SIEMENS

POLYDOROS SX 65/80

AX

Start-up

POLYDOROS SX

beginning with VE02D

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2000

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General Remarks

This document was originally written in German.

Safety Note

NOTE

When performing the work steps and tests, the product-specific safety information contain in the documents as well as the general safety information must be observed.

Remarks Regarding Text Emphasis

- 1. All texts labeled with "WARNING" are intended to call attention to a potential risk to health or life.
- 2. All texts labeled with "CAUTION" contain information regarding risk and preventive measures to avoid a dangerous situation.
- 3. All texts labeled "**NOTICE**" contain additional information regarding the procedure which follows, and is given to provide a better understanding of the procedure or to provide a warning about unnecessary risks and avoidable problems.

Important Information Pertaining to Startup

- Record measurements indicated with the symbol in the specific test protocol or image quality measurement certificate (IQ Certificate).
- In addition, perform the customer and system-specific programming and adjustments.

The generator may have been shipped as:

- A subsystem, e.g. as a replacement in an existing system.
- part of a system, e.g. SIRESKOP CX/SX.

Subsystem shipment

The generator has been equipped with the options ordered according to the BZ and tested at the factory (see test certificate).

Follow these instructions for startup

System or subsystem shipment

For generator startup, refer to the system binder (with the yellow spine), Reg. 4.

Product-specific Remarks

Required Documents

- Generator Wiring Diagram
- Test Certificate

Magnifier

- Instructions for the options
- Image Quality Test Certificate

Required Tools and Measurement Equipment

•	Standard	installation	tool kit
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•	Cu filter set	44 06 120 RV090
•	Resolution test, type 41/42	28 71 820 RE999
•	Internal line impedance meter	84 28 104 RE999
•	Inductive field meter (if needed)	97 02 713 Y7933
•	Precision copper filter (2.1 mm)	99 00 598 XE999
•	Digital multimeter, Fluke 8060 A	97 02 101 Y4290
•	mAs-meter	81 60 400 RE999
•	Memory oscilloscope, Fluke 3390A or	99 00 861 RE999
	2-channel memory oscilloscope Tektronix 2232	97 02 239 Y3155
•	Cathotest / X-ray tube phantom	according to X-ray tube used
•	kV/Dosimeter PTW-NOMEX	97 08 637 Y0388
•	Protective conductor meter	44 15 899 RV090
•	Service PC	per ARTD Part 1, 3.1.0
•	PC connection cable, 5 m	99 00 440 RE999
•	Victoreen 07-424 densitometer	PTW-Freiburg



To eliminate the risk of electric shock, the ground wire may not be disconnected under any circumstances when performing measurements with the oscilloscope.

The ground wire may be neutralized by using a separating transformer only if no voltages greater than 25 V AC or 60 V DC can occur on metal parts that can be touched. For measurements in which existing ground loops can have a disturbing effect on the measurement result, an isolation transformer (e.g. GOULD Contec 9000 or TEKTRONIX A6902B) must be used, (see ARTD/Part 3).

Generals

- The following tests have been performed in the test lab and documented in the test protocol according to the Federal Republic of Germany's X-ray Regulations, §16 and the USA Acceptance Test:
 - Accuracy of X-ray tube voltage
 - Accuracy of voltage display for fluoroscopy
 - Briefest switch time for automatic exposure
 - Reproducibility of radiation

NOTE

These measurement values and values determined during start-up may be copied from the test protocol into the acceptance test protocol.

- The tests required per DHHS regulations must be carried out in accordance with the particular generator Maintenance Instructions.
 - In addition, the initial value of the test exposure from the Chap. System Configuration must be entered into the Maintenance Instructions/Measurement Certificate, Chapter 2.

Prerequisites and Remarks

- Prerequisites for configuring the system using the Service PC are:
 - Basic knowledge, such as PC handling and operation of the Windows program.
 - The prerequisites for the Service PC can be tested in the SSW under **Help / Index / PC-HW-Check**

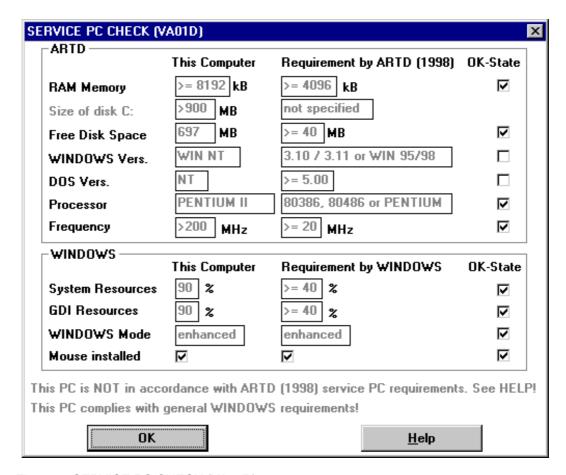


Fig. 1: SERVICE PC CHECK (VA01D)

- A completed POLYDOROS SX 65/80 training course or a completed system course.
- Programming the options

POLYDOROS SX 65/80

-80 kW

is permitted only if the appropriate license is available!

The license is shipped along with the BZ and is filed in the generator binder, Register 9.

Legend

Example for Text Descriptions

• Select "XCS Service Application-Main Program/Configure/Site Structure" Window name/Main menu/Submenu.

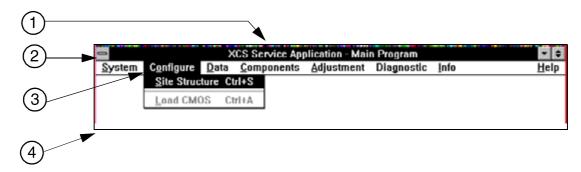


Fig. 2: XCS Service Application-Main Program

Pos. 1 = Window name
Pos. 2 = Main menu
Pos. 3 = Submenu
Pos. 4 = Window

• In the window, "Configure:Site Structure:Component selection" select the components in the field "available".

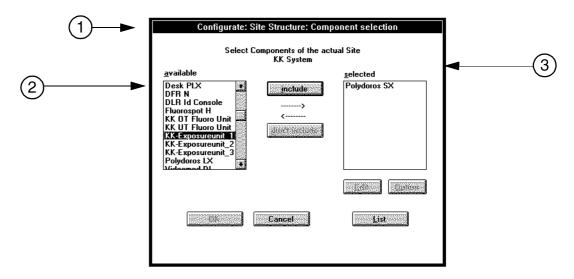


Fig. 3: Configure:Site Structure:Component selection

Pos. 1 = Window name

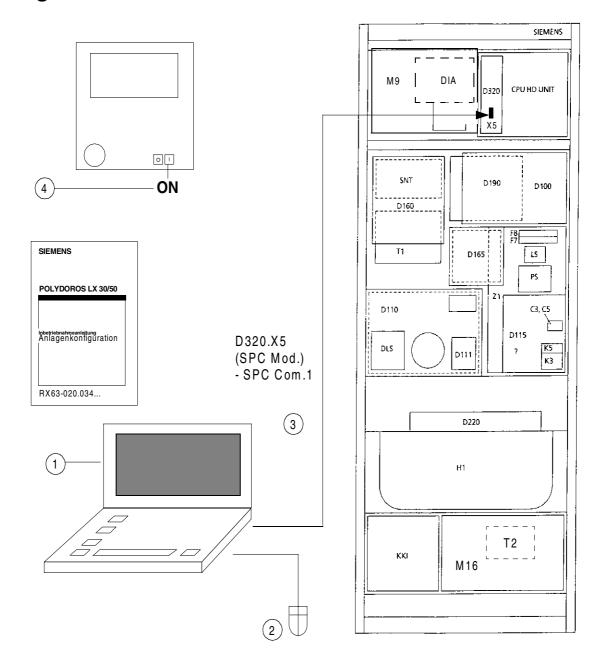
Pos. 2 = Field
Pos. 3 = Window



Fig. 4: Site Configuration
Pos. 1 Message window

• Exit the window with **OK**

Connecting the Service PC to the POLYDOROS SX



Important!

- Connect the system controller (D320.X5) to Com 1.
- Connect the PC mouse to the PC BUS mouse connector

Fig. 5: Connecting the Service PC

POLYDOROS Service / Adjustment, Toggle of S3 on the D100

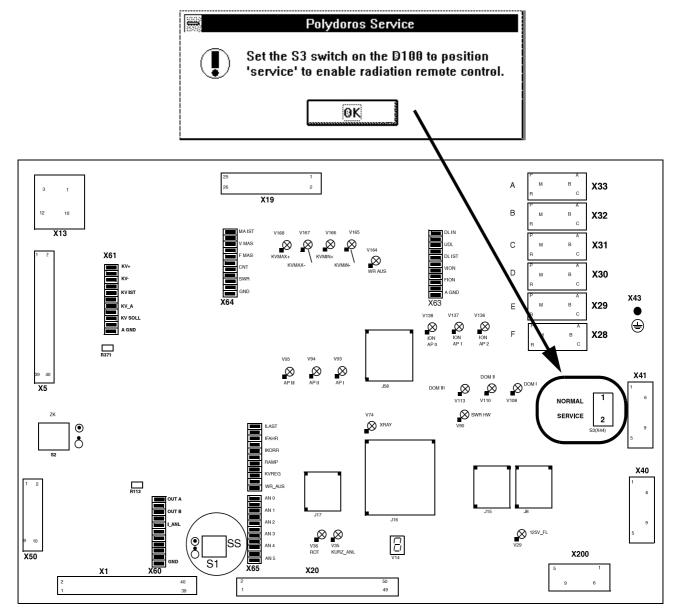
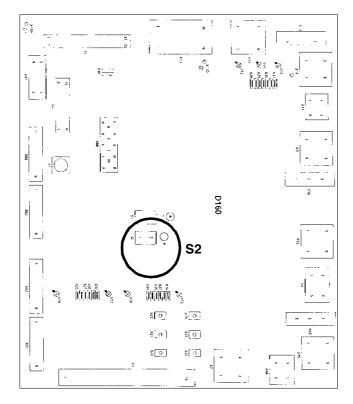


Fig. 6: POLYDOROS Service

Safety Measures for POLYDOROS SX



D160

Fig. 7: PL SX / D160

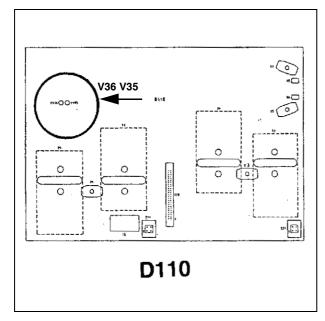


Fig. 8: PL/D110

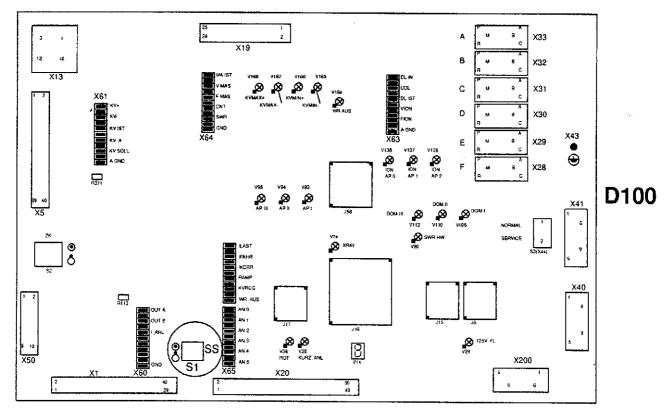


Fig. 9: PL / D100

 Use the power OFF switch on board D 160 to switch off the generator before working on it (/S2/Fig. 7 / p. 16).

∆WARNING

When the generator is switched off, there is still line voltage present at the T1 transformer and at the D160 switch-on circuit (see Wiring Diagram).

After switching off the generator, there is still approx. 600 V direct current present on the inverter!

- This is indicated by the LEDs V35 and V36 on the D110 (Fig. 8 / p. 16) (visible through the round opening in the cover panel on the inverter) and LED V89 on the D220 goes on. The voltage dissipates within approx. 1.5 minutes to 0 V; the LEDs go off at approx. 30 V.
- Set the main system switch to OFF to switch off power to all components (generator and connected equipment).
- To avoid unintentional release of high voltage or radiation, switch OFF (S1) SS on the D 100 board (Fig. 9 / p. 17) (no inverter power). When the generator is switched off, there is still line voltage present at the T1 transformer and at the D160 switch-on circuit (see Wiring Diagram).
- Install or remove assemblies only with the generator switched off, and in accordance with ESD guidelines.

∆WARNING

For checks or adjustments that must be performed with radiation switched on, make sure that appropriate radiation protective measures are provided.

These work steps are labeled with the radiation warning symbol .

Line Connection 19

Switching to another Line Voltage and Line Frequency (if necessary)

The test protocol shows the line voltage and line frequency used to test the generator. If the generator is being connected to another line voltage, perform the changes according to wiring diagram (*1 and *2).

50Hz/60Hz Line Frequency Adaptation

 Adaptation of the line frequency is performed by means of programming on the D160 board.

NOTE

For the D160 "E1" and "E2" versions, programming is implemented using solder jumpers; with the D160 "E3" version, removable jumpers are used.

Line fre- quency	Jumper position on D160	
50 Hz	X20X21	X23X24
60 Hz	X21X22	X24X25

Checking the Phase Connection

NOTE

For units with use three-phase power, e.g. SIRESKOP CX, KLINOGRAPH 4-4, \dots

Check the correct line phase connection with the inductive field meter at M16.L1, L2, L3:

- Connect the inductive field meter to connections L1, L2, L3 (incoming side).
- System breaker ON
- Take measurement.
- If needed, correct the phase connection and repeat the measurement.
- System breaker **OFF**
- Remove the inductive field meter.

Line Connection 21

Measuring the Internal Line Resistance

Measure the internal line resistance at M16.L1, L2, L3 using the internal line resistance meter (phase-to-phase):

- Connect the internal line impedance meter between 2 phases of L1, L2 and L3.
- System breaker ON
- Take measurement.
- System breaker ON
- Remove the internal line resistance meter and test the other phases.



• Record the measurement value in the Test Certificate. For tolerance, see the Test Certificate.

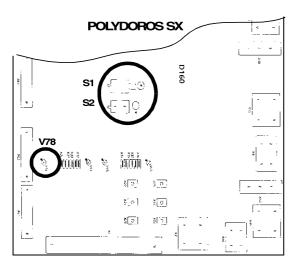
Important Preliminary Steps

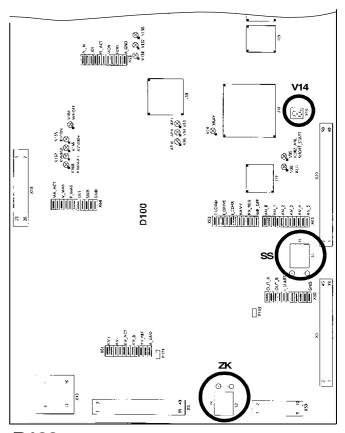
- On board D 100: switch (S1) SS OFF (Fig. 10 / p. 23)
- Connect the Cathotest X-ray tube phantom to the high voltage cable at the cathode side (negative side).

NOTE

When replacing the tube assembly, particularly when tube assemblies with the 0.3 mm filament are replaced with tube assemblies with the 0.22 mm filament, programming of the tube assembly model must be carried out with the Cathotest or with the X44 (D160) connector plugged in.

Switching On the POLYDOROS SX





D100

D160

Fig. 10: PL SX D160 / D100

System breaker ON

The red LEDs (V78) on the D160 switch-on boards must go on.

NOTE

If there is a malfunction, check the fuses on the T1 transformer (below the D160).

Generator ON

Switch S2 to ON on D160 and press the S1 key.

- The generator initializes to "2" only (when system is shipped subsystem shipment up to " | " see the V14 7-segment display on D100)
- Check the locking mechanism:
 - Switch generator OFF with S2 on D160
 - The generator is no longer operable from the console.
- on D160.S2 to ON
- on D100.SS OFF

• on D100.ZK - **OFF**

Performing System Programming

System programming is performing using the Service PC.

Perform the following work steps for system programming of the generator:

NOTE

This flowchart is intended to be only a guideline.

Perform the system configuration according to the following flow-chart.

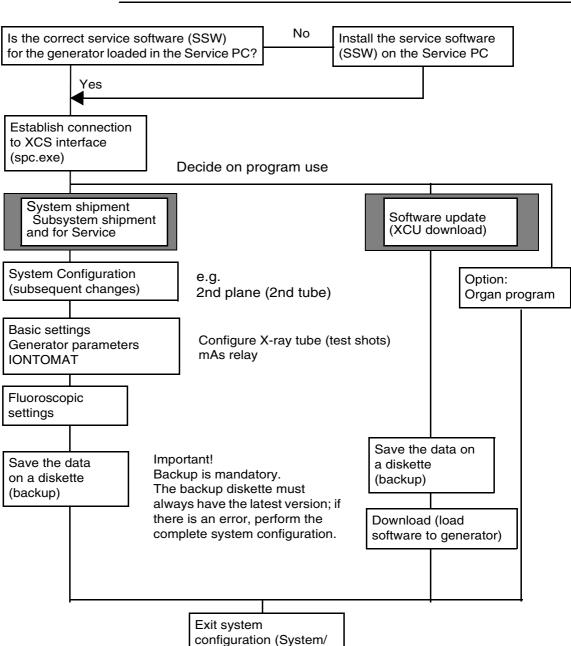


Fig. 11: Installing and Starting the Service Software

Help Text

Select in the main menu "Help/Index".

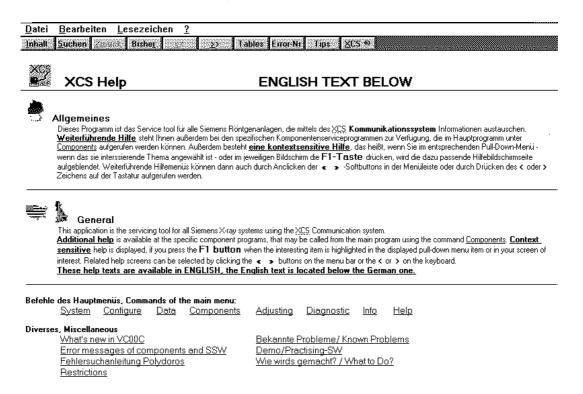


Fig. 12:

Installing the XCS Service Software on the Service PC

beginning with VE00D

NOTE

Threre is a SSW manager with the XCS SSW; with it, several versions of the XCS SSW can remain loaded on the Service PC and selected accordingly as the current working version.

- Install the XCS service SW version on the Service PC; to do this, prior to installation, rename the existing SSW directory to e.g. SSWold or SSWVxxx using the File Manager.
- Insert SSW diskette 1+ into drive A: .
- Select the File Manager in Windows.
- In the "File" menu, select Run
- Enter A:\Install.exe in the "command line" and confirm with OK.
- Confirm the message window with OK.
 - A prompt will appear to insert the appropriate diskette.
- Confirm the window that follows with OK.
 - Then the software will create a **SERVICE** program group.

NOTE

"C:\SSW" is already set. Do not change!

Selecting the XCS Service Program

Select XCS SERVICE.

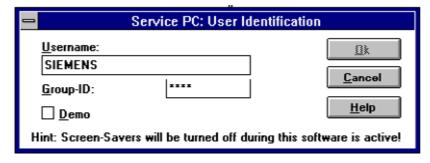


Fig. 13: Service PC:User Identification

- User name: enter Name.
- Group ID: "enter_siemens".

NOTE

If "Demo" is checked, the software can work without the XCU. Communication with the XCU is not possible under "Demo function".

Exit the window with OK.

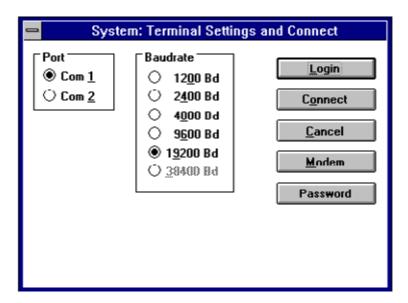


Fig. 14: System Terminal Settings and Connect

NOTE

- When Connect is selected, "System" "Realtime CI" (clock time for the XCU) and "ID Codes" are enabled in the main menu.
- If Password is selected, a password is requested; see the chapter "Variable Password"
- Exit the window with Login.
- If **Login** is selected, a connection to the XCU is established.

ID Codes in the System Menu

NOTE

Setting the system ID code is necessary:

- prior to entering the variable password
- the first time there is a log-in with a newly installed XCS SSW
- when there is a replacement of the D200

To set the ID codes in the system controller, it is permissible to have performed CON-NECT but not yet LOGIN. The entries are used here to generate the variable password. While the System Host ID is only displayed and cannot be changed, the two other Serial Numbers and Product Types (maintenance unit numbers) must be entered specifically.

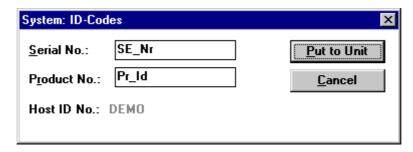


Fig. 15: System: ID-Codes

- Put to Unit The data that were set are saved in the system controller.
- Cancel The data are not changed in the system controller
- Serial Number = entry of the System Serial Number
- Product No. Maintenance Unit No. (in combination with the variable password)

Variable Password

What is referred to as a variable password must be generated for XCU-based systems. To generate a variable password, please contact the person responsible for this in your Regional Unit. If this person cannot be contacted, you can also have the password generated by HSC in exceptional cases.

The following data must be available to generate the password:

- Host ID
- System Serial No.

The Host ID can be read out from the XCU under <System><ID Codes> using the Service PC.

NOTE

Prior to entering the variable password, set the System Serial Number and the maintenance unit under <System> <ID Codes>.

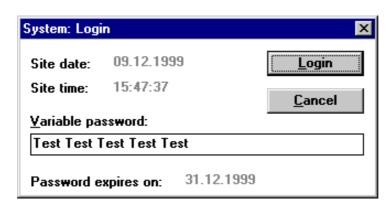


Fig. 16: System: Login

System Configuration

Remark

Configuration and adjustment have already been performed for systems shipped as systems. The SSW diskette, "Site Data Disk", included in the shipment is a backup.

For safety, a written document of the configuration and adjustments can be printed out.

- Printing Out the Site Structure Configuration:
 - Select **Configure / Site Structure**, press the **List** button in the Component Selection window.
 - In Configure / Site Structure in the Component Selection window, press the OK button, in the Edit System window, press the List button.
 - In Configure / Site Structure in the Component Selection window, press the OK button, in the Edit System window, press the OK button, in the Fluoro Details window, press the List button.
 - In Configure / Site Structure in the Component Selection window, press the OK button, in the Edit System window, press the OK button, in the Fluoro Details window, press the OK button, in the Edit Fluoro Programs window, press the List button.
 - In Configure / Site Structure in the Component Selection window, press the OK button, in the Edit System window, press the OK button, in the Fluoro Details window, press the OK button, in the Edit Fluoro Programs window, press the OK button, in the Site Adjustment window, press the List button.

Tip: If you always enter the same name for the file name in all print dialogs for Site Structure Configure, all print to files will be written to the same file, one after the other.

- Printing Out the Adjustment Results:
 - Component / Polydoros SX / Diagnostics / Adjustment Results / Display all Parameters.

NOTE

Programming the options is permitted only if the corresponding license is available!

The licenses are shipped with the BZ and are filed in the Generator Binder, Register 9.

 Select the system under Configure / Site Structure / Site Selection and confirm with OK.

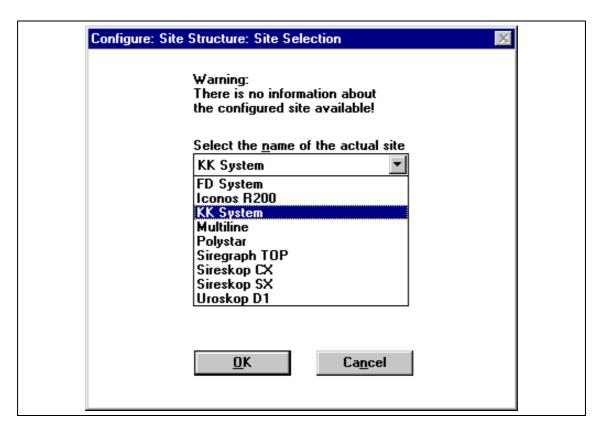


Fig. 17: Configure:Site Structure:Site Selection

NOTE

If Configure / Site Structure / Site Adjustments has been saved once, the Configure / Site Structure / Component Selection window is selected immediately when Configure / Site Structure is selected. Changing Configure / Site Structure / Site Selection is possible only if Data / Erase Configuration was performed first. All configuration and adjustment data are lost when Data / Erase Configuration is selected.

• Select the configured components under **Configure / Site Structure / Component Selection** and configure them with Edit and/or Option.

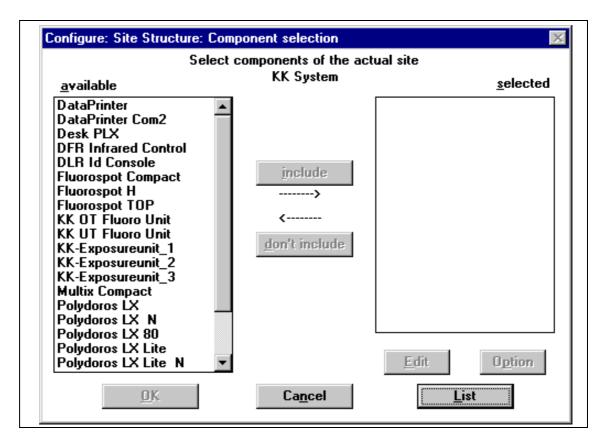


Fig. 18: Configure:Site Structure:Component selection

Configure / Site Structure / Edit System

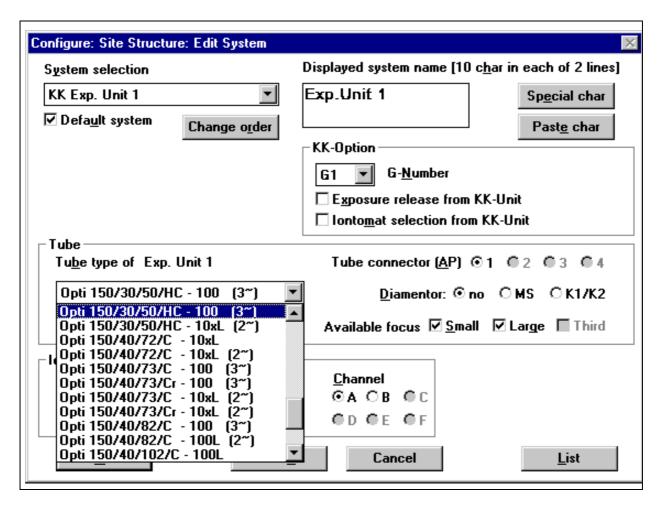


Fig. 19: Configure:Site Structure:Edit System

NOTE

Window: Configure / Site Structure / Edit System:

- If tube unit type is clicked, even if it is not changed, the tube unit data are immediately set back to the default data. This means that test shots of the tube unit must be performed every time this is clicked.
- Stator designation (see Speed Info 105/93):

OPTI and MEGALIX with "L" at the end of the designation means a 2-phase X-ray tube, e.g. Opti 150/30/50/C-100L

OPTI and MEGALIX without "L" at the end of the designation means a 3-phase X-ray tube, e.g. Opti 150/30/50/C-100

Configure / Site Structure / Site Adjustments

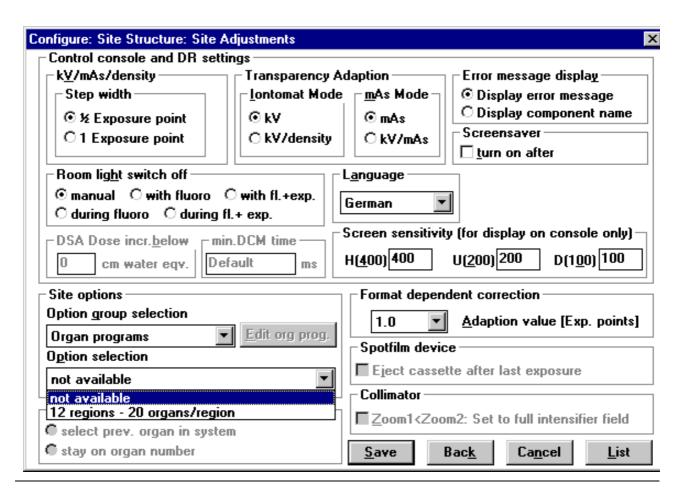


Fig. 20: Configure: Site Structure: Site Adjustments

NOTE

In systems with the FLUOROSPOT T.O.P., no "Default organ programs" may be loaded from the program Configure / Site Structure / Site Adjustments.

If "Default organ programs" are loaded, they cannot be used in combination with the FLUOROSPOT T.O.P.

Window: Configure / Site Structure / Site Adjustments:

If a license is available, the "Organ Program" option can be enabled in the Site Options menu - "Default organ programs" will then be available.

• Exit the Configure / Site Structure / Site Adjustments window with "Save".

NOTE

The configuration is saved in the XCU with Save and a backup is generated on the "Site Data Disk".

- Exit the message window that follows with OK.
- Language Download for Displayed Texts on the Touchscreen Console

NOTE

Perform only if the D230, Part No. 48 19 640 X2076, is configured.

Select Component / PLSX Desk.

ullet

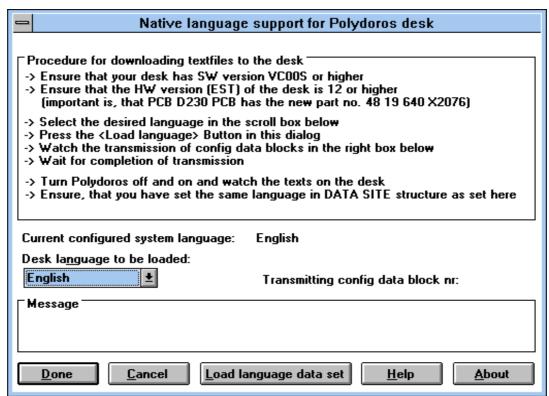


Fig. 21: Native language support for Polydoros desk

- Select Desk language to be loaded and the appropriate language.
- Select Load language data set.
- Exit the service window with **Done**.

Testing the Operating Console

Default position after switch-on

- 1. Selected system
- 73 kV
- 2-point-technique
- 20 mA
- ■ (large focus)
- 80% kW

Testing the Filament Heating Circuit and Anode Starter

NOTE

If a D220 heating filament board with Part No.: 56 58 864 is configured, the X200 and X201 jumpers must be installed.

LEDs V514 and V515 must go on.

- At the console, select the X-ray tube assembly to be tested via the appropriate system.
- Connect the Cathotest X-ray tube phantom and check the correct focus for the respective X-ray tube:

At console	Release	At X-ray tube phantom						
		Large filament	small filament					
I / I	S27 OFF	lights up*	lights up*					
	S27	lights up+	does not light up					
	S27	does not light up	lights up+					

^{*} standby heating, + radiographic heating

Check the fluoroscopy and exposure circle

Fluoroscopy circle (if configured)

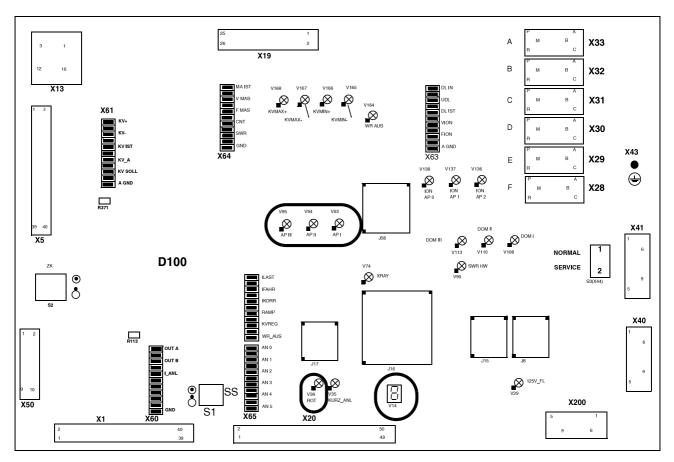


Fig. 22: PL LX:D100 / Displays

- Set fluoro switch to **ON** at the system.
- The following LED's on D 100 have to light up (Generator wiring diagram):

AP1/AP2 (AP3) ROE1/ROE2 (ROE3)
ROT, V36 Generator enable

SWR-HN, V90 Radiation release safety circuit

d. on 7 segment display V14

NOTE X-RAY "radiation display" lights up only in response to radiation ON.

• Set fluoro switch to **OFF** at the system.

Exposure circuit

Preparation:

- Press the S27 trigger button to Preparation
- The following LED's on D100 have to light up:

WS1/WS2 (AP3) ROE1/ROE2 (ROE3); depending on system X-ray tube

ROT, V36 Starter

h. \rightarrow r. on 7 segment display V14 (boosting \rightarrow continuous without

"ZK")

Exposure release

• Push S27 button down to "release".

SWR-HW, V90 radiation enable safety circuit with "HK"

□ on 7 segment display V14 (boosting → continuous without "ZK")

NOTE

X-RAY "radiation display" lights up only in response to radiation ON.

• Release button S27.

NOTE

If the 7-segment display does not switch from \rightarrow A:

Check release circuit.

Press release button S27 for 10 s and read the error message at the console.

Preliminary Steps

Switch generator to OFF

NOTE

Prior to starting the test, remove the fuses for the I.I. line voltage in fluoroscopy systems to protect the I.I. and the multiplier. Close the collimator and cover the I.I. opening. (e.g. with a lead apron).

- Remove the Cathotest X-ray tube phantom from the high voltage cables at the cathode side and connect the cables to the X-ray tube. Because the Corona disks expand slightly when they absorb the silicon oil, use a new Corona disk (Part No. 17 86 508 R4186) every time the high voltage connector is plugged in (see Installation Instruction).
- Generator OFF
- Switch ZK on board D100 ON
- Generator ON

Testing the Anode RPM (without radiation)

Test with the FLUKE 8060A

NOTE

The frequency can be measured directly, if a FLUKE 8060A is available. Perform the measurement as described in b); set the FLUKE to 200 mV AC and Hz.

Test with the oscilloscope

- At the console, select the X-ray tube to be tested.
- Press switch S27 to "prep": The rotating anode starts up.

∆CAUTION

Voltage approx. 1500 V!

□ Do not connect the oscilloscope yet!

- Switch OFF generator.
- Connect the oscilloscope to the X-ray tube to be tested:
 - Tube assembly I to K3.R2 and K3.R4
 - Tube assembly II to K3.2 and K3.4

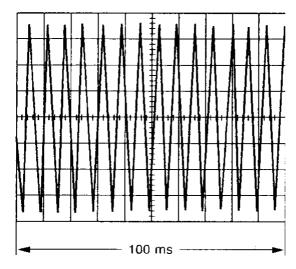


Fig. 23: Oscillogram: X-ray tube rpm

- Evaluate the oscillogram:
 - Count the number of periods within 100 ms.
 - The period number multiplied by 10 provides the frequency.
 - With 3-phase or high-speed X-ray tubes: rpm **143 ± 10 Hz** (Rapid tubes).
 - With low-speed X-ray tubes: $rpm = 50 \pm 5 Hz$

NOTE

Disconnect the oscilloscope before switching the generator back on!

It is not possible to measure the RPM's for the OPTI 154.

Generator Basic Settings

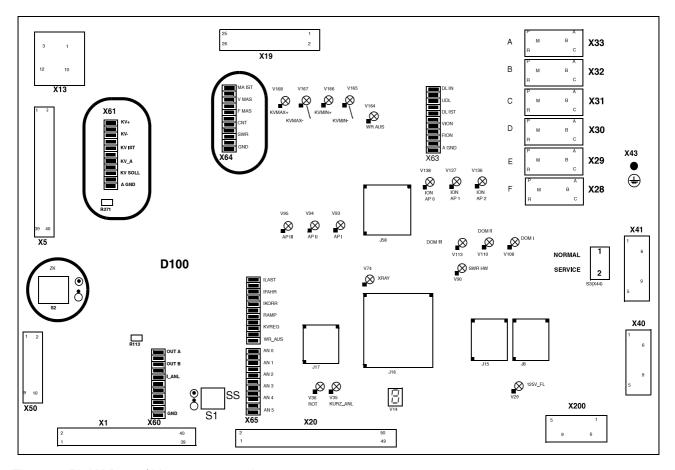


Fig. 24: PL LX:D100 / Measurement point

Set SS to ON

NOTE

Complete system configuration for both X-ray tubes has already been performed in the factory.

Radiation is released during the measurements described below. Observe radiation protection measures!

Observe the required cooling pauses for the X-ray tube!

Perform the following settings and tests for all connected X-ray tubes!

- The generator adjustments are made in the main menu "Components"/"Polydoros"/"Adjustment".
- To check the tube voltage and the tube current during the following settings, connect the oscilloscope to the following test points on the D100.

X61.kV IST 1 V
$$\stackrel{\triangle}{=}$$
 20 kV 0V/AGND (X61)
1 V $\stackrel{\triangle}{=}$ 200 mA

X64.mA IST $1 \text{ V} \triangleq 1 \text{ mA}$



Trigger: SWR Start/Stop inverter (SWR/X64)

- In the main menu, select "Components"/"Polydoros ..".
- Set the S3 / X44 switch on the D100 to Service.
- Exit the message window (D100.S3 service switch) with OK.

Generator Parameters

- In the window "Polydoros .. Service\Adjustment\select Generator Parameters".
- In the window "Generator Parameters" select the high voltage cable lengths for the particular tube unit (Tube 1, 2).
- Exit the window with **OK**.

Adjusting the Fluoroscopy Attachment

NOTE

Carry out the adjustment of the "FC Attachment" for

- 1. During startup (already carried out when system is shipped)
- 2. When the D100 is replaced
- 3. When inverter components are replaced (fluoro option)
- The generator should be switched of for at least 10 minutes (operating temperature).
- Select the window "Polydoros .. Service\Adjustment\FC Attachment Adjust".
- In the window "Fluoroscopy Attachment Adjust" select the field "Auto-Calibration".
- Confirm the message window with OK

NOTE

he adjustment is carried out for several points (kV, mA). When this is done, fluoroscopy is switched on and off automatically.

Exit the window with **OK**

NOTE

Following "Erase Configuration" or the first time this module is adjusted, the message: "You are about to generate Init Block # 110! Do you really want to do this?" appears. Answer this question with "Yes"

Tube Unit Adjustment

In the window"Polydoros .. Service\Adjustment\select Warm UP".

∆CAUTION

Radiation will be released in the next work step.

Close the collimator, cover the I.I. with lead-rubber.



- In the window "Warm Up": click on "Fluoroscopy **ON**": fluoroscopy is automatically switched off **after 10 min**..
- Exit the window with **OK**.
- The adjustment points: "Pre Heating, Filament Correction, Filament Pushcurrent" are guided by the software. For them, fluoroscopy or exposure is switched on in the window in each instance until the "**OK Button**" is activ.

NOTE

First the small focus, then the large focus is completely calibrated (test shots).

- Exit the window with OK
- Repeat the fluoroscopy option adjustment.

Testing the Exposure Voltage and the Tube Current

Testing radiographic heating

- At the console select the kV value and the tube current values (mAs/ms).
 - 3-point technique
 - 81 kV
 - 40 mAs
 - |



- 100 ms or nearest possible value
- Make an exposure for each X-ray tube (S27: approx. 2s prep, then press HK ON) and check the curve of the exposure voltage and of the tube current on the oscilloscope:

The exposure voltage should remain constant throughout the exposure. Within 50 ms, the tube current should be within $\pm\,10\%$ of the nominal values and then remain constant throughout the exposure.

If the measurement values deviate from those given, recalibrate the X-ray tube.

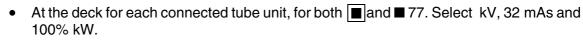
Testing the filament boosting



Release an exposure using the above values (push S27 to "release") and check exposure voltage and tube current on the oscilloscope: The exposure voltage should remain constant throughout the exposure.

Within 50 ms, the tube current should be within \pm 10% of the nominal values and then remain constant throughout the exposure. If the measured values differ from the nominal values, the X-ray tube must be conditioned again (calibrated).

Testing the kV accuracy





Release an exposure for each tube and check the kV value on the oscilloscope.

Record the measurement value in the test protocol. For tolerance, see Test Certificate.



Use a kV meter (NOMEX) for the acceptance tests (RöV §16). Follow the operating and the measurement requirements in the instructions. If the measurement values deviate from those given:

- Check the length of the high-voltage cable
- or recalibrate the X-ray tube.

Testing the Exposure Displays at the Console

- At the console select 77 kV / 100 mAs and release an exposure:
 - The radiation ON indicator must light up during the exposure.
 - The tone (beep) must sound at the console for the duration of the exposure.

mAs Relay Adjustment

- In the window "Polydoros .. Service\Adjustment\select mAs Relais Adjust".
- Connect the mAs meter to D220.X16 (mAs socket).
- Exit the message window with **OK**.

NOTE

Perform the mAs relais adjustment::

- 1. during startup (not when the sytem is delivered)
- 2. after replaceing the D100
- 3. when there are differences in the mAs values in 2-point technique.



- Select "Exposure ON".
- Enter the value measured in "Measured value: ..." using the arrow keys.
- Exit the window with OK.
- Disconnect the mAs meter and reinstall the mAs jumper.

NOTE

Following "Erase Configuration" or with the first adjustment of this module, the following message appears: "You are about to generate Init Block # 103! Do you really want to do this?"

Respond to this message with "Yes".

Testing the mAs valuese

- Switch **OFF** generator.
- Remove the jumper from the mAs sockets on board D220 (on the H1).
- Connect the mAs meter to the mAs sockets.
- Connect the oscilloscope at the following points: D100/X61.kVactual
- Trigger SWR D100/X64



- Switch ON generator.
- At the console, select the following values for the X-ray tube with the highest rating:
 - ■, 77Select kV, 80 mAs and 100% kW.
- Release the exposure and check the mAs value on the mAs meter.

For tolerance, see Test Certificate.



• Record the measurement value in the test protocol.

If the measured values differ from those in the Test Certificate, the mAs counter must be reset (see SSW Description, RX63-020.034...: "mAs Relay Adjust").

DIAMENTOR MS Adjustment

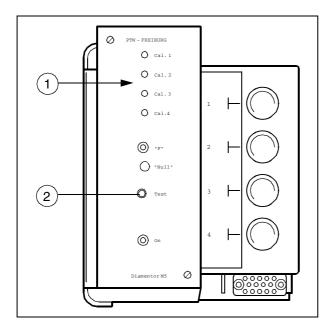


Fig. 25:

Performing

- Select the window "Polydoros .. Service\Adjustment\Diamentor".
- Enter the following values in the box "Diamentor Factors" in the window "Diamentor Calibration": the KG value(s) for the measuring chamber/chambers and read the QT value of the DIAMENTOR MS from the assembly or take it from the DIAMENTOR MS Function Description.

NOTE

Only with SIRESKOP SX, multiply the KG value by the factor 0.86.

- Select the window "Diamentor Calibration**Start Autocycles**" and start the adjustment by pressing the "Test" button on the DIAMENTOR.
- Select the window "Diamentor Calibration"; in the field "Actual-Expected Value", 0 must be displayed. If it is not, use the particular CAL1 ... CAL4 potentiometer (1/Fig. 25 / p. 50) to carry out a zero adjustment. Every time the potentiometer setting is changed, press the "Test" button (2/Fig. 25 / p. 50). Repeat the procedure until 0 is displayed in the "Actual-Expected Value" field.
- Exit the window with **OK**

NOTE

There is a separate set of Installation and Setting Instructions, RX63-055.033... for the Diamentor K1/K2.

Manual Control of Exposure Termination



- At the console, use the ms key to select a time of 2.0 s for values set previously.
- Manually release an exposure and terminate it immediately by releasing the exposure switch:

The exposure time should be significantly shorter than the previously displayed exposure time.

Testing the max. Generator Power/X-ray Tube Output



- Select the menu "XCS-Service Application-Main Program/Components/Polydoros .../Polydoros .../Service/Diagnostic/ Nominal Power".
- Release exposure. Measure the kV and mA with the oscilloscope.
- Use the measured kV and mA to calculate the maximum power

$$\mathsf{P}_{\mathsf{kWmax}}\!\!=\!\,\frac{\mathsf{kV}\!\times\!\mathsf{mA}}{1000}$$

For tolerance, see Test Certificate



• Record the measured mA value and the calculated power in the test protocol.

Film-Screen Combinations Used

Three different exposure stages (BSt) can be programmed on the generator corresponding to the 3 different film-screen combinations.



- The screen and the film intended for it must be recorded in the IQ Test Certificate for each exposure step with the data:
 - the sensitivity S
 - the theoretical dose requirement K_S
 - the minimum resolution RGR
 - the color sensitivity of the film and screen

NOTE

Make sure that only films for the light color for which the screen is sensitize determined are used (green sensitive film for green screen, blue for blue screen).



- Record the manufacturer's sensitivity S (speed) for each film-screen combination used.
 - The sensitivity of a film-screen combination is defined according to ISO 9236 as the quotient of 1000 μ Gy and the air kerma (dose) K_S required to reach the optical density (blackening) 1 above base fog.

$$S = \frac{1000 \mu Gy}{K_S}$$

Fig. 26:



 At a known sensitivity S, please also refer to the appendix / Sensitivity of the film-screen systems, the theoretical dose requirement K_S must be calculated and documented:

$$K_S = \frac{1000 \mu Gy}{K}$$

Fig. 27:

- A minimum resolution R_{Gr} in LP/mm is assigned to each required dose K_S, i.e. the higher the required dose is for a film-screen combination, the higher the resolution that must be reached in order to justify the increased dose.

The relevant minimum resolution R_{Gr} is shown in the following diagram for every film-screen combination used.

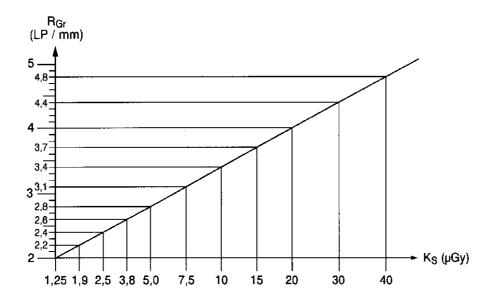


Fig. 28:

K_B = Dose requirement of the film screen combination according DIN 6867

R_{Gr} = Minimum resolution of the film screen combination according DIN

6868

S (Speed) = S (Speed) = sensitivity of the film screen combination (ISO 9236)

NOTE

Regarding the use of the film-screen combinations, no internationally uniform regulations exist; national regulations (e. g. §16 RöV - X-ray Regulations) must be observed in the respective country.

Checking the Chamber and Measuring Field Selection

Perform the following checks for all connected IONTOMAT detectors and their measuring fields (dominants):

Detector selection

- At the generator console, select the IONTOMAT workstation (system).
- Open the collimator at the unit so that the measuring fields for the IONTOMAT chambers are fully exposed.



- SS ON.
- Release an exposure (with default value 73 kV).
 - Required: An immediate switch-off must take place; if there is incorrect chamber selection or if there is a cable break, ERROR 550 appears (dose monitoring).

Measuring Field Selection

- At the generator or at the unit, select a measuring field for the IONTOMAT chamber.
- Cover the measuring fields that are not selected on the IONTOMAT chamber (e.g. with a lead apron).



Release an exposure:



- Required: An immediate switch-off must take place.
- Select one of the covered measuring fields and trigger an exposure:
 - □ Required: The exposure must take a log time or ERROR 550 must be displayed.

NOTE

If measuring field selection is done at the unit (Configurate: Site Structure: Edit System"), all measuring fields will be dark (touch-screen console) when the generator is switched ON at the generator console - only with KK systems!!!

Checking the Drift and Hum Voltage

Checking the Drift

Preparations

- Generator **OFF**.
- Connect the oscilloscope to:
 - D100.X63 VION and D100.X63 AGND
 - Trigger D100.X64. SWR
- Generator ON.
- Perform the following checks for all connected detectors; to do this, select the corresponding IONTOMAT work station. Depending on the unit, insert, e.g. an empty cassette.

NOTE

The generator must be switched on for at least 5 minutes prior to performing the checks.

If a digital oscilloscope is used, do not measure in the "Glitch Detect mode" (mean value calculation, smoothing) because if this is done, the measuring results will be falsified.

The drift measurement is relative to the integrator output of the U/F converter, i.e., if the SWR is ON and the threshold voltage 0 V is reached, the output voltage will be set to 1.5 ± 0.3 V.

- Start the XCS SSW.
- Select < Components/Polydoros LX or. SX/ Diagnostic/Iontomat Drift>.
- Perform the further work steps per the SW window "Measure steps".



Enter the measurement values in the Test Certificate (Quality Certificate or Test Certificate 1).

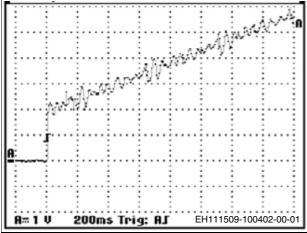


Fig. 29: Oscillogram 1 example: Drift measurement

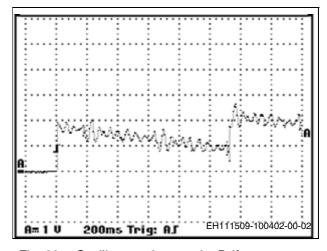
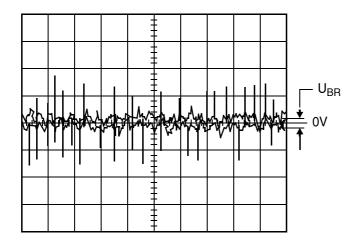


Fig. 30: Oscillogram 2 example: Drift measurement

Checking the Hum

- Connect the sensor to D100.X63 DL IN.
- SS OFF
- Trigger exposure and measure the hum voltage U_{BB} for all 3 chambers.
 - Maximum permissible hum: ≤ 20 mVpp

Enter the measurement values in the Test Certificate (Quality Certificate or Test Certificate 1).



Hum voltage on D100.X63.DL IN (Example) 10 mV/div

10 ms/div

Fig. 31: Oscillogram: Hum at D100.X63.DLIN

Causes and Corrective Measures for Drift and Hum Voltage Values that are too High

NOTE

Undefined switch times and noise in the IONTOMAT mode may be caused by routing the IONTOMAT cable through the same cable duct as the line voltage cable and high voltage cables.

The IONTOMAT cable must be a minimum of 10 cm away from the signal and power cables. The IONTOMAT cable may not be laid in loops.

Insufficient insulation of the IONTOMAT chambers.

Corrective measure: See "Connecting the Detectors" in the Generator or System Installation Instructions.

Disturbances over the IONTOMAT cable.

Corrective measure: Check how the complete cable is laid. If needed, replace the IONTOMAT cable.

Only with Multiplier Operation:

If the drift or hum is too high, it can be caused by the following:

- Multiplier incorrectly connected on the base
- Multiplier cable shielding defective

Testing Optical Density

NOTE

Tables are located in the chapter "Sensitivity of the Film-Screen Systems" from which the values can be determined.



Make test exposures for all film-screen combinations and workstations using 81 kV, small focus, 80% with 20 ± 0,5 cm and 5 ± 1 cm water (film format ≥ 18 x 24 cm) and check the film density for each exposure:

The films must have the density requested by the customer. If there is no customer specification, set the optical density DN = 1 (density 1 + 0.2 above fog).

 If necessary, correct the programmed sensitivity values (plug positions) using the "POLYDOROS LX Service: Adjustment:IONTOMAT Sensitivity" window on the PC.

When releasing exposures with the right or left measurement chamber, the film density shall not exceed $\pm\,0.2$ optical density in the area of the measurement chambers.



Record the programming of the basic sensitivity of the film-screen systems
 (= exposure step), the resulting optical density and the film format being used in the IQ
 Test Certificate.

IONTOMAT Adjustment

- Select the window "Polydoros .. Service/Adjustment/Iontomat Sensitivity".
- Select the detector to the adjusted.
- Determine the required basic sensitivity for the existing film-screen combination and program it.
- Determine the delay time in accordance with the system-specific object path and program it.

Basic Adjustment

Recommended values for the basic adjustment

Empfindlichkeit/Sensitivity						
400 / 11						
200 / 14						
80 / 17						

NOTE

The data can be updated in the XCU with "Transfer Value" and can then be used for the control exposures without having to exit the SSW.

- Exit the window with **OK**.
- Enter the values that have been set in the IQ Test Certificate.

Determining the IONTOMAT Voltage Response Correction



Voltage Response Correction

 Prepare test exposures at 60 kV and 125 kV with 20 cm water for all screens used and check the film density in each instance:

The film density at 60 kV and 125 kV must match the film density at 81 kV (Section "Checking the Film Density).

The difference in density can be between

Dopt (81 kV) - Dopt (60 kV) \leq 0.2

Dopt (81 kV) - Dopt (125 kV) \leq 0.2 of the optical density.

- Select the window "Polydoros .. -Service/Adjustment/Voltage Responce Corr."
- Select the corresponding detector type.
- Determine the correction values for the film-screen combination that is configured and enter it.

Value range < 81 kV: 0...13

≥ 81 kV: - 13.. 0

NOTE

The data in the XCU can be updated with "Transfer Value" and control exposures can be made using these data without having to exit the service software.

- Exit the window with OK.
- Enter the values set in the IQ Test Certificate.



Enter the programming for the voltage response corrections, the resulting optical densities at 60 kV and 125 kV in the IQ Test Certificate. Perform a voltage response correction for all detector types - 6 mm chamber / 12 mm chamber / HSE chamber.

In the following illustration and corresponding value table, the correction curves 1...13 for the lower kV range (40...81 kV) and the correction curves 1...-13 for the upper kV range (81...150 kV) are shown. From it, it is possible to read what change in exposure points or in density for the corresponding kV value results when there is a change to a different correction curve.

NOTE

A change of 1 exposure point results in a density change of approx. \triangle S = 0.25.

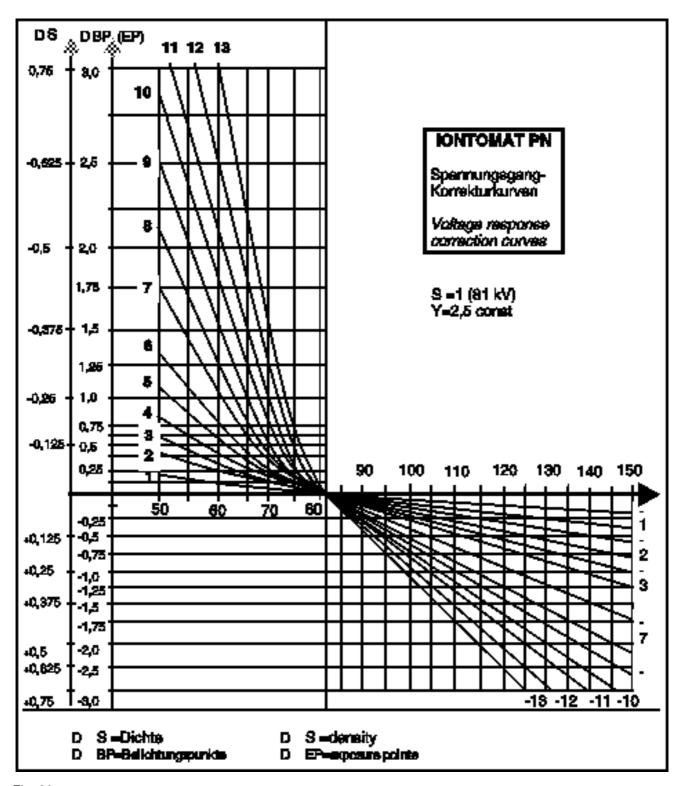


Fig. 32:

(≤ 81 kV)	Corrections for the lower kV range (≤ 81 kV)												
kV	13	12	11	10	9	8	7	6	5	4	3	2	1
40	48	42	35	32	28	24	20	16	13	11	8	6	3
41	47	41	34	31	27	23	19	15	13	10	8	6	3
42	46	40	33	30	26	23	19	15	12	10	8	5	3
44	44	38	31	28	25	21	17	13	11	9	7	5	2
46	41	35	30	26	23	20	16	12	10	8	7	4	2
48	39	33	28	25	22	18	15	11	10	8	6	4	2
50	37	31	26	23	20	17	14	10	9	7	5	4	2
52	34	29	24	21	18	15	13	9	8	6	5	3	2
55	30	26	21	18	16	13	11	8	7	6	4	3	1
57	28	23	19	17	14	12	9	7	6	5	3	2	1
60	24	20	16	14	12	10	8	6	5	4	3	2	1
63	20	17	13	11	10	8	6	5	4	3	2	2	1
66	16	13	10	9	8	6	5	4	3	2	2	1	1
70	11	9	7	6	5	4	3	3	2	2	1	1	0
73	8	6	5	4	3	3	2	2	1	1	1	0	0
77	3	3	2	2	2	1	1	1	1	0	0	0	0
81	0	0	0	0	0	0	0	0	0	0	0	0	0
85	-2	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0
90	-4	-3	-3	-2	-2	-2	-1	-1	-1	-1	-1	0	0
96	-7	-6	-6	-4	-4	-3	-3	-2	-2	-1	-1	-1	0
102	-10	-8	-8	-6	-5	-4	-4	-3	-2	-2	-1	-1	0
109	-13	-11	-11	-9	-7	-6	-5	-4	-3	-2	-1	-1	-1
117	-18	-15	-15	-11	-10	-8	-6	-5	-4	-3	-2	-2	-1
125	-24	-20	-20	-14	-12	-10	-8	-6	-5	-4	-3	-2	-1
133	-31	-25	-25	-17	-15	-12	-10	-7	-6	-5	-4	-2	-1
141	-40	-32	-32	-21	-18	-15	-11	-8	-7	-6	-4	-3	-1
150	-53	-40	-40	-26	-21	-17	-14	-10	-8	-7	-5	-3	-2
kV	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1
(> 81 kV)	Corrections for the upper kV range (> 81 kV)												

BP = exposure points

In the table, Δ EP are listed in 1/8 EP.

PLANI-IONTOMAT

Checking PLANI-IONTOMAT Selection

- Generator ON
- At the console, select the IONTOMAT and select a tomo time at the tomo device.
- On the control console, the displays for the "IONTOMAT" and "Tomo device" operating
 modes must go on, and the tomo time selected at the tomo device must be displayed in
 the ms display.

Density Correction with the PLANI-IONTOMAT

Prerequisite: The basic setting of the IONTOMAT (IONTOMAT Sensitivity) must already be completed.

- Select the direct mode at the tomo device and insert a cassette.
- Position a 20 ± 0.5 cm water phantom on the tabletop.
- Set the collimator accordingly.
- Select 8°/0.6 sec at the tomo unit.
- Select 81 KV, screen H and the middle lontomat measuring field.
- Start the XCS-SSW.
- Select < Components>, < Polydoros SX>.
- Select <Adjustment>, >Plani lontomat>, <OT Tomo Vid>, <Tomo Programs 1>.
- Select the briefest tomo time on the tomo device.
- Develop the film and measure the optical density. If the desired density is not reached, change the "Iris Correction", <Put to Unit>

NOTE

In this instance, the iris adjustment is not changed with "Iris Correction", but the dose!

- Trigger a tomo exposure, develop the film and measure the optical density. Change the "Iris Correction" until the desire optical density is obtained.
- <Tomo Programs 2> and select 20°/0.8 sec at the tomo unit and proceed in the same was as for 8°/0.6 sec.
- Select <Tomo Programs 3> and at the tomo unit, select $40^{\circ}/1.2$ sec and proceed the same way as for $8^{\circ}/0.6$ sec.
- < < OK>
- Click on <System>
- Click on <Quit Ctrl X>
- Click on the top left of the monitor screen and click on <Close>.
- In the line "Working on", enter any desired letters and click on <Put to Unit>.
- Switch of the system.

Iris Adjustment for Digital Tomo

NOTE

Perform only in systems with the FL-Compact!

- Select DFR, select Zoom 0 (full format)
- Position the water phantom on the tabletop
- Set the collimation accordingly
- Select a focus-I.I. distance (SID) of 115 cm
- Select 20°/0.8 sec at the tomo device
- Set the SS to ON
- At the FLC, click on <Set> and then select <IQ On> or <IQ ON>
- Click on <Service> and enter "test" as the password to call up the service mode
- Click on <Acq> and select the **Program 1** service program. If "Service Program 1" cannot be selected, then first make a tomo exposure.
- Click on <Set> <Organ> and check whether 70 kV is set in Program 1 for exposure; if not, then set 70 KV and save the change with <Store>.
- Start the XCS SSW, select <Component>, <Polydoros SX>, <Adjustment>, <Plani-Iontomat>, select <OT DFR Tomo> und <Tomo Programs 2>. Make sure that "Iris Correction" is set to 0.0, click on <Put to Unit>, <OK>, <System>, <Quit Ctrl X>
- <Acq> and trigger a tomo exposure
- Click on <ROI 20> and measure the gray value in the center of the image. Required value: 400 ± 15 %
- If there is a difference, start the XCS SSW: Change <Adjustment>, <TV-Parameter>,
 <Exposure Tomo>, "Iris-Correction", <Put to Unit>, <Start>, trigger exposure, <Stop>,
 measure the gray value (again using <ROI20>) and, if needed, change the "Iris-Correction" further until the desired required value is reached. <Close>
- Select 8°/0.6 sec at the tomo device
- Start the XCS SSW, select <Component>, <Polydoros SX>, <Adjustment>, <Plani-Ion-tomat>, select <OT DFR Tomo> und <Tomo Programs 1>, <Put to Unit>, <Start>, trigger a tomo exposure
- Click on <Stop>, <ROI 20> and measure the gray value in the center of the image. If the required gray value of **400** ± **15** %is not reached, change the "Iris Correction".
- Using <Put to Unit>, <Start>, trigger a tomo exposure and, if needed, further change the "Iris Correction" until the desired required value is reached.
- Select 40°/1.2 sec at the tomo device
- Select <Tomo Programs 3> and proceed as described for 8°/0.6 sec and <Tomo Programs 1>.
- <OK>, <System>, <Quit Ctrl X>
- Record the results in the IQAP, chapter "Check Iris Setup for Tomography".
 (20 ± 0,5 cm keep the water phantom)

Checking the kV Reduction Value

NOTE

Perform the following points:

- Checking the kV Reduction Value
- Checking Control when Exposure is Triggered
- Checking Drift and Hum
- Checking Dose Rate Control

only if problems occurred during adjustment of the density correction or iris adjustment with digital tomography!

Otherwise, continue with the section "Cut-off Dose".

- Switch the SS OFF and the generator ON
- Connect the oscilloscope:
 - Channel 1: Connect D100.X61 KV_∆ and D100.X61 A_GND (1V \(\triangle 20 kV).
 - Trigger: D100.X64 SWR (leading edge)
- PLANI-IONTOMAT (IONTOMAT and Tomography) selected.
- Select 81 kV at the console.
- Trigger exposure using the trigger button

Calculation:

Starting value kV_{ANF} for kV controller = 40 kV \triangleq 2,0V KV_ Δ = kVSOLL - kV_{ANF} = 81 kV - 40 kV = 41 kV \triangleq 2.05V

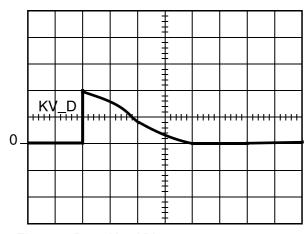


Fig. 33: D100.X61 KV_∆

Channel 1: 1V/div.
Offset: 10 ms/div.

Checking Control when Exposure is Triggered

- Connect the oscilloscope:
 - Channel 1 to D100.X64 SWR
 - Channel 2 to D100.X61 kV_{SOLL} (1 V $\stackrel{\triangle}{=}$ 20 kV)
 - Ground to D100.X61 A GND

- PLANI-IONTOMAT (IONTOMAT and tomo) selected.
- Select 81 kV at the console.
- SS OFF

 Trigger exposure and check the signal curve of SWR (pulse-pauses control) and kV NOM (kV reduction).

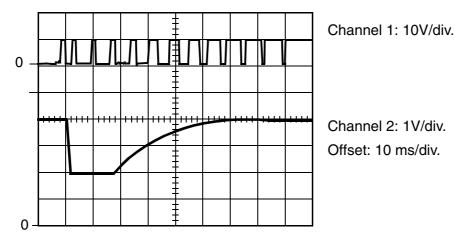


Fig. 34:

Checking Drift and Hum

- Connect the PC to the XCU and establish a connection. Under Components, select \Polydoros\Adjustment\Iontomat\Sensitivity.
- Work station (CH: A...F) program sensitivity 10 (Sensitivity = 10) (make a note of the original sensitivity).
- Connect the oscilloscope:
 - Channel 1: D190.X26 UDL and D190 A_ GND(0V)
 - Triggering: D100.X64 SWR
- Select the particular tomo time at the tomo device; perform the checks, once after the other, for all selectable tomo times.

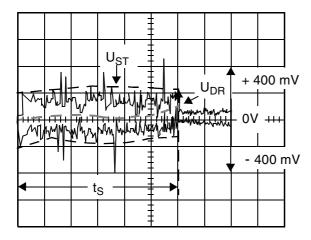
• Trigger exposure (SS **OFF**) and check drift and hum:

- Drift:

The drift (U_{DR}) may be a maximum of \pm 400 mV/tomo time (ts). In the following oscillogram, the max. drift is \pm 100 mV.

- Hum

The hum (U_{ST}) may be a maximum of 1 V_{pp} . In the following oscillogram, the max. hum is 500 mV.



Drift and hum at D190.X26 UDL

Channel 1: 200mV/div.

Offset: 200 ms/div.

Fig. 35:

 At the PC, in the main "Configuration" menu, select the "IONTOMAT" menu item for the PLANI-IONTOMAT work station (CH: A...F) reprogram the originally determined sensitivity (SENSIT.) and use "Data" / "Restore" to download from the PC to the generator.

Checking Dose Rate Control

- Connect the oscilloscope:
 - Channel 1: D190.X26 UDL
 - Channel 2: D100.X61 KV Act
 - Ground: D100.X61 A_GND
 - Trigger: D100.X64 SWR (leading edge)
- SS ON
- Select the IONTOMAT (middle measuring field) and 81 kV at the console.
- Use a 20 cm water phantom ±1 cm for the following test exposures; collimate to the phantom.
- Select the particular tomo time at the tomo device. Perform the check for all tomo times, one after the other.

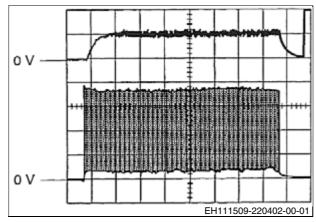


• Trigger an exposure for each tomo time (Caution: Radiation!) and perform a check with the following oscillogram:

After max. 1/4 of the tomo time, ts, the dose rate actual value, UDL, must have reached the corresponding required value. The required values are between 4 V and 8 V.

Oscillogram, Fig. 7:

- Tomo time 0.8 s, 81 kV, 20 cm-water phantom ±1 cm
- Offset: 100 ms/div.



UDL (5 V/div.)

 KV_{act} (+1V \triangleq 20kV) 1 V/div.

Fig. 36: Planiiontomat kV_{ist}-Messung

Sample Exposure

"Lung exposure"= tomo exposure of a 10 cm water phantom ± 1 cm with PLANI-ION-TOMAT.

Adjustment Values:

- At the tomo device: Tomo time 1.25 s

- At the console: 125 kV, 12.5 mAs, ms

Test Points:

Oscilloscope:

Channel 1: D190.X26 UDL

Channel 2: D100.X61 KV Act

Ground: D100.X61 A_GND

Trigger: D100.X64. SWR (leading edge)

Offset: 200 ms/div.

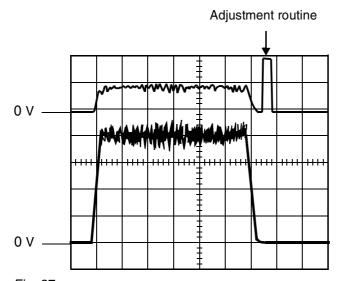


Fig. 37:

UDL

5 V/div.

kVact (+1V $\stackrel{\triangle}{=}$ 20 kV)

1 V/div.

Cut-off Dose

The cutoff dose must be measured at each application unit for IONTOMAT P and for PLANI-IONTOMAT for all exposure steps (screen) used.

Test conditions:

- Exposure parameters: 81 kV, small focus, 80% power; middle measuring field
- Position the scatter radiation grid in the beam path.



• Set SID: OT systems 115 cm; UT systems max. distance (no Distator); record the SID.



Release the exposures.

If exposures are made at the workstation using another kV value (e.g. 125 kV at a Bucky wall stand), record the kV value.

Procedure:

Insert the 2.1 mm precision copper filter in the beam path:
 For OT systems at the collimator, for UT systems on the tabletop, if the collimator is not accessible.



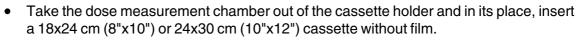
The dosimeter must be switched on for 15 minutes prior to beginning measurement and then must be calibrated. No additional filtering may be selected at the collimator.

Set the density correction to 0 \pm exposure points.



 Insert the dose measurement chamber into the cassette holder and collimate slightly larger than the chamber size.

- Release an exposure.
- Measure the switch-off dose K_B and record the result.





- Repeat the exposure and record the mAs value displayed at the generator console.
- If the measuring location K_B in the image receptor plate for the dose measurement chamber is not accessible, measure the transmission dose K_T and covert it to the image receptor dose K_B using the following formula.

$$K_B = \frac{K_T \times 0.94}{m}$$





Record both dose values (K_T and K_B) in the Test Certificate.

- The dose K_T is measured on the tabletop for OT units, with UT units, it is measured on the back wall of the spotfilm device.
- The factor **0.94** takes the radiation attenuation of the dose measuring chamber into consideration.
- The correction factor m takes into consideration all attenuation layers (grid, ION-TOMAT chamber, etc.) between the patient and the image receptor plane.
- The corrector factor m (unit attenuation factor) should be taken from the unit Test Certificate for the particular application unit.
- Compare the measured cutoff dose values, K_B with the film-screen combination being used with the required dose K_S recorded in the IQ Test Certificate.
- Admissible difference:

$$K_B \le 2.5 \times K_S$$
; $\left(K_S = \frac{1000 \mu Gy}{S}\right)$

Fig. 39:

Maintenance and service

- When maintenance is performed or in a service situation, the function of the automatic exposure control unit can be checked easily and quickly using what is referred to as the "Indirect dose control":
- Insert the 2.1 mm precision X-ray filter into the beam path.
- Insert a cassette without film into the cassette holder and collimate to the cassette size.



- Set all exposure parameters and test conditions listed in the Test Certificate.
- Trigger exposure and compare the mAs value displayed at the generator or measured using the mAs meter with the value recorded in the Test Certificate.
- If the recorded value is reached within a tolerance of ± 10%, nothing has changed in the automatic exposure control. If K_B > 2.5 K_S, check the film processing and the film material being used. The film-screen combination may also have undergone mechanical wear or is defective.

Resolution Power

Determine the resolution power for each film-screen combination.

Test conditions:

- Small focus, 80% power; middle measuring field; 81 kV.
- SID: OT systems = 115 cm; UT systems max. distance (no Distator)
- 1.2 mm Cu filter; OT systems at the collimator, UT systems on the tabletop, if the collimator is not accessible.
- Place the lead strip test outside the IONTOMAT measuring field:
 OT systems on the tabletop, UT systems on the back of the spotfilm device.

Procudure:

Trigger an exposure with every film-screen combination recorded in the IQ Test Certificate.



- Determine the effective optical resolution using a magnifier (at least 6x magnification) on a light box and record the result in the IQ Test Certificate.
- The minimum resolution R_G for each film-screen combination must reach the minimum resolution recorded in the IQ Test Certificate.
- If the minimum resolution is not reached, check the screen the screen for damage and direct and examine the cassette to make sure the screen is properly flattened.

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Checking the disappearance of grid lines

For each application unit with a movable grid, a check must be performed to determine at which exposure time tg grid lines can no longer be detected on the film.

Test conditions:

- Small focus
- 80% power
- Middle measuring field
- No filter in beam path
- SID= grid focus distance or next possible SID

Procedure:

 Insert a cassette (subdivisible, if possible) without film into the cassette holder. Set for serialography.



Release an exposure with 40 kV and read the exposure time at the generator console.
 Release several exposures with increasing kV values to determine which kV values produce exposure times of approx. 6, 8, 10, 12 ms, etc.



• Insert a high-resolution cassette into the cassette holder. Select subdivision, if possible, and release exposures with the determined kV values (switch times) in succession.



 Use a magnifier on the light box to determine at which switch time grid stripes can no longer be detected on the film. These switch times must be recorded in the IQ Test Certificate with the data for the screen that is used as well as the kV value. 74 IONTOMAT

Test exposure

Measure the dose after the X-ray beam has passed a specified absorber.

- Set the following values:
 - 81 kV
 - 32 mAs
 - small focus, 80%
- Center the detector for the dose meter in the beam.
- Remove all selectable filters.
- Measure the distance between the bottom edge (cross hair) of the collimator and the
 detector mount (tabletop) to exactly 70 cm. If this distance cannot be reached, set to the
 next possible value and record the value reached in the Test Certificate.
- Collimate the radiation field close to the edge of the detector, but make sure that the entire detector is in the radiation field.
- Insert radiation absorbers between the X-ray tube and the detector close to the X-ray tube.



(preferably insert the 2.1 mm Cu precision filter into the lower filter rails of the collimator)

Trigger an exposure and make a note of the dose that is achieved.

For DHHS, also enter the **initial value** in the Maintenance Instructions and the IQ Test Certificate.



Initial value: mGy/min

Adjusting the Dose Rate

Adjusting the Dose Rate with the PDA / SDM

• DVM to **D100.X63.DL IST** and **A GND** (\bot)

Required value: 0V 10 mV in standby (fluoro OFF)

If the display is > 10 mV, there is possibly too much ambient light on the PDA. Corrective measure:

- □ Install the cover panel on the light distributor.
- See the Image Quality Test Procedure for:
 - General Remarks regarding the Dose Measurements
 - Test Conditions
 - Test Preparations



- Select the window "Polydoros .. Service / Adjustment / Doserate".
- In the "Doserate Adjust" window, select Fluoroscopy
- Change the tube current ... mA until the desired dose rate (see the Image Quality Test Certificate) is displayed on the dose measurement meter.
- Switch fluoroscopy **OFF** in the "Doserate Adjust" window and exit the window with **OK**.
- Remove the measuring chamber
- Remove the cover on the light distributor

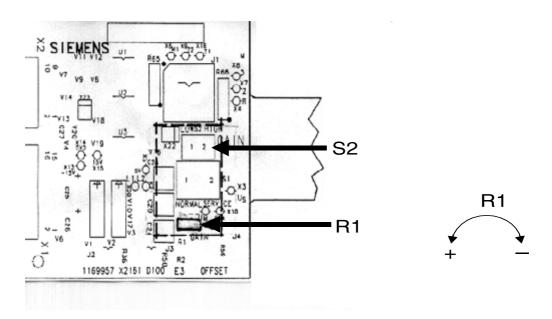


Fig. 40: Camera adapter

NOTE

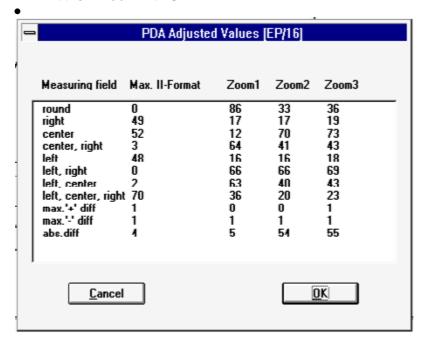
During the adjustment, the room must be darkened, otherwise the adjustment will be falsified because of ambient light. Following each change of the R1, reinstall the cover.

Set the D100.S2 switch (amplification) to Position 1.

- In the "PDA Preadjust" window, select Fluoroscopy **ON**.
- Using R1 on the D100 in the camera adapter, set the compensation to 0 ± 1 ($\pm 1/4$ EP). If the range is not sufficient, reset the S2 switch on the S100 in the camera adapter and repeat the adjustment.
- Exit the window with **OK**. (OK button is active when the adjustment is within the tolerance).
- Install the cover on the light distributor

Adjusting the Sensitivity

- Start the adjustment in the "PDA Sensitivity Autocalibration" window. The adjustment takes place automatically for all I.I. formats and measuring field combinations. Fluoroscopy is automatically interrupted for approx. 1 second between the individual adjustments.
- Exit the window with OK.



Admissible deviation at max. I.I. format: max. difference \pm 8 absolute difference \pm 16 only between the left, middle and right measuring field

Fig. 41: PDA Adjusted Values

NOTE

A combination of 2 measuring fields (e.g. middle and right) has approx. the same area as the "round" measuring field and thus similar correction values.

The combination of all 3 measuring fields (middle, left, right) has the highest correction value.

Adjusting the Dose Rate with the B-Signal (VIDEOMED DI)

- See the Image Quality Test Procedure for:
 - General Remarks regarding the Dose Measurements
 - Test Conditions

- Test Preparations



- Select the window "Polydoros .. Service / Adjustment /Doserate".
- In the window "Doserate Adjust" Fluoroscopy ON
- Change **Tube current** ... **mA** until the desired dose rate (see the Image Quality Test Certificate) is displayed on the dose meter.
- In the window "Doserate Adjust" Fluoroscopy **OFF** and exit the window with **OK**.
- Remove the measuring chamber
- Enter the B-signal value (see the Image Quality Test Certificate) in the "Dialog" window.
- Verify the B-signal with **OK**



- Click on
- "Fluoroscopy" ONin the "CCD Brightness Adjust" window.
- If the "Ref-Act display" (difference between anticipated and actual values) indicates" 0 ± 1 , exit the window with **OK**.
- If the required Ref-Act display is not reached, click on Fluoroscopy OFF in the "CCD Brightness Adjust" window and adjust the iris diaphragm on the camera.

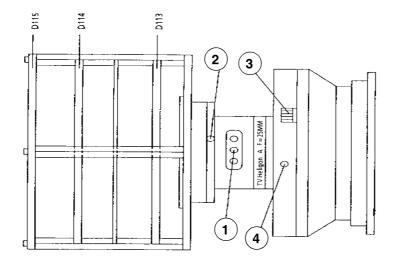


Fig. 42: Camera lens

Pos. 1 = Focusing

Pos. 2 = Securing screw

Pos. 3 = Diaphragm securingscrew

Pos. 4 = Securing screw

- Adjust the collimator closure screw (Pos. 3) on the camera so that die "Ref-Act display (difference between anticipated and actual value) indicates" 0 ± 1 in the "CCD Brightness Adjust" window with Fluoroscopy ON.
- Exit the window with OK.
- Turn in the securing screw (Pos. 4) until it is up against the iris collimator adjustment wheel (noticeable tightness). Then turn the screw one quarter to one half turn further, check by observing the position of the slot on the screw head.
- If the "Ref-Act display" (difference between anticipated and actual values) indicates" **0** ± **1**, check again in the "CCD Brightness Adjust" window.

Adjusting the Dose Rate with the VIDEOMED DIC

- See the Image Quality Test Procedure for:
 - General Remarks regarding the Dose Measurements
 - Test Conditions
 - Test Preparations



- Select the window "Polydoros .. Service / Adjustment / Doserate".
- In the window "Doserate Adjust" Fluoroscopy ON
- Change the Tube current ... mAuntil the desired dose rate:
 - 261 nay/s ±10% with a 23HDR I.I. (see Image Quality Test Certificate)
 - $113 \, \text{nGy/s} \pm 10\%$ with a 23HDR I.I. (see Image Quality Test Certificate) is displayed on the dose measurement meter.
- In the window "Doserate Adjust" Fluoroscopy **OFF**and exit the window with **OK**.
- Remove the measuring chamber
- Enter 155mV for the B-signal in the "Dialog" window.
- Verify the B-signal with **OK**



- Click on
- "Fluoroscopy" **ON**in the "CCD Brightness Adjust" window.
- If the "Ref-Act display" (difference between anticipated and actual values) indicates" 0
 ± 1, exit the window with OK.
- If the required Ref-Act display value is not reached, click on Fluoroscopy OFF in the "CCD Brightness Adjust" window.
- Loosen the securing screw (Pos.2 in the following illustration) on the iris diaphragm.

 Adjust the collimator closure screw (Pos. 3) on the camera so that die "Ref-Act display (difference between anticipated and actual value) indicates" 0 ± 1 in the "CCD Brightness Adjust" window with Fluoroscopy ON.

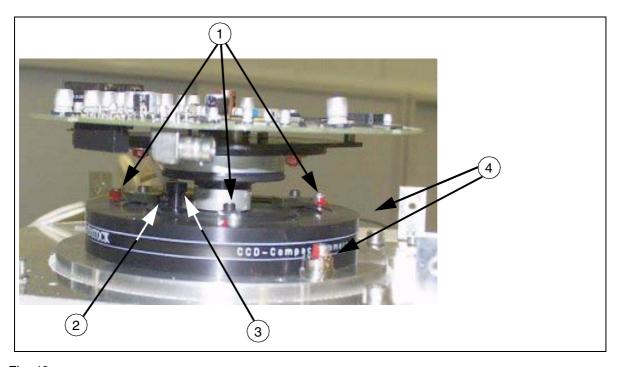


Fig. 43:

Pos. 1 Adjustment screw for I.I. optics

Pos. 2 Locking of the iris
Pos. 3 Iris adjustment

Pos. 4 Adjustment screw for centering

- Exit the window with **OK**.
- Set the iris diaphragm opening adjustment using the securing screw (Pos. 2).
- If the "Ref-Act display" (difference between anticipated and actual values) indicates" **0** ± **1**, check again in the "CCD Brightness Adjust" window.

Adjusting the TV Iris Diaphragm

Adjusting the min./max. Iris Opening (not for VID.DH, FL-C)

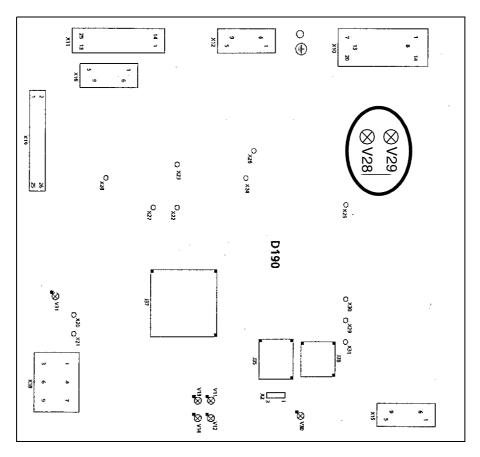


Fig. 44: Adjusting TV Iris D190

NOTE

This adjustment window can be reached in two ways:

- "Adjustment/Doserate" (after the adjustment of dose rate, "TV Iris" is automatically selected).
- "Adjustment/TV Iris"

If the adjustment is selected again, the values used until now are reset, (Reference B to "0" and the actual adjustment with and without gray filter/ mirror to 10.25 EP). Make a note of the values used to up to this time in the Table.

Date	Ref.A (max)	Ref.B (min)	Grey filte	er/Mirror	Current
Date	Hel.A (max)	rtei.b (IIIIII)	without	with	Current

- Change the iris opening with Reference A (max.) until V29 on the D190 goes out.
- Change the iris opening with Reference B (min.) until V28 on the D190 goes out.
- Exit the window with OK.

Adjusting the min./max. Iris Opening with VID.DH and FL-C

NOTE

If the iris is controlled in the min./max. range, the PTC in the iris motor circuit (FL-C) heats up very much within 3...4 sec. It is necessary to wait approx. 5 minutes until it has cooled.

Date	Dof A (may)	Dof P (min)	Grey filte	er/Mirror	Current	
Date	Ref.A (max)	Ref.B (min)	without	with	Ourient	

- Use Reference A (max.) to change the iris opening until V29 on the D190 goes on, then change it **immediately** until V29 goes off again.
- Use Reference B (min.) to change the iris opening until V28 on the D190 goes on, then change it **immediately** until V28 goes off again.
- Exit he window with OK.

Adjusting the TV Iris Diaphragm

NOTE Open the collimator all the way.

Preparations (Test Setup)

- Set the SID
 - Overtable units: 115 cm
 - Undertable units: max. SID (do not move out the Distator)
 - C-Arm units: 100 cm
- Select I.I. full format.
- Move in the grid.
- Set oscilloscope to test point 8 and 0V (ground).

• Measure B-signal values from one line in the image center (noise center) (reference values, see table).

Exceptions:

VIDEOMED HD:

- Connect oscilloscope to TP BAK (VZ board), trigger to Ext.A on the AZ board (with SUPERVISION trigger to BAS+)

VIDEOMED K / Sirecon Compact:

- Connect oscilloscope to Test Point M95 / D15.C 1 (+) versus TP F

VIDEOMED DI / DIM / DIK:

- Connect oscilloscope to Test Point D1.X401

VIDEOMED SX:

- Connect oscilloscope to TP 8 (X230) on the D8 board in the TV CCU VIDEOMED DH (XCS-SSW, Iris-Adjust, B-Signal, Get)

NOTE

For systems without FLUOROSPOT TOP, the antiisowatt curve must be programmed on automatic system 1, 70 kV is automatically output with FLUOROSPOT TOP.

Performing the adjustment according to the "TV Iris Diaphragm" screen

- Perform Step 1 with 2.1 mm Cu and
- Steps 2 and 3 with 1.2 mm Cu.

NOTE

Identical B-signal values must be set in Steps 2 and 3; we recommend that you set the corresponding value as in Step 1 (see table).

Television CCU	TV camera tube	Bias light or dark cur- rent portion	B-Signal without bias light or dark current portion
VIDEOMED H1X	Saticon	without DFR: $20 \pm 5 \text{ mV}$ with DFR: $40 \pm 5 \text{ mV}$	110 mV; + 10 / - 20 mV *
VIDEOMED HD	DG-Saticon	$30\pm 5~\text{mV}$	130 mV; + 10 / - 20 mV
VIDEOMED H1	Saticon	20 ± 5 mV	110 mV; + 10 / - 20 mV
VIDEOMED H1,N1	Hivicon	≤ 100 mV	180 mV; ± 15 mV
VIDEOMED N1	DG-Saticon	20 ± 5 mV	110 mV; + 10 / - 20 mV
VIDEOMED K,Sirecon Comp.	Hivicon	n.a.	27 38 mV

VIDEOMED DI,DIM,DIK***	CCD-Chip	n.a.	155 mV; ± 20mV
			Urology:
			300 mV; ± 40 mV
VIDEOMED SX,H1X Emulation	Saticon	$60\pm10~\text{mV}$	80 mV; + 10 / - 20 mV *
VIDEOMED SX HD Emulation	Saticon	$70\pm15~\text{mV}$	180 mV; + 15 / - 20 mV **
VIDEOMED SX,***	Saticon	60 ± 10 mV	80 mV; + 20 /-10 mV
FLUOROSPOT T.O.P.	Salicon	00 ± 10 111V	60 IIIV, + 20 /- 10 IIIV
VIDEOMED H,N	Plumbicon	n.a.	165 mV; ±15 mV
VIDEOMED S	Saticon	60 ± 10 mV	80 mV; + 20 /-10 mV
VIDEOMED DH / DHC***	CCD-Chip	n.a.	110 ± 10% gray steps

NOTE

With high contrast fluoroscopy, Supervision:

*** = With system shipments, the target values for the Image Quality Test Certificate, RXD0-000.037... must be set.

NOTE

During adjustment, switch the FLUOROSPOT H or FLUOROSPOT TOP to the bypass mode (FLUOROSPOT TOP via control keyboard dual mode).

Gray Filter Correction (Mirror Correction)

NOTE

With DR exposures, the anticipated iris setting is inquired. Beginning at a certain opening (> 60 mm, with SDM > 50 mm) the gray filter (mirror) automatically moves out and the iris opening becomes smaller.

Determining the Correction Factor for the TV Iris Diaphragm for Zoom Formats

- Select the window "Zoom Iris Correction"
- Insert 2.1 mm Cu in the collimator

NOTE

Open the collimator all the way.



- Exit the message window with OK.
- In the window, "Zoom Iris Correction", switch fluoro ON

The fluoro current must be between 0.5 mA and 3.5 mA. If it is not, add Cu filters or remove them and repeat the adjustment.

 $^{* = \}pm 20 \text{ mV}$

^{** = + 25} mV / - 20 mV



- With fluoro ON set the prescribed B-signal (see table in the Chap. "Setting the TV Iris Diaphragm") for all Zoom formats (Zoom 1, 2, 3) by changing the correction value.
- Store the values and exit the window with OK.

Checking the Dose Rate for Fluoroscopy

Preparations (test setup)

- Select the antiisowatt fluoro curve.
- Insert 2.1 mm copper (precision radiation filter) into the collimator (for UT units, on the tabletop).
- Set the focus-I.I. distance
 - OT units: 115 cm
 - UT units: max. SID (Distator not moved out)
 - C-Arm units: 100 cm
- Select Automatic 1 and I.I. full format.
- Move in the grid.
- With the 40 cm I.I.:
 - With PDA/SDM: select the middle, rectangular measuring field.
- Position the dose measurement chamber above the SDM measurement field and collimate to the dose measurement chamber size.

NOTE

- If it is not possible to measure directly at the I.i. input, measure on the tabletop or on the grid and calculate for the I.I. input using the equipment attenuation factor (m).

The loading slot of the spotfilm device applies as the I.I. input.

- With TV systems for which the ADC measuring field is larger than the dose measurement chamber, switch to automatic STOP after the fluoroscopy has stabilized and only then, insert the dose measurement chamber into the beam path. In this case, do not take the factor 0.94 caused by radiation attenuation of the dose measurement chamber into consideration. First enter the measured dose rates (K_{Bg} or K_{Tg}) into the Test Certificate and then calculate the corrected value, KB, and enter it.
- For the 12 cm and 14 cm I.I. formats (if not measured directly at the I.I. input), the dose measurement chamber is not fully exposed. The measured dose rate values are thus lower than the actual values. This fact must be stated under remarks in the IQ Test Certificate.



Check

Switch fluoro ON at the unit



- Measure the dose rate values for all I.I. formats $(K_{Bg} \text{ or } K_{Tg})$ and record the values in the IQ Test Certificate. Admissible difference with the I.I. full format: $\pm 10\%$
- Remove the dose measurement chamber from the beam path.
- Completely open the collimator.
- Record the kV and mA values that stabilize under fluoroscopy (display on the control console for all I.I. formats) in the IQ Test Certificate.

Admissible tolerance for indirect dose control: $\pm 2 \, kV$; mA: $\pm 10\%$

Checking the B-Signal Values

- Increase the Cu to 2.1 mm.
- Select the antiisowatt fluoro curve.



- Switch fluoro ON at the unit
- Measure the B-signal for all I.I. formats and record the values in the IQ Test Certificate.

Checking the Selected ADC Measurement Field

Prerequisites

• The dose rate must be adjusted. See Chapter: "Adjustment" / "Dose Rate".



- Select the rectangular on the left of the unit.
- Switch Fluoro **ON** at the unit
- Move the DSA finger in the universal collimator so that it is over the left ADC measuring field (measuring field is displayed on the monitor with the FLUOROSPOT).
- The fluoro kV and/or fluoro mA must increase on the generator control console display.

NOTE

- In systems configured with the digital collimator, carry out the test with 2.1 mm Cu on the tabletop.
- Switch fluoro OFF
- Repeat the test using the measuring field on the right side.

Adjusting the Water Value Acquisition

Preparations (Test Setup)

- Select the window "Polydoros .. -Service/Adjustment/Water Equivalent".
- Position the 20 cm water phantom (observe exactly) in the beam path.
- Set the SID

Overtable units: 115 cmUndertable units: min. SID

- C-Arm units: 100 cm

- Select the I.I. full format.
- Move in the grid.
- With the 40/33 cm I.I.:
 - with Multiplier: select the round, center ADC measuring field
 - with PDA/SDM: select the rectangular measuring field.



- In the window "Water Equivalent", switch fluoro ON
- The new correction factor is calculated by pressing the "Start Button" and fluoroscopy is switched off again.
 - ¬70 kV must be set as the exposure voltage, admissible tolerance: 68...71.5 kV

 ¬80 kV must be set as the exposure voltage.

 ¬90 kV must be set as the exposure voltage.

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 ¬90 kV must be set as the
- The correction factor is stored and the adjustment window is exited with **OK**.

Checking kV Acquisition

- Position the 20 cm water phantom in the radiation path.
- Collimate to the water phantom.
- Select the program with the 0-Point technique.
- Select the 29 kV curves in the organ program.



- Switch fluoro ON
 - 70 kV must be set as the exposure voltage. Admissible tolerance: 68.....71.5 kV



The adjustment values (setting values) can be read out in the window "Polydoros... Service/Diagnostics/Adjustment Results".

Maximum Skin Dose Rate

NOTE

The adjustment should be performed only in countries in which limitation o the skin dose rate is required.

Depending on the country, set the maximum admissible values as defined by the regulations.

In the area where DHHS regulations apply, set the following for::

Normal fluoro 9 R/min (1305 μGy/s)

High-contrast flu- 18 R/min (2610 μ Gy/s)

oro

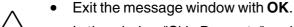
If no such regulations apply, perform the routine in the window with "SS" **OFF**. For 110 kV and 70 kV, set **18 mA** for each.

Adjustment

- Select the I.I. full format.
- Set the minimum focus-I.I. distance (SID).
 - OT units: 115 cm
 - UT units: min. SID (Distator not moved out)
 - C-Arm units: min. SID (POLYSTAR: 86.6 cm)
- Use the dose measurement chamber for:
 - OT units at a distance of 30 cm above the tabletop
 - UT units on the tabletop
 - C-Arm units at a distance of 30 cm from the I.I.

This distance must be maintained -- regardless of the SID.

- Collimator to the dose measurement chamber.
- Remove the fuses in the I.I. power supply:
 - with the POLYSTAR and SIRESKOP SX: F7 trip breakers in the M3
- Also cover the I.I. input, e.g. with lead-rubber (risk of burn-in).
- Select the window "Polydoros .. -Service/Adjustment/Skindoserate".



- In the window "Skin Doserate", switch fluoro ON
- Change the tube current until the max. skin dose rate of 9 R/min. is measured.
- Exit the "Service Program".
- After completing the POLYDOROS adjustment, exit the adjustment program using "SYSTEM: QUIT". In the main program, select System/Quit -> window "System Logoff" exit with "Put to Unit", DISCONNECTED will be displayed below in the status line.



Checking the Skin Dose Rate

- Set up the same test conditions as for "Adjustment of the max. Skin Dose Rate".
- Change the focus-I.I. distance and check the dose rate.
- The dose range of 9 R/min. may not be exceeded at any of the distances.
- Set the minimum focus-I.I. distance.
- Select the automatic steps (at the first and second pressure points if conured).



- Record the values that result for
 - the resulting dose rate and
 - the kV and mA values that stabilize in the IQ Test Certificate.
- Reinstall the fuses in the I.I. power supply.

Checking the Fluoroscopy Display



At the unit, select the "Antiisowatt" curve. If necessary, program this curve for the time
of the check.

- At the unit, switch on fluoroscopy and by using collimation (closing the collimator) run through the range from 50 kV to 110 kV.
 - (Caution: risk of burn-in on the TV camera and at the I.I.); when doing this, check the fluoro current and kV displayed on the deck.



 Record the mA values at approx. 50 kV and 110 kV in the generator Test Certificate in Register 9 of the Generator or System Binder. The current and kV may not exceed the 5% tolerance.

If this is the case, readjust the tube unit.

Saving the Data on Diskette (Backup)

NOTE After the adjustment is complete, make a "Backup".

- Insert the backup diskette in Drive A:
- Select the window"XCS Service Application Main Program/Data/Backup to disk".

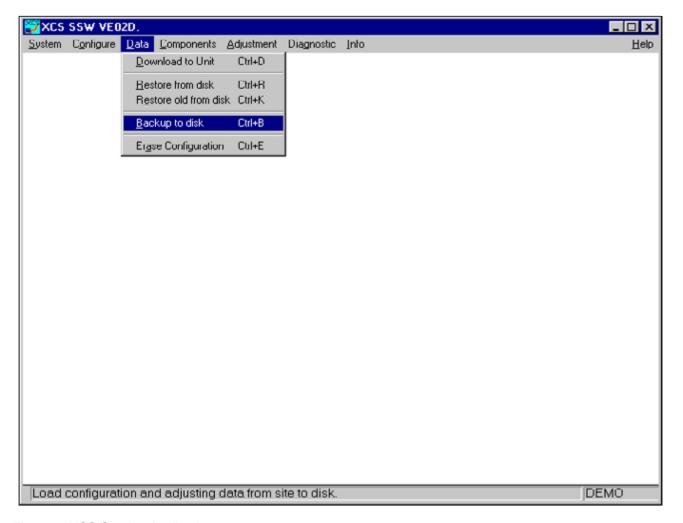


Fig. 45: XCS Service Application

Exiting the System Configuration

• Select the window "XCS-Service Application - Main Program/System/Quit".

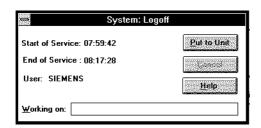


Fig. 46: System Logoff

• Working on:

Enter text, e.g. "Restore carried out". (Texts can be read out in "Main Program / Info").

• Switch the generator OFF / ON

NOTE

After adjustment is completed, carry out a "Backup".

Indicators and Monitoring Devices for Radiation Protection

Upon customer request, the following monitors and indicators may be installed in the power cabinet (installation instructions).

Function Check of the Oil Pressure Switch

- Unplug connector X61/X62/X63 D160 X2206
- Check:
 - Radiation release must be blocked.
 - The message "Error 628 APID 80" must appear on the control console, the red tube symbol must light up.
 - The message "door is open" must appear on the console touchscreen.
- Plug the X61/X62/X63 connector back in.

Door contact for radiation blocking (e.g. at the door to the examination room)

- Test:
 - Radiation release is not possible when the door is open.
 - The message "door is open" (console touchscreen) and
 - The message "Error 628 APID 80" appear

Indicator lamps for tube selection



• Test the function of the lamps via workstation selection.

Indicator lamps for tube display

 The appropriate radiation indicator should light up for each X-ray tube during fluoroscopy or exposure prep/release.

NOTE

Display with radiation prep or only with radiation can be programed with jumper X36 on the D160 board.

Additional Work Steps

Connection and startup of options

- Install the options (if present) and connect them to the generator according to the applicable installation and adjustment instructions.
- Start up all options according to the applicable instructions.

Programming the organ fields (option)

The organ names are entered on the PC; in the case of a touch-screen console, this is possible on the console as well.

Programming the exposure data

This data may be programmed by the customer, and is described in the generator operating instructions.

Checking the Switch Settings

- Disconnect the measurement devices and the PC.
- Check the following switch positions:

D160: - Line voltage switch **ON** (S2)

D100: - Switch SS ON

D100: - Switch ZK ON

Final system check

 Measure the protective conductor resistance with the protective conductor resistance meter.

Nominal value ≤ 0.2 Ohm.

• Visually inspect the system and perform a function test.

POLYDOROS SX 65/80 XCU-Download

NOTE

The software for the XCU and the D220 filament heating for the generator have already been loaded at the factory.

Perform an XCU download only:

- after a software change
- after replacing the XCU

Carry out download as follows:

- Switch the generator **OFF**
- Insert the download diskette in the XCU drive.
- Switch the generator ON
- Download will be carried out automatically.
- Switch the generator **OFF**
- Remove the download diskette from the XCU drive.
- Switch the generator ON

Carrying Out the Filament Heating Download:

Important:

If a PC is operated without a power supply, it must be assured that the battery is completely charged. Prior to performing the download, the "System time" must agree with the PC time (see the Chap. "Calling Up the XCS Service Program").

NOTE

Carry out a filament heating download only if:

- the red LED on D220 is blinking
- If the D220 is replaced, a download is not necessary because it has already been carried out at the factory.

If problems occur during download of heating:

- Check the 5V voltage, D220.X18.A1

Performing the Heating Download:

- Insert the download diskette in the Service PC.
- Select the window "XCS-Service Application Main Program/Data/Download to Unit".
- In the window "Data/Download Select Component", select "SX_Heating".
- In the window "Data/Download", select the "Start" Button.

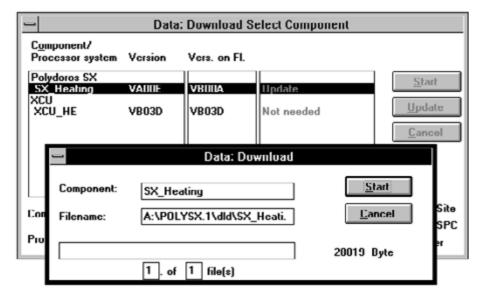


Fig. 47: Data: Download Select Component

Entering and Editing the Organ Data

IBy the term system, the selected exposure system is understood. By the term system, the selected exposure system is understood. To make the organ programs available, the following must be programmed in the configuration in the window: Site Structure: Site Adjustments" in the box: Option Selection "12 regions-20 organs/region". In this window, the default organ programs can be reloaded by selecting: "not available" -> "ok" -> "12 regions-20 organs/region".

- Select the "Edit org prog." Button to generate the organ programs in the window "Configure: Site Structure: Site Adjustments".
- Exit the window with "OK" and "Save".

NOTE Carry out a "Backup".

- Select System/Quit in the main program Æ exit the "System Logoff" window with "Put to Unit".
- Switch the generator **OFF**.

Conditioning the X-Ray Tube

he following program must be performed by Siemens service personnel with each initial startup of the X-ray tube assembly or after a long period of not operating the system during servicing and in case of system operating problems which might be due to electrical instability of the X-ray tube. After a prolonged downtime of the tube assembly (more than 2 weeks), we recommend that the user carry out a shortened initial operation procedure in accordance with point 2.

∆CAUTION

Radiation

During conditioning, ensure that radiation protection safety precautions are taken; an existing image intensifier must be protected against radiation (e.g. place a lead apron in the beam path).



Program (for starting with cold anode)¹

Switch on fluoroscopy with 40-70 kV (depending on type of generator). Boost to 110 kV/4,1 mA within approx 1 minute and maintain this value for 10 minutes. 5 min. cooling interval.



or tubes with an idle time of > 2 weeks:

Condition the X-ray tube

 Select 80% kW and large focus; trigger the following exposures in quick succession and without braking the rotating anode between the two exposures.

70 kV / 100 mAs 2x 1 min. pause 90 kV / 400 mAs 2x 3 min. pause 109 kV / 400 mAs 2x 3 min. pause



Perform only if a new tube assembly is installed

- 125 kV / 63 mAs 2x
 - Interval 1 minute
- 150 kV / 50 mAs 2x
 Interval 1 minute

^{1.} If during the execution of this program strong disturbances repeatedly occur in the tube assembly, the procedure must be stopped 8 danger to sensitive components of the system electronics).

General

The sensitivity S of a film-screen combination is defined by DIN 6867 as the quotient of 1000 mGy and the air kerma (dose) KS needed to obtain an optical density (blackening) of 1 + 0.2 above base fog:

Dose KS can be calculated if sensitivity S is known:

The following tables summarize the approximate sensitivity values S for a selection of screens from various manufacturers used in combination with blue or green-sensitive standard X-ray films (sensitivity factor F=1). Another table lists the sensitivity factor F for a selection of X-ray films. It is easy to calculate the sensitivity factor S for a film-screen combination using the data in these two tables. Simply multiply the sensitivity S of the screen by the sensitivity factor of the film F.

$$\Rightarrow$$
 S = S'x F

The values obtained should be viewed as references. Differences are caused primarily by manufacturing variations (particularly in the film) and different developing conditions.

Manufacturer	Screen	Film	Sensitivity
Agfa	CURIX fin	blue	50
	CURIX universal	blue	100
	CURIX	blue	200
	CURIX MR 50	blue	50
	CURIX MR 200	blue	200
	CURIX MR 400	blue	400
	CURIX MR 600	blue	600
	CURIX MR 800	blue	700
	CURIX Ortho fine	green	100
	CURIX Ortho medium	green	200
	CURIX Ortho regular	green	400
Auer	Sinissima	blue	30
	FZ	blue	70
	Universal	blue	100
	HV	blue	160
	Special	blue	160

Manufacturer	Screen	Film	Sensitivity
	Gravina	blue	300
		1	,
CAWO	Universal	blue	100
	Special	blue	200
	SE 2	blue	200
	SE 4	blue	400
	SE 6	blue	600
Dr. Goos	Ultra Detail	blue	50
	Fine definition	blue	80
	Universal	blue	100
	Ultra Rapid	blue	200
	Special	blue	200
	Superma LGY	blue	300
	Superma LGY	green	200
 Kodak	X-OMATIC Fine	blue	40
	X-OMATIC Regular	blue	200
	X-OMATIC Rapid	blue	400
	Super Rapid	blue	800
	LANEY E	1	105
	LANEX Fine	green	125
	LANEX Medium	green	230
	LANEX Regular	green	450
	LANEX Fast	green	700
Konika / Sakura	Konika ND	blue	100
	Konika NH	blue	200
	1		1
	Konika KF	green	100
	Konika KM	green	200

Manufacturer	Screen	Film	Sensitivity
	Konika KR	green	400
Kruppa	Fine structure	blue	40
	Universal	blue	100
	Express	blue	160
	Special	blue	200
	TR 2	blue	200
	TR 4	blue	400
	TR 6	blue	600
	,	,	,
Kyokko / Fuji	FS	blue	70
	MS	blue	100
	HS	blue	160
	LF-II	blue	70
	LT-II	blue	100
	LH-II	blue	160
			·
	Super HS	blue	200
			·
	BF-III	blue	70
	BM-III	blue	100
	BH-III	blue	200
	BX-III	blue	250
	Spezial	blue	400
			·
	GF-1	green	100
	GM-1	green	200
	GH-1	green	400
	GX-1	green	600
3M	TRIMAX 2	green	100
	TRIMAX 4	green	200

Manufacturer	Screen	Film	Sensitivity
	TRIMAX 6	green	300
	TRIMAX 8	green	400
	TRIMAX 16	green	600
Philips	Micro	blue	40
	Universal	blue	100
	Ultra S	blue	200
	Azuray N	blue	300
	Azuray S	blue	400
	Amueli OD 0		140
	Ampli GR 2	green	140
	Ampli GR 4	green	400
	Ampli GR 6	green	500
Du Pont	Detail	blue	25
	Fast Detail	blue	50
	Par Speed	blue	100
	HI-Plus	blue	200
	Overte Detail	blue	100
	Quanta Detail	blue	100
	Quanta Fast Detail	blue	400
	Quanta II	blue	400
	Quanta II	blue	800
	Cronex Ortho Fine	green	100
	Cronex Ortho Medium	green	200
	Cronex Ortho Regular	green	400
Siomono	Super Dubin (rub.)	blue	25
Siemens	Super Rubin (ruby)	blue	25
	Rubin (ruby)	blue	40

Manufacturer	Screen	Film	Sensitivity
	Saphir (sapphire)	blue	80
	Diamant (diamond)	blue	200
	Special	blue	200
	Titan 2 UD	blue	50
	Titan 2 D	blue	80
	Titan 2 U	blue	200
	Titan 2 HS	blue	400
	Titan 2 UD	green	30
	Titan 2 D	green	50
	Titan 2 U	green	125
	Titan 2 UD	green	30
			·
	Orthex D 110	green	100
	Orthex U 220	green	200
	Orthex HS 440	green	400

Manufacturer	Screen	Film	Sensitivity
Agfa	Curix MR 4	blue	0.5
	Curix RP 1	blue	1
	Curix RP 1L	blue	1
	Curix RP 2	blue	1.4
	Medichrom	blue	0.5
	Curix Ortho L	green	1
	Curix Ortho GS	green	1
	Curix Ortho ST-G	green	1
CEA	Wicor XRP	blue	1
	Wicor L	blue	1

Manufacturer	Screen	Film	Sensitivity
	Wicor XOG	blue	1
		,	
Fuji	RX-G	blue	0.5
	RX-L	blue	1
	RX	blue	1
	RXO-G	green	1
	HR-G	green	1
Kodak	X-Omat S	blue	1
	X-Omat L	blue	1
	X-Omat G	blue	0.5
	Ortho G	green	1
	Ortho H	green	2
	T-MAT G	green	1
	T-MAT-L	green	1
Konika / Sakura	A 2	blue	1
	AOG	green	1
	MGH	green	1
	Medical AX	blue	1
ЗМ	Typ R 2	blue	1
	Trimax XUD	green	1
	Trimax XDA	green	1
	Trimax L	green	1
	Trimax XD	green	1
	Trimax XM	green	2
		1	
Du Pont	Cronex 7	blue	0.5
	Cronex 10	blue	0.5
	Cronex 7L	blue	0.5

Manufacturer	Screen	Film	Sensitivity
	Cronex 2	blue	1
	Cronex 4	blue	1
	Cronex L	blue	1
	Cronex 8	green	1
	Cronex 8L	green	1

Selektive Dominant Measurement (SDM)

General

SDM (Selective Dominant Measurement) is a multiple field measuring system to determine the output brightness of the image intensifier for all indirect techniques (fluoroscopy, DSA, DFR).

A PDA (**P**hoto **D**iode **A**rray) is used as a detector which basically takes over the function of the multiplier. The PDA is composed of individual segments which are connected to ADC measuring fields.

The measuring fields can also be selected parallel and are comparable to lontomat measuring fields. In addition, there is a round measuring field that cannot be combined with the other measuring fields.

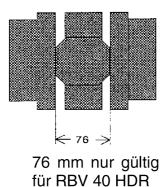
The size of the measurement fields is switched according to the zoom step.

Checking the Size of the PDA

Prerequisites

- TV system and DFR system must be operational and the TV camera must be centered.
- Select I.I. full view at the unit.
- Switch the SS OFF
- Mark the setting of the brightness/contrast controls on the monitor and release the lock.
- Use the footswitch to trigger fluoro and leave it switched on for the following steps.
- Remove the cap on the light distributor.
- On the D100, S1 on "Service" in the camera adapter/light distributor (PDA is exposed)
- Switch fluor OFF
- On the D100, set S1 to "Normal"
- Change the brightness and contrast at the monitor until the PDA is visible, if needed, store the LIH image and change the windowing or edge enhancement at the DFR system.
- Measure the size of the PDA as shown in (Fig. 48 / p. 109) and compare this to the value in Table 1.

• Place the cap back on the light distributor.



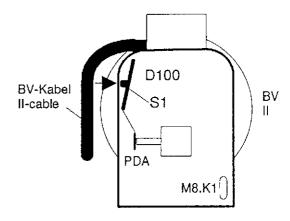


Fig. 48: PDA

Fig. 49: Light distributor

PDA measured on the SIMOMED H - 44 cm

	40 cm I.I.	33 cm I.I.	23 cm I.I.	Urology 40 cm I.I.	Urology 33 cm I.I.
PDA size (mm)	76	91	116	76	91
Tolerance (mm)	± 7	± 9	± 11	± 7	± 9

Table 1

NOTE

With other monitor sizes, the reference values must be converted: ratio value M = 24.5 cm: monitor height (in cm)

If the PDA size is not within tolerance, proceed as follows:

- Loosen the set screws on the lens of the PDA.
- D100, S1 ON (SS OFF)
- Use the footswitch to switch fluoro ON.
 Adjust the PDA size per Table 1 by turning the lens (plastic ring).
- Retighten the set screws.

Checking the Selected ADC Measuring Field

Prerequisite

- Adjust the dose rate; to do this, see the Chapter: "Adjustment" / "Dose Rate"
- Select the rectangular measuring field on the left of the unit.
- Use the footswitch to switch fluoro ON.
- Move the DSA finger in the collimator until it is over the left ADC measuring field (Measuring field will be displayed on the monitor with the FLUOROSPOT)

• The fluoro kV and/or fluoro mA must increase on the generator control console.

NOTE

Carry out the test with 2.1 mm CU on the table in systems with a digital collimator.

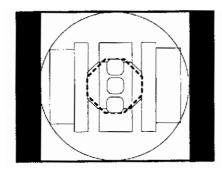
- Switch fluoro OFF
- Repeat test using the measuring field on the right.

Applicable only in combination with FLUOROSPOT H Checking measuring field display on the monitor

- Select I.I. full field of view and the octagonal measuring field at the unit.
- Make the PDA visible by following the instructions provided previously.
- Mark the width and the middle of the octagonal measuring field.
- Use the footswitch to briefly switch fluoro **ON** (SS **OFF**) until the measuring field collimation of the FLUOROSPOT appears.
- The width and position of the collimation must line up with the marks. The admissible deviation of size and position is as follows:

40 HDR	1.4 cm
33 HDR	1.8 cm

- The size of the collimation can be adjusted in the Fluorospot System configuration in window 6, "Measurement field scale factor".
- The position of collimated field cannot be changed.



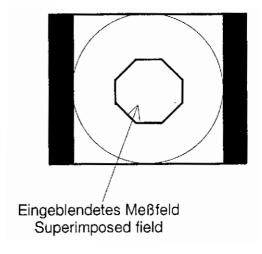


Fig. 50: Measuring Fields on the Monitor

Measuring field sizes with Zoom (with 40 HDR I.I.)

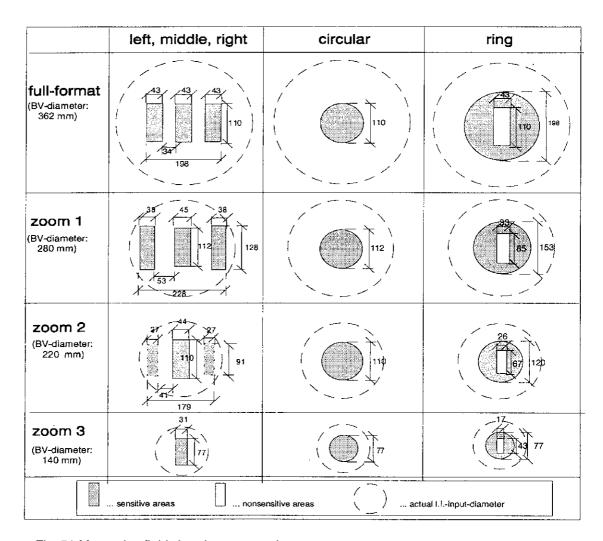


Fig. 51:Measuring field sizes in zoom mode

Chap: Fluoroscopy Adjustments

The B signal value for the VIDEOMED DH / DHC was adapted to the IQAP by adjusting the TV iris diaphragm.