SIEMENS

POLYDOROS LX 30/50

AX

Function Description

POLYDOROS LX

Function Description POLYDOROS LX

Also for:
POLYDOROS LX 30/50 Lite
POLYDOROS LX 80

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General Remarks

Basic Principle

The versatile design of the new POLYDOROS LX microprocessor-controlled X-ray generators permits implementation in fluoroscopic as well as radiographic systems.

Two different consoles are available for user-friendly operation: a standard touch-key console or a touch-screen. Pre-selected organ programs (option) facilitate rapid selection of parameters. The touch-screen uses a two-page display for quick, efficient technique selection.

IONTOMAT PL automatic exposure control has been integrated into the generator. It assures optimum film density for each exposure.

Configuration

The basic POLYDOROS LX configuration includes:

- Control console with 1, 2 and 3-point technique,
- Operating console with membrane key pad or touch screen;
- Power cabinet with integrated high-voltage generator;
- IONTOMAT PL automatic exposure control;
- 150 Hz anode starter;
- Tomographic function.

Special Features

High frequency with multipulse voltage wave form:

- High data accuracy;
- Exact reproducibility;
- Quick control of high voltage and tube current;
- Minimum space requirement;
- Continuous falling load in automatic exposure control with 1-point technique;
- Shortest exposure time: 1 ms;
- Post-display of time and mAs in 1, and 3-point techniques IONTOMAT);
- Organ programming (option);

Working Modes

- 1-Point Technique (Iontomat)

  The exposure contrast can be set using the plus or minus keys for the kV value.The film density can also be corrected using the density correction.Three film-screen combinations can be selected. Several IONTOMAT measurement fields can be selected simultaneously.

- 2-Point Technique

  Contrast and density can be adjusted using the Plus/Minus kV and mAs keys.The time is displayed prior to the exposure.
- 3-Point Technique

  The exposure time for special examinations (e.g. breathing exposures, blurred exposures) can be extended using this operating mode.
- 3-Point technique with IONTOMAT

  The mAs and time values selected via the 3-point technique serve as maximum values. The values that are used at the time of exposure are displayed after the exposure.

POLYDOROS LX 30/50

- Possibility of connecting 2 X-ray tube-units

Options

- Organ programs;
- Fluoroscopy;
- Printer connection to print out fluoroscopy and exposure data.

POLYDOROS LX 30/50 Lite

- No fluoroscopy;
- Only **one** 3-phase X-ray tube unit[1].

POLYDOROS LX 80

A new generator, the **POLYDOROS LX 80** is in production. This generator is used exclusively at dedicated exposure work stations. Thus fluoroscopy is not possible. Aside from this and the higher load, this generator corresponds to the POLYDOROS LX 50 in appearance and function.

The higher performance values are achieved because the more powerful inverter and high voltage transformer from the POLYDOROS SX 65/80 are used.

System Wiring Diagram

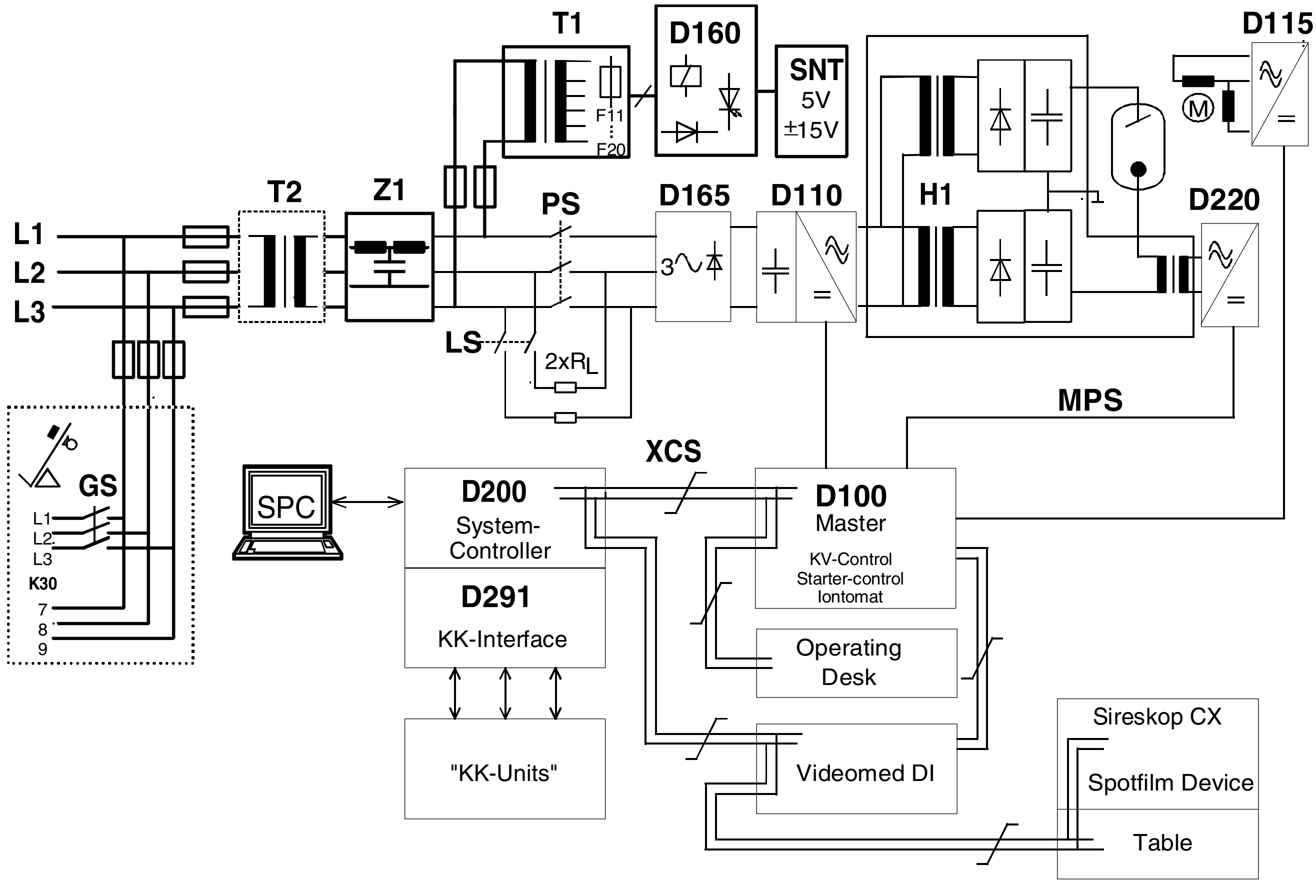

Fig. 1:

Power Connection

The power supply is connected at terminals L1, L2, L3. The rated supply voltages are 400 V, 440 V and 480 V. The T2 pre-transformer, which is required for 440 V and 480 V line voltages, is built into the generator cabinet, and may not be subjected to additional loads. The three phases are individually protected with 35 A (for LX80 50A) fuses. No special line breaker is provided, i.e. the line input is live as soon as the external system breaker is switched on.

A 3-phase connection protected with a 20A fuse is provided for the power supply to external components (examination units, I.I./TV). This connection is interrupted by the unit voltage breaker when the system is switched off.

NOTE	**Beginning with POLYDOROS LX Serial No. 3370, fusing for the K30 is accomplished by means of the F4 three-phase trip breaker (3 x 25A).**

Line Resistance (see PG or Data Sheet)

POLYDOROS LX 30	POLYDOROS LX 50	POLYDOROS LX 80
0.27 ohm / 400 V	0.17 ohm / 400 V	0.11 ohm / 400 V
0.34 ohm / 440 V	0.20 ohm / 440 V	0.14 ohm / 440 V
0.40 ohm / 480 V	0.24 ohm / 480 V	0.16 ohm / 480 V

Z1 (Noise/Interference Filter)

The noise-interference filter integrated in the generator cabinet prevents interference spectrum on the generator side from being fed back into the power line, and vice versa.

Transformator T1

The T1 transformer is connected between phases L1 and L2. It is used for the potential-separated power supply of internal generator components such as DC power supplies, heating circuit, various breakers and relays and the power-up circuit.

NOTE

Beginning with POLYDOROS LX Serial No. 3370, the T1 tranformer has a DC current connection. It is fused by means of the F7 three-phase trip breaker.

D 160 (Power-up Circuit)

The power-up circuit and according electronics are located here. Also located here are various relays for controlling the power supply and the breakers of the intermediate circuit. The connections for external radiation warning and workstation indicators as well as their power supplies (24V/max.5W!) are also located on board D160. For simple testing, measuring points and indicators for the input and output voltages are located on the D160 board.

SNT (Switching Power Supply)

The SNT generates the + 5 V, + 15 V and - 15 V supply voltages. It is supplied with 230 V AC from the power-up circuit.

LS and PS Breakers; DC Intermediate Circuit

The DC intermediate circuit supplies the main inverter and inverter of the rotating anode starting device. Due to the high charging currents, the power-up procedure is performed in two steps. In the first step, the intermediate-circuit capacitors are charged via the LS breaker. Following charging, the power-up damping circuit is by passed along over the PS breaker. The function of the breakers, charging process and the intermediate-circuit voltage are monitored by the micro controller system on the D100 board. The three-phase intermediate-circuit rectifier and its protective circuitry are located on the D165 board. The intermediate-circuit capacitors are located on the D110 inverter board.

⚠CAUTION	**Prior to taking any steps, it is absolutely necessary to wait until the discharge time of approx. 2 minutes has expired.**

➩ **After switching of the generator, the intermediate circuit capacitors are still charged to approx. 600 V. This is indicated by LEDs V35 and V36 on the D110.**

D110 (Inverter)

The intermediate-circuit DC voltage is converted by the inverter to a high-frequency AC current which constitutes the power supply for the H1 high voltage transformer. **I**nsulated **G**ate **B**ipolar **T**ransistor (IGBTs) are used as switching elements in the inverter. Therefore a high oscillation frequency (25 kHz) and a drive frequency of max. 22 kHz are possible. A separate drive circuit and current monitor is provided for each of the IGBT modules. The drive signals are generated by the kV control located on board D100. The current monitor signals are fed to the generator control also mounted on D100. In the test mode (ZK-service switch off on the D100 board, no voltage for the intermediate circuit) there is measured a frequency of approx. 33 kHz if exposure is released.

H1 (High Voltage Transformer)

The high-frequency oscillating current from inverter D110 is converted to high voltage in the H1 high-voltage transformer. The oil-filled transformer tank contains-the high-voltage transformers (one each for the anode and cathode connection of the x-ray tube), the high-voltage rectifiers and capacitors, measurement resistors for sensing the actual value, damping resistors and filament-heating transformers.

⚠CAUTION	**The high-voltage transformer may be transported only in a horizontal position.**

➩ **Oil level at 20°C = 25 mm below the sealing surface of the compensating valve.**

NOTE	**Only one X-ray tube assembly can be connected to the POLYDOROS LX 30/50 Lite high voltage generator.**

D220 (Filament Heating Circuit)

The board D220 is mounted directly on top of the high-voltage transformer. It contains a microcontroller system, two inverters, an intermediate circuit and the actual-value acquisition for the tube current and the high voltage. The heating current and the tube current controller are integrated in the microcontroller system. The inverters are designed with

SIPMOS transistors (IGBTs since 10/98) and activated by a constant frequency of approx. 20 kHz with variable pulse width (pulse width control). Communication with the generator control is performed via a serial interface (MPS).

D115 (Rotating Anode Starter)

Designed for connection of two-phase and three-phase stators, the starting device generates frequencies of 30 Hz to 180 Hz. Three frequencies are currently used:

Operating Mode	Drive Frequency	Rotation Speed
Fluoroscopy	30 Hz	ca. 1000 min^{-1}
Radiography	70 Hz	ca. 3000 min^{-1}
Radiography	180 Hz	ca. 9000 min^{-1}

The inverter is designed with a hex IGBT module connected to a three-phase bridge. The transistors are activated to generate the AC and the three-phase current for accelerating the anode and DC for decelerating it. The inverter operates in pulsed mode, thus setting the currents. The pulse pattern in generated by the starter control located on board D100.

Three-phase current is **also used** for 30 Hz and 70 Hz drive with two-phase stators.

The phase-shifting capacitors are only required with 180Hz two-phase stators. They are connected in series with Bixxx/30/50R or Opti 150/../.. tube units. When operated with the (two-phase) Opti 154/30/50R the capacitors must be connected in parallel via a wiring modification. For this reason, only a second Opti 154/30/50R, a tube unit with a three-phase stator or a Bixxx/30/51 can be used as a second tube unit.

NOTE

The connection for the OPTI 150/30/50C X-ray tube assembly is provided on the starter unit of the POLYDOROS LX 30/50 Lite, 2-phase stators only with connection of the 2PH tube assembly option.

D100 (Master)

NOTE

Beginning with POLYDOROS LX Serial No. 3370, a D100 with a modified design has been integrated. In particular, the number and arrangement of the test points as well as the layout have been changed. This D100 is also used in the POLYDOROS SX 65/80.

The entire **generator control** is located on the D100 assembly, which includes the following subcomponents:

kV Control

The kV control compares the actual value of the high voltage coming from the D220 board with the nominal value and levels out the difference with an analog PI controller. The output signal of the controller is then converted to a frequency by a V/F converter and is used to control the inverter. The high voltage is switched on and off by enabling or disabling the V/F converter.

kV Monitor

The kV monitor monitors the actual positive and negative value of the high voltage, interrupting the radiation when it exceeds or falls below a preset threshold.

kV_{max} - threshold: ± 80 kV without delay

kV_{min} - threshold: ± kV_{soll} - 10 kV with delay

(depending on the height of the nominal/actual difference)

Starter Control

The starter unit controller supplies the pulse pattern for the six IGBT´s of the D115 rotating anode starter device (illustrated in Wiring Diagram X2169, Page 31). In this regard, how the drive frequency is set depends on the type of X-ray tube and the operating mode. For exposure mode, only a start is carried out and then no further drive; however with fluoroscopy, push power is supplied every 60 seconds. To be noted: beginning with Serial No. 3370, with a 3-phase starter the startup is made in three steps (60 Hz,120 Hz and 180 Hz). Startup of the rotating anode is monitored with the help of the pulse obtained from the load current of the starter device.

IONTOMAT

The automatic exposure control IONTOMAT is also located on the D100 board. A maximum of 4 detectors can be connected.

Permissible detectors include: 6 mm chamber, 12 mm chamber, HSE, B-signal and photomultiplier.

Beginning 9/94, the D191 interface is available for connection of a single-pole chamber.

For **dose control**, the chamber current is converted at the detector to a voltage which is proportional to the dose rate. This voltage is fed to the Iontomat, where it is appropriately amplified and converted to a proportional frequency. A counter adds up the pulses and terminates the exposure when the nominal value has been reached (digital integration).

For **dose rate control** with SIRECON COMPACT as well as with SIRECON 2 with photomultiplier, a voltage which is proportional to the I.I. output light is fed to the Iontomat and converted into a proportional frequency. A frequency measurement is then performed. The difference from the nominal value is fed to the master processor system, where it is used for dose rate control.

VIDEOMED DI Interface

The **VIDEOMED DI** TV system supplies the brightness value as a digital signal. This signal is fed via a serial interface to the master processor system for dose rate control.

mAs Integrator

The tube current measuring circuit (on the D220 board) supplies a voltage proportional to the tube current. This voltage is converted to a frequency which is added up by a counter (digital integration).The exposure is terminated when a preset mAs value is reached.

XCS Interface

Communication to the D200 system controller is handled via the XCS interface. After establishing the connection, initialization data (generator settings, tube data, etc.) are received. For the radiography and fluoroscopy modes, the D100 receives the reference values to be set and sends back the actual values (XCU Software / p. 41).

D200 (Anlagenkontroller)

The system controller is the central processing and control unit for the entire **X-ray system**. All of the data from the functional units (system components such as the generator, operating console, SIRESKOP CX, VIDEOMED DI, etc.) are centrally administered or made available to the functional units here. Data transfer takes place via the XCS serial communication system in the form of special telegrams.

In principle, the system controller consists of two parts, the communication interface (XCI) and the controller unit (XCU). The communication part is responsible for communication of the XCS system components and this is also where connection to the Service PC (SPC) and connection of the D291 KK interface takes place.

The SPC is used to configure, adjust and perform troubleshooting for the entire system.

D291 (KK Interface)

Connection of units which do not have an XCS interface is made using the KK interface. As with all function units, it is also controlled by the system controller. The KK interface permits connection of max. 4 units (connectors KK 1B G1/G2, KK 1B G3, KK 1B G4); of these, two units can be equipped with tomo workstations (connectors KK2 G1/G2, KK2 G3-G4. In addition, connection of a remote program selector is possible (connector k1).

To connect a SIRECON 2 I.I./TV system, connector kk16 as well as the photo multiplier voltage from connector X18 are needed (see also Wiring diagram X2169, Page 27 5A).

Connection of a SIRECON Compact system is made at connector ASK 1.

Control Console

Switch on and switch off of the entire system is carried out at the control console, as well as selection of the examination and exposure stations and to select and display exposure parameters. System errors are centrally displayed here. The control console is connected to the XCS as an autonomous function unit. Data transfer is performed only with the system controller.

XCS Network

The XCS is a serial communication system between the D200 system controller and the functional units such as generator, control console, VIDEOMED DI, SIRESKOP CX, etc. The XCS is what is referred to as a "Local Area Network" (LAN), based on the ARCNET technology (Attached Resource Computer Network). The ARCNET protocol is realized as a sequencer in a hardware component. Such a component is installed in all functional units which are connected to the XCS network. Management of the communication environment is located in the system controller.

The illustration shows the physical connections in the network using the example of a SIRESKOP CX system. A logical ring structure results from the token passing procedure specified by the Arcnet protocol (a send order is passed from function unit to function unit), however communication takes place only between the system controller and the function unit (XCS, XCU / p. 38).

Power-on Circuit

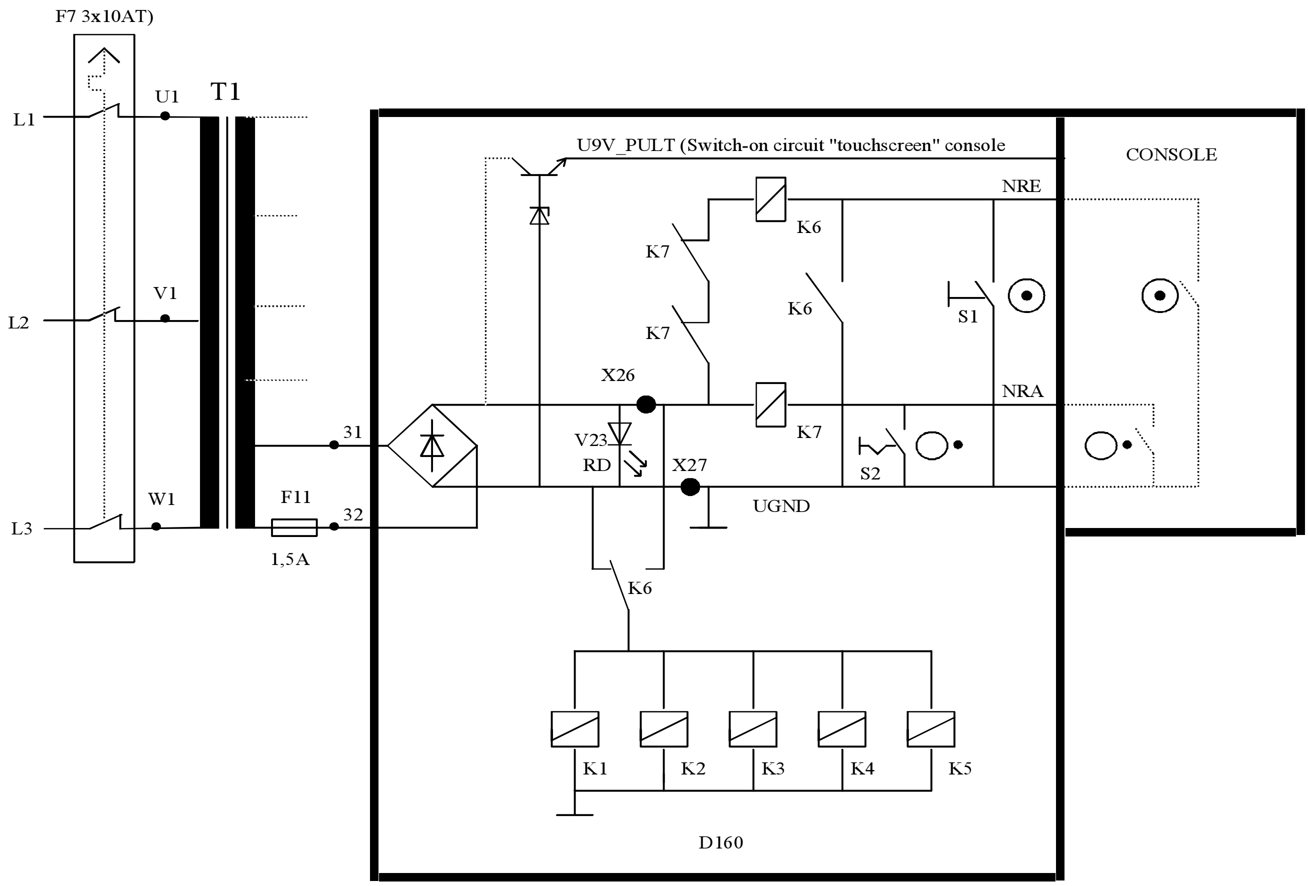

Fig. 2:

The power-on circuit is mounted on board D160, which is located at the bottom left inside the generator console.

As soon as the system breaker is switched on, transformer T1, and therefore the power-up circuit as well, is live. The red LED (V23) lights up. Pressing the ON button on the control console applies voltage across relay K6. K6 then goes into self-hold and energizes relays K1...K5, which in turn switch on the internal generator power supply. Pressing the OFF button energizes K7, thus switching off K6. While servicing the unit, push button S1 can be used for switching it ON and switch S2 for switching it off. All attempts to switch the unit on are disabled as long as switch S2 is set to the OFF position.

The stabilized voltage U9V_PULT is only used for the switch-on circuit of the operating console with touch-screen.

NOTE	**Up to POLYDOROS LX Serial No. 3369, the T1 transformer had a two-phase connection.** **Fusing was handled by the F7 and F8 melt fuses.**

Internal Power Supply

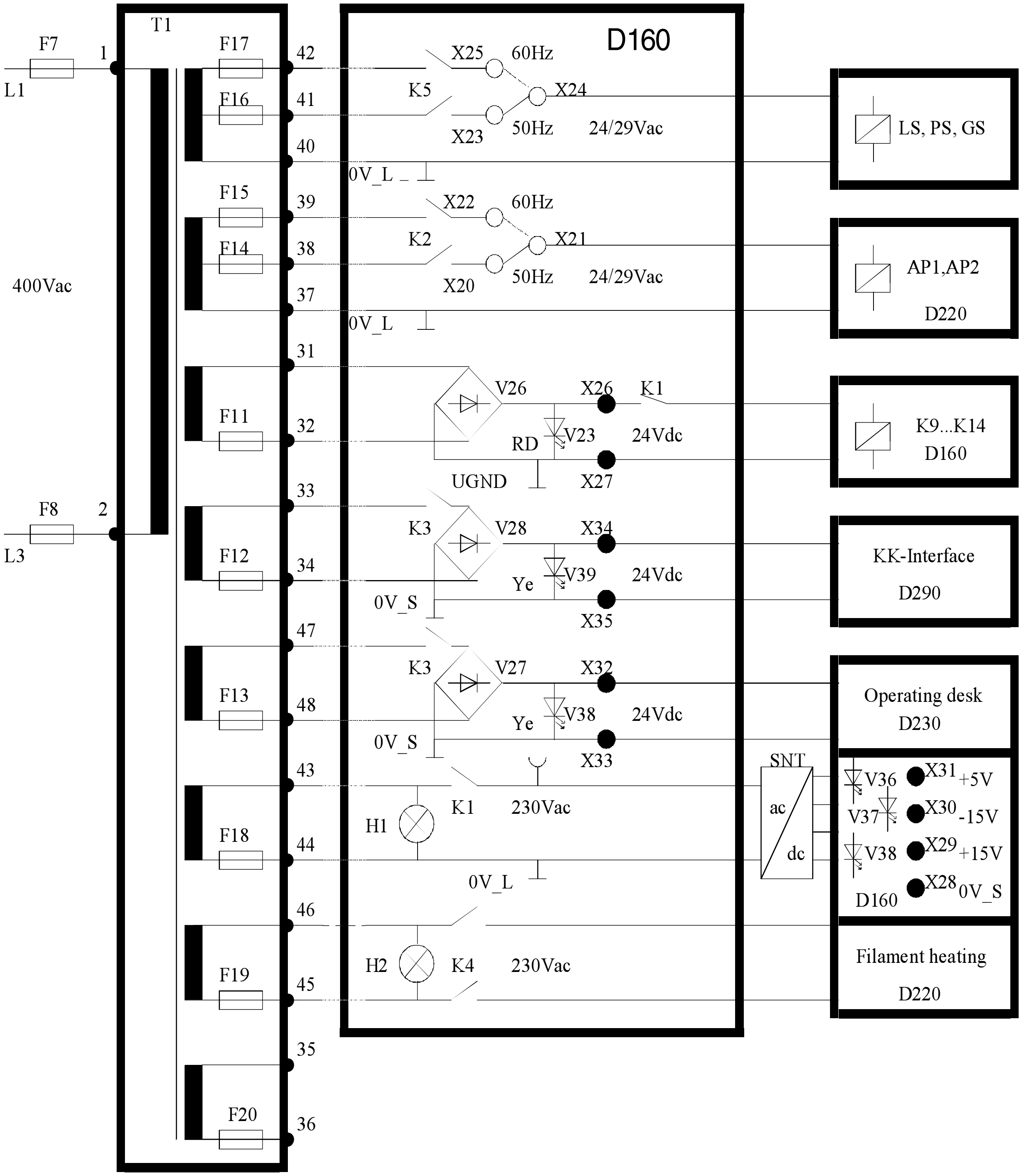

Fig. 3:

Relays K1...K5 are controlled by the power-on circuit, which connects through the transformer"s secondary voltages to supply power to the generator subassemblies.

The block diagram provides a general overview of the internal power supply. All test pins and displays are shown here in simplified form. For the real wiring only the generator circuit diagram (X2169 page 10 and 12) is binding.

Diamentor Connection

At plug X88 (existing from boards version D160 E3) a DIAMENTOR[1] could be connected. The Diamentor signals are transferred to the pcb D100 via X5. Here the signals are detected and transferred to the XCS net.

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KV Control

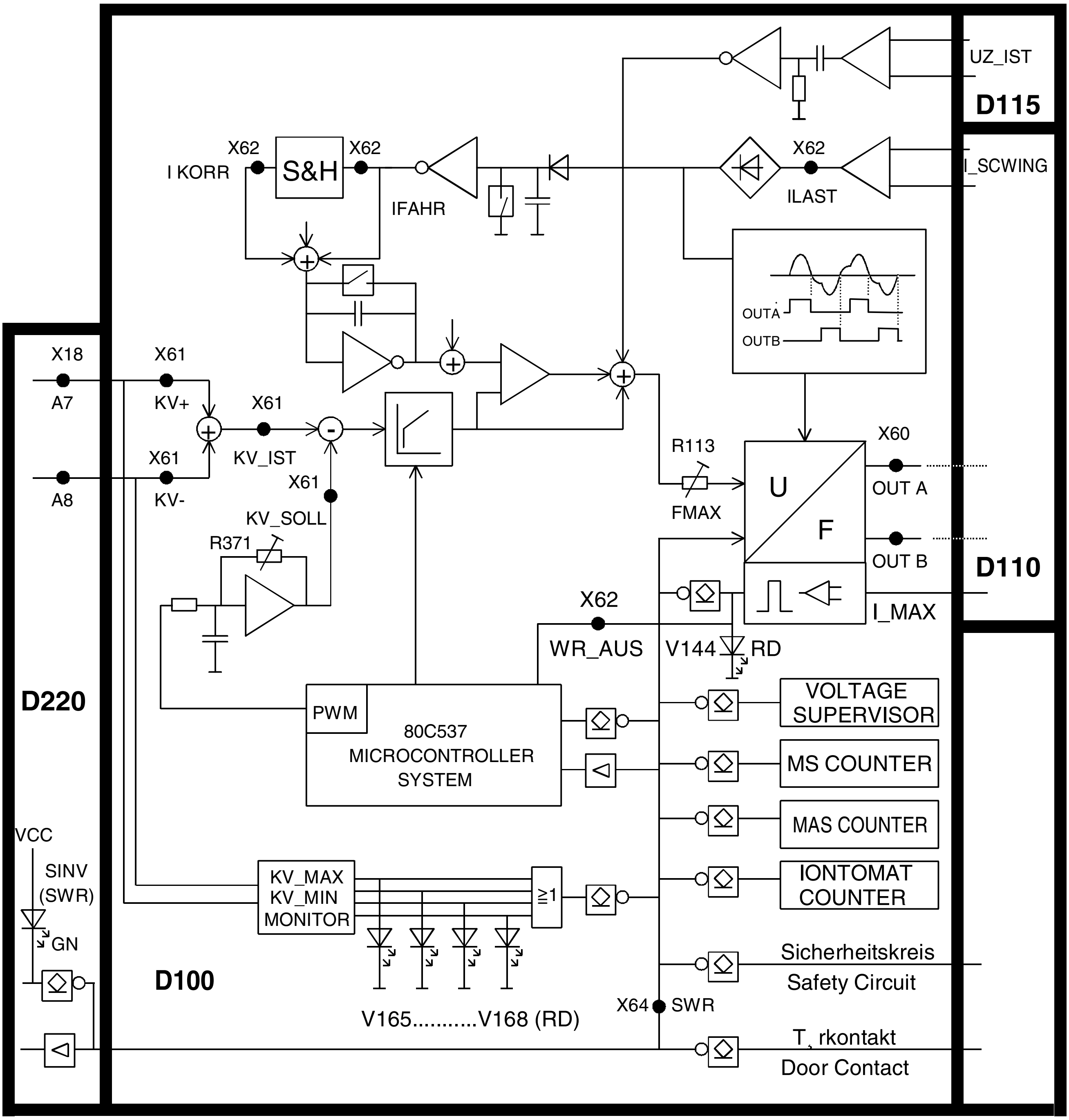

Fig. 4:

KV controller with ramp current limiting on the D100 beginning with POLYDOROS LX Serial No. 03370. The illustration also shows the inverter controller.

The kV controller compares the actual value for high voltage with the target value and compensates any difference using an analog PI controller. The output signal of the controller is then converted by a U/F converter to a frequency and is used this way to control the inverter. Switching high voltage on and off is achieved by enabling or blocking the U/F converter with the "SWR" signal.

Formation of the Nominal KV Value

The microcontroller system supplies the nominal value as a pulse-width signal (PWM). The pulse-width signal is then filtered and is then converted to an analog nominal value. Adjustment of the nominal value using R371, and thus also of the actual value of the high voltage, is done at the factory and should not be changed.

Sensing of the Actual KV Value

The actual value of the high voltage is sensed separately on the positive and the negative side of H1 with measurement dividers, processed on D220 and fed to the KV regulator, where the actual KV value is added.

Nominal-Actual Comparison and PI Controller

The deviation is determined by calculating the difference between KV-Nom and KV-Act. Controller parameter P (for sensitivity) and I (for time response) are automatically set by the microcontroller. The parameters depend on the operating mode (radiography, fluoroscopy, KV, mA) and the length of the high voltage cables.

The effect of the ripple of the intermediate circuit voltage on the oscillating current is compensated by switching this interference value to the controller output signal.

Current Ramp Limitation

The high voltage is increased to its nominal value by means of a ramp. This is controlled so that the oscillating current in the inverter does not exceed the maximum value of approx. 550 A.

In addition, the peak value of the current oscillation (IFAHR) is compared to the previous oscillation (IKORR). In this way it can be determined how a subsequent (third) oscillation would also be increased in amplitude. If there is a inadmissible increase, the increase in the ramp is limited accordingly. Limitation begins at approx. 450 A.

U/F Converter

The analog output signal of the controller is converted by a V/F (voltage-to-frequency) converter to the drive frequency of the inverter (signals OUTA and OUTB).

The oscillating current I_LAST is used to control the signals OUTA and OUTB in order to switch-off the inverter transistors at zero cross-over.

Inverter Control

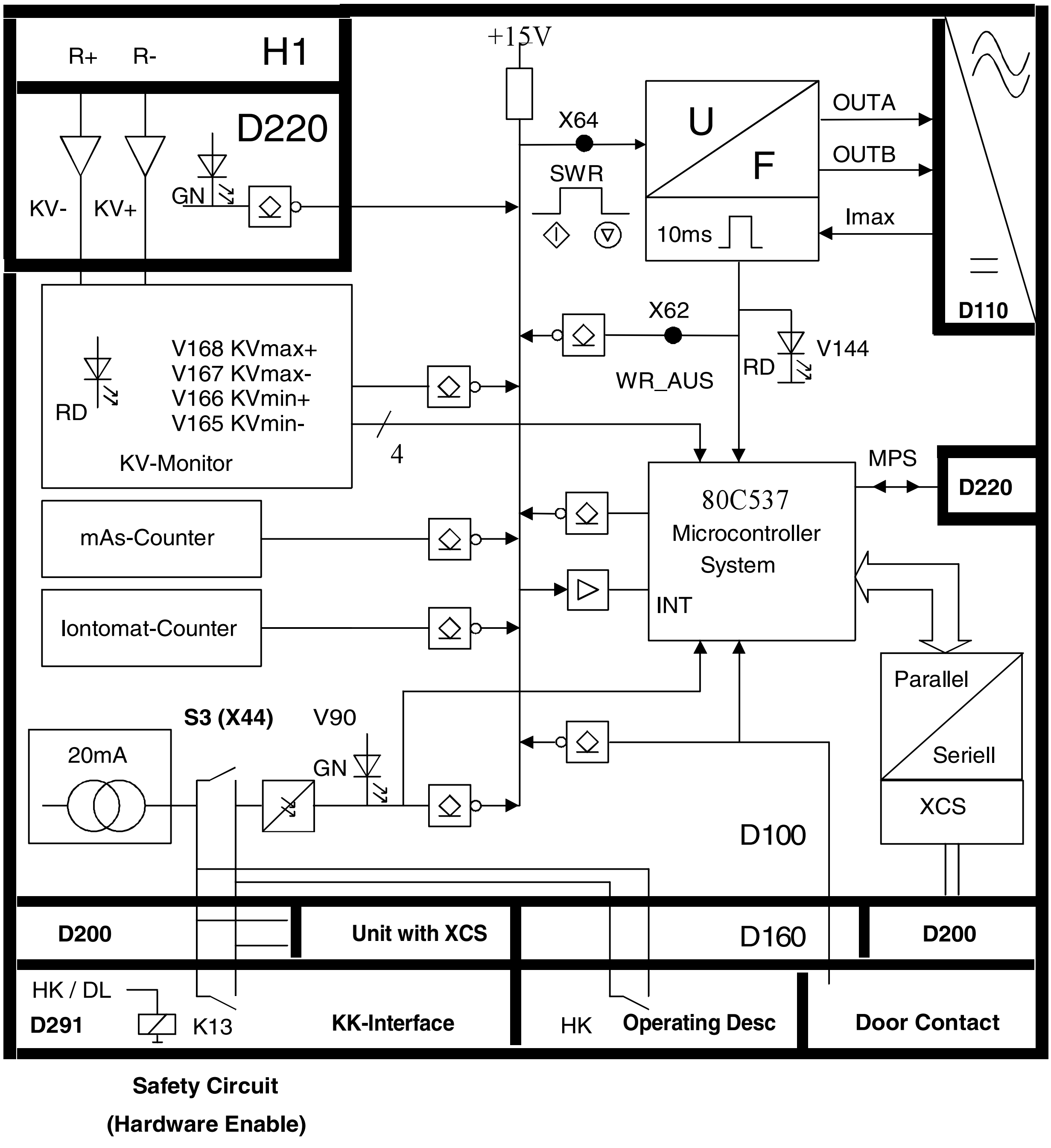

Fig. 5:

The high voltage is switched on and off by enabling or disabling the V/F converter with the **SWR** (**S**tart **W**echsel-**R**ichter = Start Inverter) signal. This signal is generated by the wired inclusive-OR operations of various control and monitoring functions. In other words, for the high voltage to be switched on, the SWR line must be enabled by all of the connected functions; each individual function can disable the line, thus interrupting the high voltage. In this case, the microcontroller investigates the cutout cause and generates an error message if necessary. The SWR signal is therefore fed via an interrupt to the processor, thus disclosing the SWR status. The various control and monitoring functions are described individually in the following text.

Filament Circuit Monitor (D220)

The filament circuit monitor accesses the SWR line directly, thus inhibiting enabling of the high voltages and switches the high voltage off, respectively. This condition is recognized by the MC on D100 via interrupt (INT). The MC then additionally disables the SWR line via SWRMC, checks the responsible HW ports and, via the MPS interface, also checks filament circuit D220 to find out the reason for disablement. The filament controller then communicates the cause of the cutout or disable signal. Then the MC generates an error message which is displayed on the main control console (ERR 4XX)[1].

kV Monitor

The kV monitor observes the positive and negative actual value of the high voltage. As soon as the high voltage drops below or exceeds a threshold, the radiation is interrupted by accessing of the SWR line. The processing of the interrupt thus triggered is as explained above, however, the cause of the fault is recognized via the HW ports in this case.

kV_{max}-threshold[2]. 80 kV; ERR 712/ 713

kV_{min}-threshold[3]: kV_{soll}-10 kV; ERR 714/ 715

mAs and Iontomat Counter

The cutout signals of the MAS integrator and the Iontomat are also routed to the SWR line, and switch off the high voltage by disabling the V/F converter. This state is reported to the microcontroller via an interrupt (INT), which also disables the SWR line (via SWRMC) and then investigates the possible cutout causes. The cutout argument is then determined by checking the counters of the MAS integrator and of the Iontomat.

SWRHW (Hardware Enable, Safety Circuit)

The generator is equipped with a safety circuit to prevent unintentional triggering of radiation following malfunctions of the generator or the unit electronics. A 20mA current loop must be closed each time a radiation release is triggered. This is accomplished on radiation release via the KK interface with relay K13, from the control console with contacts connected parallel to the HK, and, for units with an XCS interface, via a special safety relay located inside the unit.

When operated with the SPC, the safety circuit must be closed with switch S3 or jumper X44 (old version of D100). The safety circuit is polled after the generator is switched on. If jumper X44 is inserted, ERR 666 appears on the control console.

The function of the safety circuit is displayed on D100 with green LED V90.

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1. See also "Troubleshooting Instructions”
2. No delay in response time
3. Delay dependent on nom/act difference

WR_AUS (Inverter Blanking)

The high-voltage inverter is equipped with a maximum current monitor. If this monitor responds, the Imax signal disables the V/F converter, thus inhibiting the inverter as well. WR_AUS triggers an interrupt signal via the SWR line, causing the MC to disable the SWR line again with SWRMC. The switch-off cause is then investigated by polling the ports. Via WR_AUS, the controller then recognizes the response of the Imax monitor, and keeps the inverter disabled for 40ms to avoid thermal overload. The high voltage is then switched-on again. If the Imax monitor responds three times within 3.5s, the generator is blocked and **ERR 711** appears on the control console.

Prolongation of the Imax signal (10ms) is necessary to give the controller enough time to process the interrupt and provide a visual display with red LED V148.

Door Contact

A radiation release can be prevented or radiation interrupted via an external contact (e.g. a door contact). This function also has hardware access to the SWR line. If a disable occurs during Standby, the x-ray tube symbol lights up on the control console and radiation release is disabled. The touch- screen console displays ”Door is open” in the message line. **ERR 628** is displayed if the disable occurs during radiation.

Inverter

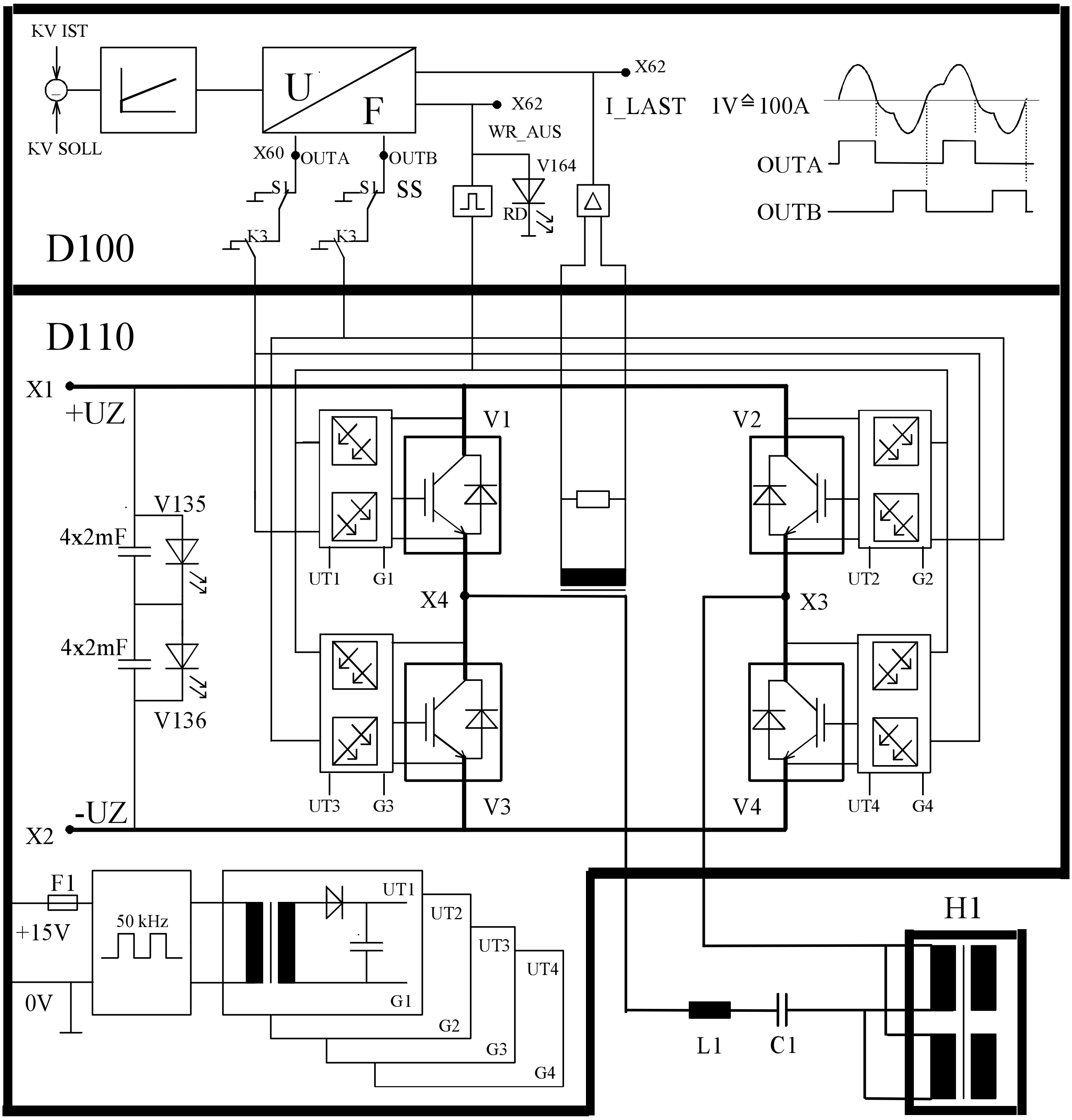


Fig. 6:

The inverter for generation of the high voltage is designed as a serial-resonant inverter in a full-bridge circuit. The resonant or oscillating circuit is formed by L1[1], C1 nd the leaking inductance by H1. IGBT (**I**nsulated **G**ate **B**ipolar **T**ransistor) modules are used as the switching elements. These modules also contain the fly-back diodes which are so important for the function of the inverter.

1. Not applicable in LX Lite

A potential-separated drive circuit including a separate power supply is provided for each transistor (UT1, G1....UT4, G4). In addition, each transistor is protected by an Imax monitor. This monitor measures voltage U_{CE} in the on-state; the transistor is disabled as soon as a threshold is exceeded.

NOTE

With the service switch S2 on pcb D100 the intermediate voltage is off and a test frequency of 33 kHz is given if an exposure is triggered.

So, if necessary, the function of the control board D110 for the high voltage inverter could be tested.

The oscillating current is detected with a current transformer and used to control the V/F converter in order to switch-off the inverter transistors at zero cross-over.

NOTE

The inverters in the POLYDOROS LX 30/50 and LX 30/50 Lite have different Part Numbers.

The inverter and the high voltage transformer of the POLYDOROS LX 80 are more powerful. These parts corresponds to them of the POLYDOROS SX 65/80.

Actual Value Detection

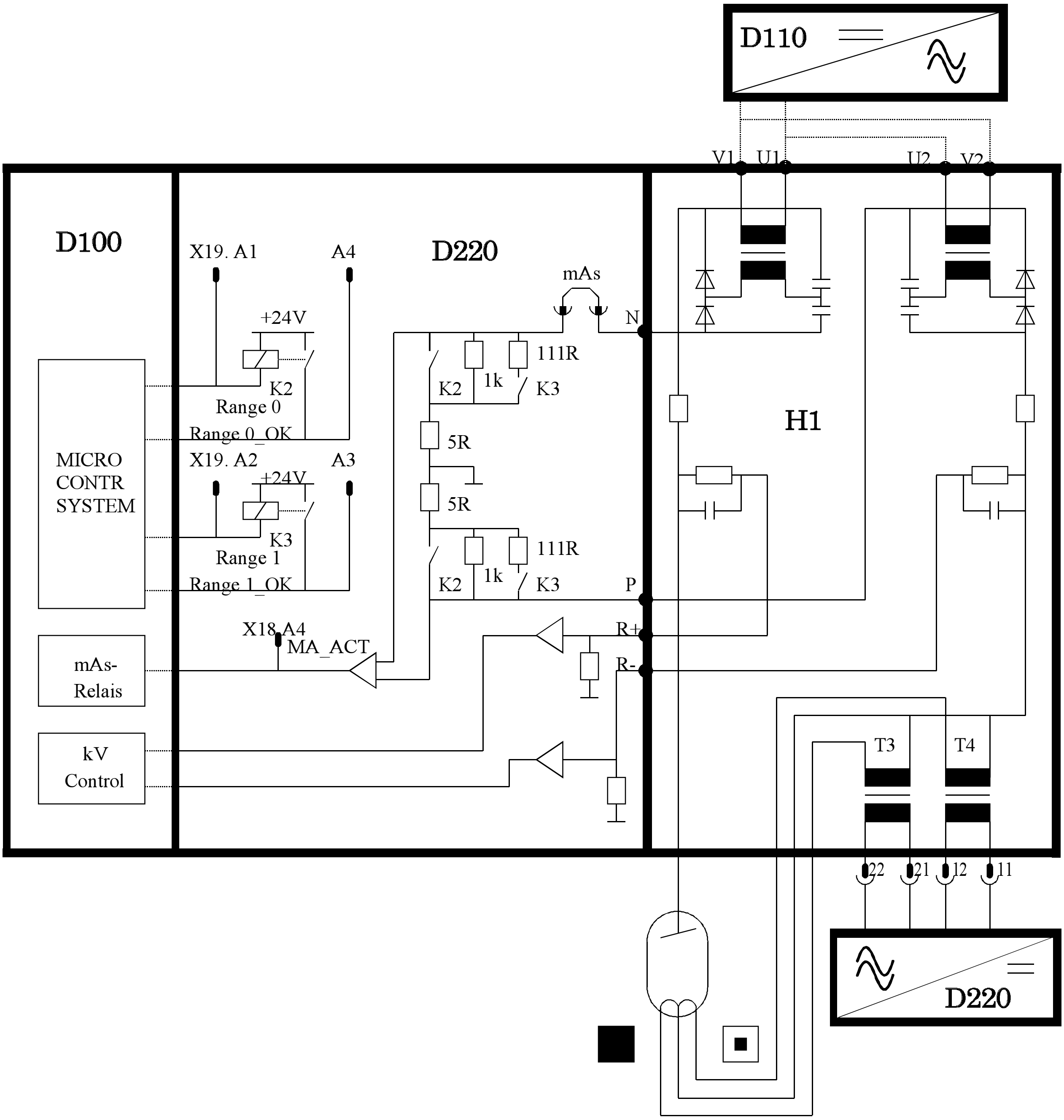


Fig. 7:

The actual-value detection for the x-ray tube current and the high voltage is located on board D220 (Heating). The mA measuring circuit is connected to the high-voltage generator via connectors N and P. The measuring resistors symmetrical to ground generate a current-proportional voltage which is decoupled via a differential amplifier free from interferences. The measuring ranges are selected by the master (D100) according to the generator mode. The assignment for fluoroscopy is: 1 V ⇔ 1 mA; with relais K2 and K3 off. The radiography measuring circuit is selected with preparation via K2. The assignment is: 1 V ⇔ 200 mA.

The assignment for LX 80, LX 30/50 and LX Lite in the extended exposure range $J_{Römin}$ 10 -> 1 mA is in the range1 - 20 mA 1 V ⇔ 10 mA (K2 off, K3 on).

The measuring circuit selection is monitored via the additional contacts of relays K2 and K3. Following malfunctions, the generator is disabled and error code ERR 606 is output. The relay drive and acknowledgment can be checked at test pins X19.A1...X19.A4. Test pins X18.A4 on D220 and X61 on D100 are available for checking the tube current with the oscilloscope. mAs measurements can be performed at the sockets on board D220.

Filament-heating Circuit (D220)

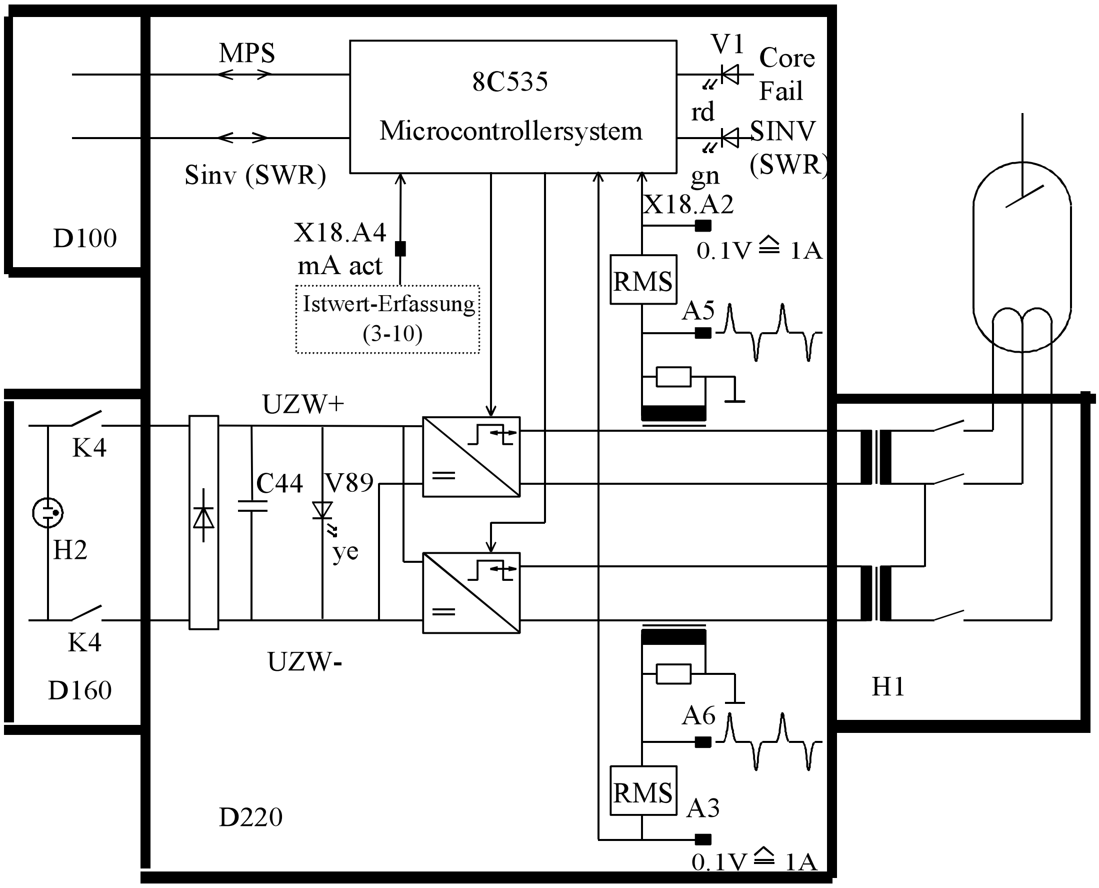


Fig. 8:

Two separate inverters are used to generate the filament current. These inverters are designed as square-wave inverters with SIPMOS transistors (since 10/98 IGBTs) in half-bridge circuits. The delay effect of the filament transformer"s inductivity generates a curve-shaped current. The inverter is activated with a constant frequency of approx. 20 kHz with a variable pulse width (pulse width control).

The filament and tube-current regulator is designed as a digital PI controller in the micro-controller system. The nominal values and all other information are fed to the controller system via the MPS serial interface.

The actual value of the filament current is sensed via current transformers. A DC voltage proportional to the r.m.s. value of the filament current is gained with RMS/DC transformers and fed to the microcontroller via an A/D converter. The corrective signal for the pulse-width control of the inverters is generated here following a nominal/actual comparison and calculation with an appropriate algorithm.

The filament current is switched over to tube-current regulation by the SINV (SWR) signal following switch-on of the high voltage. Following a Nom./Act. comparison and a corresponding calculation, the tube current is then regulated via the filament current.

LED's on D220:

V1 red on: Processor kern test or processor kern error

V1 red blinks:	Firmware destroyed or not downloaded
V1 green on:	Standby
V1 green on:	Heating current okay for exposure and fluoroscopy
V89 yellow on:	Intermediate circuit voltage present; (in older version there were two yellow LED's and two intermediate circuit capacitors).

NOTE

The D220 board has been redesigned. Now it can be used in all POLYDOROS LX and SX generators. However, pay attention to correct jumpering (see the Wiring Diagram or the Startup instructions)!

Processor System (Design and Interfaces)

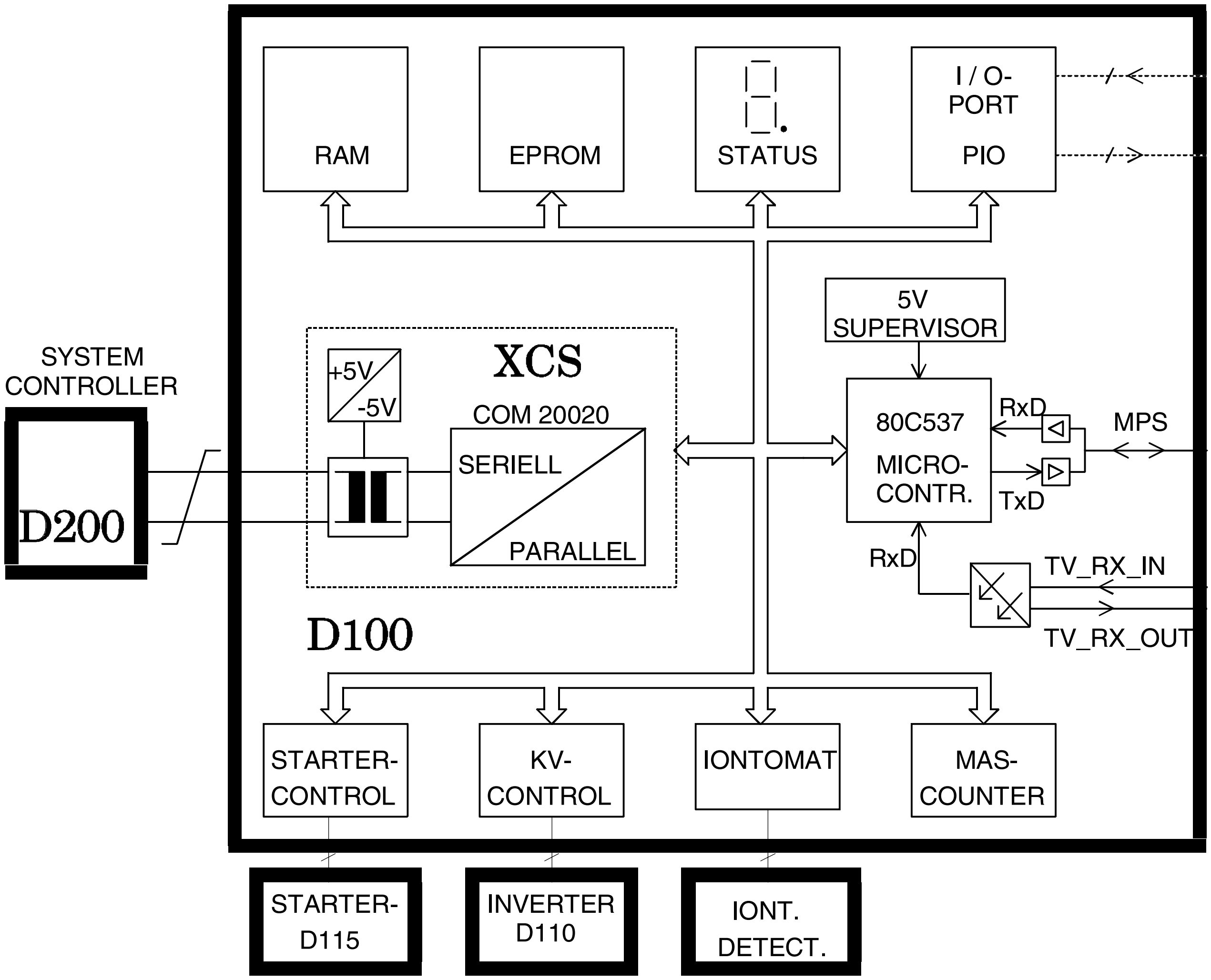


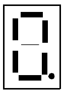
Fig. 9:

The processor system on D100 is designed around a 80C537 microcontroller. This microcontroller controls and monitors all functions of the generator. Communication with the individual function circuits is made via the data and control bus and via I/O ports. The filament circuit is connected via the (bidirectional) serial MPS interface. A further serial connection links the controller with the TV system VIDEOMED DI. This system transmits digital brightness information for the control of the dose rate in fluoroscopy via a current loop (TV_RX_IN - TV_RX_OUT).

Connection to the higher-level system controller is established via the XCS network. In this case, the interface consists of the Arcnet controller COM 20020 which processes the transmission protocol and performs the data conversion. Connection to the XCS line is made with a special circuitry which contains the transmitter, the receiver and the transformer. The voltage of - 5 V required for this switching circuit is obtained with a converter module of +5 V.

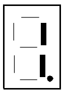
A Voltage Supervisor module monitors the 5 V - supply voltage on board D100. When the voltage falls below a critical level, radiation is blocked and a defined reset of the processor is performed.

Status indications on D100



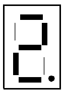
Initialization

Fig. 10:



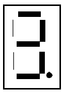
Initialization completed, waiting for commencing communication with XCU via XCS

Fig. 11:



Communication started, D100 waits for initialization by XCU

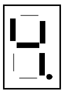
Fig. 12:



Initialization through XCU, D100 receives generator settings, tube assembly data, Iontomat settings etc.

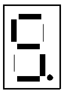
The display stays on 3 if the ”Priv POLYDOROS LX have not been assigned.

Fig. 13:



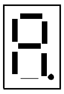
Initialization by XCU completed, waiting for tube assembly selection

Fig. 14:



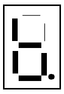
Tube assembly selection received

Fig. 15:



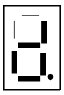
Exposure (HK is ON)

Fig. 16:



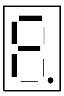
Ready for fluoroscopy / exposure

Fig. 17:



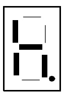
Fluoroscopy is ON

Fig. 18:



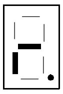
While FLASH Prom of the filament circuit (D220) is programmed or deleted. (Download for filament is running)

Fig. 19:



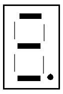
Rotating anode acceleration for exposure / fluoroscopy

Fig. 20:



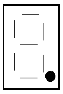
Ready for radiation, acceleration (rotating anode and filament) successful

Fig. 21:



Connection with XCU lost

Fig. 22:



Blinking decimal point indicates cyclical live messages of XCS

Fig. 23:

Detector Connection

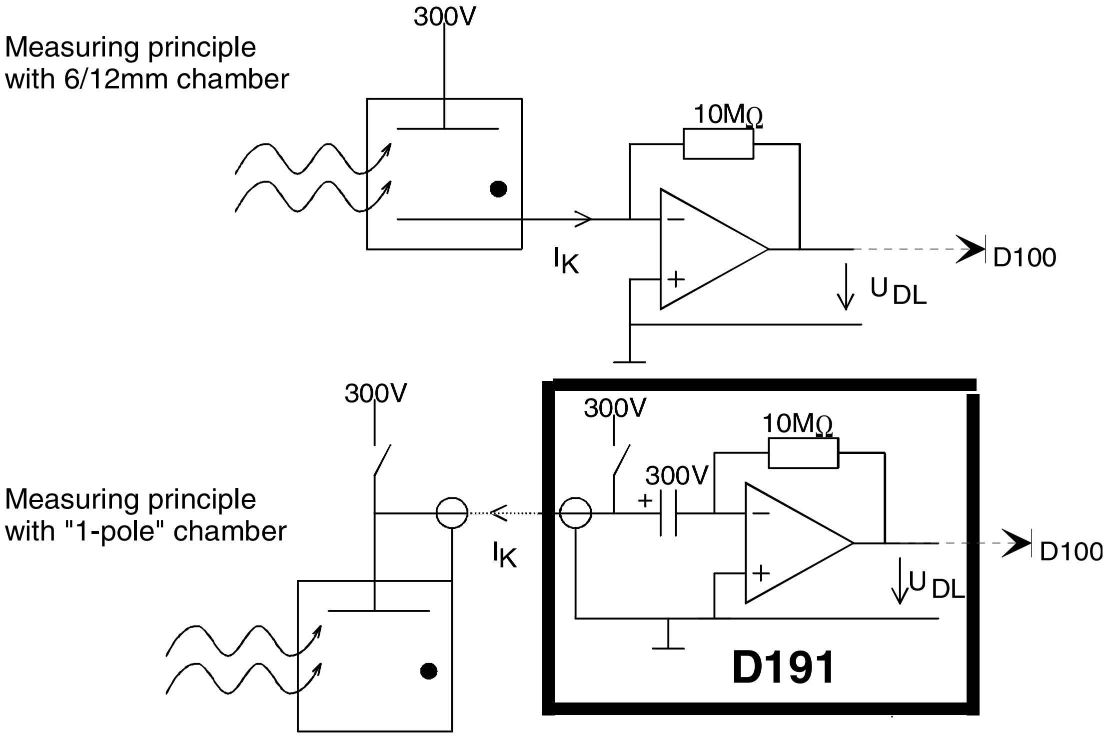


Fig. 24:

In the case of POLYDOROS LX, the Iontomat is integrated in the D100 assembly. Here, you can also find the four connections for the detectors. The following detectors are permissible for the dose control (exposure mode):

- 6 mm chamber;
- 12 mm ch amber(with adapter III or IV);
- Semiconductor radiation detector (HSE).
- 1-polige chamber with D191 interface as of 9/94

The following devices can be used as sensors for the dose rate control (fluoroscopy mode):

- B-signal (SIRECON Compact);
- Photomultiplier

Measuring principle of the Iontomat chamber

The chamber works in compliance with the ionization principle. Here, a current (IK) proportional to the dose rate is generated by X-ray radiation in an air capacitor charged with 300V. This very small current (pA...nA) is converted into a voltage UDL (mV...V) and is fed via the Iontomat cable to the measuring value processing circuit on the D100 (connection JK2A...F.C).

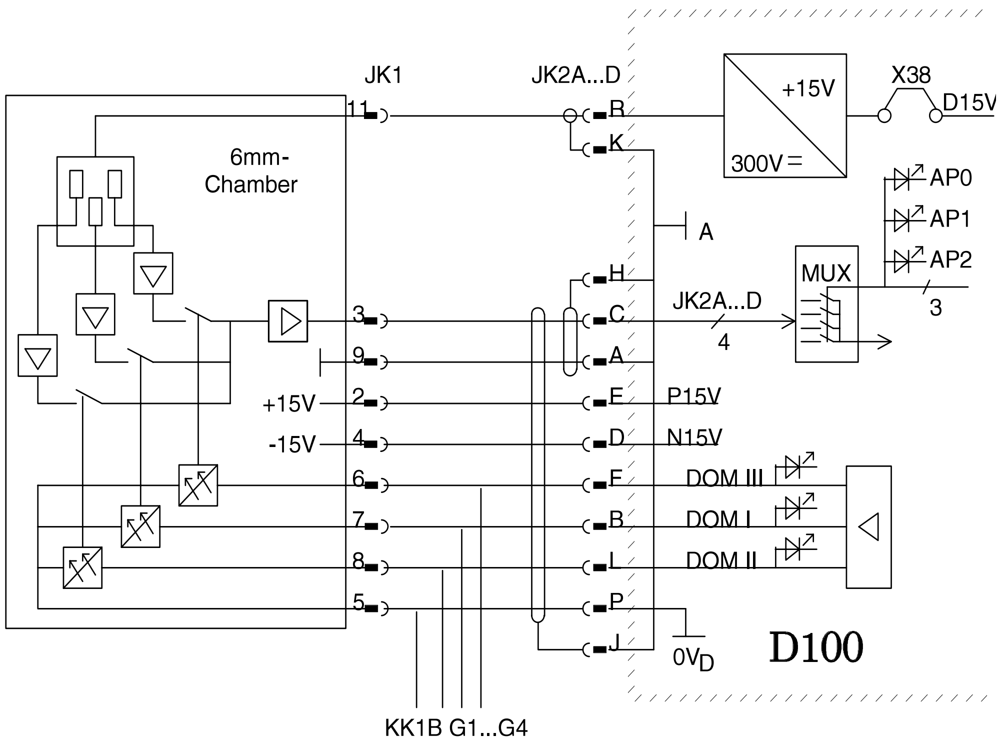


Fig. 25:

6 mm chamber with integrated chamber current amplifier

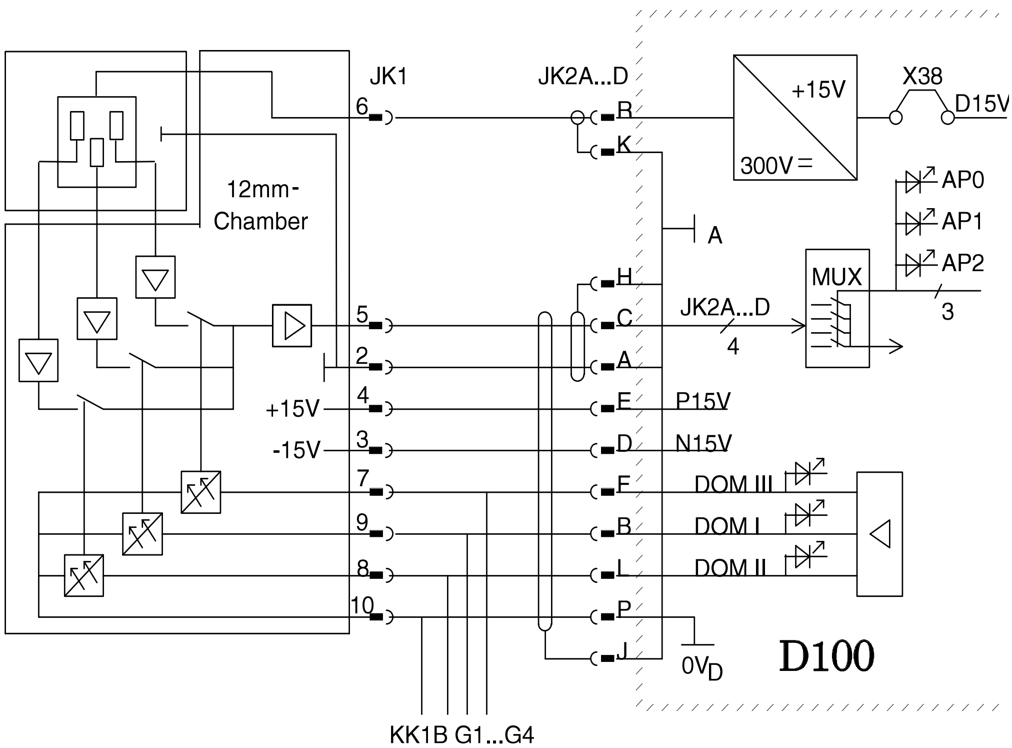


Fig. 26:

12 mm chamber with Adapter 3

Iontomat Detectors

The Iontomat chambers are equipped with one or three measuring fields. The 6 mm chamber, is provided with integrated electronics for selecting the measuring dominants and the I/U converters.

With the 12 mm chamber these parts are inside a connectable adapter; (AD III for the three-field-chamber, AD IV for the measuring chamber with one measuring field).

The "1-pole"chamber is fitted with an adapter at or near the chamber which contains the selection of the dominants; the I/U converter is on the D191 chamber current converter in the generator cabinet. The voltage supply of the ionization chamber (300 V) is located on the D100. It can be switched off for trouble shooting by removing the X38 jumper. The LEDs AP0...AP2 for the Iontomat workstation selection and DOM I...DOM III for the selection of the dominants are intended for the diagnosis.

Selection of the measuring dominants is done via the Iontomat unit cable (for units with XCS connection) or via the KK interface.

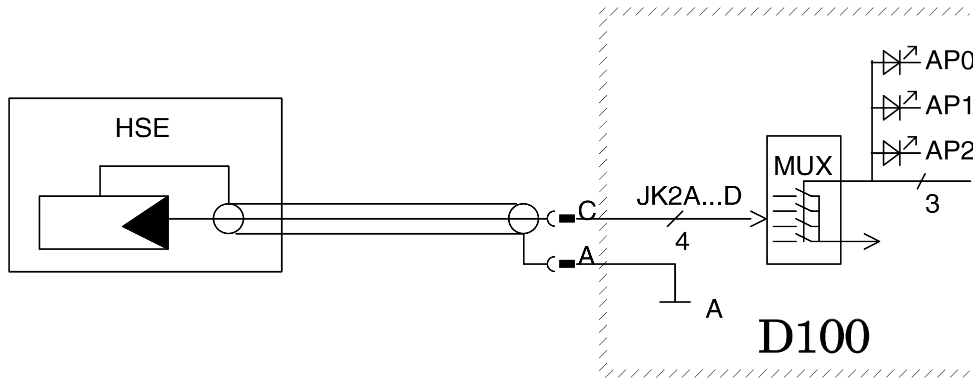


Fig. 27:

Semiconductor radiation detector

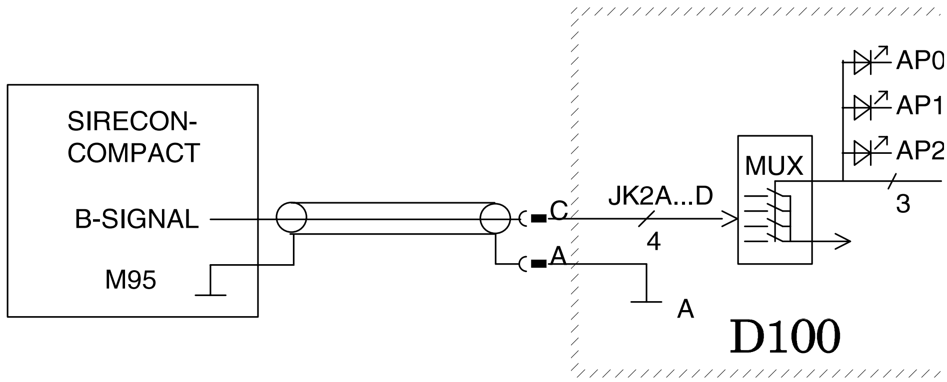


Fig. 28:

SIRECON COMPACT

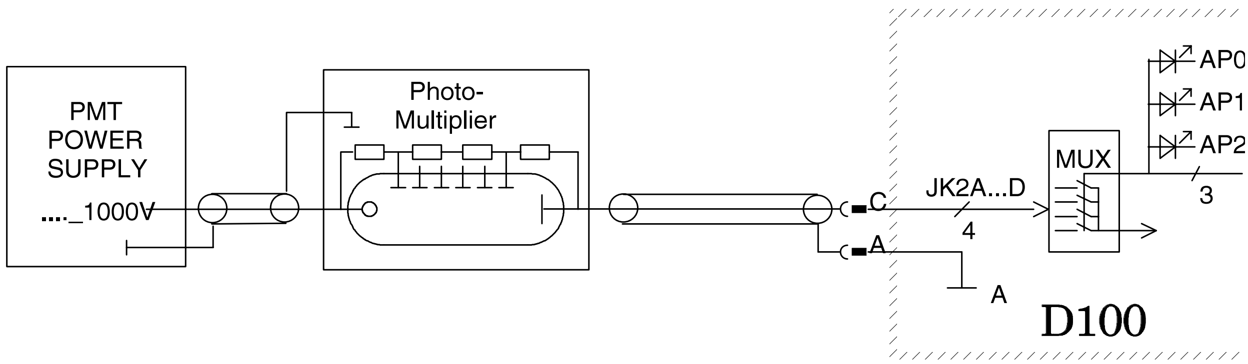


Fig. 29:

Photomultiplier

Semiconductor Radiation Detector

In contrast to the ionization chamber, the semiconductor radiation receiver is located behind the film cassette. It generates a current that is proportional to the dose rate. This current is applied to the measuring value processing on D100 (connection JK2A...F.C).

SIRECON COMPACT

A manipulated value derived from the B-signal of SIRECON Compact is intended for the control of the dose rate in fluoroscopy mode.

Photomultiplier

A photomultiplier can also be connected as sensor for the dose rate. The corresponding voltage supply can be found on the D291 KK interface.

NOTE	**With the POLYDOROS LX 80 and LX Lite fluoroscopy mode is not possible!**

Iontomat Measuring Value Processing

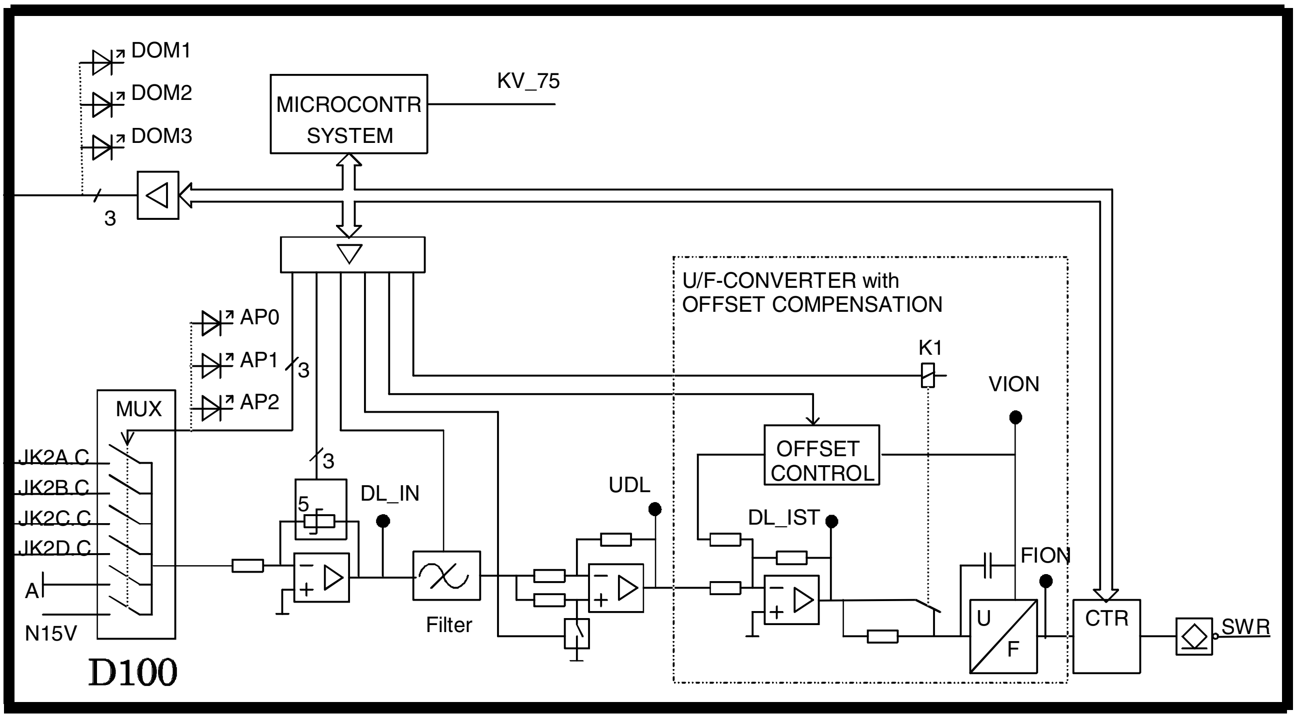


Fig. 30:

Dose control (exposure mode)

The main parts of the measuring-value processing circuit are the voltage to frequency converter (U/F) and the counter (CTR) that follows. The U/F converter converts the voltage proportional to the dose rate into a frequency (100 kHz/Volt at X14) that is proportional to the voltage. The generated pulses are summed up in the counter which corresponds to a digital integration. For this purpose, the counter is loaded prior to the measurement with a number that corresponds to the dose required and is counted downwards by the pulses. With the counter empty, the output changes to 5 V and switches off the radiation via the SWR signal.

The U/F converter is equipped with a subordinated control circuit which compensates offset and error voltages in the Iontomat signal circuit. Because the control circuit can only compensate direct voltages, alternating components during the compensation phase are eliminated using a filter.

The switchable inverter provides for the correct polarity at X63 UDL (negative voltage.

The gain adjustment which depends on the detector is carried out with the input amplifier. When operating with the Iontomat chamber, the gain is set to one; in HSE mode, however, the amplifier serves as current/voltage converter.

Selection of the Iontomat input, as well as all settings and control functions are carried out by the microcontroller system in accordance with the Iontomat and system configuration.

Dose monitoring is also implemented. This leads to an abort of radiation in the case of an insufficient dose rate. For this purpose, the status of the counter 100 ms after radiation has started is polled and an extrapolation determines whether the dose can be reached within the available time. If the dose rate is too low, radiation is interrupted and ERR 550 is displayed on the operating desk. The start of the radiation is transmitted to the controller via the signal KV_75 (75% kV_{req}).

Dose rate control (fluoroscopy mode)

1. **SIRECON Compact**

   A manipulated variable derived from the B-signal of SIRECON Compact is used for the control of the dose rate in fluoroscopy mode. This variable is measured after the frequency conversion and is used as actual value for the control of the dose rate.

   The gain of the input amplifier is set to one, the inverter is active.

2. **Photomultiplier**

   The photomultiplier generates a current that is proportional to the I.I. output light and thus to the dose rate.

   The input amplifier is used as current/voltage converter, the inverter is **not** active. The dose rate actual value can be used for the control system after the U/F conversion and the frequency measurement (pulse/20 ms) have been performed.

NOTE	**Connection of SIRECON Compact requires modifications in the M95 (see RX63-020.034....)**

XCS

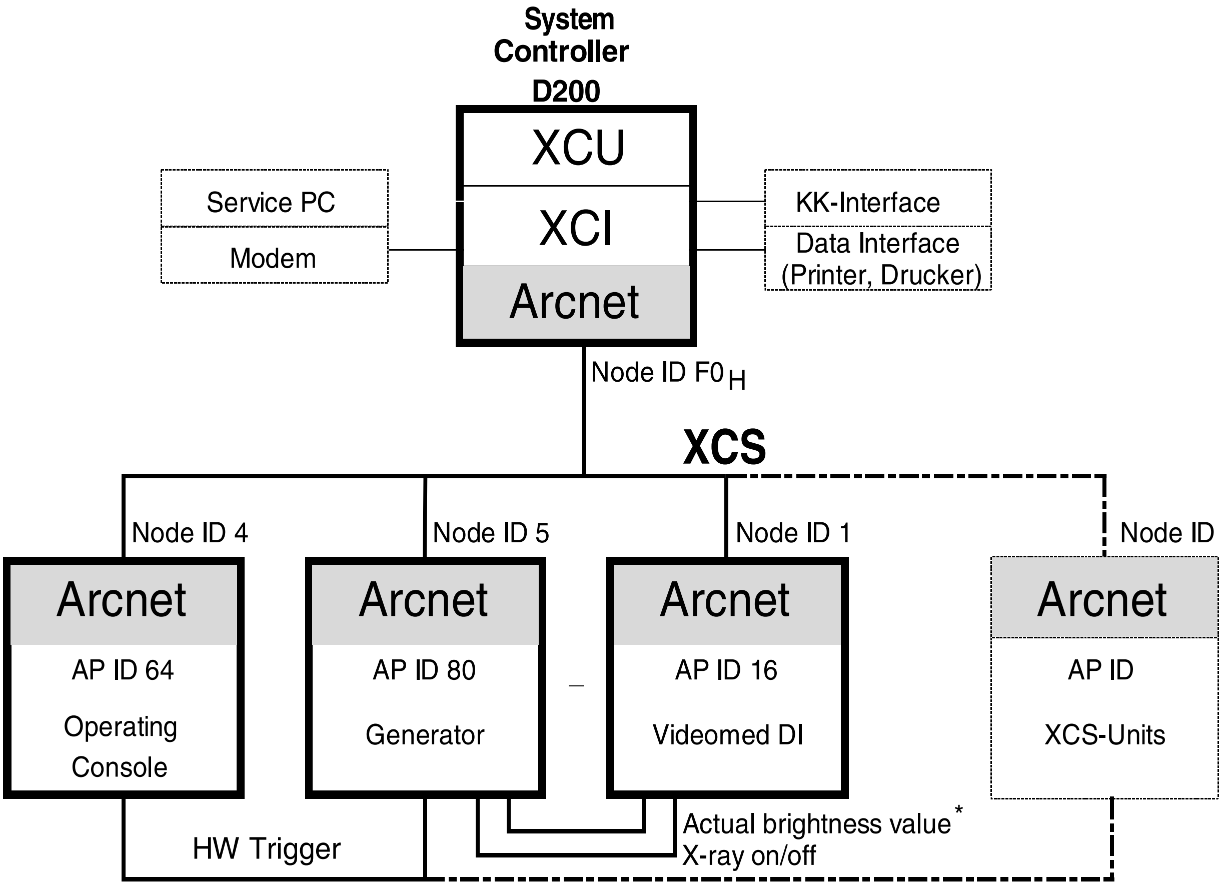


Fig. 31:

The XCS (X-Ray Communication System) is a serial communication system between the XCU (X-Ray Controlling Unit) and the system components. The driver software for operating the hardware and administration of the XCI communication environment (X-Ray Communication Interface) are also included.

The XCS is what is called a "Local Area Network" (LAN), based on the ARCNET technology (Attached Resource Computer Network). The ARCNET protocol is realized as a sequencer in a hardware chip (SMC COM20020). The individual system components are connected to each other in a star-shaped configuration using special cables. (The actual wirings are shown in the graphics in chapter 2 of this description using the example of the SIRESKOP CX unit).

However, due to the use of ”Token Passing”, the connections represent a logical ring. This is done by passing on an ”Invitation to send” from one Arcnet controller to the next one. For addressing, Node ID´s (Node Identification) are used. The XCS interface offers a 2-point-connection on a logical level between the system components and the XCU. The data exchange is effected via special telegrams. The addressing is effected by AP ID´s (Application Process Identification). However, parallel to this, in exceptional cases, there is also communication between unit components if necessary for safety reasons. (For instance: drive enable from the SIRESKOP CX spotfilm device to the basic unit).

Interconnections for the transmission of time-critical or safety-relevant analog or digital signals are usually realized by hardware such as the safety circuit (HW trigger), VIDEOMED DI actual brightness value, radiation on/off or connection of the IONTOMAT measuring chambers.

Administration of the XCS is handled by the XCI. The XCI controls also the interfaces to the XCU, to the service PC or the modem as well as the KK interface and printer connection options.

D200 System Controller

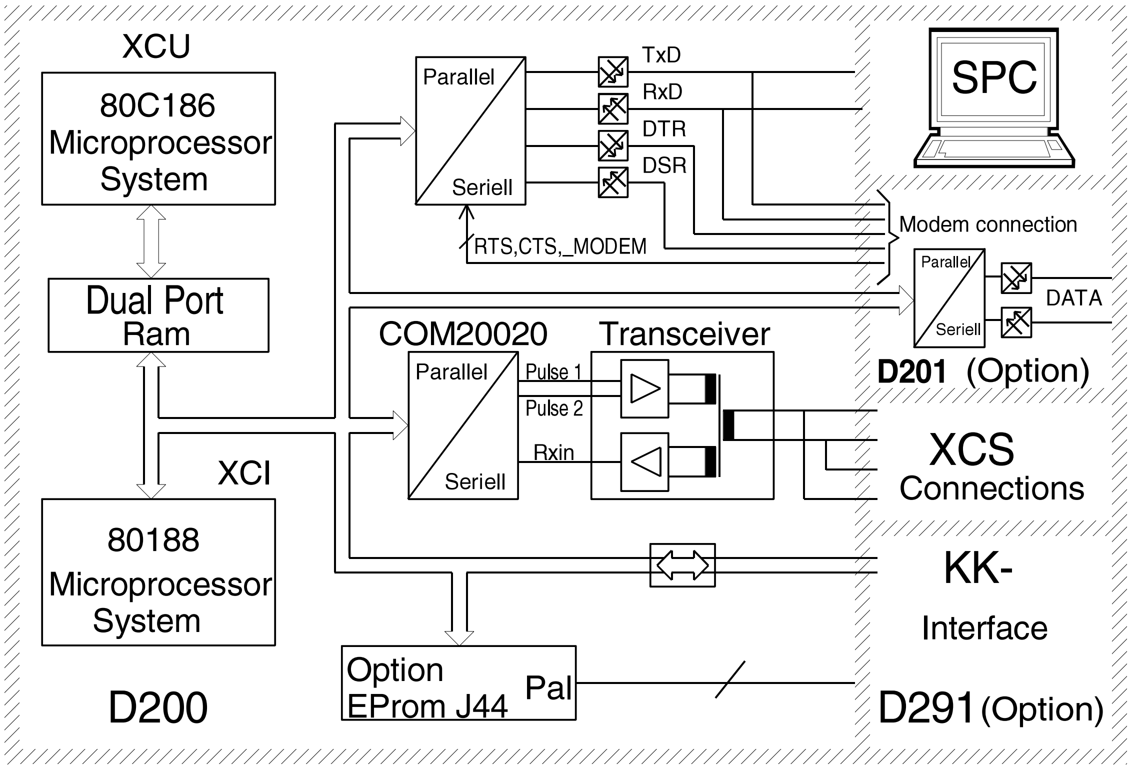


Fig. 32:

The system controller is the central control unit in the XCS. Here, all data from the configured components are received and all data and commands are given to the components. For this purpose, a central processing unit (XCU), the communication processor (XCI), the serial interface to the Service PC (SPC) as well as the Arcnet controller (COM20020) can be found here. A transceiver serves for the coupling to the XCS network.

In the XCI the log-in and log-out of the system components to the XCS net take place via AP IDs, here the assignment AP ID to Node ID is effected as well; in addition to that, the components here give notice in what is called an “Inlist” of which telegrams they would like to receive. The XCI also controls the interfaces to the XCU, to the Service PC or the modem as well as the KK interface and printer connection options.

When using the D291 KK interface option, the J44 Eprom is required. J44 is also required when using the D201 Printer-Interface option. D201 provides a serial data interface for the output of the exposure and fluoroscopy data. After an exposure kV and mAs, after reset of the fluoroscopy displays at the control console, the average values of kV and mA as well as the fluoroscopy time are printed out. In addition to this, there is a modem connection on D201 for remote diagnostics, which is used as an alternative to the SPC. Selection is made by using the S1 switch on D201.

The XCU takes over all tasks which are not fulfilled by the individual system components:

- Provision of the components with initialization data;
- Central processing of operating requests and operating tasks;
- Sending requests to the components;
- Making parameters available for request processing in the components;
- Evaluating request responses from the components;
- Control and synchronization of all routines that encompass several components;
- Storage of configuration data of all components configured in the XCS.

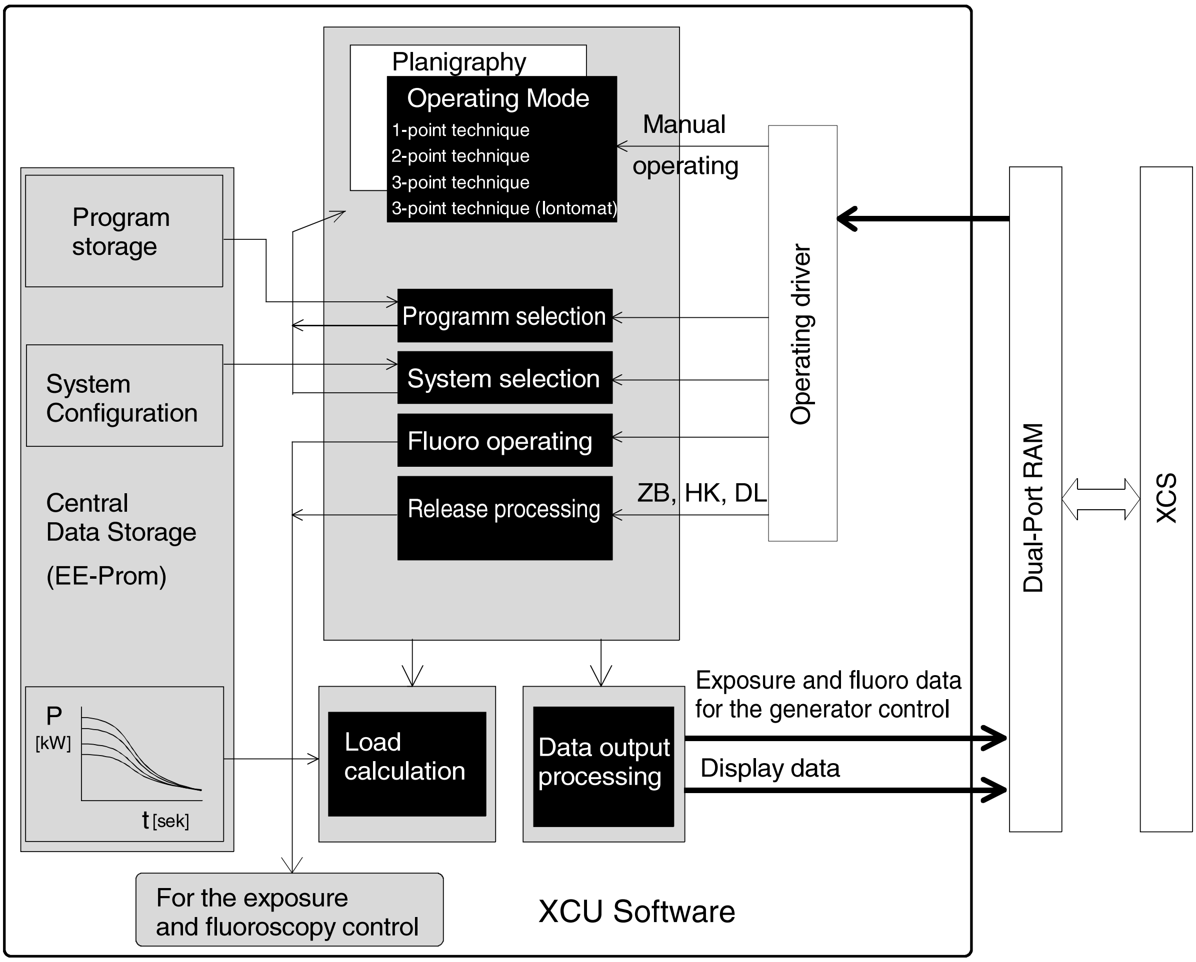


Fig. 33:

XCU Software

Processing of the POLYDOROS LX Control Console (Principle)

The data from the control console arrive in the XCU via the XCS and the Dual-Port RAM. Here, they are interpreted and corresponding to the operating mode as well as the system configuration it is checked whether they are permissible. After tube load calculation, the exposure data are determined and sent to the generator and the display. From this point, they are sent to the XCS via the dual port RAM and arrive in the D100 generator control as well as in the control console for the display.

The signals exposure preparation (ZB), exposure request (HK) and fluoroscopy (DL) are sent to the exposure and fluoroscopy control respectively for further processing.

NOTE	**Similar processes are also realized for the operating of the SIRESKOP CX.**

Fluoroscopy and exposure control (principle)

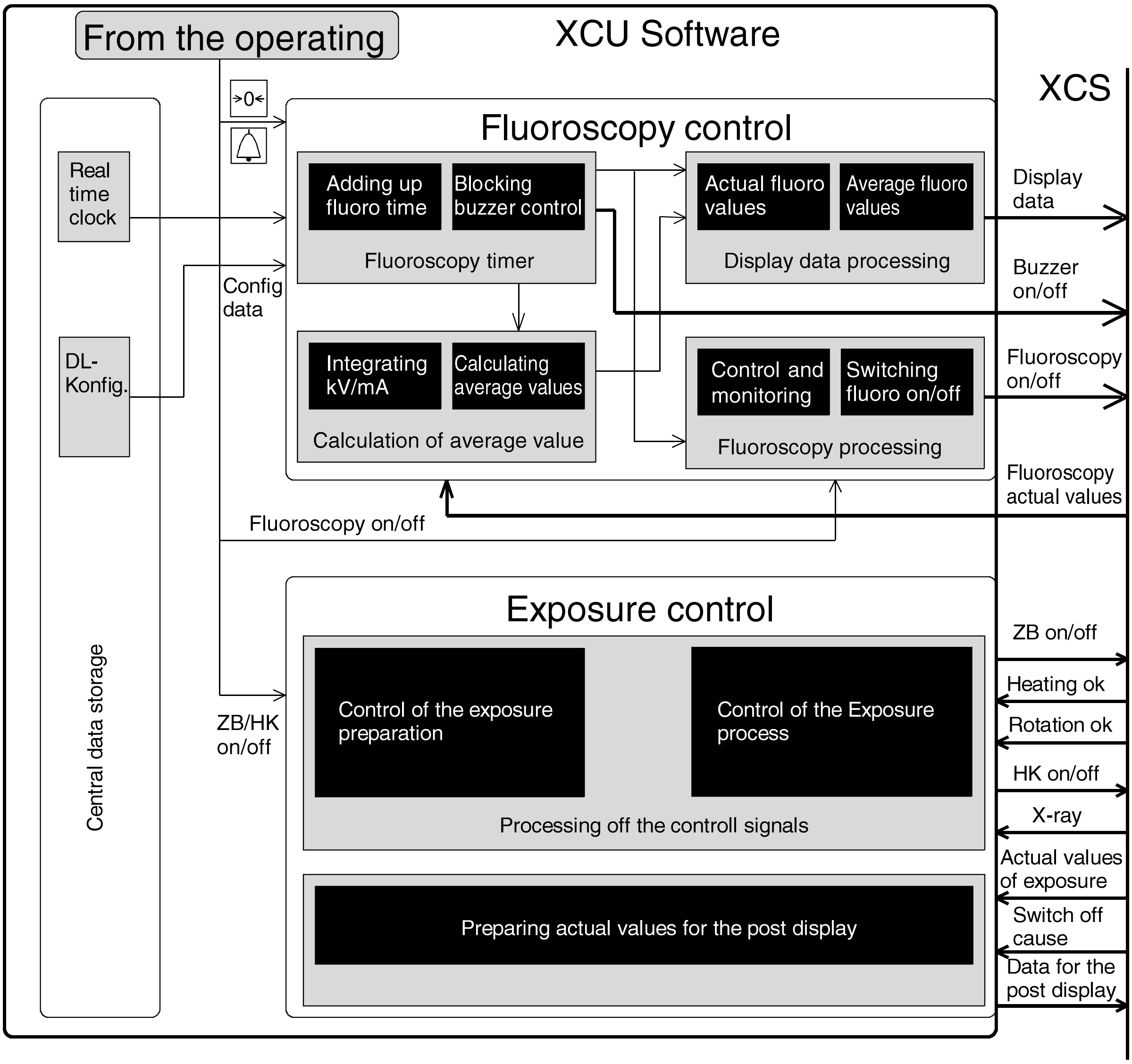


Fig. 34:

The fluoroscopy request is given to the XCS and thus to the generator via the fluoro processor. With the beginning of the radiation the DL-timer starts; the DL actual values and mA are received and given to the display together with the fluoro time; the displays are permanently updated. For the calculation of the average value to follow, kV and mA are integrated. 0.5 min before the expiration of the configured time for the buzzer to be switched on. If the latter is not reset, radiation is blocked. After the switching off fluoroscopy, the average values of kV and mA as well as the expired time are sent to the display. With resetting of the displays, the values are printed at the data printer (option)..

The request for the exposure preparation (ZB) is sent to the controller. If there is no blokking (door contact, thermo switch), a ”ZB **ON**” is sent to the generator.

After the receipt of the acknowledgments ”heating ok, rotation of rotating anode ok, ready for radiation” (Display ”r” on D100) the exposure request (HK) is evaluated and given to the generator as well. The acknowledgment ”X-ray” is among other things used for switching on the radiation displays on the control deck. After termination of the exposure, the generator sends the reason for the switch-off for possible required processing of the error, as well as the actual exposure values for the post display in the operating desk and the data printer (option).

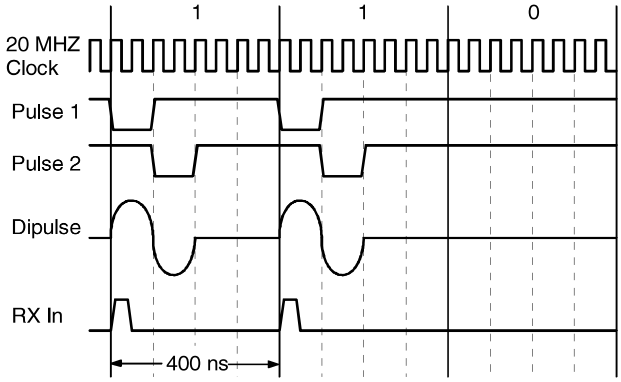


Fig. 35:

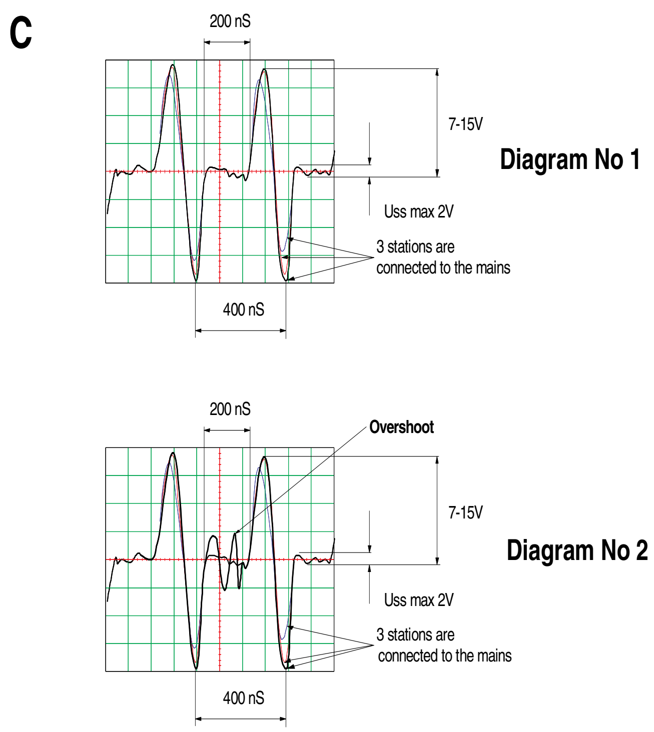


Fig. 36:

The trigger point has to be adjusted so that all XCS stations are visible.

XCS Network

The coupling to the network is done by way of a transceiver (transmitter / receiver). For the sending of a logical ”1” the Arcnet controller generates two pulses (Pulse 1, 2) which are converted into a 200 ns dipulse signal in the transceiver. This signal arrives at the cable via a transformer. For the reception of a ”1” the dipulse signal is converted into the positive Rxin pulse. A ”0” represents the absence of pulses. The diagram shows the sending (or reception) of...1, 1, 0.

Measurements at the XCS Network

General Remarks

For the transmitting of data shielded Twisted Pair cables are used (referred to as Phase A and Phase B in the wiring diagram). These cables have a defined impedance and attenuation.Therefore, the amplitude of the sending signal is lower when coming from a station farther away from the measuring point. As all stations send the token cyclically to the cable, one receives the oscillogram that visible on the left when the trigger point is adjusted adequately.

Interference on the XCS Network

Interferences during the transmitting of data come to existence due to reflections (overshoots in the oscillogram visible on the right). They occur, for example, because of cables which are not terminated correctly. This means: there must be a defined resistor at the corresponding last station in the net. This resistor is permanently soldered to the LX control deck; if VIDEOMED DI is the last station in the net, jumper X20 must be plugged to D5 XCS interface. In the SIRESKOP CX spotfilm device, it is terminated on D3 with the help of JP1.

Defective cables also lead to interference in the transmission of data; e.g. if the lines Phase A and Phase B are switched at one connector.

Bad connections and contact resistances also lead to interferences in the XCS.

Order of XCS-Stations

The following list shows the number of stations at the XCS for systems chosen. The order of the stations also corresponds to the cabling.

- A KK-system has three stations:

  operating desk, D100 generator control, and D200 system controller
- SIRESKOP CX has six stations:

  operating desk, D100 generator control, D200 system controller, VIDEOMED DI, SIRESKOP CX basic unit and SIRESKOP CX spotfilm device..
- SIRESKOP CX System 4 has seven stations:

  operating desk, D100 generator control, D200 system controller, VIDEOMED DI, MULTIX CX, SIRESKOP CX basic unit and SIRESKOP CX spotfilm device

- SIREGRAPH CF has four stations:
  operating desk, D100 generator control, D200 system controller, VIDEOMED DI,

Introduction

The service SW is subject to continuous change. New functions are added and others are not used any more. Furthermore, this service SW is also used for the POLYDOROS SX 65/80. This means there is a universality which is not necessary for the LX-generators.

The following explanations refer to SW version VC00C.

Each SW version could also be used in an offline mode. This means it is possible to make yourself familiar with the new functions.

For new SW versions, see Online Help!

System: Connect

The service PC is connected with the system and the required interface parameters are entered via this command.

Com1 and **19200 Baud** are offered as default settings. Modified settings (including the user name) are stored for the next session.

NOTE	**If you use COM 2!** **- Some applications started from the service PC do not use the setting, but carry out an automatic interface selection as soon as they are selected with the Components menu.** **- If your mouse is connected to Com1, a system failure may occur.** **- In this case, switch the Com1 and Com2 interfaces.** **- If this is not possible, disconnect the mouse and use only the ALT keys.** **- However, when this is done, no mouse pointer appears and functions that are linked to the mouse pointer such as the hour glass are not possible.**

If the ID Codes or the real-time clock are to be modified, perform only **connect**. These parameters are needed for internal confirmation of the variable password, they cannot be modified while the password-protected login is active.

System: Logon

Logon is necessary to carry out the download and the service on the components. The password is displayed after selecting the LOGON command.

LOGON

With Logon, authorization to carry out service on this system is confirmed; logon is carried out only if a valid password is set in the system.

After logon has been completed, the system can display a window with the prompt to carry out a backup. This is the case if configurations, settings or organ programs have been changed (by the user) since the last service call.

CANCEL

No connection is made, but the help texts can be selected. (Select a menu, then press F1).

System: Logoff

Logoff terminates the connection to the X-ray system without stopping this application in the Service PC. For reconnection, select CONNECT/LOGIN in the system menu.

Logoff causes a window to appear in which the reason for the service call must be entered (it is mandatory to enter at least one character). This remark can be then recalled during a later service call in the menu: Info: Service Data.

System: Real time Clock

Display and modification of the real time clock in the system

In order to set the clock time in the system controller, only **CONNECT** but not **LOGIN** may have been performed. If the clock time has already been called up or set during a previous session, the clock time option can only be reselected after complete termination (QUIT command in the system menu) and a restart of the service program.

- Click the XCS service ICON.
- Enter the user name and the group authorization code (e.g. poly lx) in the Service PC window: USER IDENTIFICATION.
- Select the OK Button.
- Do not click on the default LOGIN but **only CONNECT** in the system window TERMINAL SETTINGS AND CONNECT.
- Select the REALTIME CL option under SYSTEM.
- The window displays the time and date of the system controller.
- Select the GET FROM DOS button to transfer the clock time of the Service PC into the appropriate fields. As an alternative, the individual fields can also be set using the mouse or by entering numbers on the keyboard.

  When you enter the date, note the following:

  - You can select any arbitrary future date. However
  - You can only back-date within a range of 47 hours
- Select Put to Unit to set the clock time in the system controller.
- Select the LOGON option in the SYSTEM menu and confirm the password window with OK to continue with the system service.

System: ID-Codes

Display and modification of the password-relevant ID codes (serial number, product ID) of the system.

In order to set the ID codes in the system controller, **only CONNECT** but **not LOGIN** may have been performed. The entries of this dialog box are used to generate the variable password. While the Host ID of the system is only displayed but can not be modified, the two other numbers, i.e., the serial number and the product type must be entered specifically.

System: Quit

After selecting **Quit**, a window is displayed where the service engineer can enter his service reason (at least one character is mandatory). This comment can be recalled during a subsequent service call using Info: Service Data.

The **Cancel** button is only active if the X-ray system has been switched off or if the connection to the service PC has been interrupted before the service PC has been able to logoff.

Configure: Site Structure: Site Selection

Selection of the type of system that is to be configured

SIRESKOP CX:	Configuration of the Sireskop CX System.
UROSKOP D1:	Configuration of the Uroskop D1 System.
MULTILINE:	Configuration of the Multiline System
KK-SYSTEM:	Configuration of the KK-cable system

Under normal circumstances, the system does not offer this menu because the system has already been set to these parameters at the factory.

However, if you still want to change the type of system, the EEPROM must be first erased (use ERASE EEPROM in the data menu)

Configure: Site Structure: Component Selection

Use Component Selection to configure the particular systems offered by the Site Selection.

Include

Including a component offered in the current configuration. When including components that are equipped with a Edit or Option function, the Option or Edit window is automatically displayed.

Do Not include

Excluding a configured component from the current configuration.

NOTE	**When excluding or including a component, its functions, such as adjustment and alignment data are replaced by default values. Excluding and including the generator experimentally, for example, leads to the fact that not only its own data but also the tube(s) must be newly set.**

Deletion of specified functions only becomes effective when the configuration is stored in the system controller at the end of the configuration procedure!

If you interrupt before this, no damage will be caused by excluding and including components.

Edit

The features of the system components can be configured with the Edit key (e.g. catapult Bucky, tomo, Bucky wall stand or bed exposure without the grid). In addition, the tomo times are entered under Edit (tomo settings).

Option

Options can be modified with the Options key. Unlike Edit, options are expansions to a component which must be individually purchased by the user (e.g. fluoroscopy or power for the Polydoros LX). Observe option enable security measures!

List

Indicates an overview of all configured systems. If a Windows standard printer is configured, the overview can be printed out.

Systems and their Components

SIRESKOP CX

- SIRESKOP CX (basic unit) with the Bucky unit option (=Bucky)
- POLYDOROS LX with options: fluoroscopy and 30 kW or 50 kW maximum power
- PLX desk (generator console, LX console (LCD) and SX console (Touch Screen))
- VIDEOMED DI (digital video camera)
- BD_CX (SIRESKOP CX floor-ceiling stand)
- BD_CX TOMO (tomographic stand, may only be selected alternatively to BD_CX)
- BWS, Bucky wall stand
- KK Exposure unit, an exposure such as Bucky wall stand, MULTIX, VERTIX, tomographic stand etc., that communicates with the generator based on KK. Requires the option KK-PROM on the D200 in the POLYDOROS LX generator as well as the D290 or D291 hardware KK-interface.
- Printer (printer connectable serially to XCU, if J44 is configured on D200. These features can be set when the EDIT key is pressed (Baud rate, parity).

Requirement components for this are:

- SIRESKOP CX
- POLYDOROS LX
- PL X Desk
- VIDEOMED DI.

The other components are optional, but BD-CX and BD-CX Tomo are mutually exclusive.

UROSKOP D1

The UROSKOP of the new generation, with POLYDOROS LX (not to be mistaken with UROSKOP D2, D3 or Uromat) consists of the following components:

- UROSKOP D (unit)
- POLYDOROS LX with the options of fluoroscopy and maximum power of 30 or 50 kW
- VIDEOMED DI (digital video camera)
- Printer (printer connectable serially to XCU, if D201 and J44 are configured on the D200. These features can be set by selecting the EDIT key (Baud rate, parity)

All components are required components, except for the printer.

MULTILINE

MULTILINE (Litho system) includes the following components:

- MULTILINE (unit)
- POLYDOROS LX with the options of fluoroscopy and 30 or 50 kW maximum power
- VIDEOMED DI (digital camera)

- Printer (printer serial connectable to XCU, if J44 on D200 is present, can also be used as data interface. These functions can be set by selecting the EDIT key (Baud rate, parity).

All components are required components, except for the printer.

KK SYSTEM

KK systems communicate via hardware cables whereby a separate cable is provided for each signal. Note the variety of control systems for the exposure and the dose rate.

Unit:

A distinction is made during configuration according to fluoroscopy units (divided into **KK UT Fluoro** and **KK-OT-Fluoro**) and pure **exposure units.**

KK OT Fluoro Unit

An overtable fluoroscopic unit at which the following applications can be selected in addition to the catapult Bucky cabinet, which is automatically included:

TOMO (tomography)

NOTE	**A tomographic system must always be positioned directly after its parent system (in the scroll box, system selection).** **The parent system is the system that is equipped with the same tube and the same image receptor and with the same unit as the tomographic unit.** **If this is not the case, the system selection at the SX operating console does not function (Adjustable with Change Order in the menu: Configure: Site Structure: Edit System**

BWS (Bucky wall stand) and

Bed (bedside exposures)

KK UT Fluoro Unit

An undertable fluoroscopy unit. Depending on the mechanical installation of the tube assembly, the tomographic system or bed system cannot be selected. Thus, no selection can be made here. Only the spotfilm device is supported. For tubes that can be pivoted (e.g. towards a BWS), an additional exposure unit must be configured for the same tube assembly.

KK Exposure Unit 1 - 3

Each of these units is a system with a tube assembly which, however, cannot apply fluoroscopy in this system. The following units or applications can be configured for each of these systems:

KRL (Catapult Bucky)

TOMO (tomography)

NOTE	**A tomographic system must always be positioned directly after its parent system (in the scroll box, system selection).** **The parent system is the system that is equipped with the same tube and the same image receptor and with the same unit as the tomographic unit.** **If this is not the case, the system selection on the SX operating console does not function (Adjustable with Change Order in the menu: Configure: Site Structure: Edit System**

BWS (Bucky wall stand) and

Bed (bedside exposures)

DLR Id-Console (DIGISCAN 2T lung work station, only with KK Exposure Unit 1).

NOTE	**POLYDOROS LX has a max. of two tube assemblies, thus only two exposure units are permissible.**

The other components are:

- VIDEOMED DI (currently only in KK systems for SIREGRAPH CF)
- POLYDOROS LX generator with the fluoroscopy and 30 or 50 kW max. power options
- Desk PL X (generator console, LX console (LCD) and SX console (Touch Screen))
- Printer (printer connectable serially to XCU, if D201 and J44 are configured on the D200. can also be used as data interface. Select the EDIT key to set these functions (Baud rate, parity).

Required components are:

- POLYDOROS LX
- PL X Desk
- At least one KK Fluoro Unit or a KK Exposure Unit, in which at least KRL, TOMO, BWS or bedside is selected. Also note that only one unit per connector of the KK system can be configured and that the POLYDOROS LX can be equipped with max. of two tube assemblies.

Configure: Site Structure: Edit System

System Selection

Selection of the system to be edited. The sequence for the console display can be changed with **change order**.

Displayed System Name

Enter the unit name for the display on the operating console.

NOTE	**Name must not exceed 20 characters (including any following blanks), only 10 characters per line. Do not use special characters.**

Default System

If a check mark has been made here, the X-ray system wakes up with this system after switching on.

Fluoro available

Display field, indicates whether this system can apply **fluoroscopy**. If it is not check marked, it could mean either that no fluoro option has been made at the generator during Component Selection or that the system is an exposure-only system, e.g. Bucky wall stand, bed etc.

KK-Option

Unit number, KK1b connector, to which the unit is connected.

Exposure Release from Unit

Check mark for exposure release from the unit.

Iontomat selection from Unit

Check mark for Iontomat measuring field selection from the unit.

Tube type

Selection of type of tube assembly.

NOTE	**Selecting a tube assembly replaces the tube setting with default values if the configuration data are stored in the system controller at the end of the configuration procedure. Stator type: note 2-phase, 3-phase.**

Tube

Selection of slot of the HV transformer to which tube unit is connected WS1, WS2.

High Voltage

Max. high voltage for the tube, limits the exposure kV to this value. Fluoro kV's are not affected by this, they are limited by the setting of the max. skin dose rate (selectable under COMPONENTS: POLYDOROS LX generator setting).

Available Focus

Indicates the focal spots of the tube.

Detector type

Selection of the X-ray detector for the dose control during exposure. Each system (spot-film device, Bucky wall stand ...) can be assigned a detector, provided that there is still a free connection channel on the generator (bedside exposures are normally not equipped with a detector). The setting "no detector" (no chamber) is also possible.

Channel

Connection channel of the Iontomat detector.

Configure: Site Structure: Fluoro Details

This window is generated only if a fluoroscopy unit is configured. If it does not appear, the reason can be, e.g. that with the POLYDOROS LX, the fluoroscopy option is not enabled (see Component Selection).

Tube Focus

Selection of fluoroscopic focus.

Detector Type

Selection of the light detector for dose rate control (SDM, B-Signal, Multiplier ....). For VIDEOMED DI, this field cannot be selected but is preset with B-Signal CCD. A,B,C,D,E,F indicate the connection channel for the fluoroscopy dose rate control. Only channels that are not allocated with an Iontomat detector in the previous menu can be selected.

Image Intensifier

Scroll box for the selection of the type of image intensifier When clicked on, the default values are set in Dose Ratio.

Dose Ratio

With POLYDOROS LX, there is only informative display of the dose rate conditions for the different zoom stages. With POLYDOROS SX, these values can be changed for "dose saving" zoom.

Fluoro Program

Program number, usually two program buttons (Automatic 1 and 2, except for SIRESKOP CX) to set which fluoro program can be activated at which button on the unit. It is also possible to allocate the same program to both buttons.

Curve Name

Name of the fluoro curve, at the moment only 4 available. Depending on the dose, the fluoro curve determines the relationship between fluoro current and fluoro voltage.

Available are:

- Antiisowatt: normal curve with 4.1 mA max. tube current
- Dose-reduced: low-dose curve with 4.1 mA max. tube current

- Litho contrast: contrast curve with 4.1 mA max tube current
- Litho 63 kV: contrast curve with over 4.1 mA max tube current

Normal Fluoro

Other fluoro types (high contrast and pulsed fluoro) are not supported with POLYDOROS LX.

Dose rate

Entry of desired dose rate.

Back

Back to previous selection.

OK

Continue with next selection.

Cancel

Quit configuration without saving the changes.

LIST

Indicates an overview of the fluoroscopy parameters that can also be printed.

Configure: Site Structure: Site Adjustments

Control console

The setting determines whether the exposure kV and mAs are modified in steps of 0.5 or in whole exposure points.

Screen sensitivity

Displays the screen sensitivity class (supported only by the SIRESKOP SX console display).

Format dependent Correction (“CONE correction”):

Determines by how many exposure points the automatic exposure control is controlled brighter if the collimator is closed beyond a certain point or if the cone is retracted.

Site options

Selection of the **ORGAN PROGRAM** option is present and loading of the **Default Organ program**.

Observe the option protection!

Fluoros Time Setting

The first time indicates how many minutes the buzzer sounds after fluoroscopy is switched on. The standard value is 4.5 minutes, except for Great Britain: 9.5 minutes (can be disabled by setting a time longer than 99 minutes).

The second time indicates after how many minutes of fluoroscopy since the last reset there is an automatic switch-off of fluoroscopy. The standard value is 5 minutes, except for Great Britain: 10 minutes (can be disabled by setting a time longer than 99 minutes.

The third value indicates after how many minutes fluoroscopy is switched off despite resetting the buzzer, standard value: 60 minutes.

NOTE	**If these time values are modified, it must be approved by an acceptance authority (TÜV, DHHS, CSA ....)**

Storing the Configuration Data

After completing the Site Adjustments, a request is made about whether the configuration data are to be stored in the XCU and on the system diskette. With confirmation (OK), first the system file with the name **struct.dat** is placed in the root directory of the system diskette (designated as backup disk). Then the save of the configuration is made in the XCU.

To be noted: If a second save routine is carried out, a subdirectory **backup** is automatically saved and the old struct.dat file, given a sequential number, is moved into the sub-directory. If there are other saves, the same thing happens. If ten struct.dat files are in the backup directory, the oldest struct.dat file (with the lowest number) is overwritten with the next save routine. For this reason, it is recommended not to use the backup disk generated at the factory, but a copy of it.

Configure: Organ Program

Display, modify, insert, delete, sort and copy organ programs.

Enabling the **organ programs** option as well as the specification of **Default Organ programs** is not performed here, but under **Site Structure**.

General Remarks

An organ program is the summary of certain exposure parameters of a data record which can simply be selected by the customer using a button. Organ programs are organized according to **system** and **region**. The exposure system selected on the generator is defined as a system, e.g. tomography, MULTIX, VERTIX, SIRESKOP CX ..... A maximum of 25 organ programs can be specified per system but a max. of 125 organ programs is supported in the system. A region serves as a summary of several organ programs to a superior unit (e.g. head region, lower extremities region, chest region, upper extremities region ...). A maximum of 20 (however only 5 are usual) organ programs are supported per region.

Touch Screen console (SX console)

The obligatory value for a console with touchscreen (SX console) is 5 organs per region,

LCD console (LX console)

With the touch keyboard, only one region that includes all organs is supported with SW version VA00C on the D230. SW versions with a higher index support several regions.

Option protection

Requirements: To assure the function of the organ programming, under Configure: Site Structure in the Site Adjustments menu, under Site Options, 12 regions/ 20 organ programs must be set. Otherwise, the option is not enabled. This option can be canceled at any time by setting this option to "not available" in this menu.

Default Organ Programme

Default Organ programs are supplied for the different system types. For the setting of these programs, select the option protection. To do so, cancel the organ programming 12 regions/ 20 organ programs - if it is set - once in the menu Configure: Site Structure in the menu Site Adjustments under Site options. Reactivate this option. Answer the subsequent question 'Load Default Organ Programs' with '**YES'** Any previously programmed organ programs are overwritten.

The default organ programs are available for tomography, fluoroscopic and BWS/Bucky systems, but not for bedside exposure.

Organ Programming

When the organ option is available, the organ programs can be entered under Configure: Organ Programs. Explanations:

System

Selection of the appropriate system (Bucky wall stand, Bucky, tomography, Sireskop ...) for which the organ programs must be entered. Selection is made directly via the selection in the scroll box. The system names cannot be modified here; this can only be done in the CONFIGURE menu.

Region

Selection of the region (on the touch screen operating console, a region is one of the 5 lines in which organ programs are to be programmed). The scrollbox offers every currently known region of the system. New regions can be added with **ADD Region**. Although the name of the region can visually and directly be modified in this scrollbox, this does not have any effect on the system. In order to change the name, enter it in the **Displayed Region Name field**.

NOTE

A region always applies globally for all system units of a system as a whole, deleting or adding in a system affects all other systems! If you, for example, delete the second region in the Multix system, it is also deleted in the Sireskop system.

Displayed Region Name

Display and modification of the **name of the affected region**. At the moment, this is not supported in any operation. Displayed name may not exceed 20 characters (2 x 10).

Add Region

Adding a new region (for touchscreen console only) and LX console beginning with version VA00D.

Del Region

Deletes the region, including all organ programs.

Organ

Selection of the organ program to be programmed. The scroll box offers all known organ program for this region. New programs can be added with ADD Organ. Although the name of the organ program can be directly modified visually in this scroll box, it has no effect on the system. To change the name, the Displayed Organ Name is needed.

Displayed Organ Name

Display and change of the particular organ program. Entry of max. 20 characters (2x10).

Add Organ

Adds a new organ program (maximum is 20 in one region!), 5 programs are necessary for touchscreen consoles.

Del Organ

Deletes the particular organ program

Organ Data

Edit the data of the particular organ program as follows:

- Technique (3-point, 2-point, 1-point...)
- kV, mAs, ms
- Max. available generator power (80% / 100%)
- Focus (small, large)
- Iontomat measuring field (MF, L=left, M=middle, R=right)
- Screen type = screen sensitivity and resolution (H=High Speed, U=Universal, D=Detail)
- Density correction

If certain fields are not selectable, this is due to the exposure technique or the configuration of the system. For example, ms cannot be selected with a 2-point technique.

Import

Not implemented (instead use **Data: Restore** and select the organ programs option in the following menu item).

List Organs

Lists of all organ programs in all systems and regions with a short list of their data. The data can also be printed via Print if a standard printer is installed under Windows.

Save Data

Saves the configuration in the system and on the floppy disk. If no floppy is inserted, use OK to enable a further write access; the writing procedure on the floppy disk is halted with Cancel and the data are only stored in the system. If the floppy is from another system, a message that the system type or the Host-ID is not correct is displayed. Saving can still be continued. The data of the current system are stored.

Sort & Copy

Modifies sort order and region definition of organ programs and copies organ program from other systems and regions in the currently selected system.

Explanations:

- **List of System**

  Name of the system currently indicated in the list.
- **Organ**

  Organ name
- **Region name**

  Region to which the particular organ program belongs

Change Sort Order

Use up to shift the organ program currently highlighted up one level, use down for downwards movement. Shifting beyond a region"s definition (change of region) is not possible (see Chg. Region). As soon as a Multiselect (several organ programs selected at the same time) is performed, Change Sort Order is not possible.

Chg Region

Changes the region of an organ program, thus the line for the SX operating console can be changed. A Multiselect is also possible (Multiselect: Select the first and the last organ to be shifted using the mouse and keeping the SHIFT button depressed; these and all organs in between are selected. Or use the CTRL button instead of the SHIFT button; then only the ones selected with the mouse but not those in between are selected).

Enable Copy

Copying of organ programs is enabled.

from System

from which system the organ programs are copied, the system itself is selected in the scroll box.

to System

display of the system that should contain the organ programs (selected in the previous window).

Select All

all organ programs are selected.

Deselect all

all organ programs are deselected.

Copy Organ

the organ programs selected (Multiselect is possible) are copied in the system that is displayed under "to system". An error message is displayed if the maximum of 20 organs is exceeded.

Messages:

- If copying is performed between systems with e.g. different operating modes (e.g. source system is tomography, target system is not a tomographic unit), the message: **“Copying not possible”**
- If copying is performed between systems that have not an Iontomat in their target but in their source, the following message is displayed: **“For Organ "NAME" copying not possible. You get default values for data”**.

List Organs

Lists of all organ programs in all systems and regions with a short list of their data.

Print

prints the data if a standard printer is installed under Windows.

Print to file

stores the organ data as a readable ascii file.

DATA

or double clicking an indicated organ program opens the data window. There you can modify the name and data but not the region. Changing regions Chg Region and modifying the sort order Change Sort Order can be performed in Sort & Copy.

Edit Remote Programm

Generation of the organ programs for the remote program selection.

Data: Download to Unit

With the download procedure, the software or the firmware is loaded in the corresponding component and is stored there in Flash-PROM´s. At the moment, only two downloadable components are available: the system controller (XCU) and the filament heating circuit.

The download code can be found in hex format on a floppy disk named Download disk.

General Data on Flash PROM's

The Flash PROM´s are equipped with memory locations similar to the EEPROM´s. Whereas for EEPROM´s, individual memory locations can be deleted and newly written, the Flash PROM"s can only be deleted and loaded as a whole. Thus they are used as storage for the program code in the same way as EPROM´s, with the advantage that no EPROM´s need to be replaced for upgrading to a newer software version.

System parameters such as configuration and settings are stored in the EEPROM's.

When is a download necessary?

Basically, the download is carried out in the factory. A download becomes necessary only if the system is to be upgraded to a newer software version or if the system controller has been replaced. An upgrading of the software may also require the replacement of the EPROM´s with the boot software.

Deleting the EEPROM´s with Data: Erase EEprom does not require a download!

A download of filament heating is necessary after replacing the D220 filament board, or if the filament firmware is destroyed (red LED on D220 blinks).

Backup of the configuration data

During a software upgrading it may occur that also the configuration and adjustment data in the EEPROM´s are deleted. Thus, Data:Backup is necessary prior to the upgrade. The Backup file is restored in the EEPROM´s after the download with Data:Restore. This makes a complicated reconfiguration and adjustment of the whole system unnecessary.

The Download Procedure

- Select download in the DATA menu.
- Select the component to be loaded.
- If no backup has been performed prior to the download, the system asks the XCU during downloading whether you wish to carry out a backup.
- The file manager window with the file convention of the component is displayed.
- Select a drive and directory with the download file.
- Press **OK**
- An error message is displayed if the file size does not fit to the component.
- Press START
- The Flash-Proms are deleted (see also: Erase Flash Prom for Download). A bar is displayed with the file names, component names and file size.
- The download starts automatically afterwards and the bar display fills up slowly. The download speed is approx. 30 - 40 kByte/minute.

- After the download, the checksum of the code is calculated and stored. Then the system is reset automatically (see also: Building Checksum after Download).
- Reset interrupts the connection to the service PC because the system is now not able to communicate with the service PC.
- Another bar fills up. The reset is then completely performed when this bar is filled up completely (see also: Reset Unit after Download).
- A window on the service PC indicates that the download has been successful and displays a prompt to switch off the system.
- Now press CANCEL in the download menu and confirm the logoff window that appears.
- Now you can log in again with CONNECT/LOGIN as soon as the system is switched on.

Erase FLASH PROM for Download

Before a new code can be loaded, the Flash PROM's must first be deleted. This procedure lasts up to 5 minutes because a memory location in FLASH may require up to 100 attempts until **it is really deleted**.

Creating checksum after download

After the download is terminated, the checksum is created and stored in the XCU. This takes up to 11 minutes. Then, the system tries a reset to activate the newly loaded software. Do not switch off the service PC or the system during the creation of the checksum and the reset. Otherwise, the system no longer has a valid code loaded.

Reset unit after download

The system loses the connection to the service PC when the system is reset. In order to give the user a feeling when he/she may switch off the system, a reset timer, which fills a bar display, is started independently from the system. Afterwards, a message is displayed that the download has been successful.

Errors that may occur during the download

Timeout:

The data blocks from the service PC are not confirmed by the XCU anymore. Check the service cable and try a new download.

Code:

The internal checksum in the download file is invalid. In this case, your floppy disk is probably damaged.

Programming Error:

It was impossible to program the Flash PROM within the normal time. Due to the fact that Flash PROMs can perform a kind of self-repair, the file can possibly still be loaded by attempting a download several times.

Data: Restore from disk

The data of the backup floppy are restored to the system controller with a Restore. This procedure can be combined in an existing configuration even if the configuration data have been deleted with ERASE EEPROM. Restore "restores" the following data: configuration data (tube type, I.I., unit, camera, fluoro curve ...), private data (Polydoros LX), organ programs, customer data (hospital name, Speed Info, service data).

Restore can not save the variable password and the ERROR.LOGS. Physically, these can be found in the NOV-RAM region and not in EEPROM and can thus be not saved.

If there already exists a configuration on the system controller, then only parts of the system configuration can be restored, e.g. adjustment data of a component or organ programs. See Select Restore Data.

Selecting Restore

Insert backup floppy of the system in drive A:. Select Restore option under DATA. A safety inquiry is displayed. Confirm safety inquiry. Restore transmits the data into the XCU. The number of data blocks is incremented in two sections. The following message is displayed at the end: RESTORE WAS SUCCESSFUL.

Restore Messages

If no floppy has been inserted, a request is displayed; this is also the case if the connection between service PC and XCU fails during the transfer.

Host ID Check

The struct.dat file is checked to see if it fits the existing system: This is made by comparing the Host ID stored on the floppy and the one present in the system. This prevents data from another system from being transferred into the present one accidentally. However, if the customer wishes to copy configuration and adjustment data from another system, this protection can be overwritten with an appropriate response.

System Type Check

If another system has been set on the system floppy, e.g. Sireskop CX instead of KK system, a message is also displayed which, however, can also be ignored here.

Select Restore Data

After selecting the Restore menu item, a selection appears indicating which data should be stored from the current backup in the XCU provided that a configuration has already been carried out in the system. If the configuration of the system is empty (ERASE EEPROM), the whole site is always offered as default value.

The following options can be selected:

Whole Site: The whole system file with all components, options and adjustment values is stored from the backup disk into the XCU.

Single Component: In the adjacent selection box, all components are listed which are configured in the stored system on the backup floppy and also in the Site. By the selection of a component, all configuration data, options and adjustment data are replaced in the XCU by those on the backup floppy.

Organ Programs: In a scroll box all systems are listed that are configured in the stored system on the backup floppy and in the XCU. Either the organ programs of a particular system or of all listed systems in the XCU can be replaced by those on the backup floppy.

Data: Restore old from Disk

With this option, which is available under DATA, older configurations can be restored from the disk in the XCU. Reason: If an error has been made during a configuration and the system does not function anymore for unknown reasons, everything can be undone using this option.

After confirming that you really wish to perform Restore old from Disk, the service PC starts receiving the current configuration of the XCU. Then all old configurations available on the inserted disk are displayed. They are arranged according to date. The index is designated with negative numbers. The lower (more negative) the number is, the older the corresponding configuration file. Use SELECT to choose one of the files, then this file is loaded into the system controller.

The current backup file of the configuration is not affected by this procedure. If the procedure has been successful and the system functions again, the DATA BACKUP command must be performed to update the default backup file to this status. If a backup is not performed after a Restore old from Disk, the incorrect configuration that was active before RESTORE OLD FROM DISK is again created if any subsequently necessary restore is carried out.

Data: Backup

Backup copies the contents of the EEPROM´s of the XCU on a floppy disk in the service PC. These are the configuration data of the XCU and all data and settings of the connected components (Polydoros LX, Videomed DI, Sireskop CX...). For a system configuration - new configuration or modification - a backup is automatically made on a disk. This backup can also be ignored if the user does not insert a disk and exits the subsequently displayed message with Cancel.

Selecting from Backup

Insert backup disk in drive A: (usually take the backup disk used for the configuration. You can also use any formatted disk). Select the backup option under DATA. Confirm safety inquiry. Backup takes the data from the XCU. The number of data blocks is counted up in two sections.

The message: BACKUP WAS SUCCESSFUL is displayed at the end.

Automatic Selection to Backup

If data have been modified, e.g. names of hospitals, organ data, adjustment values of the generator or the unit, the backup bit is set in the XCU. If this bit is set, the user is informed after the login with the message: "Actual Data has been changed, you should backup your data" that his/her backup floppy does no (longer) corresponds to the current setting in the XCU. After performing this backup command, the bit is reset and the message does not appear at the following login.

Organization of the Backup Floppy Disk

The backup file has the name struct.dat and is saved by the backup in the root directory as a default file. If a second backup is carried out, backup creates the backup subdirectory and overwrites the struct.dat file (given a sequential number) from the root directory to the subdirectory. The new backup data are then saved again in the root directory under struct.dat.

To be noted: If there are ten struct.dat files in the backup directory, the oldest struct.dat file (the one with the lowest number) is overwritten the next time backup is carried out. For this reason, it is recommended that the backup disk from the factory not be used, but a copy of it.

Restore always saves the struct.dat file from the root directory back into the XCU; on the other hand, Restore old from Disk offers the struct.dat files from the Backup directory for selection (see also Restore old from Disk).

Backup Messages

drive a: not ready

This message is displayed after the regeneration of the data. Use Cancel to abort the entire procedure, reattempt to write with OK. Insert a floppy and carry out the backup with OK.

Cannot write on Sitedatafloppy. Write protection

This message is displayed after the regeneration of the data. Use Cancel to halt the entire procedure, try again to write with OK. Insert a write-protected floppy and carry out the backup with OK.

There must be at least 150 kB available

This message is displayed if at least 150 kB are not available on the floppy.

Different Host IDs in XCU and Site Data Floppy

If the struct.dat file already exists on the floppy, it is checked by comparing the Host ID whether it fits to the present system. This prevents data of another system being transferred into the present one accidentally. However, f the customer wishes to copy configuration and adjustment data of another system, this protection can be overwritten with the appropriate response.

Different Site types configured in XCU and Site Data Floppy

If another system is set on the system floppy, e.g. SIRESKOP CX instead of KK-system, a warning message is also displayed but this message can be ignored here as well.

Data: Erase EEprom

The Erase EEprom option, which can be selected under DATA, deletes all settings and configurations in the system controller. Subsequently a new configuration or a RESTORE of the whole system configuration must be carried out. Erase EEprom takes approx. 1 - 2 minutes. During the delete routine, the decimal point on the display of the D200 does not blink for a short time. When it starts blinking again, the display must indicate 20 instead of 00. The bar display indicates the procedure of Erase EEprom. After completing Erase EEprom, many menu items, which are based on a valid configuration, indicate error messages.

Data: Priv POLYDOROS LX

NOTE	**This menu point is eliminated beginning with XCS SSW VC00C.** **Instead, select in the Configure menu: Site Structure: Option Selection POLYDOROS LX. Observe security for the options!**

In this menu, generator data based on power requirement (private data) are loaded into the XCU. This menu item must in any case be performed after a new configuration of the system. New configuration means: Erase EEprom has been performed and the configuration has not been transferred with a complete Restore but was newly configured.

Private data has been loaded if the message: 3 blocks transmitted is displayed.

NOTE	**This menu item must not be reselected after the generator has been adjusted because the loading of the private data overwrites or destroys adjustments previously performed in any case.** **If the Private Data are not downloaded after a reconfiguration, the status display remains at 3 on the D100.** **(download of the "Init Data" could not be completed).**

Diagnostic: Error Log

The system controller stores errors occurred in the system in a ring memory. That means, when the maximum number of storable errors is reached, the oldest entry is overwritten with the next error occurring. For this reason, the list is not completely chronological. There is a gap in time between the oldest and the most current entry. Because the complete sort of the list requires a great deal of time, the most current entry is not at the top of the list.

The Error log only functions if the service PC is logged into the system controller (under the SYSTEM LOGIN menu bar).

Error Log: Get from Unit

Errors and warnings (each max. 50) contained in the error memory of the XCU are fetched from the system controller and indicated.

Error Log: Enviroment

If an error is selected, additional information (e.g. program address) is also displayed.

Error Log: load from file

Errors stored on the SERVICE-PC or on a floppy disk can be loaded in the ERROR LOG Tool with SAVE TO FILE and are indicated there.

Error Log: save to file

The currently displayed list is stored in a file, the file name should end with ERR. This file is readable only with the ERROR LOG TOOL. After selecting SAVE TO FILE, a file manager window is displayed which indicates the file name *.e**. After a directory and a drive (e.g. a: for diskette) have been selected, a character or a figure must be entered for the stars (*) to determine the file name for WINDOWS. A clear file name is: max. 8 characters (0 - 9, A-Z) before the dot and max. 3 characters after the dot.

Error Log: print error list

Prints the current list on the printer available under Windows. This only functions if a printer is connected and configured with Windows.

Error Log: print to file

If no printer is available, this command can be used to save the list as ASCII file which then can be printed and indicated on each standard PC via floppy.

Disadvantage: The file cannot be loaded back into the Error Log Tool.

After selecting PRINT TO FILE, a file manager window is displayed which indicates the file name error*.asc. After the directory and the drive (e.g. for a diskette) have been selected, a character or a figure must by all means be entered for the asterisk (*) to determine the file name for WINDOWS. A clear file name is: max. 8 characters (0 - 9, A-Z) before the point and max. 3 characters after the point.

Error Log: Delete in Unit

The error memory in the system controller is deleted.

Error Log: More Info

Not implemented

Filter in the Error Log

If an error list is available (from Get from Unit or Load from File), certain selection criteria can be determined with the filter.

Unit

Here it is decided, if only the errors of specified components should be indicated. Only those components can be selected which left an error in the error log list (or all).

Error Category

Determination of the error classification (warning, minor error, serious error, fatal error). (Organization into error categories is not always completely clear, as the example below shows).

Error Number

Determination of a certain error number, e.g. to determine the frequency. Error log lists the error numbers which are present in the currently loaded error list.

Exclude No.

Masks out an error number.

Since Data

Only displays errors which are newer than the set date.

Apply

Use this command to apply the filters to the list.

Example of an error entry

Date	Time	ID	Err No	M	Short text
16.02.96	16:24:07	080	R0402	N	heating current at min
12.03.96	11:40:46	080	R0604	N	ZK voltage below min
28.03.96	14:18:54	016	W0007	N	component turn off

ID: Number of function unit in which the error occurred

Err No: Error classification and number

Mode: Currently not active

Short text: Error short text

Pre-Heating

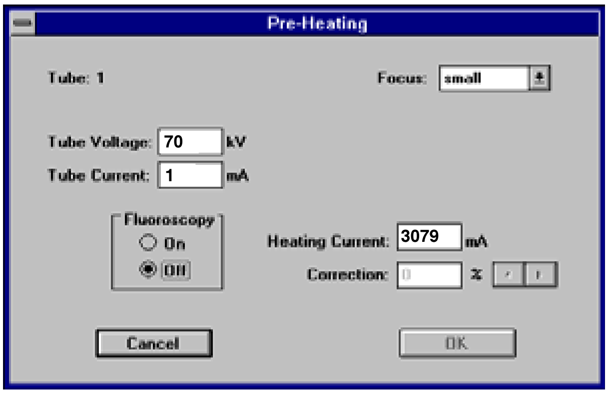


Fig. 37: Pre-heating for the “fluoroscopy” heatingfilament

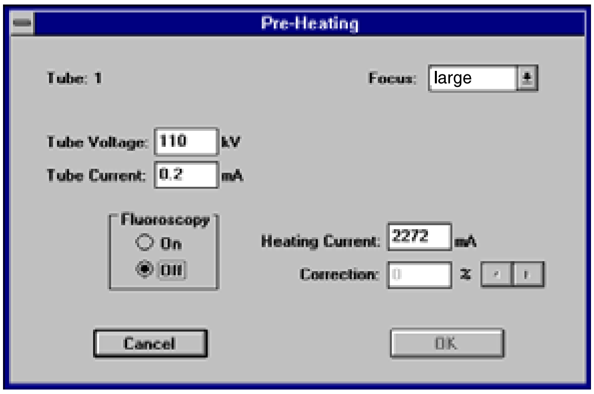


Fig. 38: Pre-heating for the “other” filament

Learn Filament Heating Circuit

The POLYDOROS LX generators are equipped with what is referred to as a "learn" filament circuit. This means: None of the previous customary settings of the potentiometer are necessary to adjust the preheating currents, exposure heating and the high filament (Pushing). The settings, or rather the calculation of the corrections required, are carried out by the microcontroller system of the D100 generator control.

Three menus are necessary for this:

- Pre-Heating;
- Learn Filament Correction (exposure heating);
- Learn Filament Pushcurrent (Pushing).

NOTE	**Prior to the filament settings, warm up the tube assembly in the Warm-up menu. The tube assembly to be set is also selected here.**

Pre-heating

In order to determine the pre-heating of the "**fluoroscopy**" filament, a tube voltage of 70 kV and a tube current of 1 mA are automatically set. The resulting filament current is measured automatically and is later used as the pre-heating current. However, if required, this pre-heating current can be changed by± 20%.

NOTE

The pre-heating value of the fluoroscopy filament is about 3000 mA with "OPTI" and "Rapid" tubes, with the Bixxx30/51 tube it is about 4500 mA.

For the pre-heating of the “**other**” filament, a current of 0.2 mA is set with a voltage of 110 kV. The filament current needed for this is reduced by 300 mA and thus represents the preheating current of this focus.

The reduction of the filament current by 300 mA ensures that the preheating remains under the emission limit.

The determined pre-heating current, however, can be changed by max. ± 20 %, if required.

NOTE

Typical value is about 2000 mA with "Opti" and "Rapid" tubes, and about 3000 mA with the Bixxx30/51 tube.

Iroe lUroe [kV] ----------------->

[mA]	40.0	50.0	63.0	**81.0**	109.0	150.0
1.0	3475.0	3472.7	3443.9	3444.6	3444.7	3440.0
5.0	3575.0	3563.6	3546.4	3540.1	3529.8	3520.0
10.0	3700.0	3677.3	3674.4	3659.5	3636.2	3620.0
20.0	3871.4	3857.1	3837.5	3826.3	3811.1	3800.0
32.0	4007.7	3981.8	3968.1	**3950.3**	3930.8	3914.3
50.0	4137.5	4123.5	4102.1	4083.6	4060.0	4035.3
71.0	4261.1	4236.4	4217.7	4198.4	4171.4	4143.5
100.0	4391.7	4357.7	4334.5	4310.8	4282.1	4253.3
120.0	4464.3	4429.0	4403.2	4374.4	4344.1	4316.2
140.0	4531.2	4493.5	4461.5	4431.9	4402.4	4370.3
160.0	4593.8	4547.4	4516.0	4485.2	4451.2	4419.1
180.0	4648.6	4600.0	4563.8	4530.7	4500.0	4461.7
200.0	4702.9	4646.5	4609.2	**4572.7**	4537.7	4503.6
250.0	4850.0	4758.7	4705.2	4661.4	4624.3	4594.5
300.0	5031.6	4863.3	4791.8	4739.4	4695.7	4594.5
350.0	5436.4	4968.1	4871.8	4811.9	4765.3	4594.5
400.0	5700.0	5097.2	4949.9	4883.3	4765.3	4594.5
450.0	5700.0	5275.0	5029.2	4950.9	4765.3	4594.5
500.0	5700.0	5453.6	5115.6	4950.9	4765.3	4594.5

Uroe [kV]	40.0	50.0	63.0	81.0	109.0	150.0
Iroemax [mA]	292.0	370.0	460.0	395.1	293.6	213.3

Fig. 39:

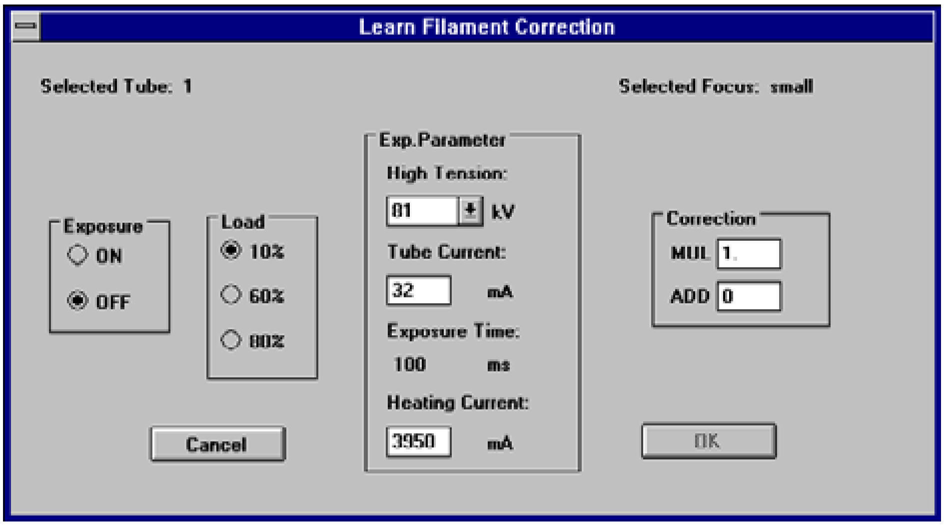


Fig. 40: Learn Filament Correction

The first window in the Learn Filament Correction menu before the first exposure.

The following is displayed:

- Selected tube assembly (selection in the Warm-up menu);
- Selected focus (selection in the Pre-heating menu);
- Scroll box for the selection of the kV column (preference value);
- 10% Iroemax and appropriate filament current (table value);
- MUL = 1, ADD = 0.

Exposure Heating

In order to determine the exposure heating values, the emission curves stored in the tube data are used. However, not every mA, kV combination can be found here. Where appropriate, the intermediate values are interpolated linearly.

The table shows the typical emission values of the Bi/xxx/30/52R tube, small focus (tube current as function of the filament current).

In order to calculate the filament current correction values one of the kV columns is used, here, 81 kV. Select two filament currents from the kV column and determine the correction values:

The first filament current corresponds to 10% of the max. tube current (or the following table value).

The second filament current corresponds to 60% (80%) of the max. tube current (or the following table value.

For the following first test exposure, the filament controller adjusts the first filament current (10%) from the table and an exposure is released by clicking the Exposure-on button.

The tube current that adjusts will differ from the expected tube current due to the pattern tolerance. Thus, in this (slightly idealized) example, not the expected 32 mA but 50 mA are measured. This means: for 50 mA tube current the filament current corresponds to I_H = 3950 mA uand not the table value of I_H = 4083 mA.

Nevertheless, to use the table a correction value is needed that converts the table value into the required filament current. This correction value is used for the entire table and it thus divided into a multiplicative (MUL) and an additive (ADD) part..

Thus the following relationship is determined after the first test exposure:

$I_{H1Korr} = I_{H1Tab}$ x MUL + ADD

I_{H1Korr} = first corrected filament current

I_{H1Tab} = first table value

3950 mA = 4083 mA x MUL + ADD

A second test exposure (measurement) is necessary to solve this equation with two unknown quantities.

For the second test exposure, the filament controller sets the second filament current from the table and the exposure is released by clicking the Exposure-on button. Here, the tube current also differs from the expected table value. In this example (again, slightly idealized), not the expected 200 mA but 300 mA are measured. This means: for 300 mA tube current, the filament current corresponds to I_H = 4572 mA and not the table value I_H = 4739 mA.

Thus second equation is determined as follows:

4572 mA = 4739 mA x MUL + ADD

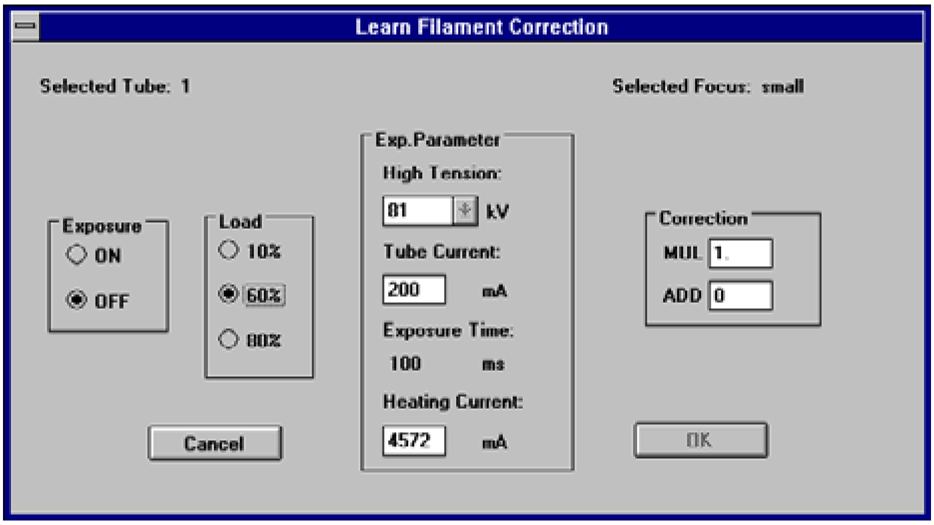


Fig. 41: Learn Filament Correction

After releasing the first exposure, the next window appears The parameters for the next exposure are displayed:

60% power and the corresponding filament current (table value).

60% power is automatically selected if a tube current of >= $1{,}2I_{roereq}$ has been measured in the first exposure.

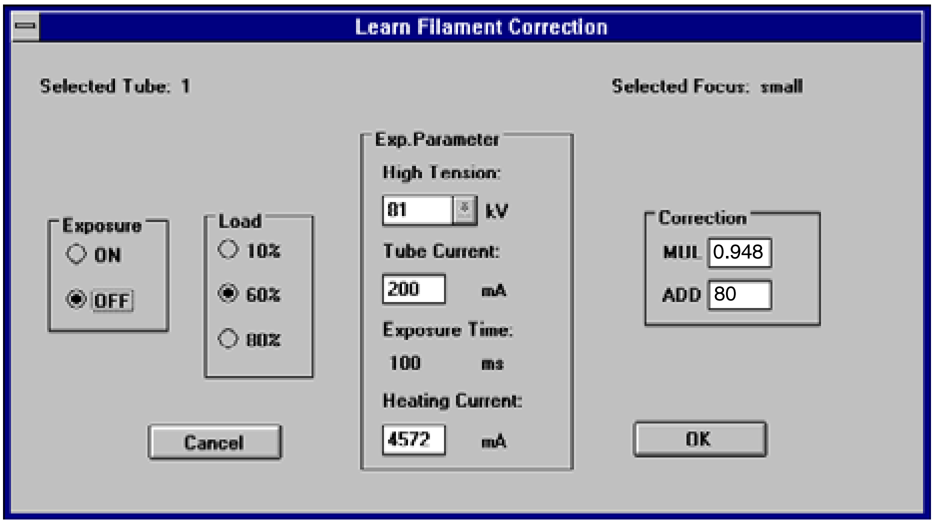


Fig. 42: Learn Filament Correction

After releasing the second exposure, the correction values MUL and ADD are displayed.

The equation system obtained this way with

1. 3950 mA = 4083 mA x MUL + ADD
2. 4572 mA = 4739 mA x MUL + ADD

is solved for MUL and ADD:

MUL = 0,948

ADD = 80 mA

NOTE

The effect on the heating current cannot be determined by observing the MUL and ADD values. Only application to a heating current shows the effect.

These correction values can now be used for the entire emission table with sufficient accuracy.

MUL and ADD are transferred to the XCU and stored there in EE-PROM when quitting the POLYDOROS LX Adjustment menu. Each time the generator is initialized, the generator settings, including MUL and ADD as well as the tube data, are transferred back to the D100 generator control as what are referred to as init data. If the exposure parameters have been modified, D100 only receives the modified parameters such as kV and mA etc. The filament currents from the emission tables and the subsequent correction with MUL and ADD are selected in the generator control.

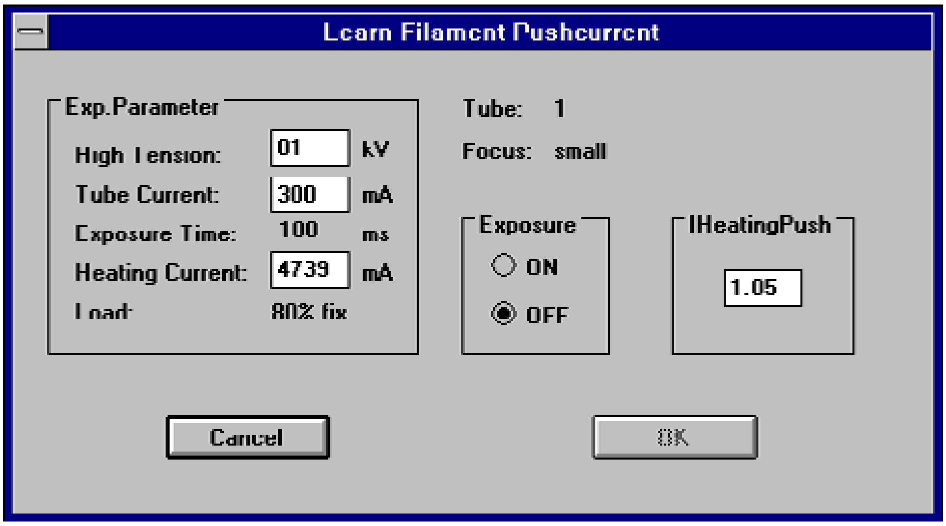


Fig. 43: Learn Filament Pushcurrent

This window appears when the Learn Filament Push Current menu is selected.

Pushing

The filament current controller of POLYDOROS LX generators has the same effect as a constant-current source. The result is a heat-up time that is too long. In order to shorten this time period, a higher current is used for approx. 0.5 s at the beginning of the exposure preparation (pushing). The factor necessary for this (push factor) is determined by a learn routine.

The exposure parameters are preset and cannot be modified. The push factor is set to 1.05. An exposure is released by clicking the Exposure-on button. The learn routine measures the tube current after the exposure has begun. If the tube current does not correspond to the required value, the push factor is modified and the next exposure is requested. Repeat this procedure until the tube current corresponds to the required value at the beginning of the exposure.

NOTE

A push factor of 1.08 is normally set for a heating filament which has been preheated for fluoroscopy (within the emission range). For a filament which has not been preheated for fluoroscopy, the push factor is generally between 1.13 and 1.19.

Restructuring of document and new layout.