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sirona
The Dental Company

HELIODENT PLUS

Service Manual

English

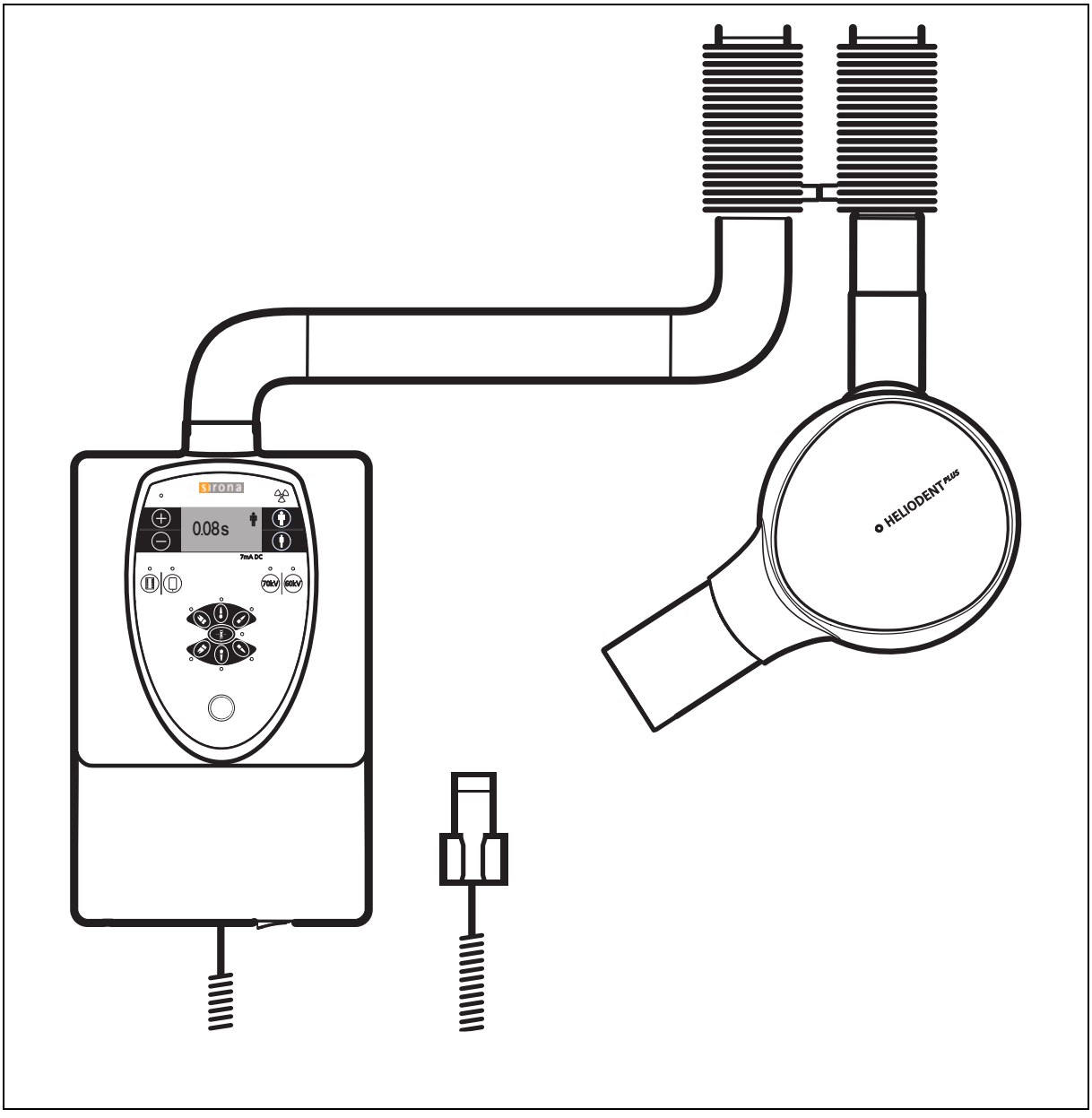


Table of contents

1 General information

1.1 Structure of the documents

Structure of the documents

The symbols and character formats used in the present manual have the following meaning:

⚠ WARNING

Identifies warnings where a medium risk of injury to persons exists if they are not observed.

⚠ CAUTION

Identifies safety information where the following hazards exist if they are not observed: Slight risk of injury to persons, risk of property damage or damage to the product.

NOTICE

Assistance

Identifies additional information, hints and tips.

✓ Prerequisite ➢ Action or ➢ **1.**, **2.**, … ↳ Result	Requests you to do something.
See chapter "Structure of the documents [→ 6]“	Identifies a reference to another text passage.
• List	Identifies a list.
“Text between quotation marks“	Identifies commands, menu items or quotations.

1.2 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.

1.3 Operation notes

Nominal line voltage

Nominal voltage:	120V, 200V– 240V
Permissible deviation:	± 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

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.

Cooling period

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

Software version

The DX4 board determines the software version.

You can find the software version with the following steps:

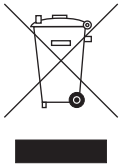
- Start service routine "2".
- A label next to the main switch includes an imprint of the software version.

Disturbance of electronic equipment caused by cell phones

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

Disposal

General



Your product is marked with the adjacent symbol. Within the European Economic Area, this product is subject to Directive 2002/96/EC as well as the corresponding national laws. This directive requires environmentally sound recycling/disposal of the product. The product must not be disposed of as domestic refuse!

Please observe the disposal regulations applicable in your country.

X-ray tube unit

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

Removing covers

Observe the section on "Removing covers".

Measurements

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 [→ 56].

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 [→ 57].

If a diaphragm is replaced or removed, this change must also be registered with service routine S07 [→ 57].

1.5 Replacing 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.

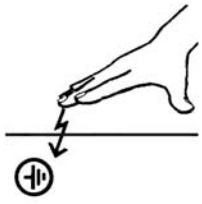
Preparation

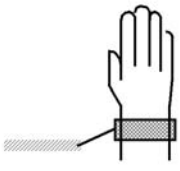
➢ Always switch the unit off before replacing parts.

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.





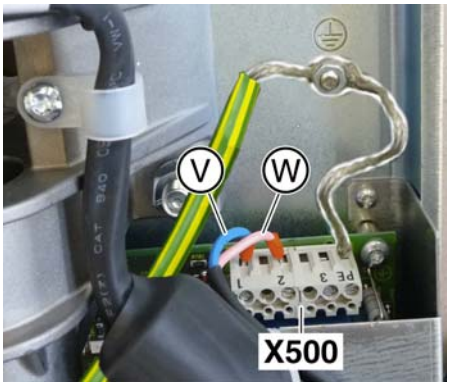
- Always wear an ESD wrist band to protect sensitive components on printed circuit boards (ESD) and attach it to a ground conductor (green/yellow).
- Always check the unit after replacing PC boards DX1 and DX4 or the X-ray tube assembly.
- For safety reasons, the support arm must be secured with the 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 [→ 49]" and "Leakage current test [→ 51]."

1.6 Demo mode



Activation

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.

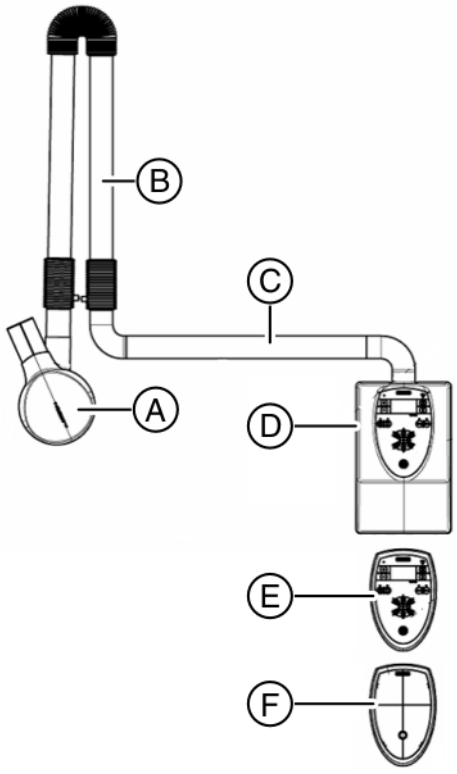
↳ The demo mode was deactivated.

↳ When a release button is activated, **X-ray radiation** will be generated.

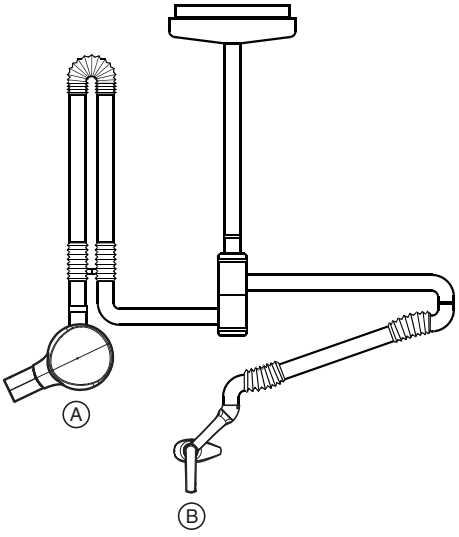
1.7 List of software versions

Software	Remarks
V02.04.00	1. Series release

1.8 The most important subassemblies

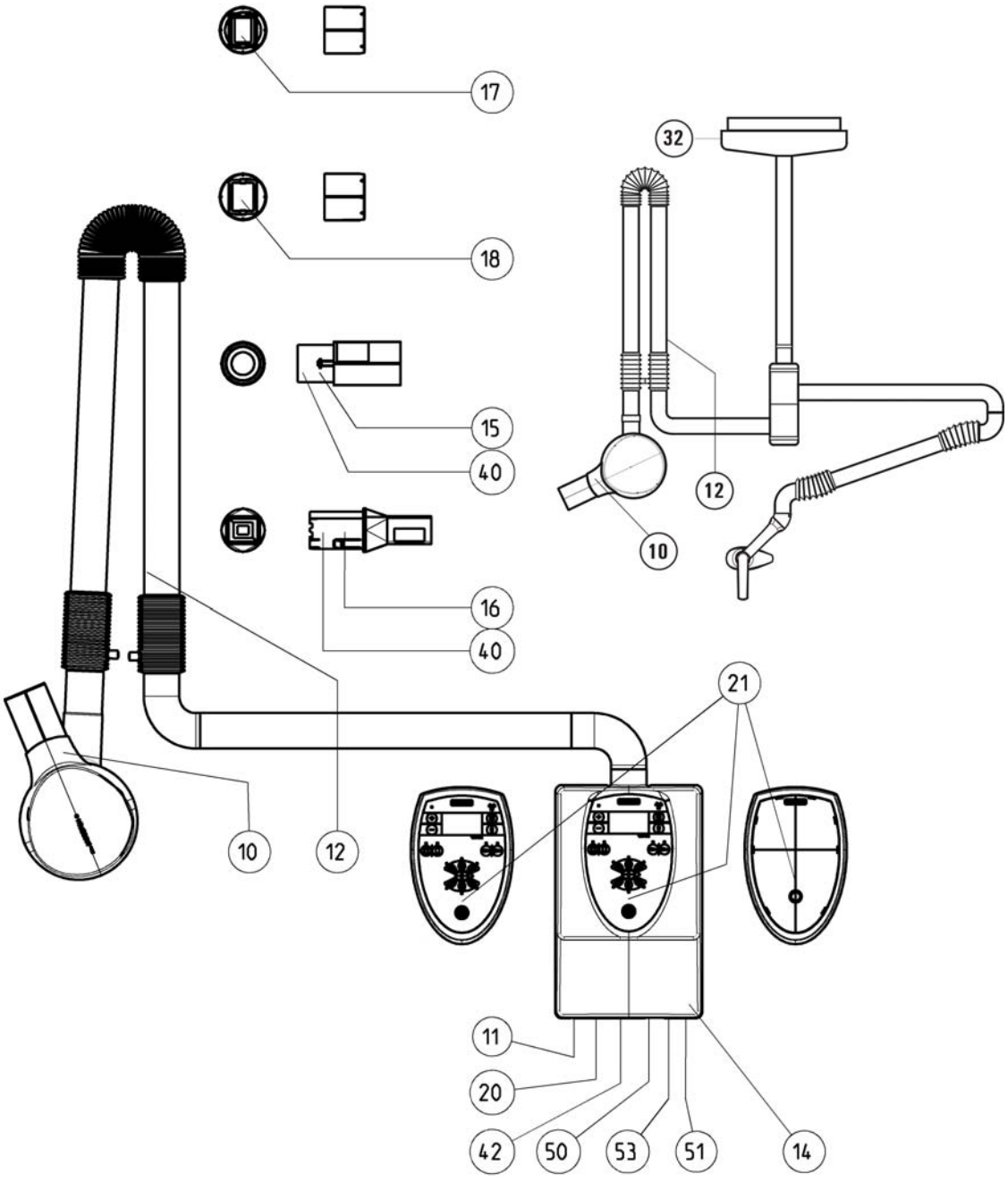


Position	Designation
A	X-ray tube unit
B	Scissor arm
C	Support arm
D	Wall module • Board DX1 • Front panel • Control board DX4
E	Remote Timer (Optional) • Front panel • Control board DX4
F	Remote control (optional)



Position	Designation
A	X-ray tube assembly on ceiling mount
B	LEDview on ceiling support

1.9 Labeling



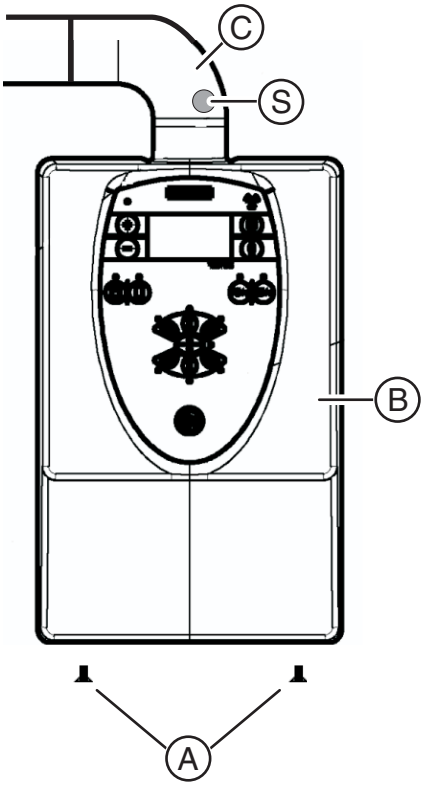
Item	Designation	Info
10	ID label of X-ray tube assembly	attached inside the cone
11	ID label of wall adapter	
12	ID label of scissor arm	
14	"Follow the operating instructions" label	
15	ID label of round cone extension	transp. / white print
16	ID label of square cone extension	transp. / white print

Item	Designation	Info
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	

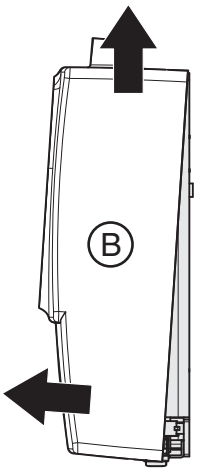
1.10 Removing covers

1.10.1 Wall module

Removing the cover



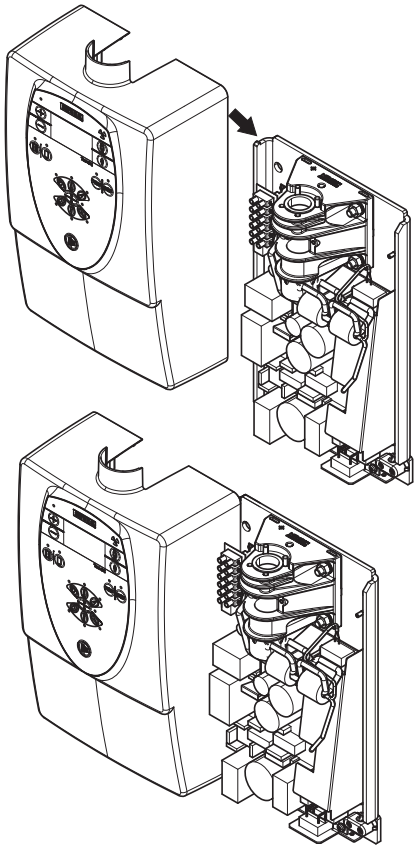
1. Switch the unit off.
2. Unlock the housing shell **(C)** of the support arm above the wall module by pinching the housing shells together at position **(S)**.
3. Remove the housing shell **(C)** from the support arm.
4. Unscrew and remove the fastening screws **(A)** from the underside.



5. Pull the protective cover **(B)** slightly away from the wall and lift it up.

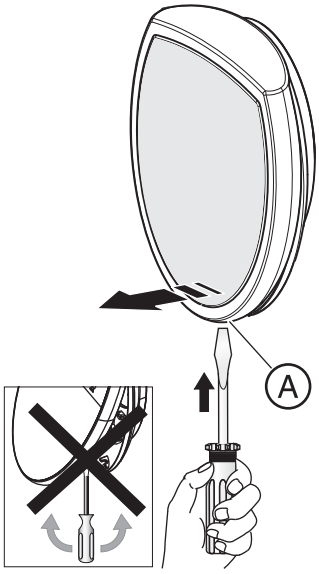
↳ You can now remove the protective cover.

Hanging up the cover



➢ Hang the cover on the side of the wall adapter plate so that it is securely positioned (see illustration).

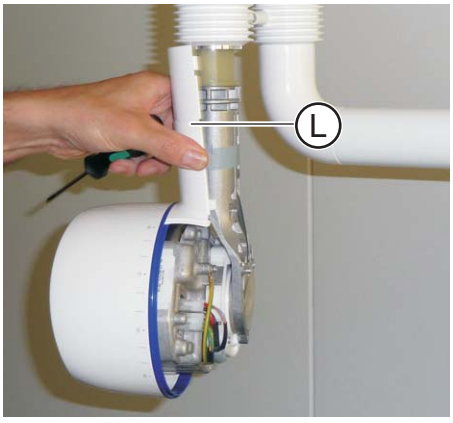
1.10.2 Remote control and remote timer



➢ 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!**

1.10.3 X-ray tube unit

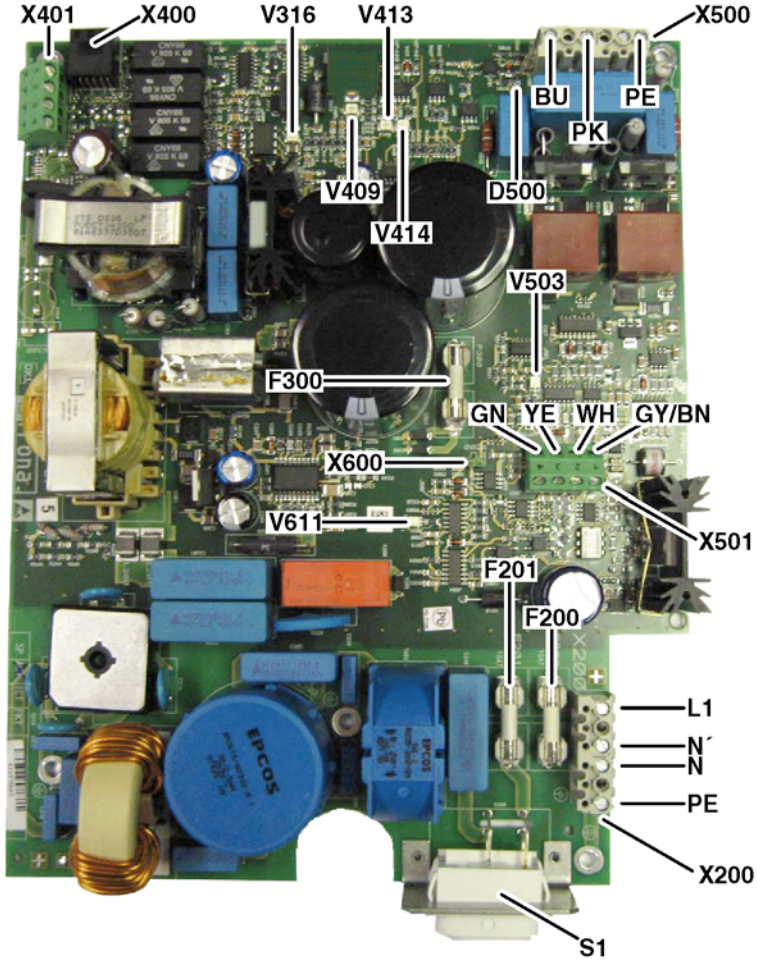
1. Unscrew and remove the cover (**A**).



2. Remove the arm cover (**L**).

1.11 Overview of PC boards

1.11.1 Generator board DX1



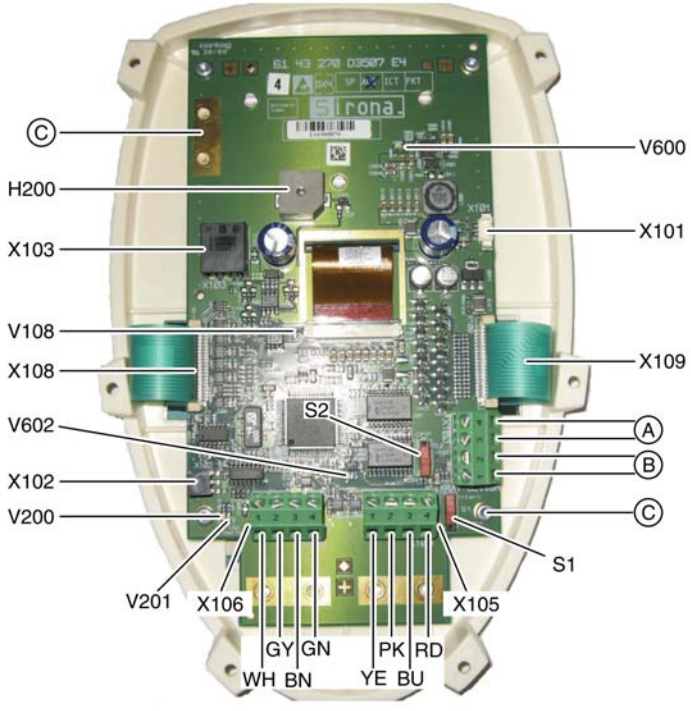
S1	Power switch
F300	Fuse for switched-mode power supply (1A 250V quick-blow, order no.: 10 77 304)
X400	Direct contact with control board DX4 [→ 17] / cable **L2** or **L6**.
V409	LED, setpoint generation - LED lights up during an X-ray exposure.
V414	LED, kV controller - LED lights up during an X-ray exposure if the kV controller is functioning correctly.

F200/ F201	Fuse for PFC (10A 250V slow-blow, order no.: 10 77 460)
V316	LED, supply voltage +15V - LED lights up when +15 V supply voltage is present.
X401	Release and safety circuit only for installation options 1, 2, 4, 6 and 6.1
V413	LED, basic heating - LED lights up when basic heating is correct. - LED lights up during an X-ray exposure.
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.
V611	LED, release - LED lights up when the release button is pressed.

X600	Measuring points for the tube current measurement (see section "Checking the tube current [→ 48]“).

1.11.2 Control board DX4



(**A**)	Protective circuit (door contact)
(**C**)	EMC shielding
V200	LED, Debugging
H200	Acoustic signal - Acoustic signal sounds during an X-ray exposure.
X103	Direct contact with generator board DX1 [→ 16] / cable **L2** (installation options 1, 2, 4, 6 and 6.1)
V600	LED, +5.0 V supply voltage

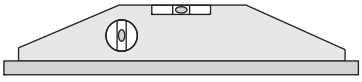
(**B**)	Release button
V108	LED, +3.3 V for LCD
V201	LED, status indicator - LED flashes with 100% unit function.
V503	LED, +8V input voltage
X105, X106	Direct contact with generator board DX1 [→ 16] as remote control / cable **L6** (installation options 3, 5, 7 and 8)
V602	LED, +3.3 V controller voltage

1.12 Required items

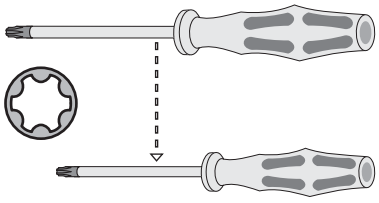
1.12.1 Additional documents

- Spare parts list
- Order No.: 62 34 111
- Wiring diagrams
- Order No.: 62 15 086

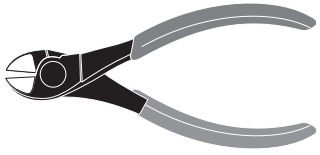
1.12.2 Tools and auxiliary materials



- Allen key / size 13:
- Spirit level

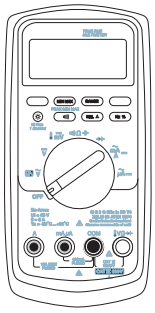


- Screwdriver, Torx®, sizes T10, T15, T20 and T30, 200 mm



- Diagonal-nosed 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, e.g. Bender tester or line-frequency, high-resistance measurement voltage source (isolation transformer) and measuring circuit (MD) that meets the requirements of IEC 60 601-1.
- **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 [→ 19]".

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 [→ 20]" 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

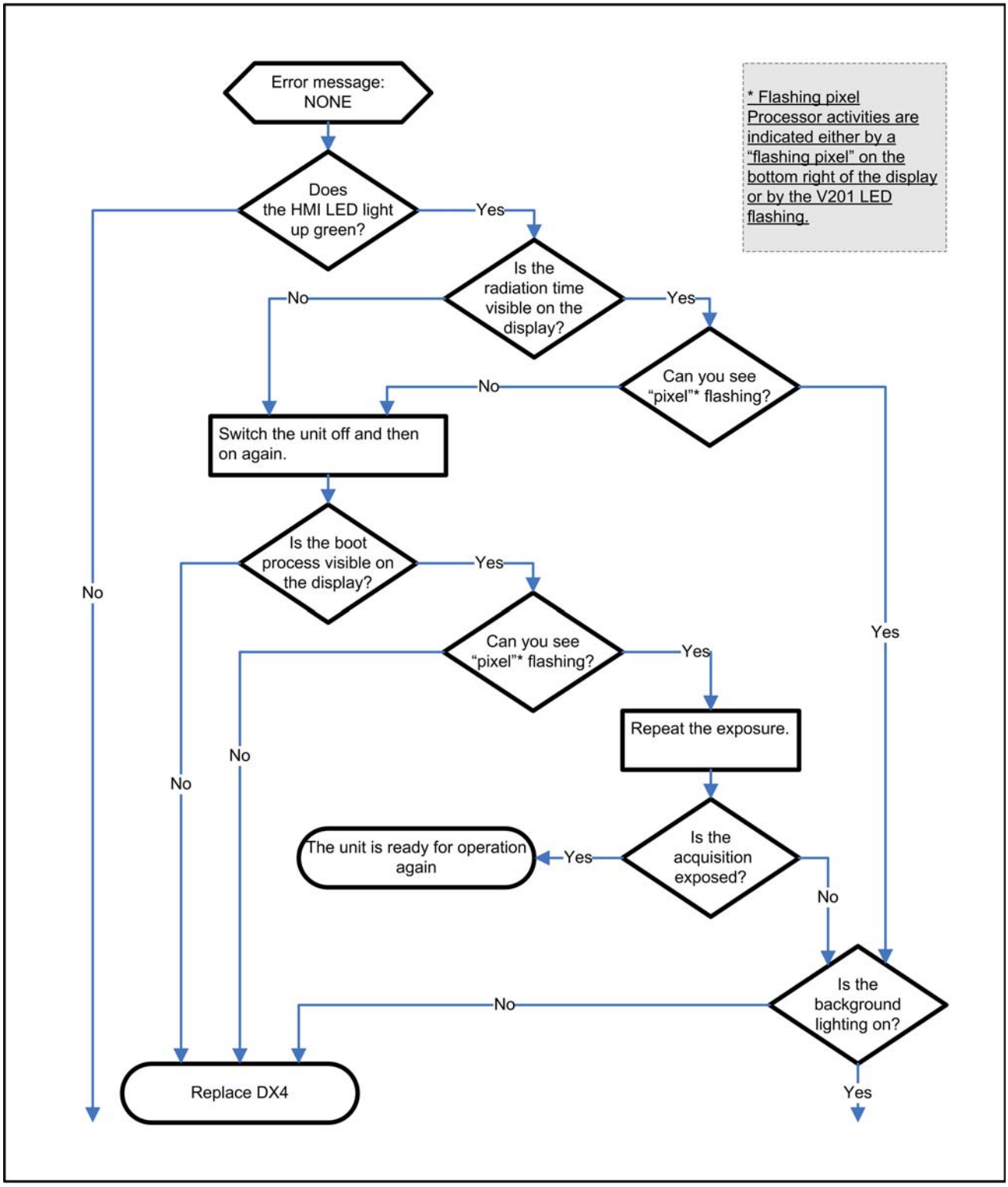
Error code	Description	Actions required
None	Release does not result in any reaction/ exposure	See Section ""Error message NONE [→ 23]"
E1 11 88	Demo mode ACTIVE	Acknowledge the error message with any key. For "normal operation" - change service routine 26 [→ 65]
E1 04 03		Acknowledge the error message 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 51	Safety circuit (door contact)	See Section ""Error message E1 04 51 [→ 26]"
E1 04 60	Error of serial port	Replace DX4.
E3 04 30	Power-up error Release button was actuated during power-on	Switch unit OFF and ON again 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 A front panel key was actuated during power-on	Switch unit OFF and ON again If the error reoccurs, perform a key test with service routine 20 [→ 63] Key defective? Replace front panel
E5 01 02 E5 01 12 E5 01 14 E5 01 32 E5 01 42	No target values are generated DX4 buzzer sounds, no exposure	Check the cable between DX1 and DX4 (B4). Replace the entire cable if necessary. If the error message reappears, DX1 must be replaced.
E5 01 02 E5 01 12 E5 01 14 E5 01 32	Buzzer sounds No exposure	Replace DX1
E5 01 02 E5 01 12 E5 01 14	Buzzer sounds No exposure	See Section ""Error message E5 01 02 / E5 01 12 / E5 01 14 [→ 27]"

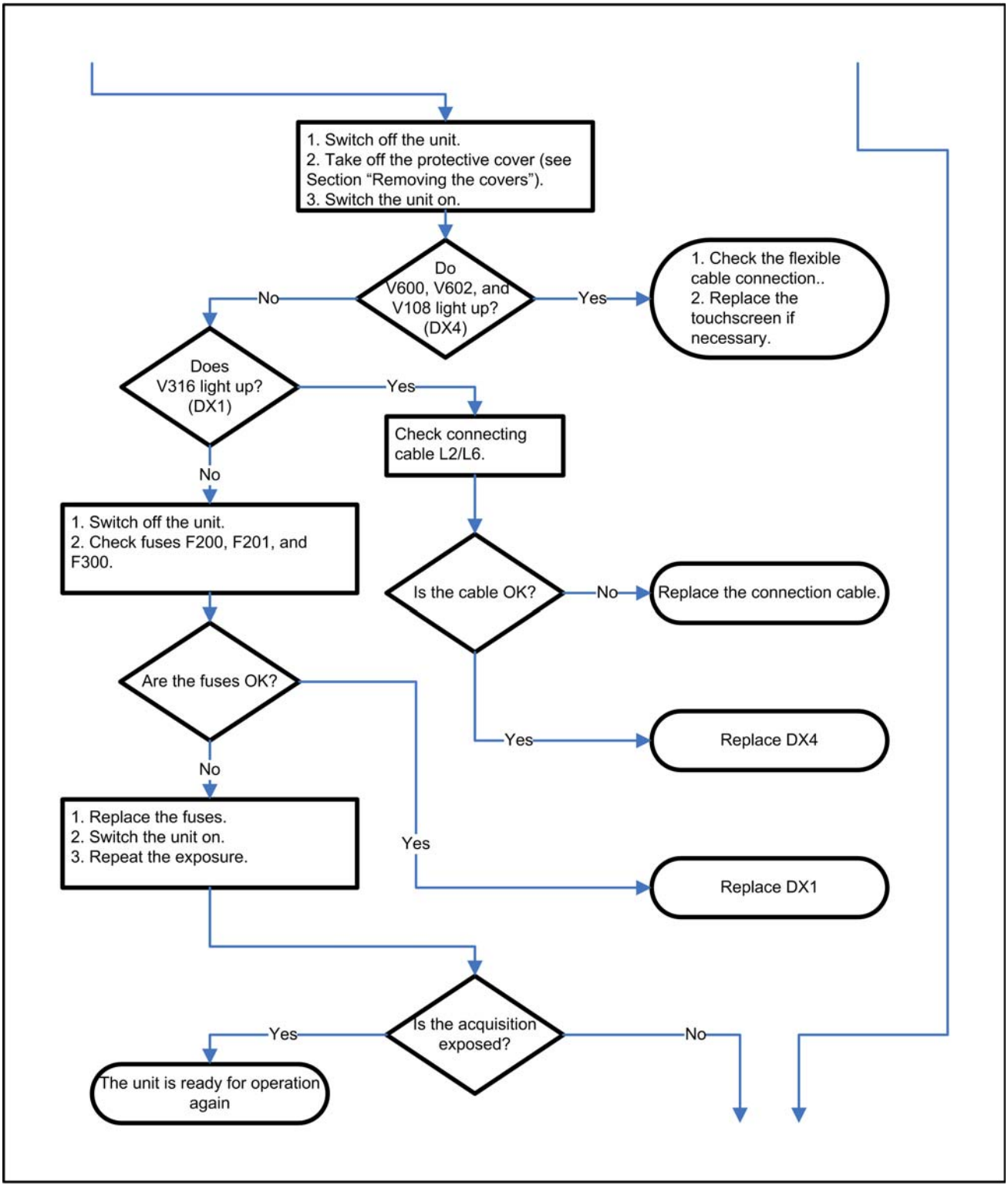
Error code	Description	Actions required
E5 01 02 E5 01 14 E7 01 51	Buzzer sounds no exposure temporarily	Replace DX1
E5 01 22	Buzzer does not sound No exposure	See Section ""Error message E5 01 22 [→ 28]"
E5 04 50	Internal software error	Switch unit OFF and ON again Repeat the exposure with the same 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 actuated	Switch unit OFF and ON again 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 ""Error message E6 01 23 [→ 29]"
E6 01 11	Internal hardware error	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

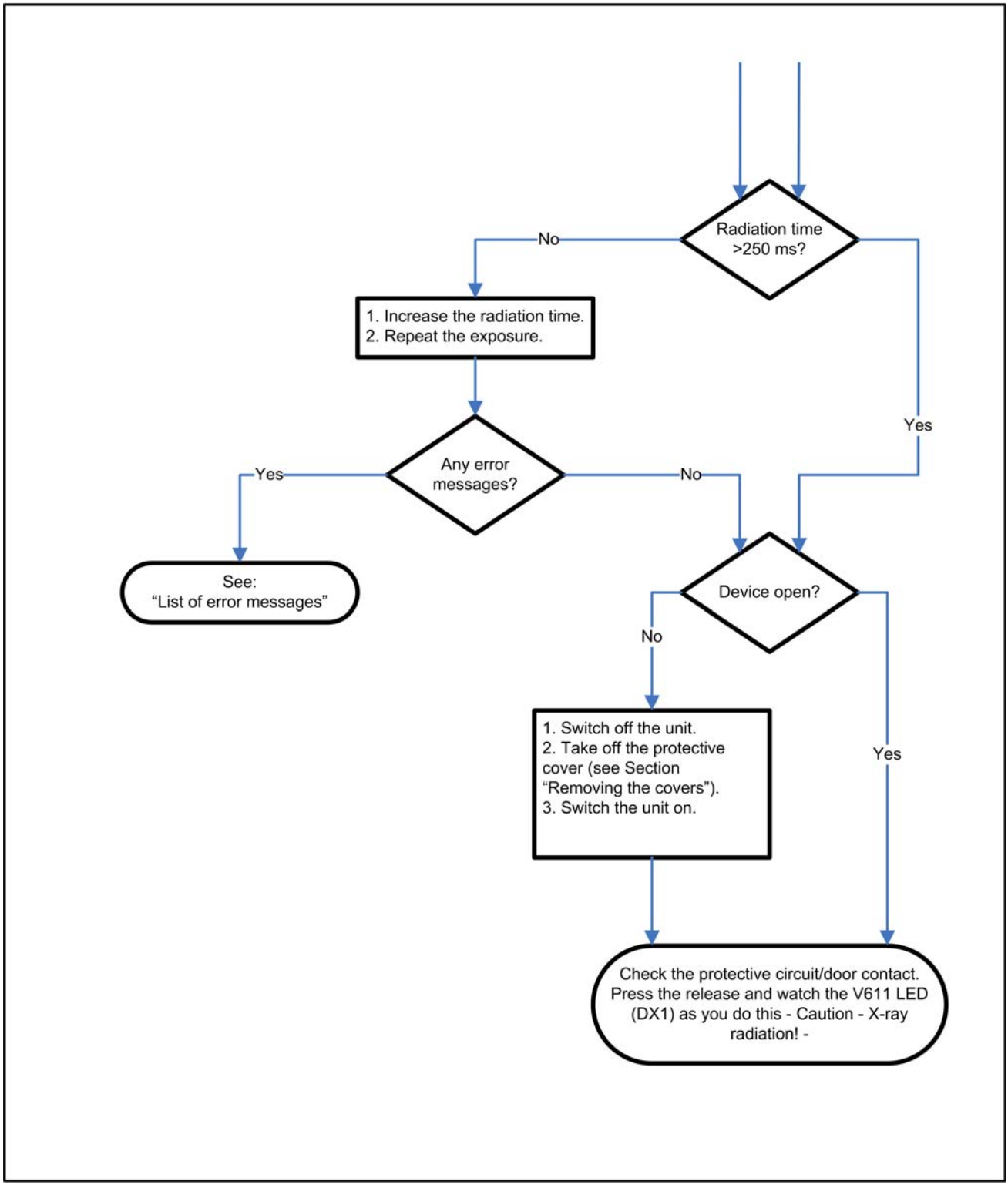
Error code	Description	Actions required
E6 04 06	Internal error	Switch unit OFF and ON again If the error message reappears, DX4 must be replaced
E6 04 12	Internal error	Switch unit OFF and ON again If the error message reappears, DX4 must be replaced
E6 04 20	Internal error	Switch unit OFF and ON again 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 [→ 31]"
E7 01 21	Release actuated No buzzer sound No exposure	Check the cable between DX1 and DX4. Cable may need to be replaced
E7 01 51	Internal hardware error	Switch unit OFF and ON again If the error message reappears, DX1 must be replaced

3 Troubleshooting

3.1 Error message: NONE




1. Switch off the unit.
2. Take off the protective cover (see Section “Removing the covers”).
3. Switch the unit on.
Do V600, V602, and V108 light up? (DX4)
No
Yes
1. Check the flexible cable connection..
2. Replace the touchscreen if necessary.
Does V316 light up? (DX1)
Yes
Check connecting cable L2/L6.
No
1. Switch off the unit.
2. Check fuses F200, F201, and F300.
Is the cable OK?
No
Replace the connection cable.
Are the fuses OK?
Yes
Replace DX4
No
1. Replace the fuses.
2. Switch the unit on.
3. Repeat the exposure.
Yes
Replace DX1
Is the acquisition exposed?
Yes
No
The unit is ready for operation again


Radiation time >250 ms?
No
Yes
1. Increase the radiation time.
2. Repeat the exposure.
Any error messages?
Yes
No
See: "List of error messages"
Device open?
No
Yes
1. Switch off the unit.
2. Take off the protective cover (see Section "Removing the covers").
3. Switch the unit on.
Check the protective circuit/door contact. Press the release and watch the V611 LED (DX1) as you do this - Caution - X-ray radiation! -

3.2 Error message: E1 04 51 - Door contact error

Explanation

Depending on the installation type, there are different approaches to address error message E1 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"

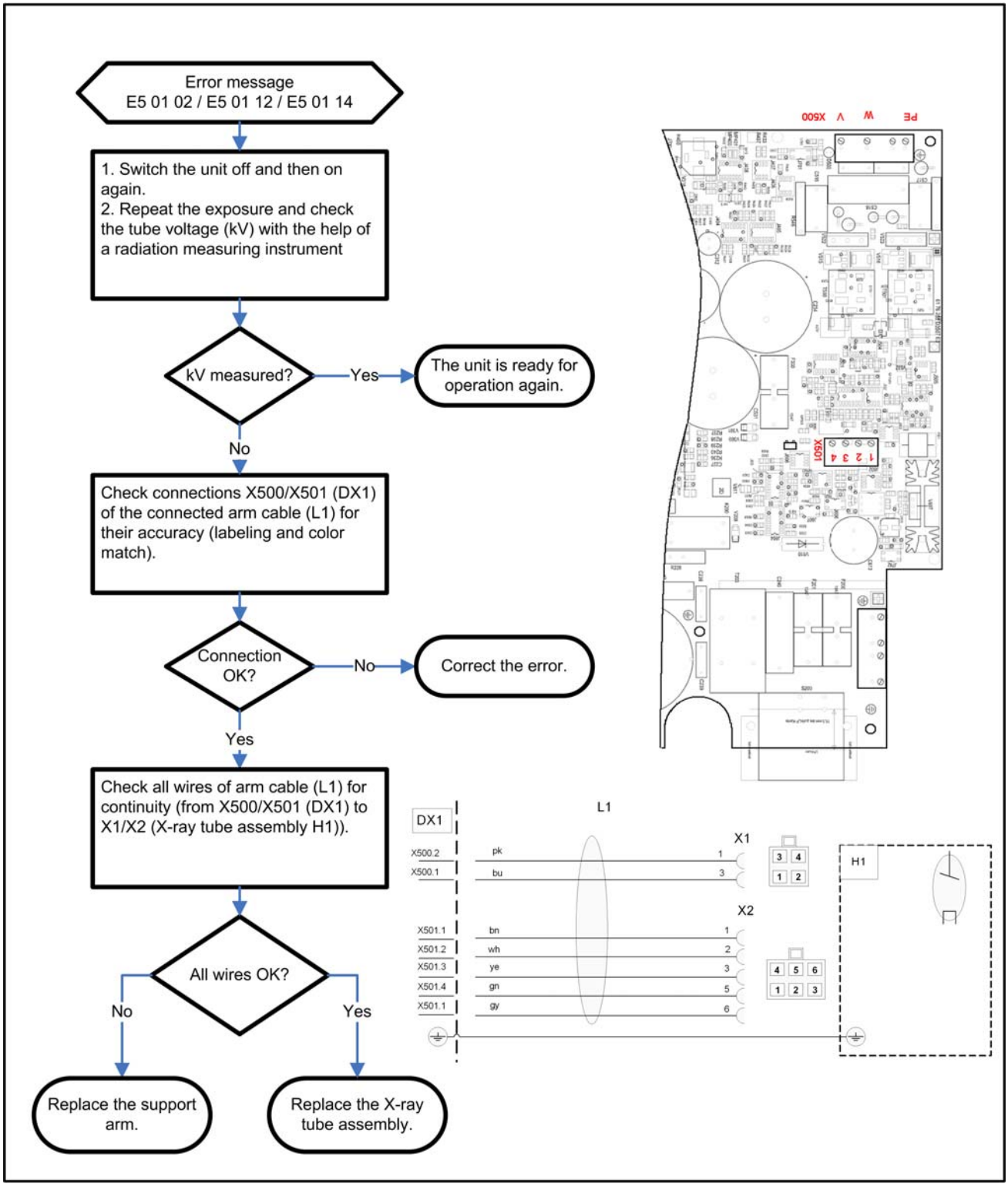
Error correction (case 1)

1. Set switch S2 on PC board DX4 to ON.
2. In service routine 012, set the value "1" and save it.
3. Switch the unit off and then on again.

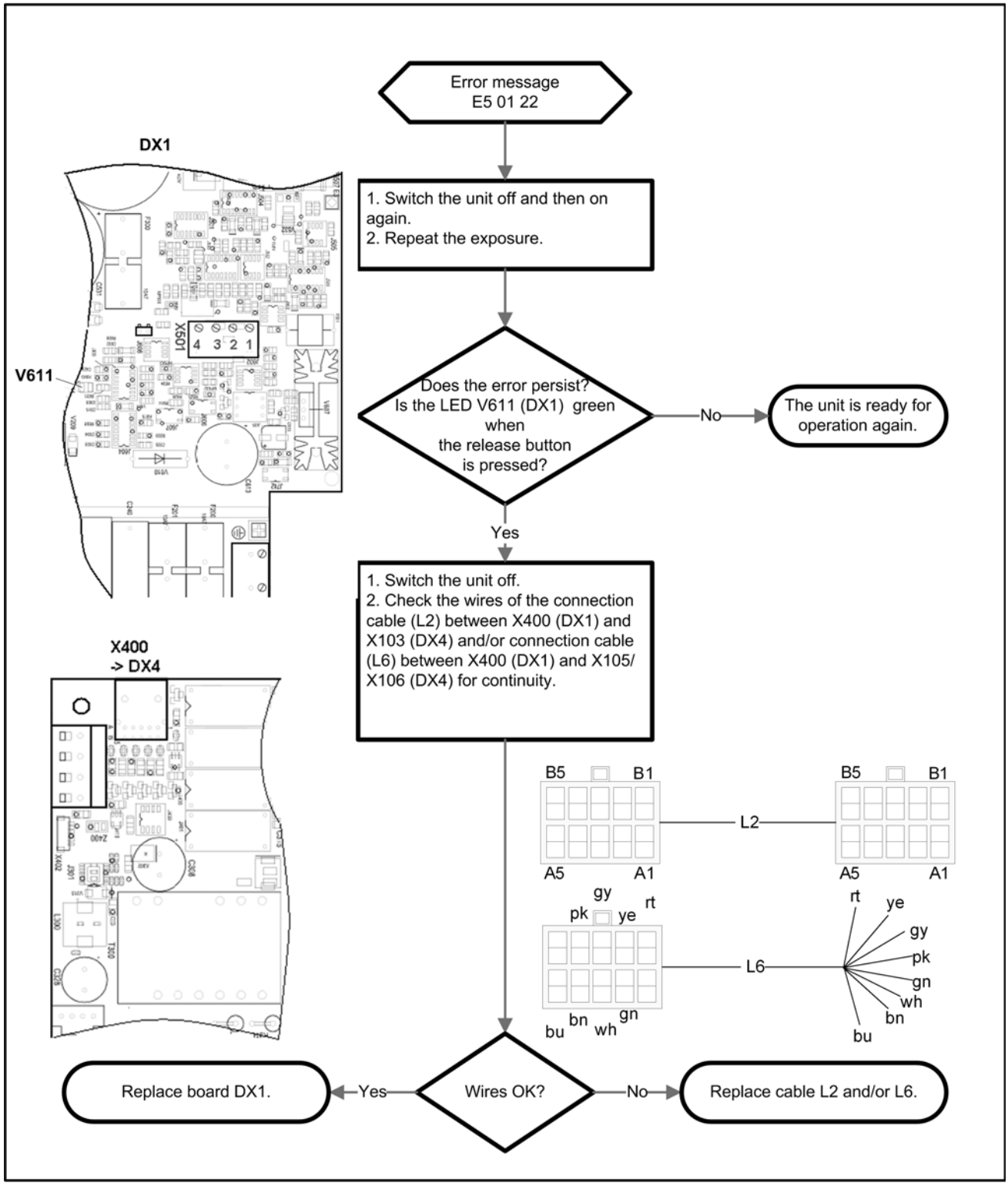
Error correction (case 2)

1. Set switch S2 on PC board DX4 to OFF.
2. In service routine 012, set the value "0" and save it.
3. Switch the unit off and then on again.

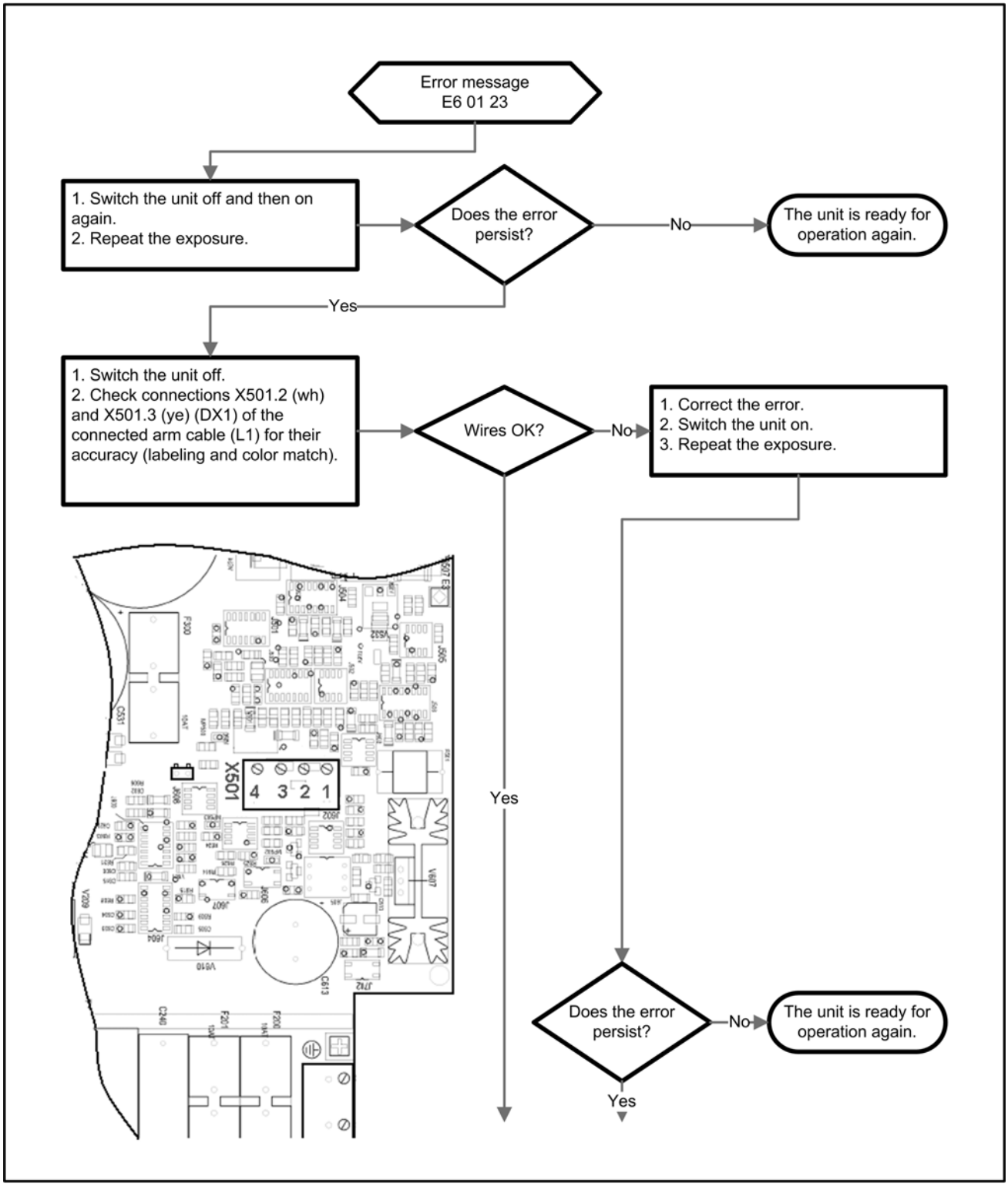
3.3 Error message: E5 01 02 / E5 01 14 / E5 01 12

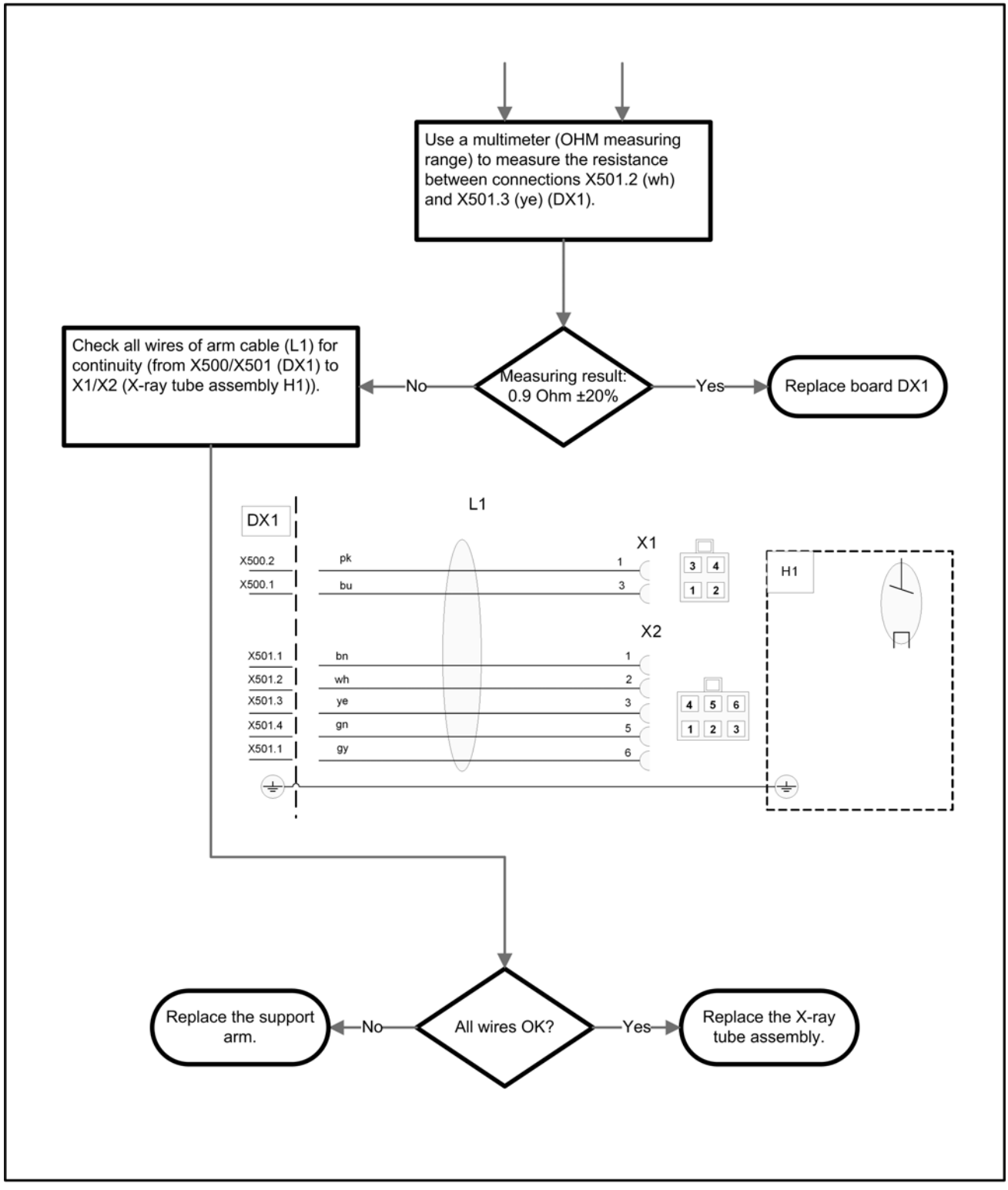


3.4 Error message: E5 01 22

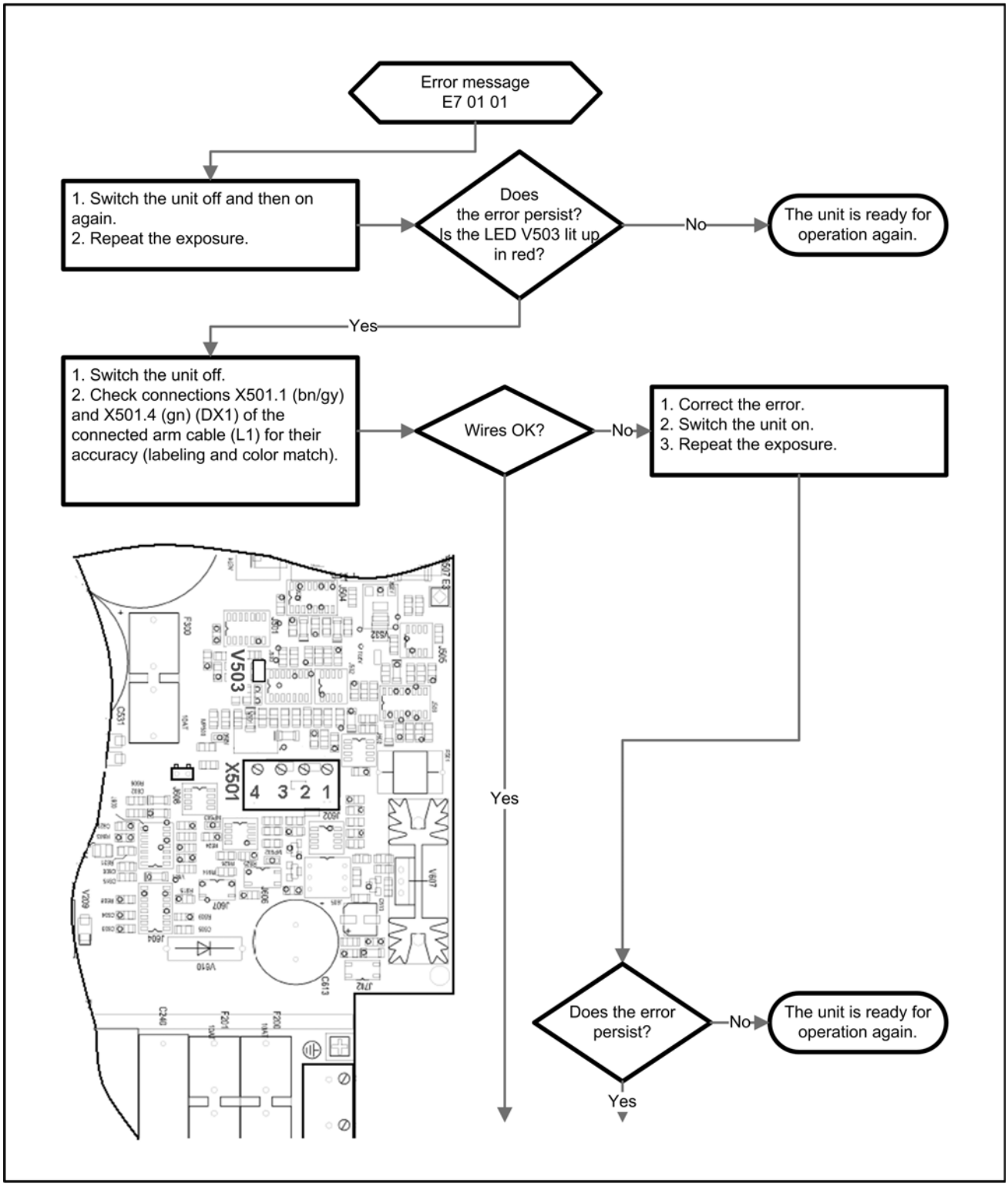


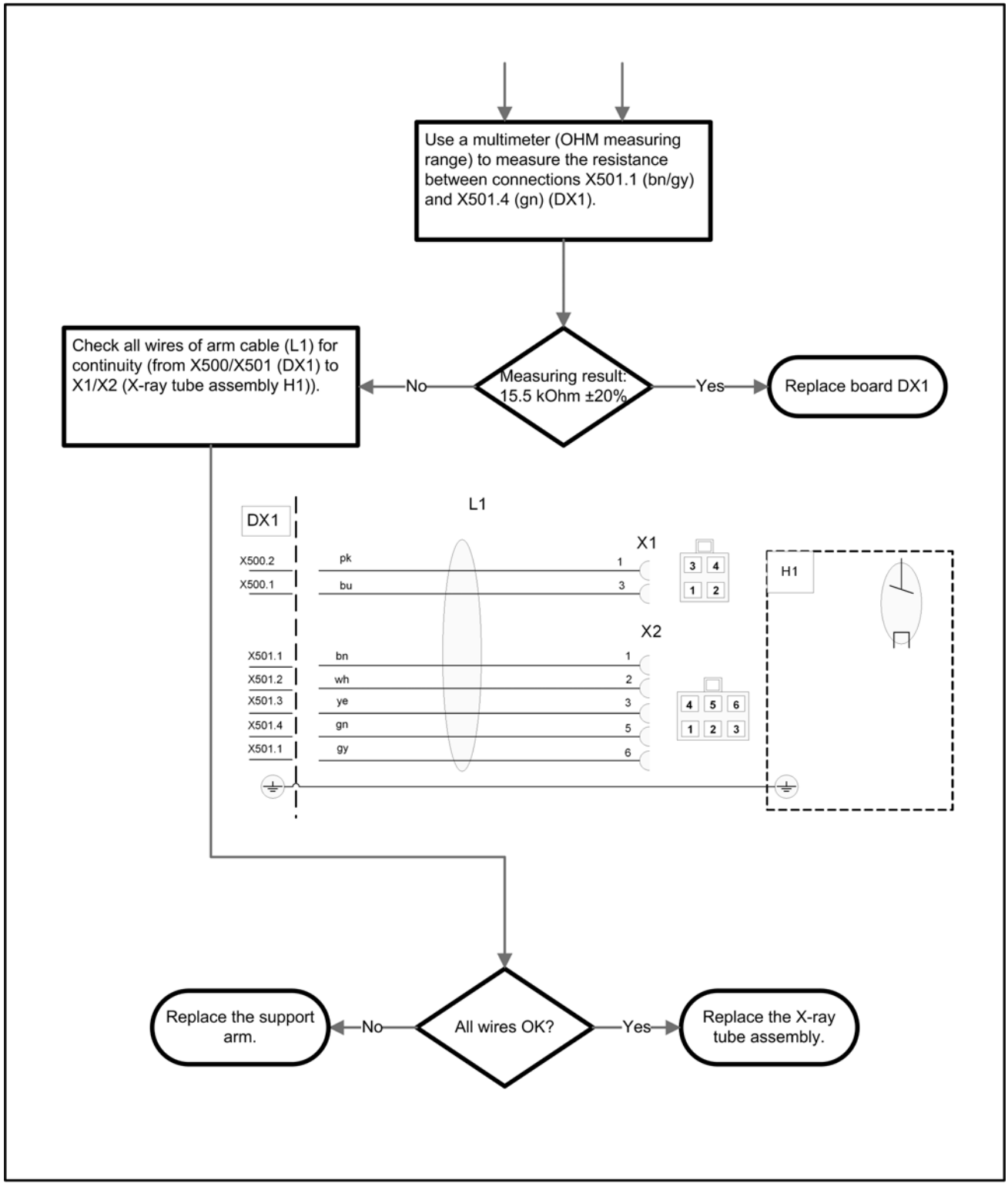
3.5 Error message: E6 01 23




Use a multimeter (OHM measuring range) to measure the resistance between connections X501.2 (wh) and X501.3 (ye) (DX1).
Measuring result: 0.9 Ohm ±20%
No
Yes
Replace board DX1
Check all wires of arm cable (L1) for continuity (from X500/X501 (DX1) to X1/X2 (X-ray tube assembly H1)).
DX1
L1
X1
X2
H1
X500.2
X500.1
X501.1
X501.2
X501.3
X501.4
X501.1
pk
bu
bn
wh
ye
gn
gy
All wires OK?
No
Yes
Replace the support arm.
Replace the X-ray tube assembly.

3.6 Error message: E7 01 01




Use a multimeter (OHM measuring range) to measure the resistance between connections X501.1 (bn/gy) and X501.4 (gn) (DX1).
Measuring result: 15.5 kOhm ±20%
No
Yes
Check all wires of arm cable (L1) for continuity (from X500/X501 (DX1) to X1/X2 (X-ray tube assembly H1)).
Replace board DX1
DX1
L1
X1
X2
H1
X500.2
X500.1
X501.1
X501.2
X501.3
X501.4
X501.1
pk
bu
bn
wh
ye
gn
gy
All wires OK?
No
Yes
Replace the support arm.
Replace the X-ray tube assembly.

4 Maintenance

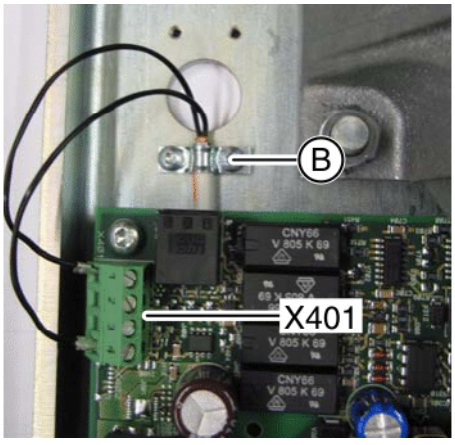
4.1 Checking the shielding

4.1.1 Test

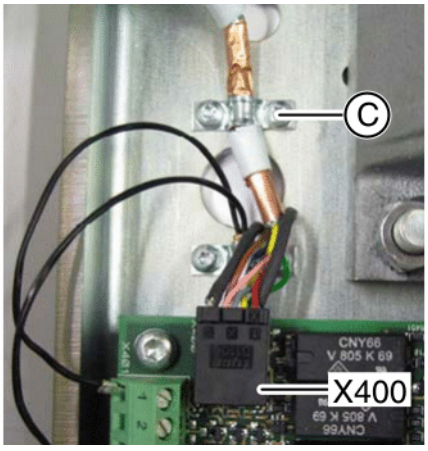
➢ Check whether the cable shieldings have contact with the shielding clamps and are firmly in place.

4.1.2 Positions

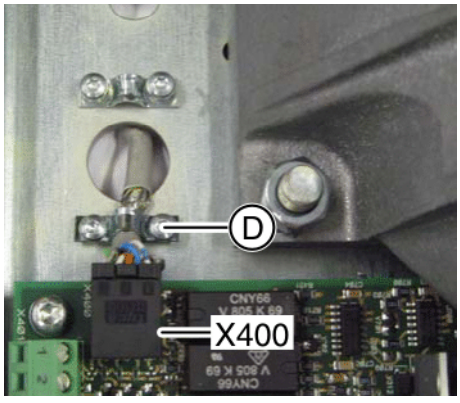
Installation panel (wall module)



- **If available:** Manual release **S3** on **X401**
- (**B**): Clamp

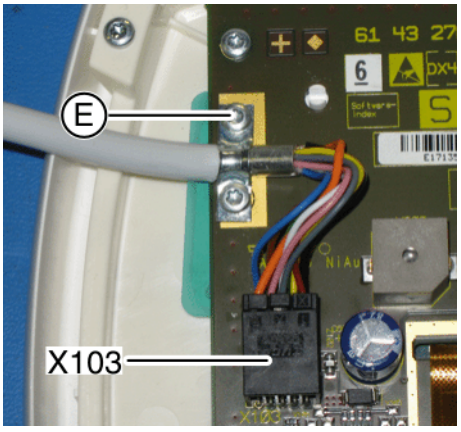


- **If available:** Cable **L2** with ferrite core on **X400**
- (**C**): Clamp



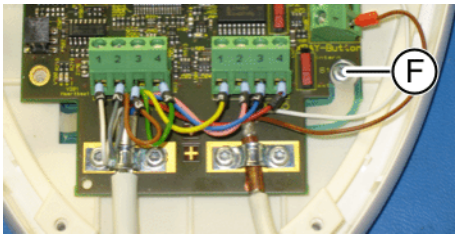
- **If available:** Cable **L6** on **X400**
- (**D**): Clamp

DX4 (wall module)

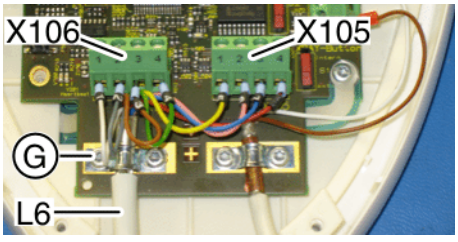


- **X103** / **L2** cable (wall mounting)
- (**E**): Clamp

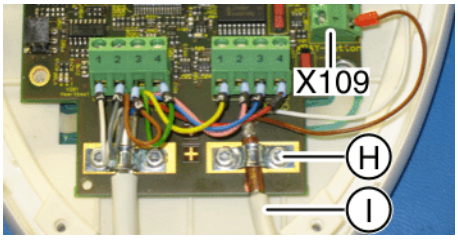
DX4 (Remote Timer)



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



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



- **X109** / Manual release **S3**
- (**H**): Clamp
- (**I**): Release button

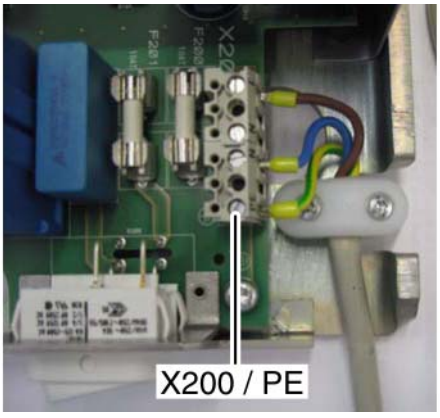
4.2 Checking the protective ground connections

4.2.1 Test

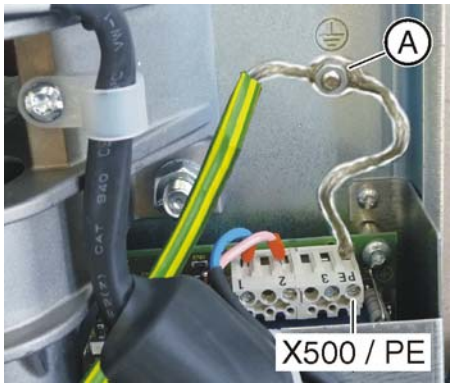
➢ Check whether all protective ground connections are firmly in place.

4.2.2 Positions

DX1 and installation panel (wall module)

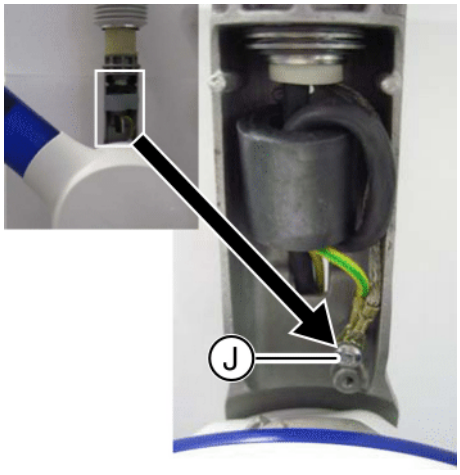


- **X200** / Power input clamp

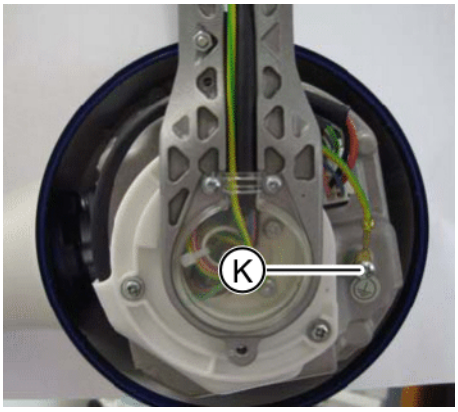


- **X500** / Output stage and installation panel
- (**A**): Screw

X-ray tube unit



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



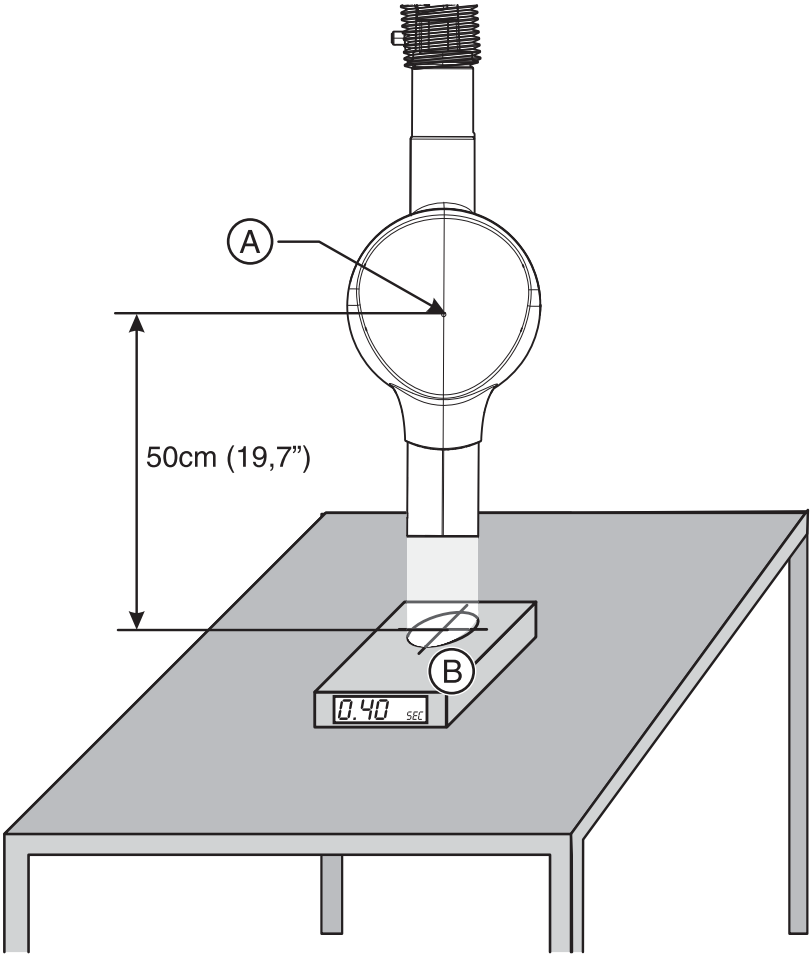
- Grounding of the X-ray tube assembly
- (**K**): Screw

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

⚠ WARNING

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) [→ 39]
- Release button on PC board DX4 (coiled cable) [→ 40]
- Release button on front panel on PC board DX4 [→ 41]

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 Ω .
- 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 Front panel test

Explanation

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

Command

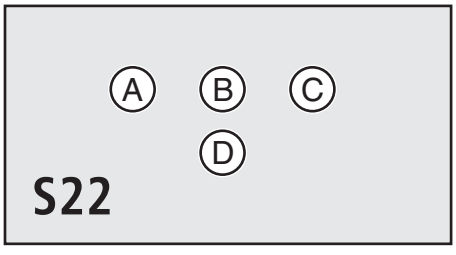
➢ Open service routine **S22** (see "Operation [→ 53]" in the Section "Service routines").

Operation

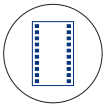
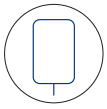
➢ Actuate every key in sequence.

↳ 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
	A	1			B	32
	A	2			B	64
	A	4			B	128
	A	8			C	1
	B	2			C	2
	B	4			C	4
	B	8			C	8
	B	16			D	1

4.7 Checking and adjusting the support arm

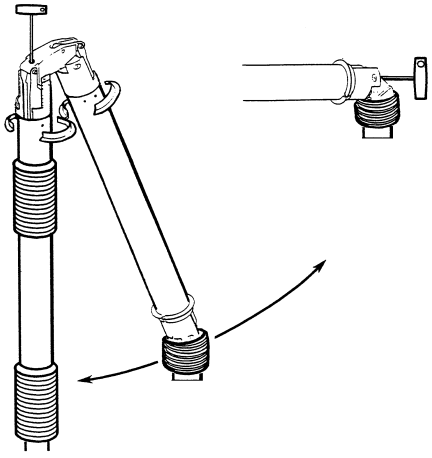
⚠ CAUTION

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

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).
5. Reassemble the support arm by completing the same steps in reverse order.

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

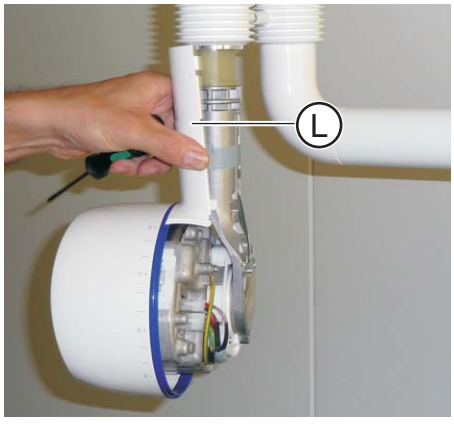
- Does the cone remain set in every position?
- Are the connecting cables intact?
- See section on "Checking the connection cables".

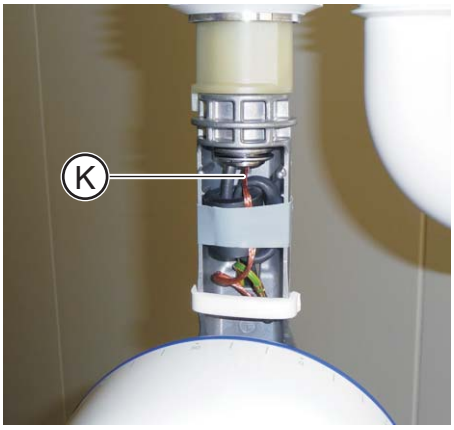
If the X-ray tube assembly fails any of these check points, it must be replaced (see Section "Replacing X-ray tube assembly H1 [→ 66]").

Checking the connection cables

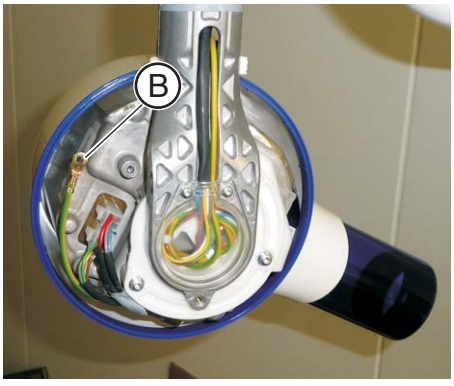
1. Switch the X-ray unit off.
2. Unscrew and remove the old cover (**A**).

3. Remove the arm cover (**L**).

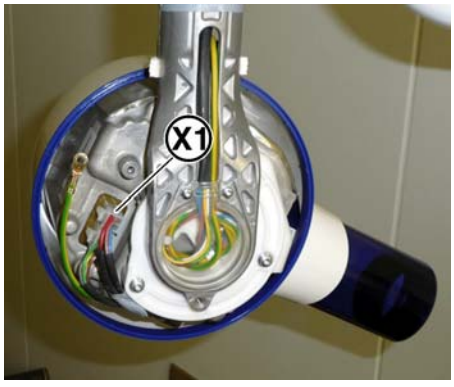




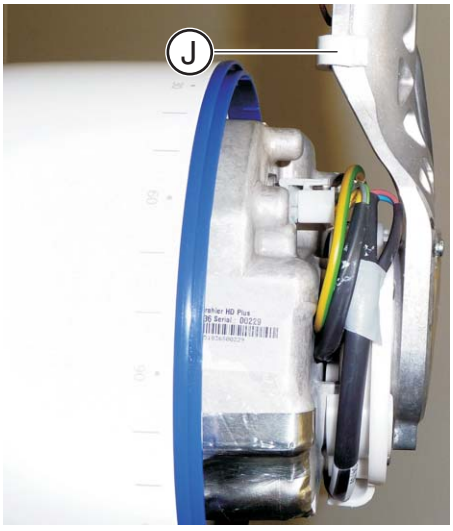
4. Check the condition of the grounding strap.
   ↳ No damage should be evident at position (**K**). Slight restriction at the position (**K**) of up to 20% cross-section loss is acceptable.



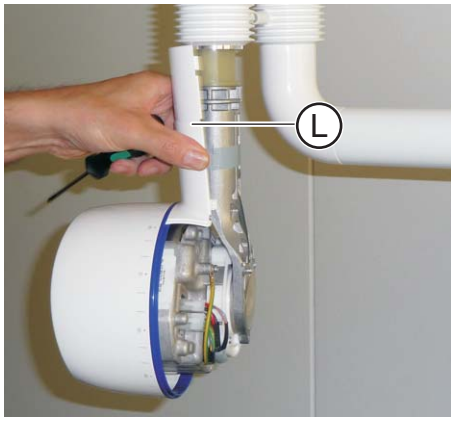
5. Check the screw terminal on the grounding wire (**B**) for damage.



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.

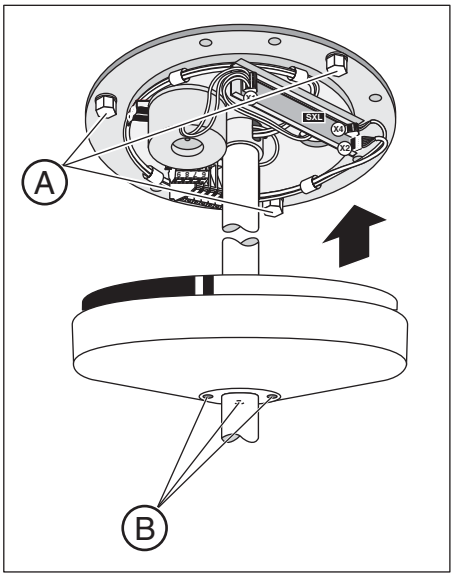


8. Attach the arm cover (**L**).

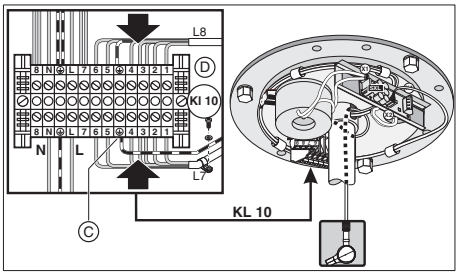
9. Attach and secure the cover (**A**).

4.9 Checking the ceiling model

Ceiling model checks

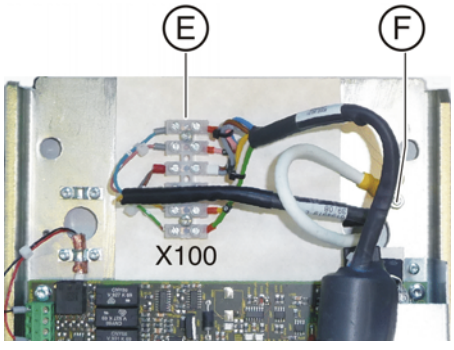


- Is the ceiling fastening (**A**) secure?
- Are the cover parts (**B**) present and free of damage?



- Is the ground wire connection (**C**) secured?
- Are the cables free from damage, and do they fit securely as prescribed to terminal K10 (**D**) in the ceiling model?

Wall adapter checks



- Is the ground wire connection (**F**) secured?
- Are the cables free from damage, and do they fit securely as prescribed to terminal X100 (**E**) in the wall adapter?

4.10 Checking the tube current

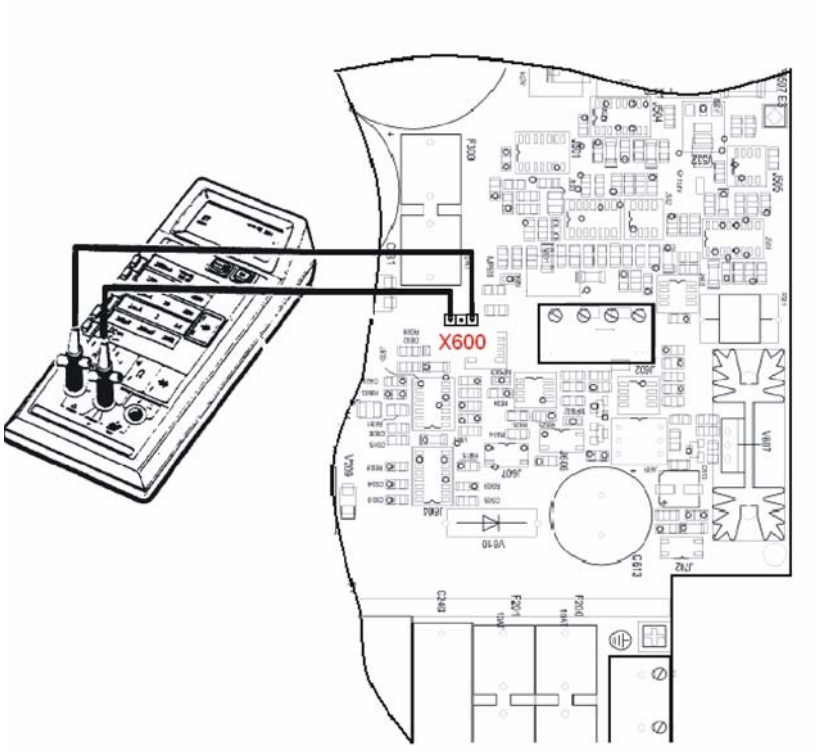
Auxiliary devices required

- Ammeter

⚠ CAUTION

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

⚠ WARNING

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.

4.11 Protective conductor test

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

⚠ WARNING

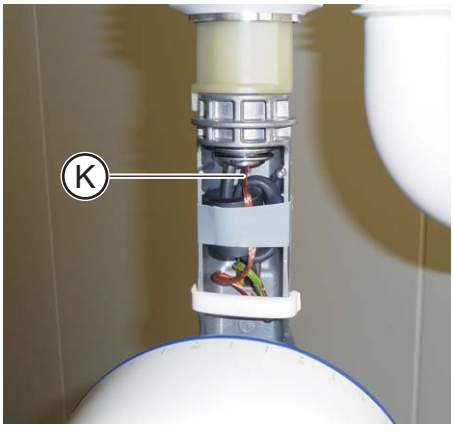
Potentially lethal shock hazard

Switch the line voltage off.

1. Switch the line voltage at the main switch of the building installation off.
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**). Slight restriction at the position (**K**) of up to 20% cross-section loss is acceptable.



Protective ground wire test

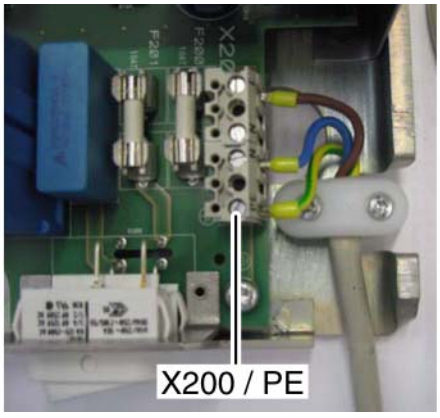
Explanation

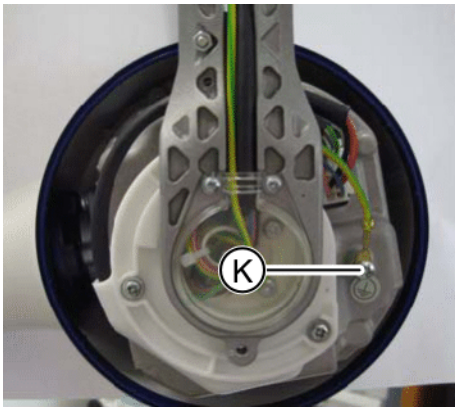
This test checks the electrical resistance of conductive and exposed parts of the X-ray unit against the protective wire connection.

Test assembly

See drawing.

test





1. 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 at the voltmeter and the current at the ammeter.
3. Calculate the protective conductor resistance with the formula "**R = U / I**."

Limit value

The calculated resistance value is not permitted to exceed 0.2 Ω .

4.12 Leakage current test

Auxiliary devices required

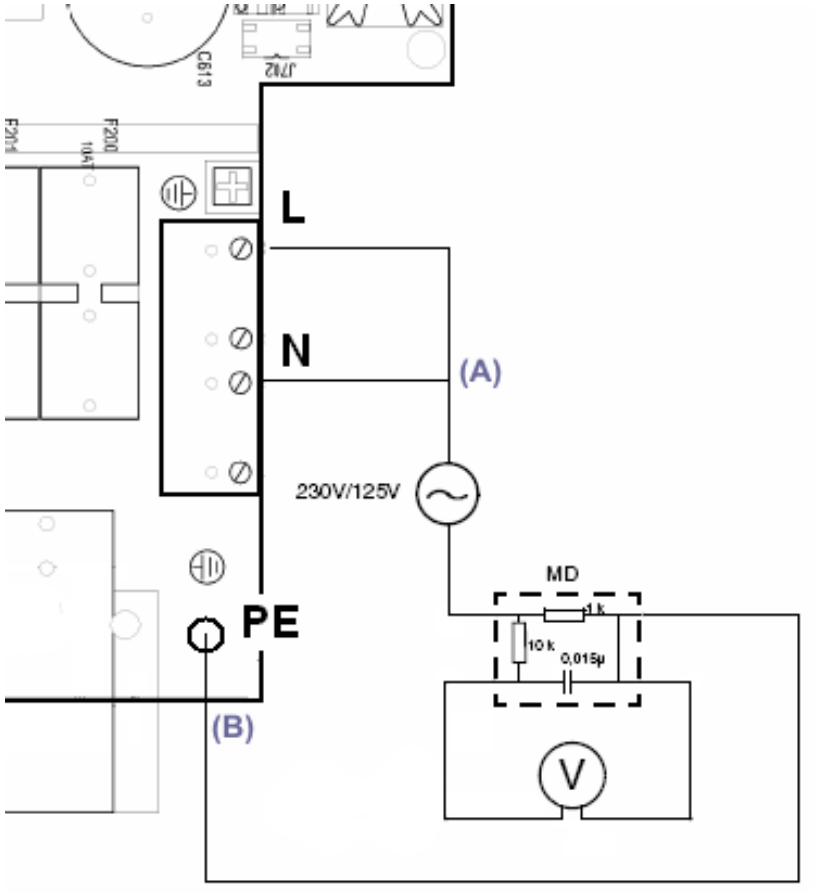
- Line-frequency, high-resistance measurement voltage source (isolation transformer)
- A measuring circuit (**MD**) that meets the requirements of IEC 60 601-1.
- Voltmeter

Alternative

Complete test units, e.g. the "Bender tester", fulfill these requirements as well.

Equivalent device leakage current measurement

Test assembly



1. Connect the measurement voltage source to the measuring circuit (**MD**).
2. Connect the voltmeter to the measuring circuit (**MD**).
3. Connect the measuring circuit (**MD**) to the metallic part **(B)** of the wall module housing.
4. Short-circuit the power connection (**N** and **L**) with a suitable cable.

5. Connect the measurement voltage source to the shorted power connection **(A)**.
6. Switch on the power supply of the unit.

Test

⚠ WARNING

Potentially lethal shock hazard!

Do not touch the unit while measuring the leakage current!

1. Switch the measurement voltage source on.
2. Read the voltage drop at the voltmeter and adjust the measuring range if necessary.
3. Switch the measurement voltage source off.

Calculation

The measured value is the exact equivalent of the leakage current.

Measuring range	Leakage current
mV	µA
V	mA

Limit value of wall model

The measured value must not exceed **0.55mA**.

Limit value of ceiling model

The measured value must not exceed **2.0mA**.

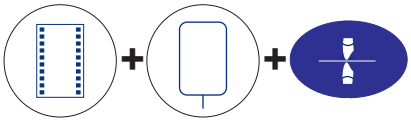
NOTICE

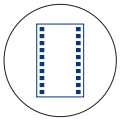
Always document your measuring results for comparative measurements performed later.

➢ Enter the measured values in the maintenance certificate.
➢ Describe the measuring instrument used (to ensure reproducibility).

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.
5. To change the setting, press the +/- keys.
6. 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 [→ 55]
S02	Configuration of transparency compensation for sensors [→ 55]
S03	Display of software version [→ 55]
S04	Selection of film type [→ 55]
S05	Selection of sensor type [→ 56]
S06	Selection of cone type [→ 56]
S07	Set diaphragm type [→ 57]
S08	Configuration of radiation time and dose display after an X-ray exposure [→ 57]
S09	Configuration of time-out time of the radiation time and dose display [→ 57]
S10	Configuration of display options: Area dose and actual radiation time [→ 58]
S11	Configuration of power-save mode [→ 58]
S12	Configuration of time-out time of the power-save mode [→ 58]
S13	Configuration of 60/70 kV toggle [→ 59]
S14	Configuration of detector medium toggle (film/ sensor) [→ 59]
S15	Configuration of safety circuit bypass [→ 60]
S16	Configuration of the dynamic pulse/pause ratio (dynamic cooling) [→ 61]
S17	Dose rate correction [→ 61]
S18	Setting the display contrast [→ 62]
S19	Setting the display brightness and color [→ 62]
S20	Setting the LED brightness [→ 63]
S21	Display self-test [→ 63]
S22	Front panel test [→ 63]
S23	Display of the exposure and radiation time counter [→ 64]
S24	Reading the status log [→ 64]
S25	Display of saved data [→ 64]
S26	Activation of demo mode [→ 65]
S27	Resetting the unit to factory default settings [→ 65]

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 (Focus type)	Cone length in mm
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 (Focus type)	Diaphragm 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.

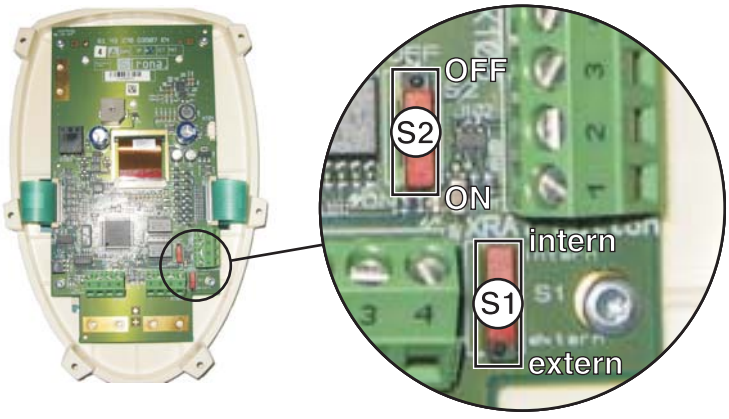
Legend

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

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 [→ 65]), 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.
4. 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 XIOS Plus 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 [→ 41]."

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
kV controller	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

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 [→ 49]" and "Leakage current test [→ 51]."

6.2 Replacing X-ray tube assembly H1

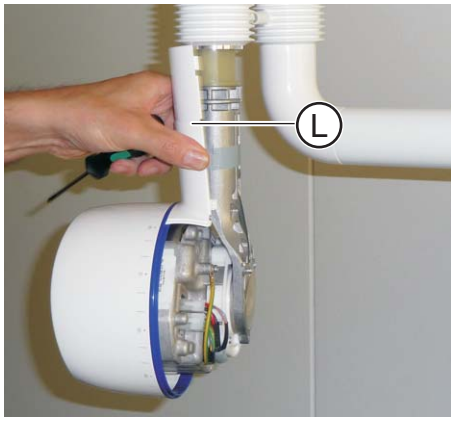
Required tools

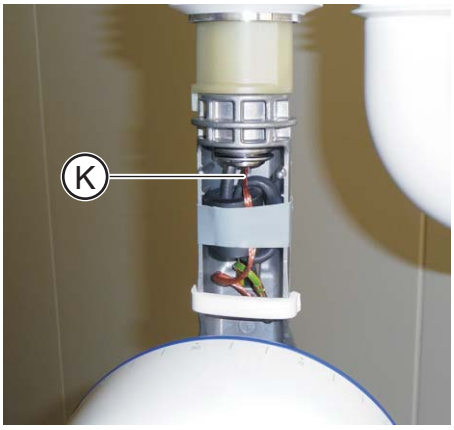
Torx screwdriver (size 10, 15 and 20)

Removal of the X-ray tube assembly

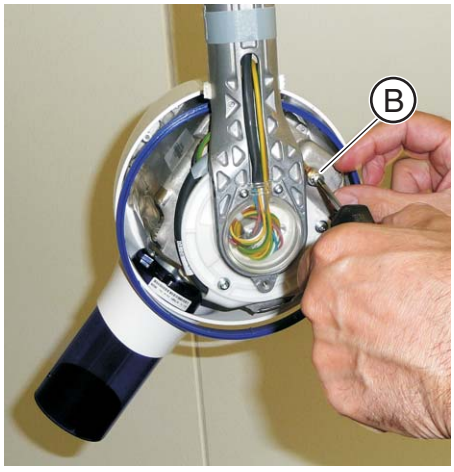
1. Switch the X-ray unit off.
2. Unscrew and remove the old cover (**A**).

3. Remove the old arm cover (**L**).

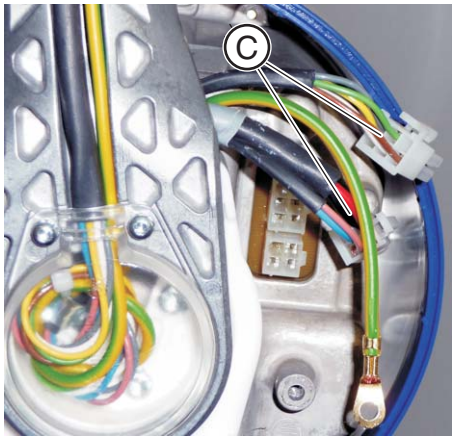




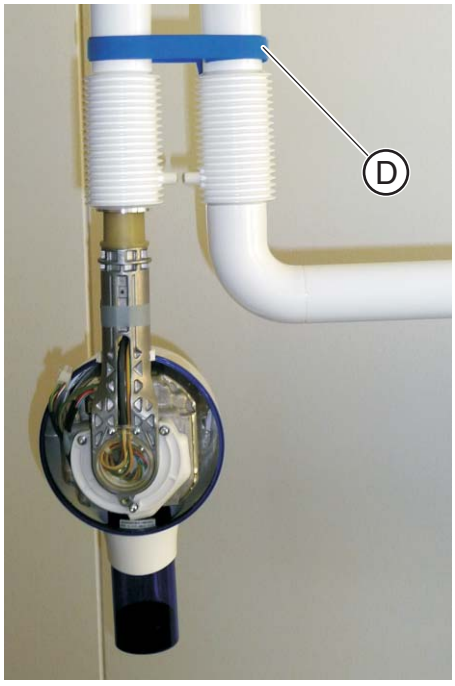
4. Check the condition of the grounding strap.
   ↳ No damage should be evident at position (**K**). A slight restriction at position (**K**) with a cross-section loss of max. 20% is still acceptable.



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



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

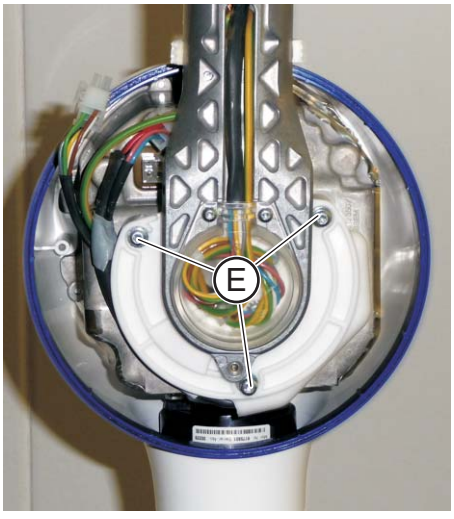


7. Secure the support arm with a belt (**D**).

DANGER

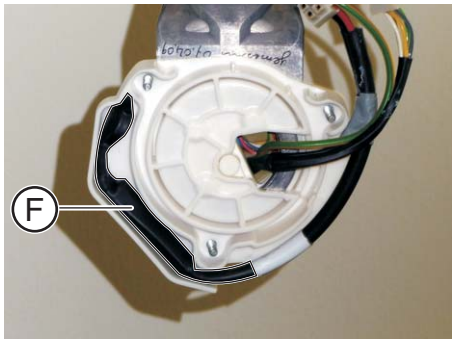
Risk of injury

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.

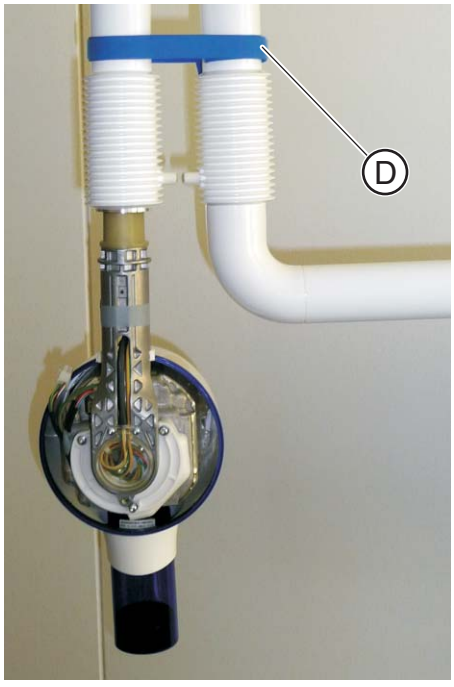
2. Firmly attach the X-ray tube assembly, using 3 new self-cutting screws (PM 3.5 x 16).

⚠ DANGER

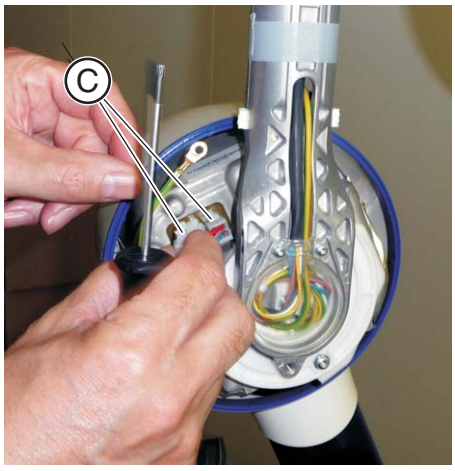
Risk of damage

Applying excessive torque may damage the threads cut by the self-cutting screws.

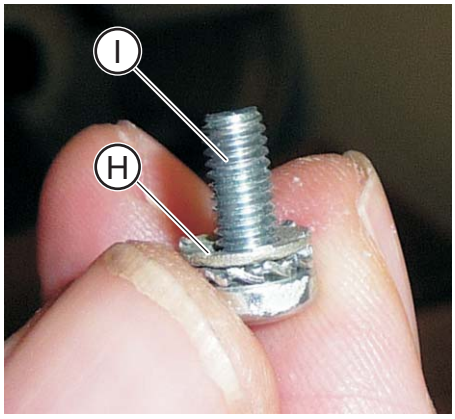
Use only a screwdriver without any other tools (e.g. to boost the power).



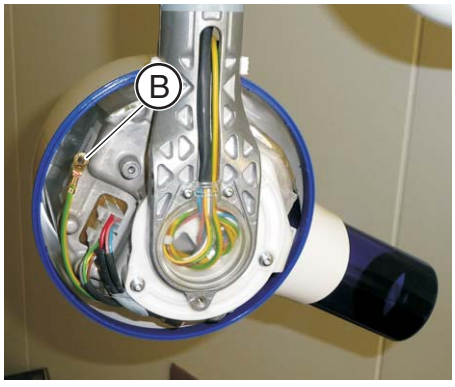
3. Remove the belt **(D)**.



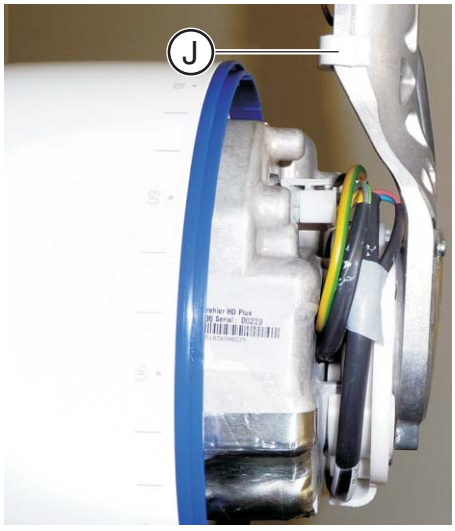
4. Plug the connectors (**C**) of the tube assembly cable onto the tube assembly.



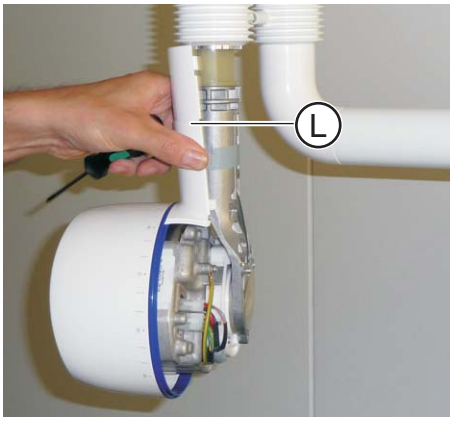
5. Mount a contact washer (**H**) on the screw (**I**) (M4 x 10).



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" [→ 37].
9. Check the tube current. See Section "Tube current verification [→ 48]."



10. Attach the new arm cover (**L**).

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

6.3 Replacing PC board DX1

Replacement

✓ The defective **DX1** 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. Unscrew and remove the defective board (fastening screws **A** (3x)).
5. Screw on the new board on securely.
6. Reattach all cables to the board (**Don't forget the strain relief!**).

Note: Connect the supply line to arm cable L1

Terminal strip **X500**:

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

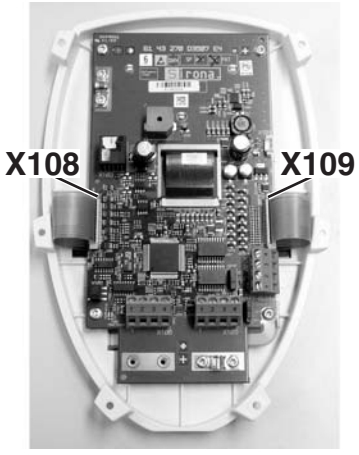
Terminal strip **X501**:

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

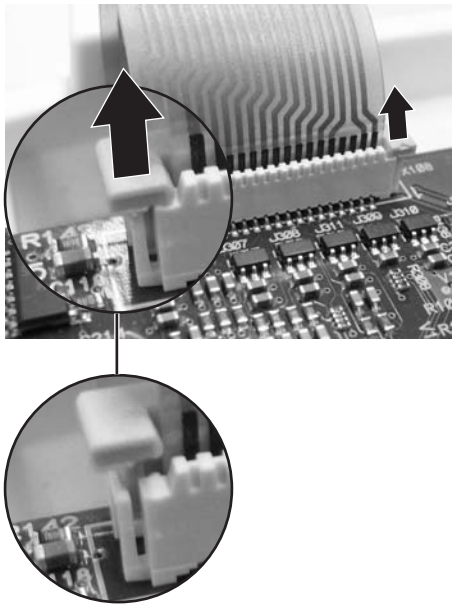
6.4 Replacing PC board DX4

✓ The defective **DX4** board is freely accessible.

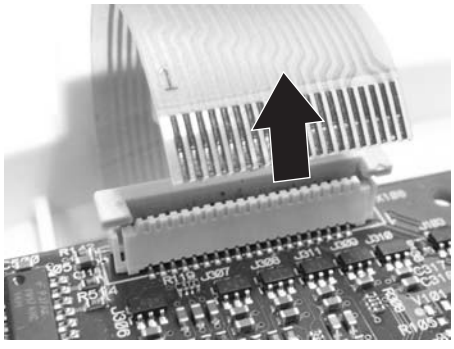
1. Switch the unit off.
2. Disconnect the unit from the main fuse.
3. Remove all of the cables connected to the board.



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!**).



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

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