | Buzzer does not sound | See Section |
| | No exposure | ""Error message E5 01 22 [→ 33]" |
| E5 04 50 | Internal software error | Switch unit OFF and ON again |
| | | Repeat the exposure with the same values |
| | | If the error message reappears, DX4 must be replaced. |
| E6 01 13 | Internal hardware error | Replace DX1. |
| E6 01 31 | Internal hardware error | Replace DX1 |
| E6 01 41 | Buzzer sounds although the release was not | Switch unit OFF and ON again |
| | actuated | If the error message reappears, DX4 must be replaced |
| | | If the error message reappears, DX1 must be replaced |
| E6 01 23 | Cable is incorrectly attached or internal hardware error | See Section |
| E6 01 11 | Internal hardware error | ""Error message E6 01 23 [→ 34]" Replace DX1 |
| E6 01 61 | Error diagnosis not working | Check the cable between DX1 and DX4. Cable may need to be replaced |
| E6 01 62 | Error diagnosis not working | Check the cable between DX1 and DX4. Cable may need to be replaced |
| | | If the error message reappears, DX1 must be replaced |
| E6 04 01 | Internal hardware error | Switch unit OFF and ON again |
| | | If the error message reappears, DX4 must be replaced |
| E6 04 02 | Internal error | Switch unit OFF and ON again |
| | | If the error message reappears, DX4 must be replaced |
| E6 04 11 | Internal error | Replace DX4 |
| E6 04 40 | LCD is somewhat darker in some cases | Replace DX4 |
| E6 04 41 | Power supply of DX4 is interrupted | Switch unit OFF and ON again |
| | | If the error message reappears, DX4 must be replaced |
| E6 04 42 | Power supply of DX4 is interrupted | Replace DX4 |
| E6 04 10 | Internal error | Switch unit OFF and ON again |
| | | If the error message reappears, DX4 must be replaced |

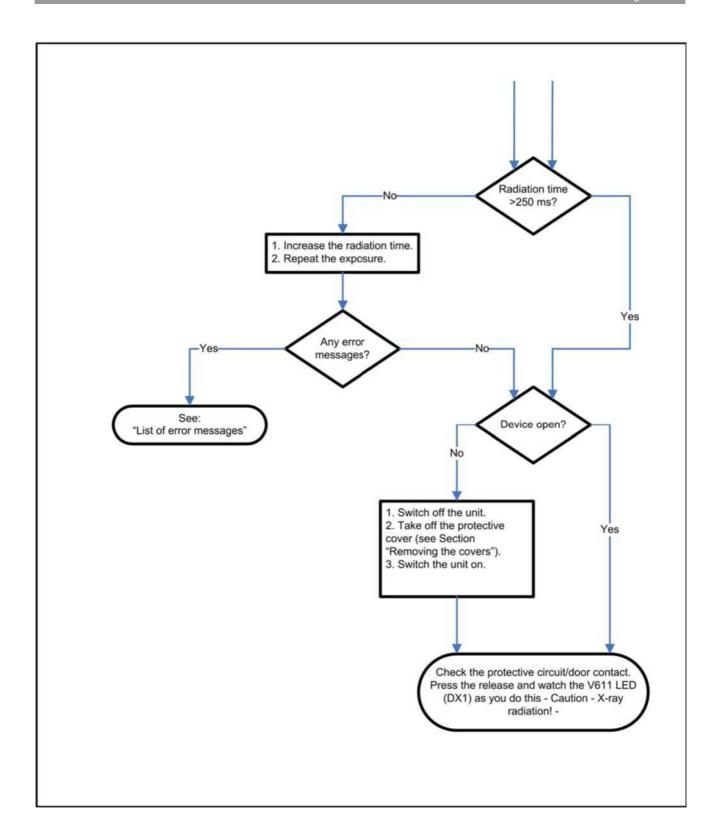
| Error code | Description | Actions required |
|------------|--|--|
| E6 04 06 | Internal error | Switch unit OFF and ON again |
| | | If the error message reappears, DX4 must be replaced |
| E6 04 12 | Internal error | Switch unit OFF and ON again |
| | | If the error message reappears, DX4 must be replaced |
| E6 04 20 | Internal error | Switch unit OFF and ON again |
| | | If the error message reappears, DX4 must be replaced |
| E6 04 21 | Internal error | Switch unit OFF and ON again |
| | | If the error message reappears, DX4 must be replaced |
| E7 01 01 | Cable is incorrectly attached or internal hardware error | See Section ""Error message E7 01 01 [→ 36]" |
| E7 01 21 | Release actuated | Check the cable between DX1 and DX4. |
| | No buzzer sound | Cable may need to be replaced |
| | No exposure | |
| E7 01 51 | Internal hardware error | Switch unit OFF and ON again |
| | | If the error message reappears, DX1 must be replaced |
| E7 04 51 | Safety circuit (door contact) | Go to section "Error message: E7 04 51 - Door contact error [→ 38]" |

3 Troubleshooting

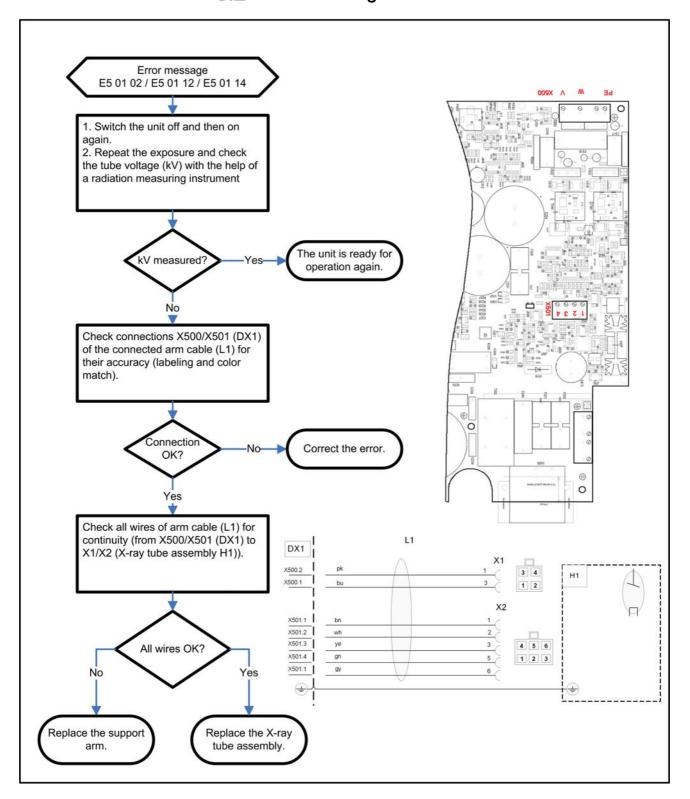
3.1 Error message: NONE



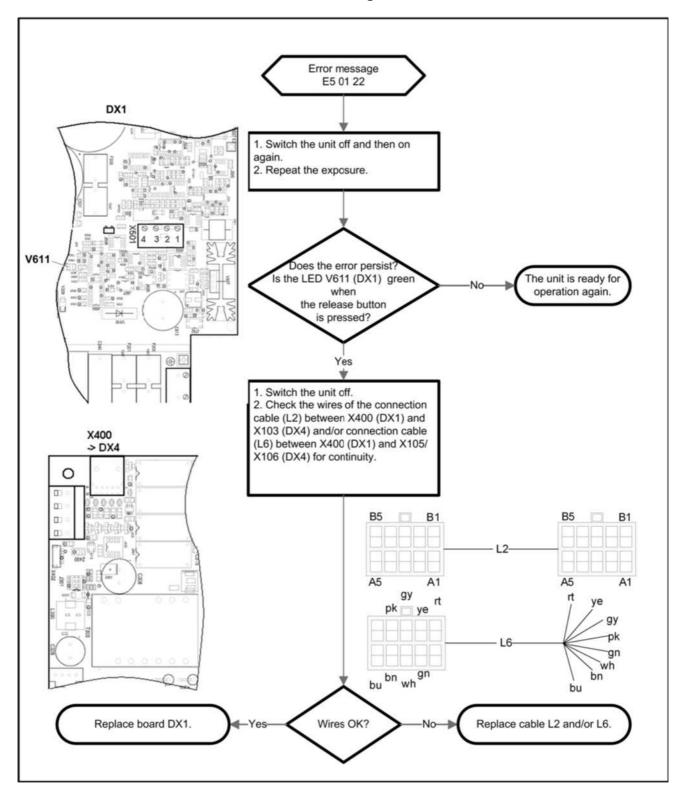




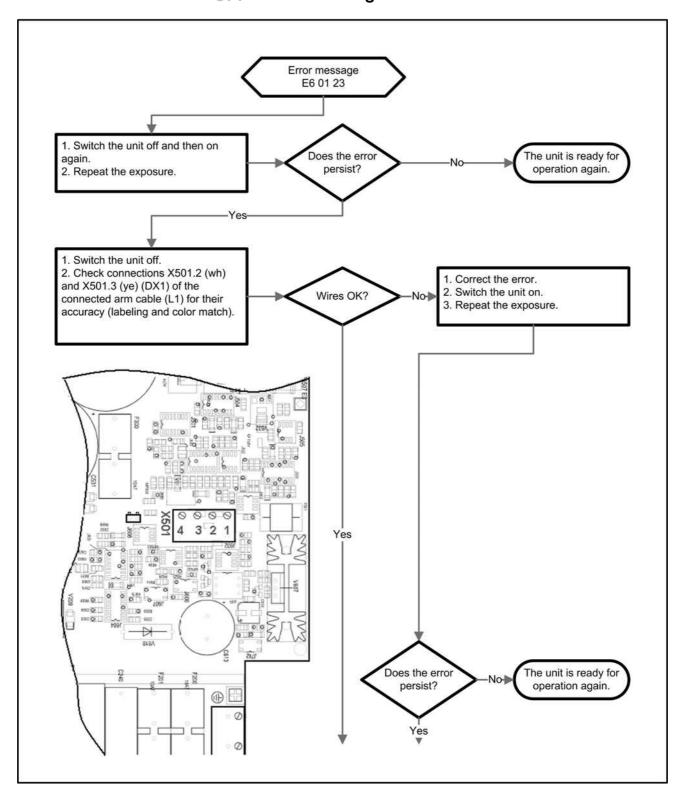
3.2 Error message: E5 01 02 / E5 01 14 / E5 01 12

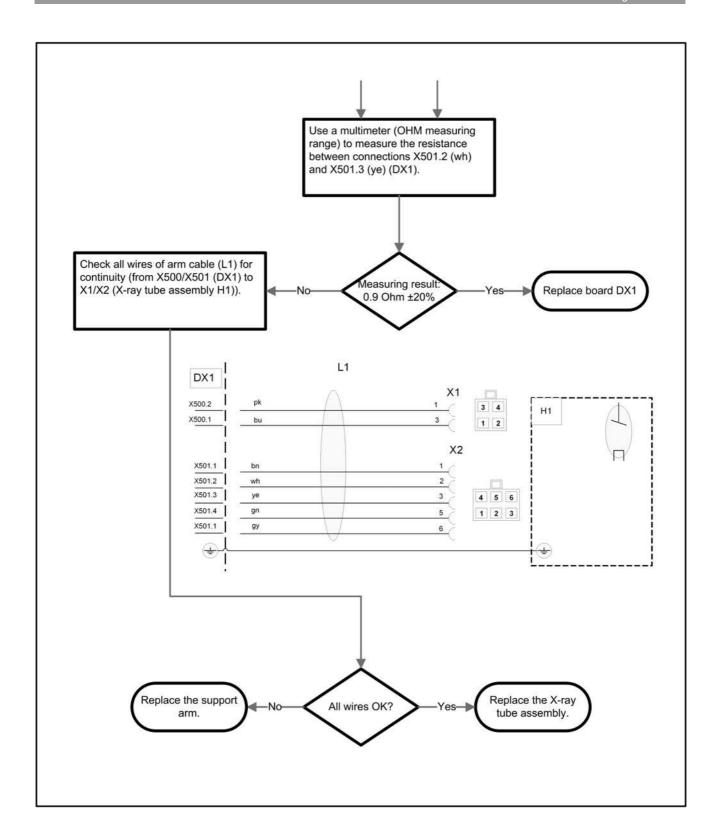


3.3 Error message: E5 01 22

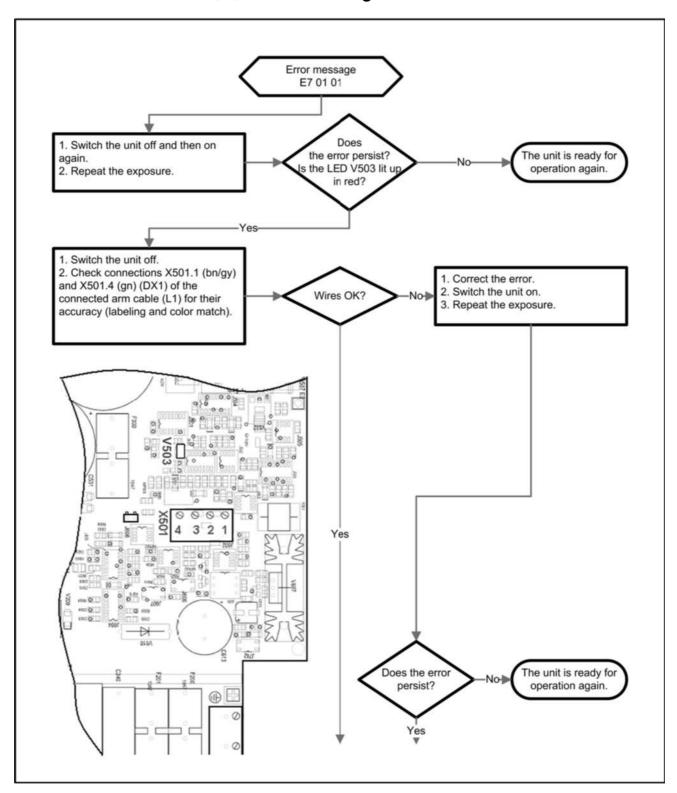


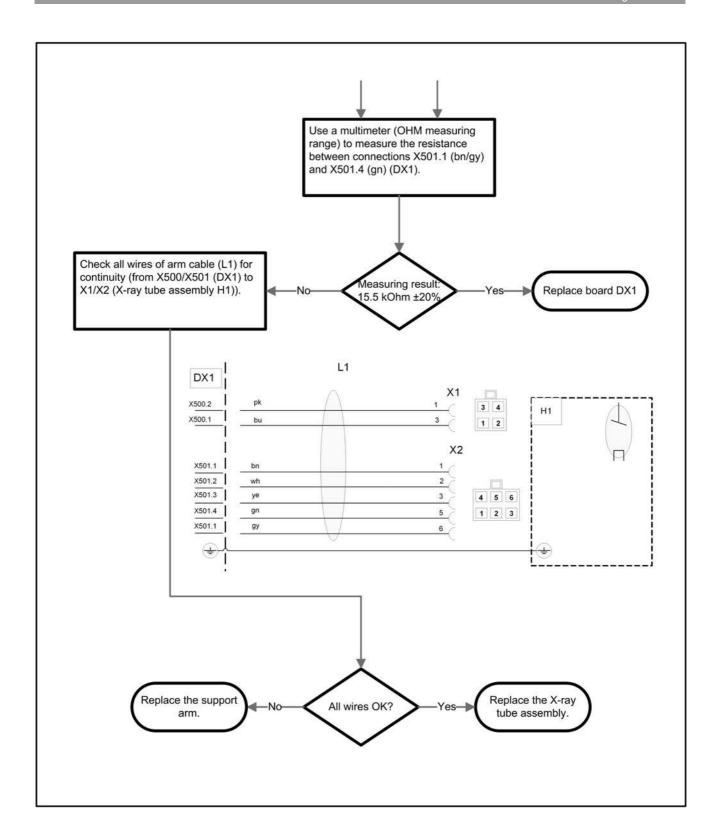
3.4 Error message: E6 01 23





3.5 Error message: E7 01 01





3.6 Error message: E7 04 51 - Door contact error

Explanation

Depending on the installation type, there are different approaches to address error message E7 04 51.

- Error correction (case 1)
 - Installation type "Wall box without door contact"
 - Installation type "Remote without door contact"
- Error correction (case 2)
 - Installation type "Wall box with door contact"
- 1. Set switch S2 on PC board DX4 to ON.
- 2. In service routine 015, set the value "1" and save it.
- 3. Switch the unit off and then on again.
- 1. Set switch S2 on PC board DX4 to OFF.
- 2. In service routine 015, set the value "0" and save it.
- 3. Switch the unit off and then on again.

Error correction (case 2)

L Maintenance

4.1 Checking the shielding

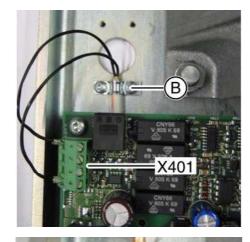
4.1.1 Test

> Check whether the cable shieldings have contact with the shielding clamps and are firmly in place.

4.1.2 Positions

Installation panel (wall module)

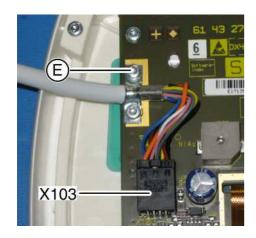
- If available: Manual release \$3 on X401
 - (**B**): Clamp



- CNY86 V 808 K E9 X400

- If available: Cable L2 with ferrite core on X400
 - (C): Clamp

- If available: Cable L6 on X400
 - (**D**): Clamp



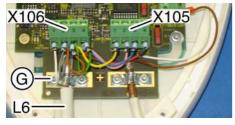
DX4 (wall module)

- X103 / L2 cable (wall mounting)
 - (E): Clamp

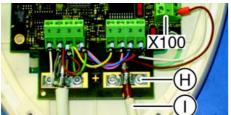


DX4 (Remote Timer)

- Grounding tab of the front panel
 - (F): Screw



- X106/X105 / L6 cable
 - (**G**): Clamp



- X100 / Manual release S3
 - (H): Clamp
 - (I): Release button

4.2 Checking the protective ground connections

4.2.1 Test

> Check whether all protective ground connections are firmly in place.

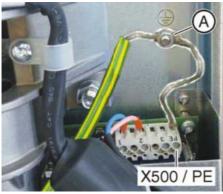
4.2.2 Positions

DX1 and installation panel (wall module)

• X200 / Power input clamp

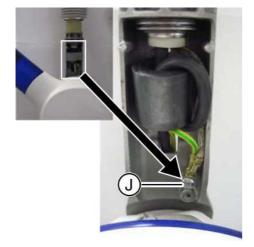


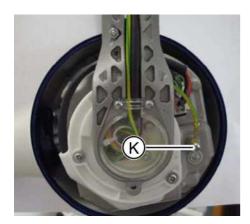
- X500* / Output stage and installation panel
 - (A): Screw
 - * PE is only connected up to serial no. 26 999 on the X500



X-ray tube assembly

- Grounding of the support bracket
 - (**J**): Screw





- Grounding of the X-ray tube assembly
 - (**K**): Screw

4.3 Checking exposure time and high voltage kV

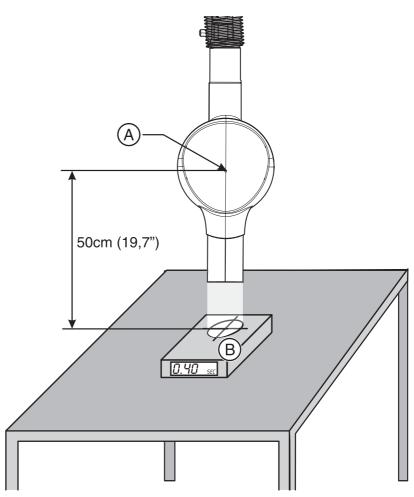
Auxiliary devices required

Suitable radiation meter.

Examples:

- Mini-X
- PMX I-D
- MOM

Preparation



- **1.** Switch the X-ray unit on.
- 2. Wait until the self-test is finished (operational readiness signal must be lit). The display reading shows the radiation time and a patient symbol).
- **3.** Set an exposure time between 0.25 and 0.4 seconds. The display of control board DX4 must be clearly visible
- **4.** Position the measuring instrument (**B**) in such a way that the active sensor measuring surface has a distance of 50 cm (19.7") from the focus (**A**) of the X-ray tube assembly.
- 5. Switch on the measuring instrument.

test

MARNING

X-ray radiation!

- > Release an exposure with the release button.
- The buzzer must be audible during radiation release.
- The radiation indicator lights up.
 - The radiation LED lights up yellow.
 - The display background lights up yellow.
- > Check the measures exposure time and the high voltage measured at the measuring instrument.

Tolerance: The permitted tolerance of the exposure time and high voltage is ±10%.

In case of error

- Radiation time outside of tolerance limits
 - Replace board DX4.
- High voltage outside of tolerance limits
 - Replace DX1.

4.4 Checking the deadman function

test

1. Set the radiation time to 3.2 seconds (display: "3.20 s").



WARNING

X-ray radiation!

- 2. Release an exposure with the release button and let go of the release button prior to the end of the radiation.
- ♦ The radiation must stop.
- The actual radiation time must be shown as a **flashing** display.

In case of an error

The unit does not stop releasing radiation.

➤ Replace board DX4.

4.5 Checking the release button

4.5.1 General

Explanation

Depending on the installation type, there are different descriptions for checking the release button.

Overview

- Release button on PC board DX1 (coiled cable) [→ 45]
- Release button on PC board DX4 (coiled cable) [→ 46]
- Release button on front panel on PC board DX4 [→ 47]

4.5.2 Release button on PC board DX1 (coiled cable)

NOTICE

Only one release button may be connected (active)!

Preparation

- 1. Switch the unit off.
- 2. Connect the measuring instrument:
- With installed door contact
 - Connect the measuring instrument to DX1 X401.1 and X401.2.
- With no installed door contact
 - Connect the measuring instrument to DX1 X401.1 and X401.4.

test

- Check the following points:
- Is the strain relief of the coiled cable fully functional?
- Is the release button easy to actuate?
- Does the release button return to its home position on its own after letting go?
- With release button **not** pressed: Measured resistance exceeds 100k Ω .
- With release button pressed: Measured resistance is below 100 Ω .
- Do the measured resistance values remain constant when the coiled cable is moved?
- ➤ After the test: Remove the measuring instrument.

In case of an error

> Replace the release button with coiled cable.

4.5.3 Release button on PC board DX4 (coiled cable)

NOTICE

Only one release button may be connected (active)!

Preparation

- 1. Switch the unit off.
- 2. Connect the measuring instrument:
- With installed door contact
 - Connect the measuring instrument to DX4 X100.1 and X100.2.
- With no installed door contact
 - Connect the measuring instrument to DX4 X100.1 and X100.4.

test

- > Check the following points:
- Is the strain relief of the coiled cable fully functional?
- Is the release button easy to actuate?
- Does the release button return to its home position on its own after letting go?
- With release button **not** pressed: Measured resistance exceeds 100k Ω .
- With release button pressed: Measured resistance is below 100 Ω .
- Do the measured resistance values remain constant when the coiled cable is moved?
- ➤ After the test: Remove the measuring instrument.

In case of an error

> Replace the release button with coiled cable.

4.5.4 Release button on front panel on PC board DX4

NOTICE

Only one release button may be connected (active)!

Preparation

- 1. Switch the unit off.
- 2. Connect the measuring instrument to DX1 X401.1 and X401.3.

test

- > Check the following points:
- Is the release button easy to actuate?
- Does the release button return to its home position on its own after letting go?
- With release button **not** pressed: Measured resistance exceeds $1k\Omega$.
- With release button pressed: Measured resistance is below 100 Ω .
- > After the test: Remove the measuring instrument.

In case of an error

> Replace the front panel.

4.6 Checking the front panel

CAUTION

Defective indicators and keys represent a risk to the safety of both the patient and the operator/user.

The user is not permitted to operate the unit until the necessary repairs have been made.

4.6.1 Visual check

Check

Visually check the front panel for external damage.

- Is the front panel of the user interface undamaged?
- Is the surface panel free of cracks or holes?

NOTICE

The transparent front panel over the light diodes must not be punctured, otherwise there is a risk of ESD damage.

4.6.2 Front panel test

Explanation

In the front panel test, you can check the function of every individual key on the front panel.

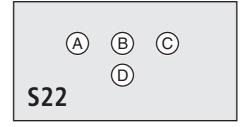
Command

➤ Open service routine S22 (see "Operation [→ 65]" in the Section "Service routines").

Operation

- > Actuate every key in sequence.
- A code is indicated in a certain area on the display each time a key is actuated.

Areas



Code table

| Key | Area | Code | Key | Area | Code |
|-----|------|------|----------|------|------|
| 0 | A | 1 | 0 | В | 32 |
| | A | 2 | 0 | В | 64 |
| | A | 4 | 9 | В | 128 |
| | A | 8 | | С | 1 |
| | В | 2 | 1 | С | 2 |
| 0 | В | 4 | 60kV | С | 4 |
| 0 | В | 8 | 70kV | С | 8 |
| | В | 16 | | D | 1 |

4.7 Checking and adjusting the support arm

CAUTION

Switch OFF the unit before connecting a measuring instrument or replacing parts!

4.7.1 Round support arm system

Check

- Are all bellows intact?
 - If the bellows are damaged, the support arm must be replaced.
 See section "Replacing the support arm".
- Does the X-ray tube assembly drift from its work position on its own?
 - If the X-ray tube assembly drifts, the support arm must be readjusted.

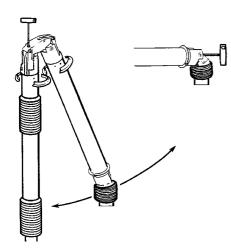
Setting

Adjusting the spring on the scissor arm (support arm side)

- 1. Invert the bellows over the half-shells (A) on both sides.
- 2. Pull off the half-shells.
- 3. Pull the scissor arm apart and slide the bellows over the bearing.
- 4. Set both support arms in vertical position.
- **5.** Insert the Torx screwdriver (T30, 200 mm) into the drilling of the bearing from the top and adjust the spring (right turn = tighter).
- **6.** Reassemble the support arm by completing the same steps in reverse order.

Adjusting the spring on the scissor arm (X-ray tube assembly side)

- 1. Invert the bellows over the upper half-shell (A).
- 2. Press the bellows downward.
- **3.** Set the support arm into a horizontal position.
- **4.** Insert the Torx screwdriver (T30, 200 mm) into the drilling of the bearing from the front and adjust the spring (right turn = tighter).
- Reassemble the support arm by completing the same steps in reverse order.



4.7.2 Angular support arm system



CAUTION

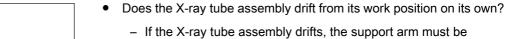
Gaps appear between the internal hinges when moving the angular support arm.

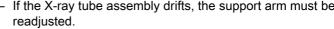
Fingers may be crushed in these gaps.

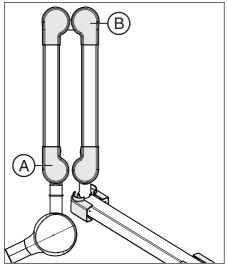
➤ Ensure that you never place your fingers in the gaps between the hinges, neither during operation nor for cleaning purposes.

4.7.2.1 Checking and adjusting the angular scissor arm

Check







Setting

Adjusting the spring on the scissor arm (support arm side)

- 1. Remove the cover part (B).
- 2. Place the rear scissor arm in a vertical position.
- 3. Insert the Allen key (SW6, 200 mm) into the bearing hole from above and adjust the spring (right turn = tighter).

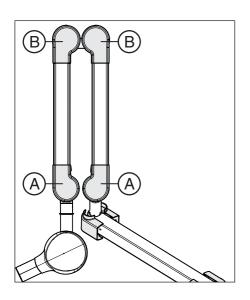




Adjusting the spring on the scissor arm (X-ray tube assembly side)

- 1. Remove the cover part (A).
- 2. Bring the front scissor arm into a horizontal position.
- **3.** Insert the Allen key (SW6, 200 mm) into the bearing hole from the front and adjust the spring (right turn = tighter).
- **4.** Reattach the cover parts.

4.7.2.2 Checking and adjusting the angular scissor arm is parallel Check



- Is the boom of the scissor arm not parallel with the scissor arm?
 - If a lateral or height offset is needed there, the scissor arm must be recalibrated.



Setting

- 1. Remove the cover parts (A+B).
- 2. Release the internal locking pins on all 4 bolts using the Allen key (SW-3).



3. Release the bolts slightly with the ring wrench (SW-13).



- **4.** Open the locking pins on 2 joints slightly (SW-1,5).
- **5.** Place both scissor arms in a vertical position. Check the alignment



- **6.** Set parallelism using the eccentric bolts.
- **7.** Reassemble the support arm by completing the same steps in reverse order.
- 8. Reattach the cover parts.

4.8 Checking the X-ray tube assembly joint

⚠ CAUTION

Switch OFF the unit before connecting a measuring instrument or replacing parts!

Required tools

Torx screwdriver (size 10, 15 and 20)

Check

- Does the cone remain set in every position?
- Are the connecting cables intact?
 - See section on "Checking the connection cables".

If the X-ray tube assembly fails any of these check points, it must be replaced (see Section "Replacing X-ray tube assembly H1 [\rightarrow 79]").

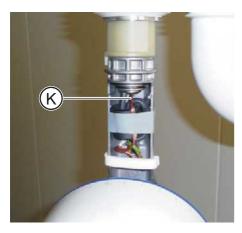
Checking the connection cables

- 1. Switch the X-ray unit off.
- 2. Unscrew and remove the old cover (A).

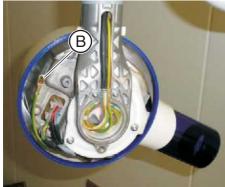


L

3. Remove the arm cover (L).



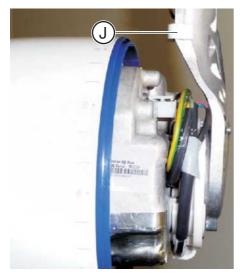
- 4. Check the condition of the grounding strap.
 - No damage should be evident at position (**K**). Slight restriction at the position (**K**) of up to 20% cross-section loss is acceptable.



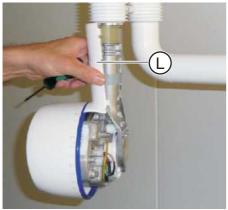
5. Check the screw terminal on the grounding wire (B) for damage.



6. Check the plug contacts on the connector (X1) for damage.



- 7. Check the scissor arm (J) to make sure it does not brush against a cable when moved.
 - No cable should touch the scissor arm in any position. Fasten the cable with a cable tie if necessary.



8. Attach the arm cover (L).

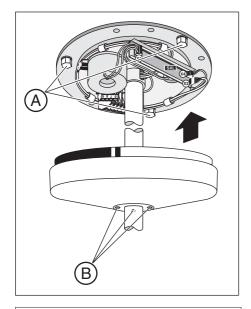


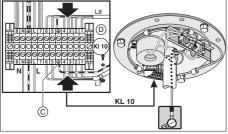
9. Attach and secure the cover (A).

4.9 Checking the ceiling model

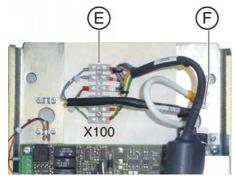
Check the overhead support

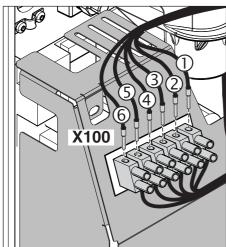
- Is the cover (A) fastening in safe condition?
- Are the cover parts (B) present and free of damage?





- Is the protective ground connection securely (C) positioned?
- Damage-free, tight and proper seating of the cables on clamp K10 (D) in the ceiling model?





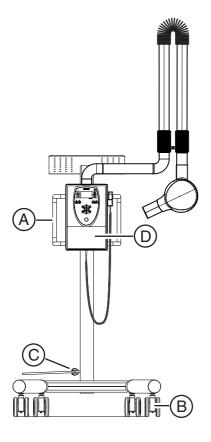
Check the wall adapter

- Is the protective ground connection securely (F) positioned?
- Damage-free, tight and proper seating of the cables on clamp X100 (E) (X100 is positioned in a different position depending on the serial number) in the wall adapter?

4.10 Checking HELIODENT PLUS on the mobile stand

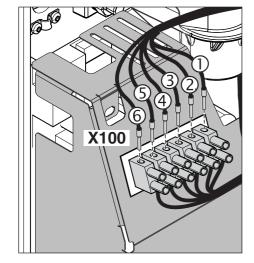
Check the mobile stand

- Is the wall module fastening on the mobile stand (A) in a safe condition?
- Is the power supply cord (C) with strain relief and bend protection on the mobile stand in order?
- Are the 4 rollers (B) of the mobile stand, including brakes, in order and free from contamination?



Check the wall module

- Is the protective ground connection securely (F) positioned?
- Damage-free, tight and proper seating of the cables on clamp X100
 (E) (X100 is positioned in a different position depending on the serial number) in the wall adapter?
- Are the cover parts (D) present and free of damage?



4.11 Checking the tube current

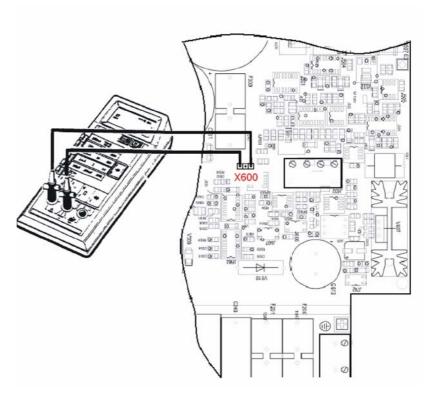
Auxiliary devices required

Ammeter



Only use battery-powered measuring devices.

Preparation



- 1. Switch the unit off.
- 2. Set the ammeter to the "10 mA DC" measuring range.
- 3. Connect the ammeter to the two outer X600 connectors on board DX1.
- 4. Switch the unit on.
- 5. Set the radiation time to 3.2 seconds (display: "3.20 s").

test



X-ray radiation!

> Release an exposure with the release button and read the tube current from the ammeter.

Tolerance: The tube current must be 7 mA ±1.4 mA.

Completion

- 1. Switch the unit off.
- 2. Remove the measuring wires of the ammeter from connector **X600**.
- 3. Reattach the housing on the wall module.

In case of an error

- The measurement value is not reached.
 - Replace the X-ray tube assembly.

4.12 Checking the protective ground wires

Auxiliary devices required

Power source

Technical data:

- No-load voltage max. 6V.
- Short-circuit current min. 5A max. 25A
- Ammeter
 - Observe the current intensity of the power source
- Voltmeter

Preparation

MARNING

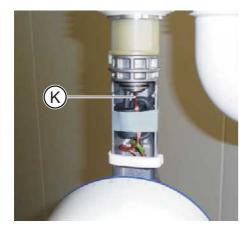
Perilous shock hazard!

Switch the line voltage off.

- Switch the line voltage off at the main switch of the building installation.
- 2. Remove the power cable from connector **X200** on PC board DX1.

Visual check

- 1. Check the assembly and firm seating of the ground conductor.
- 2. Check the main fuse (F200, F201).
- 3. Check the condition of the grounding strap.
 - No damage should be evident at position (**K**). A slight restriction at position (**K**) with a cross-section loss of max. 20% is still acceptable.



Protective ground wire test

Explanation

This test checks the electrical resistance of conductive and exposed parts of the X-ray unit against the protective wire connection.

Test assembly

See drawing.

Test

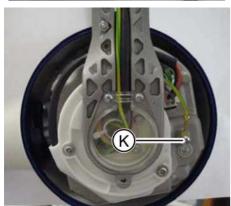
 Set the test current for at least 5 seconds between protective wire connection X200 / PE (board DX1) and ground connection B (X-ray tube assembly).



- 2. Read the voltage drop on the voltmeter and the current on the ammeter.
- Calculate the protective conductor resistance with the formula "R = U / I."

Limit value

The calculated resistance value must not be greater than 0.2 Ω .



4.13 Checking the unit leakage current

DANGER

Perilous shock hazard!

It is essential to switch the unit off and to wait at least one more 1 minute before beginning the check!

Prevent the device from unintentionally switching back on.

NOTICE

Important information on building installation

The connection and disconnection of the unit (power cable) to/from the building installation must be performed by a qualified expert in compliance with the national regulations. DIN VDE 0100-710 applies in Germany.

For measurements, Sirona recommends an automatic tester (example illustration) which complies with standard IEC 62353. If you do not use an automatic tester, please pay attention to the specifications in the standard IEC 62353.

- Switch the line voltage off at the main switch of the building installation.
- DANGER! Note the electrical safety rules without fail.
 Disconnect the power cable and the second protective ground wire from the building installation.
- **3.** Attach a connector compatible with the tester (see the user's manual for the tester) to the unit's power cable.
- **4.** Plug the connector of your power supply unit into the intended socket on the tester in accordance with the user's manual for the tester.
- **5.** Check whether the unit power switch is turned on.

IMPORTANT

According to Note 2 in Table 3 of standard IEC 62353:2014, the maximum device leakage current permitted by the manufacturer is 2 mA for permanently connected units.

- **6.** Perform the measurements according to the operating instructions of the tester.
- 7. Document the measured value of the leakage current in the technical document "Inspection and maintenance and safety-related checks", to identify changes from the original value.
 - A maximum deviation of ±20% from the original value is permitted for the measured leakage current.

Threshold value of wall-mounted model

The measured value must not exceed 2.0mA.

Threshold value of ceiling-mounted model

The measured value must not exceed 2.0mA.

Threshold value with mobile model

The measured value must not exceed 2.0mA.

8. Reconnect the unit to the building installation (fixed connection) (see the installation instructions for the unit).



4.14 Checking insulation resistance on the power supply cord of the mobile stand

Auxiliary devices required

Safety tester for insulation resistance

Preparation

MARNING

Perilous shock hazard!

Switch the line voltage off.

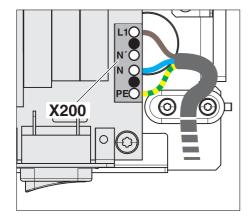
- Measure the insulation resistance between each active conductor and protective ground conductor.
- ✓ Switch the unit off and unplug the connector from the power socket.
- **1.** To remove the cover, see Removing covers $[\rightarrow 19]$.

Elect. connection 1 phase

- 2. Disconnect the power supply cord from clamp X200 on DX1.
- **3.** Set a test voltage of 500 V on the safety test device and follow the instructions in the test device's description.
 - The tester displays the insulation resistance of the short-circuited power supply cords L and N against the protective ground conductor.

The insulation resistance must be greater than 100 M Ω .

- **4.** Re-connect the power supply cord to clamp X200 on DX1.
 - L1: brown
 - N: blue.
 - PE: green/yellow
- **5.** Insert the connector into the socket, check the functioning of the unit. Reattach the covers.



5 Service routines

5.1 Operation



- 1. Switch the unit on.
- **2.** Press the Film key, the Sensor key and the Bite Wing key simultaneously.
 - The service routine "S01" is displayed in front of a white background.



3. Scroll through the list of service routines by pressing the +/- keys.



- **4.** Press the Film key to show the setting of the displayed service routine and make any changes which then may be necessary.
 - ♦ The setting is displayed.





- $\textbf{6.} \quad \text{To save the current service routine, press the Adult key}.$
- 7. To discard the settings of the current service routine and quit it, press the Child key.
- 8. Finally, switch the unit off and then on again.



5.2 Overview

| Service routine | Function |
|-----------------|--|
| S01 | Configuration of transparency compensation for films [→ 67] |
| S02 | Configuration of transparency compensation for sensors [→ 67] |
| S03 | Display of software version [→ 67] |
| S04 | Selection of film type [→ 67] |
| S05 | Selection of sensor type [→ 68] |
| S06 | Selection of cone type [→ 68] |
| S07 | Set diaphragm type [→ 69] |
| S08 | Configuration of radiation time and dose display after an X-ray exposure [→ 69] |
| S09 | Configuration of time-out time of the radiation time and dose display [→ 69] |
| S10 | Configuration of display options: Area dose and actual radiation time [→ 70] |
| S11 | Configuration of power-save mode [→ 70] |
| S12 | Configuration of time-out time of the power-save mode [→ 70] |
| S13 | Configuration of 60/70 kV toggle [→ 71] |
| S14 | Configuration of detector medium toggle (film/ sensor) [→ 71] |
| S15 | Configuration of safety circuit bypass [→ 72] |
| S16 | Configuration of the dynamic pulse/pause ratio (dynamic cooling) [→ 73] |
| S17 | Dose rate correction [→ 73] |
| S18 | Setting the display contrast [→ 74] |
| S19 | Setting the display brightness and color [→ 74] |
| S20 | Setting the LED brightness [→ 75] |
| S21 | Display self-test [→ 75] |
| S22 | Front panel test [→ 75] |
| S23 | Display of the exposure and radiation time counter [→ 76] |
| S24 | Reading the status log [→ 76] |
| S25 | Display of saved data [→ 76] |
| S26 | Activation of demo mode [→ 77] |
| S27 | Resetting the unit to factory default settings [→ 77] |
| S28 | Setting the overall X-ray filter strength [→ 78] |
| S29 | Setting the maximum radiation time from 0.4 s - 3.2 s [\rightarrow 78] |

5.3 Service routines (list)

5.3.1 Service routine S01

Explanation

Configuration of transparency compensation for films

Configuration

You can adjust the transparency compensation in the range from -6 to +6 by pressing the +/- keys (factory default setting = "0").

5.3.2 Service routine S02

Explanation

Configuration of transparency compensation for sensors

Configuration

You can adjust the transparency compensation in the range from -6 to +6 with the +/- keys (factory default setting = "0").

5.3.3 Service routine S03

Explanation

Display of software version

5.3.4 Service routine S04

Explanation

Selection of film type

You can toggle between the following film types:

- FILM D
- FILM E
- FILM F

Operation

Toggle between the film types by pressing the +/- keys.

Legend

| Display | Film type |
|---------|----------------------------------|
| FILM D | FILM D |
| FILM E | FILM E (factory default setting) |
| FILM F | FILM F |

5.3.5 Service routine S05

Explanation

Selection of sensor type

You can toggle between the following sensor types:

- Sirona sensor
- Non-Siemens sensor
- Imaging plate

Operation

Toggle between the sensor types by pressing the +/- keys.

Legend

| Display | Sensor type |
|---------|---|
| Sirona | Sirona XIOS/XIOS ^{Plus} sensor (factory default setting) |
| General | Non-Siemens sensor |
| Scanner | Imaging plate |

5.3.6 Service routine S06

Explanation

Selection of focus type (cone length)

You can toggle between the following focus types (cone lengths):

- 200 mm (8")
- 300 mm (12")

Operation

Toggle between the focus types by pressing the +/- keys.

Legend

| Display | Cone length in mm |
|--------------|---------------------------------------|
| (Focus type) | |
| 200mm (8") | 200 mm (8") (factory default setting) |
| 300mm (12") | 300 mm (12") |

5.3.7 Service routine S07

Explanation

Selection of diaphragm type

Operation

Toggle between the diaphragm types by pressing the +/- keys.

Legend

| Display | Diaphragm type |
|--------------|--|
| (Focus type) | |
| Off | no diaphragm (factory default setting) |
| 2x3cm | Diaphragm, 2x3cm |
| 3x4cm | Diaphragm, 3x4cm |

5.3.8 Service routine S08

Explanation

Configuration of radiation time and dose display after an X-ray exposure

Operation

Toggle between 0, 1, 2, and 3 by pressing the +/- keys.

Legend

| Display | Configuration |
|---------|---|
| 0 | No radiation time and dose indication |
| 1 | Display until time-out |
| 2 | Display until key actuation |
| 3 | Display until time-out or key actuation (factory default setting) |

5.3.9 Service routine S09

Explanation

Configuration of time-out time of the radiation time and dose display

Operation

Set the time-out time to a value from 0 to 255 seconds by pressing the +/ - keys (factory default setting = "10" seconds).

5.3.10 Service routine S10

Explanation

Configuration of display options: Area dose and actual radiation time

This option allows for the display of the area dose and actual radiation time after an exposure.

Operation

Toggle between Off and On by pressing the +/- keys.

Legend

| Display | Option |
|---------|-------------------------------------|
| Off | deactivated |
| On | activated (factory default setting) |

5.3.11 Service routine S11

Explanation

Configuration of the power-save mode

Operation

Toggle between *Off* and *On* by pressing the +/- keys.

Legend

| Display | Power-save mode |
|---------|----------------------------------|
| Off | Inactive |
| On | active (factory default setting) |

5.3.12 Service routine S12

Explanation

Configuration of time-out time of the power-save mode

You can set the time-out time for changing to power-save mode in minutes.

Operation

You can adjust the time-out time in minutes with the +/- keys (factory default setting = "30" minutes).

NOTICE

The smallest value is 1 minutes.

5.3.13 Service routine S13

Explanation

Configuration of 60/70 kV toggle

You can activate or deactivate the kV toggle with the kV keys "60kV" and "70kV."

Operation

Toggle between Off and On by pressing the +/- keys.

- If the kV toggle is deactivated, the current kV setting will become the default setting.
- The active kV setting can be selected with the kV keys "60kV" and "70kV."

Legend

| Display | kV switching |
|---------|---|
| Off | deactivated |
| On | activated (factory default setting with "60kV" preselected) |

5.3.14 Service routine S14

Explanation

Configuration of detector medium toggle (film/sensor)

You can activate or deactivate the detector medium toggle with the "Film" and "Sensor."

Operation

Toggle between Off and On by pressing the +/- keys.

- If the toggle is deactivated, the active detector medium setting will become the default setting.
- The active detector medium can be selected with the "Film" and "Sensor" keys.

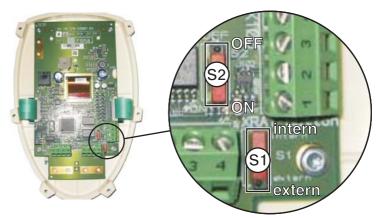
Legend

| Display | Change-over |
|---------|---|
| Off | deactivated |
| On | activated (factory default setting with "Sensor" preselected) |

5.3.15 Service routine S15

Explanation

Configuration of the safety circuit bypass.



The safety circuit can be bypassed via hardware on DX4 (slide switch **S2**) (See section "Setting switch S1 and S2 on DX4".

- Slide switch **S2** "On" = safety circuit bypassed
- Slide switch **S2** "Off" = safety circuit activated

If the setting of slide switch **S2** is changed, then the setting of service routine **S15** also must be changed.

- If slide switch **S2** is set to "*On*", then "*On*" also must be activated in service routine **S15**.
- If slide switch **S2** is set to "Off", then "Off" also must be activated in service routine **S15**.

Factory setting

• Slide switch **S2** and service routine 15 are set to "On" ex works.

Operation

Toggle between Off and On by pressing the +/- keys.

5.3.16 Service routine S16

Explanation

Configuration of the dynamic pulse/pause ratio (dynamic cooling)

Operation

Toggle between Off and On by pressing the +/- keys.

Legend

| I | Display | Dynamic cooling | | | | |
|---|---------|-------------------------------------|--|--|--|--|
| - | Off | deactivated | | | | |
| (| On | activated (factory default setting) | | | | |

5.3.17 Service routine S17

Explanation

Adaptation of the dose rate display to the measured dose rate of an external measuring instrument.

The nominal value for a radiation time of one second at 60 or 70kV is used as the basis here.

NOTICE

If the factory default setting is reset (Service routine S27 [\rightarrow 77]), the adjustment will be deleted.

NOTICE

The measurement should be performed for both voltages (60 and 70 kV).

Operation

- 1. Measure the dose rate on the external measuring instrument (measuring range mGy/s) with a radiation time of one second.
- 2. Start service routine S17.
- **3.** Set the tube voltage used with the kV keys (60kV, 70kV).
 - The nominal values of the dose rate for a radiation time of one second and of the tube voltage used are displayed in the first line.
- Set the measured dose rate in the second line by pressing the +/keys.
- 5. Acknowledge the setting by clicking the Adult key.

5.3.18 Service routine S18

Explanation

Setting the display contrast

You can set the display contrast in the range from 0 to 100%.

Operation

Set the contrast between 0 and 100 (%) by pressing the +/- keys (factory default setting = "40" (%)).

5.3.19 Service routine S19

Explanation

Setting the display brightness and color

The color and brightness of the display are determined via three adjustable color light sources.

The combined intensity of these light sources influences the brightness and color of the display (additive color mixture).

It is thus possible to adapt the display to the color and brightness of the display of a XIOS^{Plus} wall module (if both units are mounted on the wall next to each other).

Configuration

In one line, the intensities of the three light sources (red, green and blue) are displayed as numerical values (0 to 255):

- Left numerical value: red light source (factory default setting = "0")
- Center numerical value: green light source (factory default setting = "165")
- Right numerical value: blue light source (factory default setting = "255")

The active light source currently being adjusted is displayed with an underline.

Operation

NOTICE

Adaptation to XIOSPlus wall module

In general, adjusting the intensity of the blue light source is sufficient to adapt the display of the HELIODENT^{PLUS} to the display of the XIOS^{Plus} wall module.

- Selection of the light source
 - You can toggle between the light sources with the kV keys.
- Setting the intensity
 - The intensity of the selected light source can be adjusted by pressing the +/- keys.
- Acceptance of previous settings
 - Press the Adult key.

5.3.20 Service routine S20

Explanation

Setting the key brightness (LEDs)

You can set the key brightness in the range from 0 to 255 (factory default setting = "255" (full brightness)).

This setting affects all LEDs of the display.

Operation

Set the brightness between 0 and 255 by pressing the +/- keys.

5.3.21 Service routine S21

Explanation

Display self-test

Procedure

- 1. The buzzer sounds.
- 2. The background colors red, yellow, blue and white are shown in sequence.
- 3. The display area is fully energized (display area turns black)
- This process is repeated cyclically.

Cancel



> Press the Child key.

5.3.22 Service routine S22

See Section "Front panel test [→ 48]."

5.3.23 Service routine S23

Explanation

Reading the status log

NOTICE

Evaluation of the statuses only by the Sirona Service Hotline.

Legend

Structure of display content:

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|-----------------|------|----------|--------------------|--------------|----------|-------------------|
| | Heat current | VH | kVactual | Rated values kV/mA | Output stage | mAactual | kVactual cable |

5.3.24 Service routine S24

Explanation

Display of the exposure and radiation time counter

Legend

- Line 1 exposure counter
- Line 2 radiation time counter (in ms)

5.3.25 Service routine S25

Explanation

This service function displays the saved data byte-by-byte.

Operation

You can increase or decrease the index by pressing the +/- keys.

Legend

- The index is displayed as the first figure.
- The second figure is the number of bytes of the saved data according to the index.

Display format:

"Index" + "saved data [index]"

5.3.26 Service routine S26

Explanation

Activation of demo mode

This service function activates or deactivates the demo mode.

NOTICE

If the demo mode is activated, error message E1 11 88 will be displayed following switch-on.

This error message must be acknowledged with any key.

Operation

Toggle between Off and On by pressing the +/- keys.

Legend

| Display | Demo mode |
|---------|-------------|
| Off | deactivated |
| On | activated |

5.3.27 Service routine S27

Explanation

Resetting the unit to factory default settings

Following a reset, all of the settings previously made via the service routines (e.g. density correction, film/sensor type setting) are cleared.

Operation

You can toggle between "---" and Reset by pressing the +/- keys.

Legend

| Display | Settings | | | | |
|---------|-----------------------------------|--|--|--|--|
| | Retain settings | | | | |
| Reset | Reset to factory default settings | | | | |

> 1.5 mm Al

,7 mm Al

(B)

5.3.28 S28 service routine

Explanation

Setting the overall X-ray filter strength.

The overall X-ray filter strength is used as a parameter for calculating the target radiation time and the dose-area product.

Operation

By pressing the +/- button, the filter setting can be amended between 1.5 mm AL and 2.5 mm AL in 0.1 mm steps.

A = Basic filter value

B = Changeable filter value

Acknowledge the setting by clicking the Adult key.

By pressing the Child key, the setting will be rejected and the service routine is exited.

Assigning the filter strength for the radiation time

Using the software, an offset is set for the radiation time according to the filter strength.

| Total filtration [mm] | >1.5 | >1.6 | >1.7 | >1.8 | >1.9 | >2.0 | >2.1 | >2.2 | >2.3 | >2.4 | >2.5 |
|---------------------------------|------|------|------|------|------|------|------|------|------|------|------|
| Additional filter strength [mm] | 0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 |
| Radiation time level offset | 0 | 0 | 0 | +1 | +1 | +1 | +1 | +2 | +2 | +2 | +2 |

5.3.29 Service routine S29

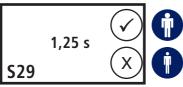
Explanation

Setting the maximum radiation time.

This setting is then set to the maximum possible adjustable radiation time.

Operation





By pressing the +/- key, the radiation time can be amended by 1 level at a time using the radiation time table.

Acknowledge the setting by clicking the Adult key.

By pressing the Child key, the setting will be rejected and the service routine is exited.

Adjustable maximum radiation times

| 0.4 s | 0.5 s | 0.64 s | 0.8 s | 1.0 s | 1.25 s | 1.6 s | 2.0 s | 2.5 s | 3.2 s |
|-------|-------|--------|-------|-------|--------|-------|-------|-------|-------|
| | | | | | | | | | |

6 Repair

6.1 Safety-related tests

A protective conductor test and a leakage current test must be performed prior to the installation or the hand-over of the unit as well as after repair work.

See Sections "Protective conductor test [\rightarrow 61]" and "Leakage current test."

6.2 Replacing X-ray tube assembly H1

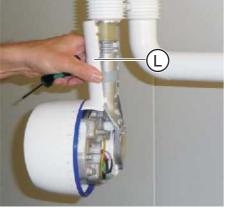
Required tools

Torx screwdriver (size 10, 15 and 20)

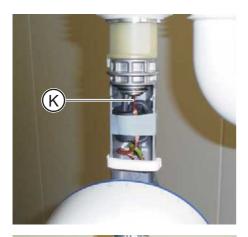
Removal of the X-ray tube assembly

- 1. Switch the X-ray unit off.
- 2. Unscrew and remove the old cover (A).

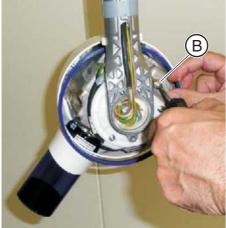




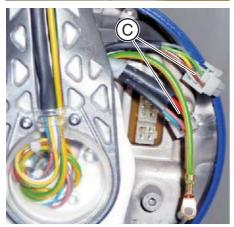
3. Remove the old arm cover (L).



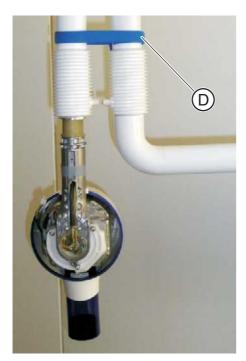
- 4. Check the condition of the grounding strap.
 - No damage should be evident at position (**K**). A slight restriction at position (**K**) with a cross-section loss of max. 20% is still acceptable.



5. Unscrew and remove the grounding wire (**B**).



6. Pull the connectors **(C)** of the tube assembly cable out of the tube assembly.

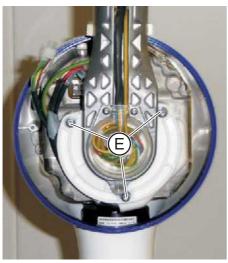


7. Secure the support arm with a belt (D).

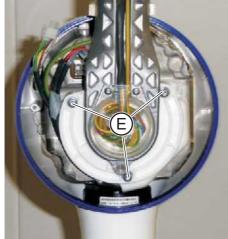
DANGER

Risk of injury

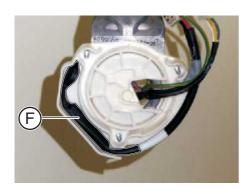
The support arm must be secured against jerking upward with a belt.



- 8. Unscrew and remove the 3 screws (E). Hold the X-ray tube assembly securely when doing this.
- 9. Remove the tube assembly from the scissor arm.

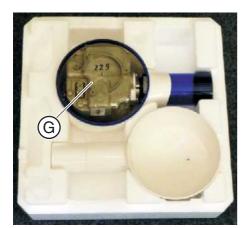


Installation of X-ray tube assembly



NOTICE

During installation, make sure that the resistor (F) remains in the holder and does not fall out.



1. Remove the X-ray tube assembly (**G**) from its packaging.



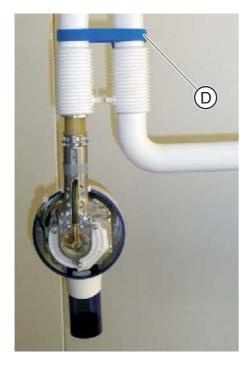
2. Firmly attach the X-ray tube assembly, using 3 new self-cutting screws (PM 3.5 x 16).

A DANGER

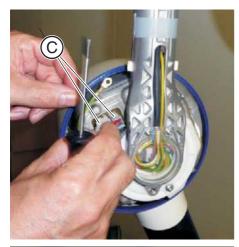
Risk of damage

Applying excessive torque may damage the threads cut by the selfcutting screws.

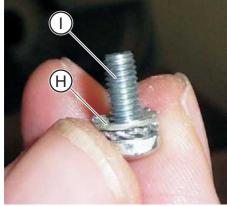
Use only a screwdriver without any other tools (e.g. to boost the power).



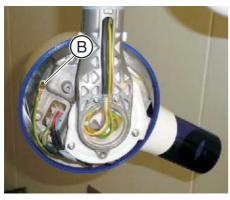
3. Remove the belt (D).



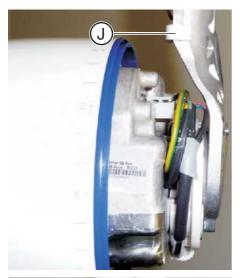
4. Plug the connectors **(C)** of the tube assembly cable onto the tube assembly.



5. Mount a contact washer (H) on the screw (I) (M4 x 10).



6. Screw the grounding wire (B) on tight with the prepared screw.



- 7. Check the scissor arm (J) to make sure it does not brush against a cable when moved.
 - No cable should touch the scissor arm in any position. Fasten the cable with a cable tie if necessary.
- **8.** Check the exposure time and the high voltage. See the section "Checking exposure time and high voltage kV" [\rightarrow 43].
- 9. Check the tube current. See Section "Tube current verification [\rightarrow 60]."



10. Attach the new arm cover (L).



11. Screw the new cover (A) on tight.

6.3 Replacing PC board DX1

6.3.1 Removing a defective board DX1

Unscrewing the board

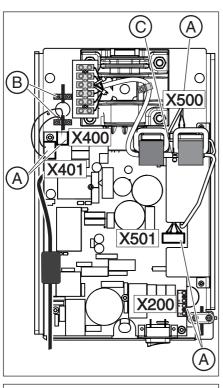
- ✓ The graphics show the DX1 board up to serial no.: 26 999

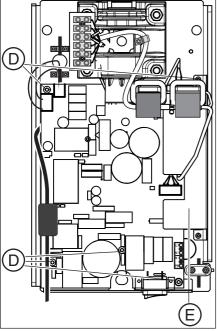
 Proceed in a similar way for DX1s from serial no. 27 000 onwards.
- ✓ The unit is separated from the mains fuse. The defective board DX1 is freely accessible.
- 1. Remove all connected cables (A) from the board.



Do not remove the shield clamps (B).

2. Remove the cable tie (C) from cable L1 to the ferrite cores.





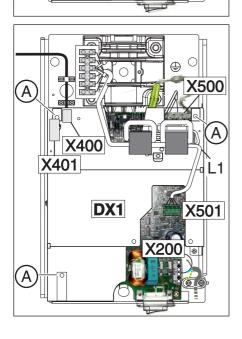
- Unscrew and remove the defective board.
 Store the mounting screws (5x D) as they are needed again.
- 4. Remove the side cover plate (E) as it is not needed any longer.

L2/L6

6.3.2 Installing the new board DX1

Screwing the new board

- ✓ Take out the 4 spacers M4x34 from the package.
- 1. Screw the new board **DX1** firmly to the wall adapter using the 4 spacers (**A**) and a screw with a washer and serrated lock washer (**B**).
- **2.** Depending on the type of installation:
 - Insert the cable **L2** or **L6**, coming from the board **DX4**, back into the power strip **X400**.
 - Insert the plug of the cable **L3** or **L9** for the release button into **X401** for cable **L3** (spiral cable): Place the ferrite core of the spiral cable inside the EMC plate.
- 3. Insert one part of the cable **L1** into the **X500** (see list below), and do not plug the second one that leads to the terminal block **X501** yet.
- 4. Do not connect the power cable to X200 yet.



X501

- 5. Place the EMC plate on the spacers and screw the EMC plate firmly using the available 3 screws (A).
- Now, insert the second part of the cable L1 into X501 by plugging the individual strands into the terminal block (see below) and tighten firmly
- **7.** Attach the two ferrite cores onto the EMC plate using the supplied cable ties, begin by using the 2 eyelets on the EMC plate.

Note: Connect the supply line to arm cable L1

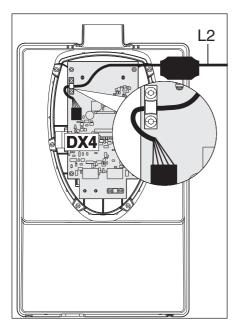
Terminal block X500:

- X500.1: blue (V)
- X500.2: pink (W)

Terminal block X501:

- X501.1: gray/brown (negative)
- X501.2 : white (heating-)
- X501.3 : yellow (heating+)
- X501.4 : green (kVact)

6.3.3 Connection in the control panel for cable L2



- ✓ This change is only required: if cable L2 is available. With DX1 boards up to serial no. 26 999
- 1. Insert the cable L2 into X103 on the DX4
- 2. Insert the cable L2, as shown, into the strain relief and firmly tighten the strain relief on the DX4.

The cable L2 should now be in the strain relief in a position that is turned as compared with the previous installation, so that the ferrite core can be placed well in the housing.

6.3.4 Connecting the power cable

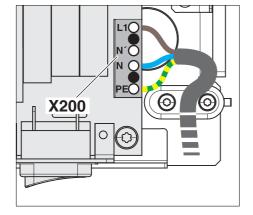
⚠ CAUTION

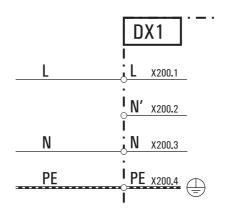
Observe the permissible nominal voltage range!

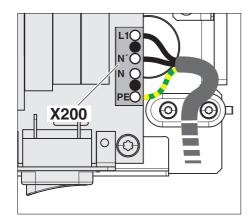
Connect 120 VAC with 1-phase connection 200 - 240 VAC with 1-phase or 2-phase connection, 50/60 Hz

1-phase connection

- X200.1: L1 (phase 1)
- X200.2: N' (Do not use!)
- X200.3: N
- X200.4: PE

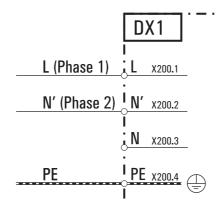






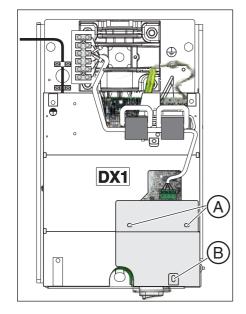
2-phase connection

- X200.1: L1 (phase 1)
- X200.2: N' (phase 2)
- X200.3: N (Do not use!)
- X200.4: PE



6.3.5 Attach the EMC additional plate for the wall adapter to the power supply

- ✓ The safety checks are performed, the power cable is connected.
- ✓ Not required for ceiling model.
- 1. Place the EMC additional plate on the EMC plate.
- 2. Screw the EMC additional plate on the EMC plate using 2 screws (A).
- 3. Screw the EMC additional plate onto the spacing bolt using screw (B).

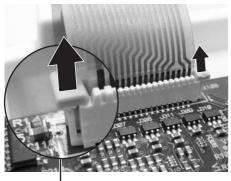


6.4 Replacing PC board DX4

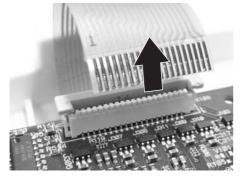
- ✓ The defective DX4 board is freely accessible.
- 1. Switch the unit off.
- 2. Disconnect the unit from the main fuse.
- 3. Remove all of the cables connected to the board.



4. Unlock the foil cable sockets X108 and X109.







- 5. Pull the foil cable of the front panel out of sockets X108 and X109.
- 6. Unscrew and remove the defective board.
- 7. Attach the new board with screws.
- 8. Plug the foil cables into the appropriate sockets and lock the sockets.
- 9. Reattach all cables to the board (Don't forget the strain relief!).

6.5 Replacing the power supply cord for the mobile stand

- ✓ Switch the unit off and unplug the connector from the power socket.
- **1.** To remove the cover, see Removing covers $[\rightarrow 19]$.
- 2. Disconnect the power supply cord from clamp X200 on DX1.
- **3.** Connect the disconnected end of the defective power supply cord with a pull cord. Pull the power supply cord in a downward motion out of the supporting tube and into the pull cord.
- 4. Connect the pull cord to the new power supply cord and, in doing so, carefully pull it upwards with pull cord inside the supporting tube. Ensure that the insulation is not damaged when lifting the power supply cord.



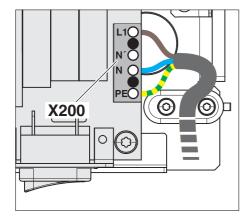


L1: brown

N: blue.

PE: green/yellow

- **6.** Apply bend protection directly on the supporting tube.
- Insert the connector into the socket, check the functioning of the unit. Reattach the covers.



We reserve the right to make any alterations which may be required due to technical improvements.

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