SIEMENS

POLYDOROS SX 65/80

AX

Function Description

POLYDOROS SX

X2206

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General Notes

Manufacturer's Note

This document was originally written in German.

Generals

The new POLYDOROS SX 65 and POLYDOROS SX 80 X-ray generators are very versatile and are used in fluoroscopy systems and exposure stations. Containing the most modern generator technology, they are particularly suitable for systems with digital image display. The easy user interface appears on a touchscreen and allows quick and reliable selection of all exposure parameters.

The various exposure parameters are selected easily and quickly by means of multiprogramming (organ programs).

The IONTOMAT PN automatic exposure control is integrated into the generator and assures the correct density of every exposure. In addition, the voltage response of the screen is compensated.

Planigraphic exposures using the automatic exposure control are also possible with the PLANI-IONTOMAT PN.

Configuration

- The standard configuration of the POLYDOROS SX is comprised of the following elements:
  - Control console with 0-,1-,2- and 3-point techniques, operation from the touchscreen;
  - Power cabinet with high voltage generator;
  - Connection for 2 X-ray tubes;
  - IONTOMAT PN automatic exposure control;
  - PLANI-IONTOMAT PN;
  - 150 Hz starter unit;
  - Planigraphic function;
  - Tube load calculator.

Options

- Organ programs;
- Connection of a 3rd X-ray tube;
- SIRECON 2 connection for retrofits;
- KK interface to connect radiographic workstations.

Special Characteristics

High frequency with multi-pulse voltage form:

→ High data accuracy;

→ High reproducibility;

→ Quick control of high voltage and Tube current;

→ Brief exposure times;

→ Small equipment footprint;

continuously falling load with the 1-Point technique;

Briefest exposure time: 1 ms;

Time and mAs redisplay for the 1- and 3-Point techniques with IONTOMAT;

Programmed exposure technique (option)

Setting Techniques

0 Point Technique

Automatic derivation of exposure voltage from the fluoro data

1 Point Technique

Exposure contrast is adjusted by means of the plus and minus kV keys.

Optical density is corrected with the density adapter. The three film-screen combinations can be selected. Selection of several IONTOMAT measurement fields is possible.

2 Point Technique

Contrast and density are adjusted using the plus/minus kV and mAs keys. The time is displayed prior to the exposure.

3 Point Technique

This operating mode is used for special examinations (e.g. extended breathing exposures, foreground reduction exposures), whereby the exposure time is extended.

3 Point Technique with IONTOMAT

In this technique, the values set by the 3-point operation for mAs and time apply as maximum values. The values are displayed after the exposure has been made.

System wiring diagram

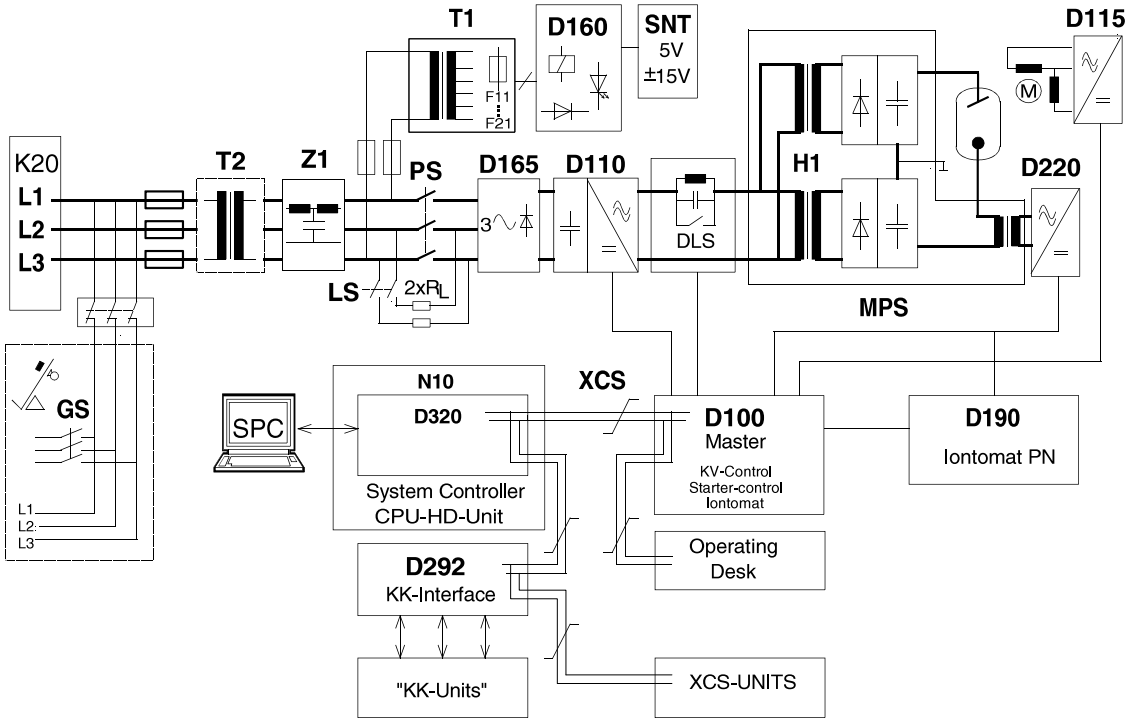

Fig. 1:

Power Connection

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

A 3-phase connection protected with a 25A fuse is provided for the power supply of external components (devices, I.I./TV). This connection is interrupted by the GS contactor when the system is switched off

Line Resistance

POLYDOROS SX 65	POLYDOROS SX 80
0,15 ≥ /400 V	0,1 ≥ /400 V
0,18 ≥ /440 V	0,14 ≥ /440 V
0,22 ≥ /480 V	0,16 ≥ /480 V

T2 (Transformer)

The T2 transformer is required for operating on 440 V-and 480 V-lines. It is built into the generator cabinet.

Z1 (Noise-interference Filter)

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

System wiring diagram

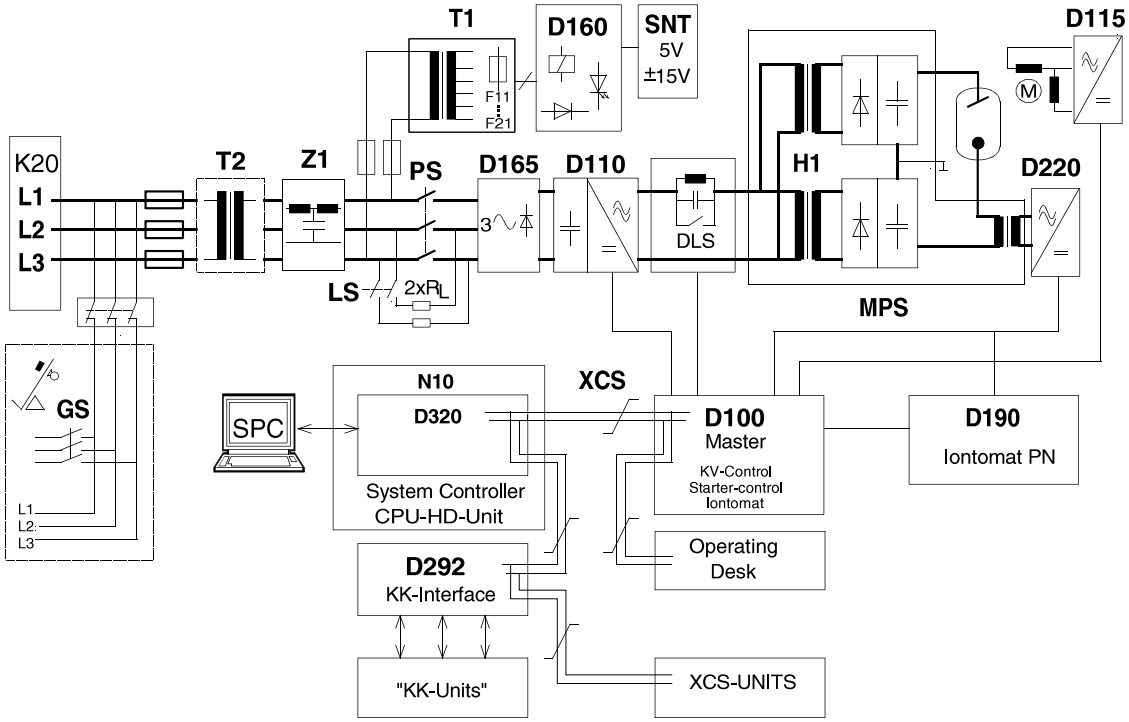

Fig. 2:

T1 (Transformer)

The T1 transformer is connected between external phases L1 and L3. It is used for the potential-separated AC power supply of generator-internal components such as the power supply, filament heating, various contactors and relays and the power-up circuit.

D160 (Power-up Circuit)

The power-up circuit and matching electronics are located here. Also located here are various relays for controlling the contactors of the intermediate circuit and the rotating anode starting unit. The connections for external radiation warning and workstation indicators as well as their power supply are also located on the D160 board.

SNT (Switching Power Supply)

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

The test pins and indicators for the input and output voltages are located on D160!

System wiring diagram

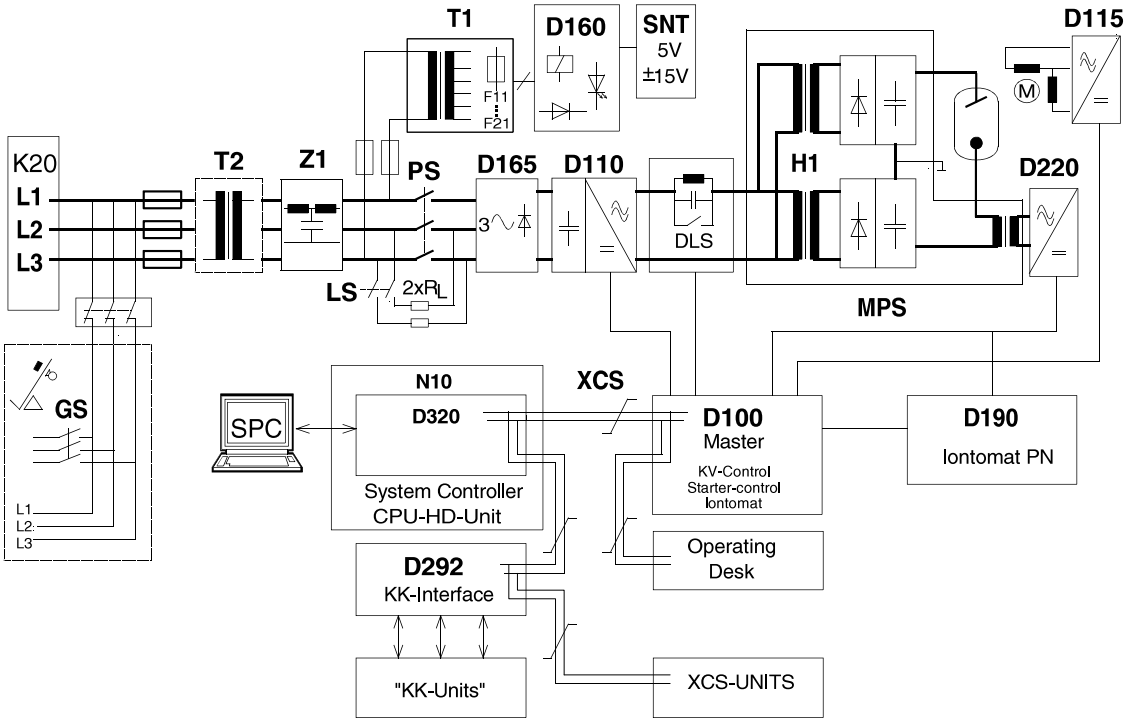

Fig. 3:

LS and PS Contactors; DC Intermediate Circuit

The DC intermediate circuit supplies the main inverter and the inverter of the rotating anode starting unit. 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 contactor. Following charging, the power-up damping circuit is bypassed via the PS contactor. The function of the contactors, charging process and intermediate circuit voltage are monitored by the processor system. 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.

After the generator is switched off, the intermediate circuit capacitors are force-discharged. You must therefore wait until the discharge time has expired before servicing this circuitry. The intermediate circuit can also be switched off for servicing (switch ZK on D100). The same rule applies to the capacitor discharge time here

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 H1high-voltage generator. The **I**nsulated **G**ate **B**ipolar **T**ransistors (IGBTs) located in the inverter are used as the switching elements. 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 four IGBT modules. The drive signals are generated by the KV regulator located on D100. The current monitor signals are fed to the generator control also mounted on D100.

Fluoroscopy Option with DLS Breaker

For fluoroscopy mode, an additional second parallel oscillating circuit is switched parallel to the high voltage transformer. The trap circuit effect causes the control frequency to be set at 15 kHz and there is thus lower ripple (hum) in the high voltage. In addition, the inverter is virtually noiseless.

System wiring diagram

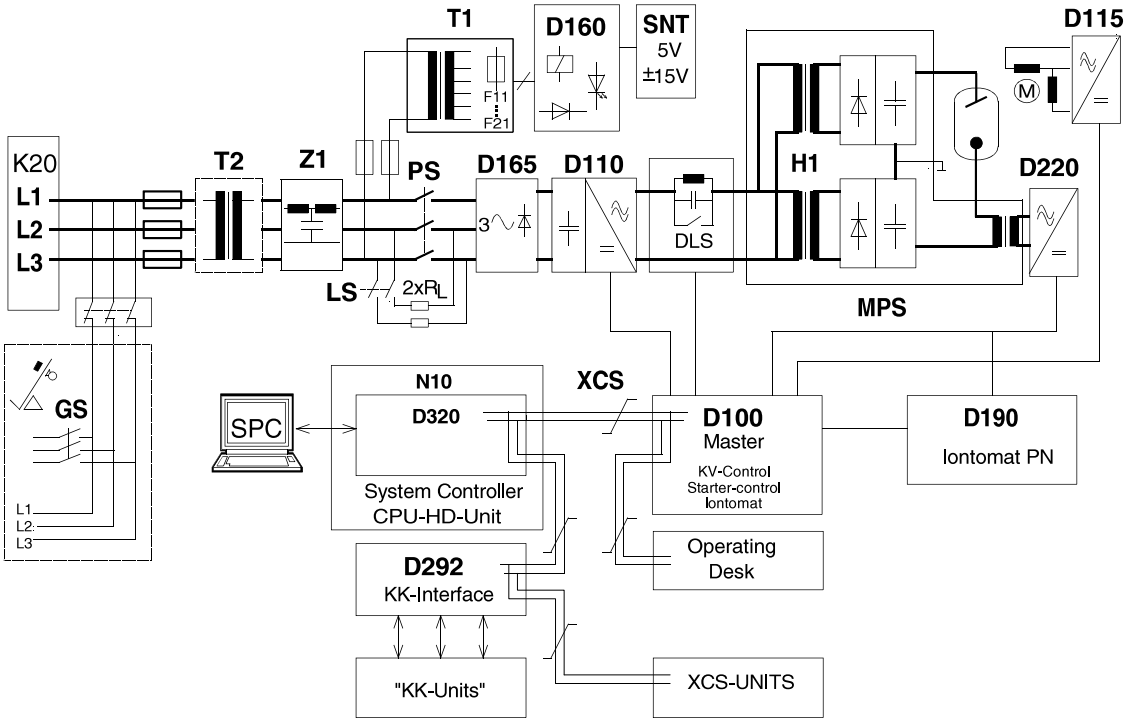

Fig. 4:

H1 (High-voltage Generator)

The high-frequency oscillating current from inverter D110 is converted to high voltage in the H1high-voltage generator. The oil-filled transformer tank contains the high-voltage transformers (one each for the anode and the cathode connection of the X-ray tube), the high-voltage rectifiers and capacitors, measurement dividers for sensing the actual value, damping resistors and heating transformers.

NOTE

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..

D220 (Filament Heating)

The D220 filament heating board is mounted directly on the high-voltage transformer. It contains a microcontroller system, two inverters, an intermediate circuit and actual-value acquisition for the tube current and the high voltage. The heating current and tube current controller are integrated in the microcontroller system. The inverters are designed with SIPMOS transistors and activated by a constant frequency of approx. 20 kHz with a variable pulse width (pulse-width control). Communication with the generator control is performed via a serial interface (MPS).

System wiring diagram

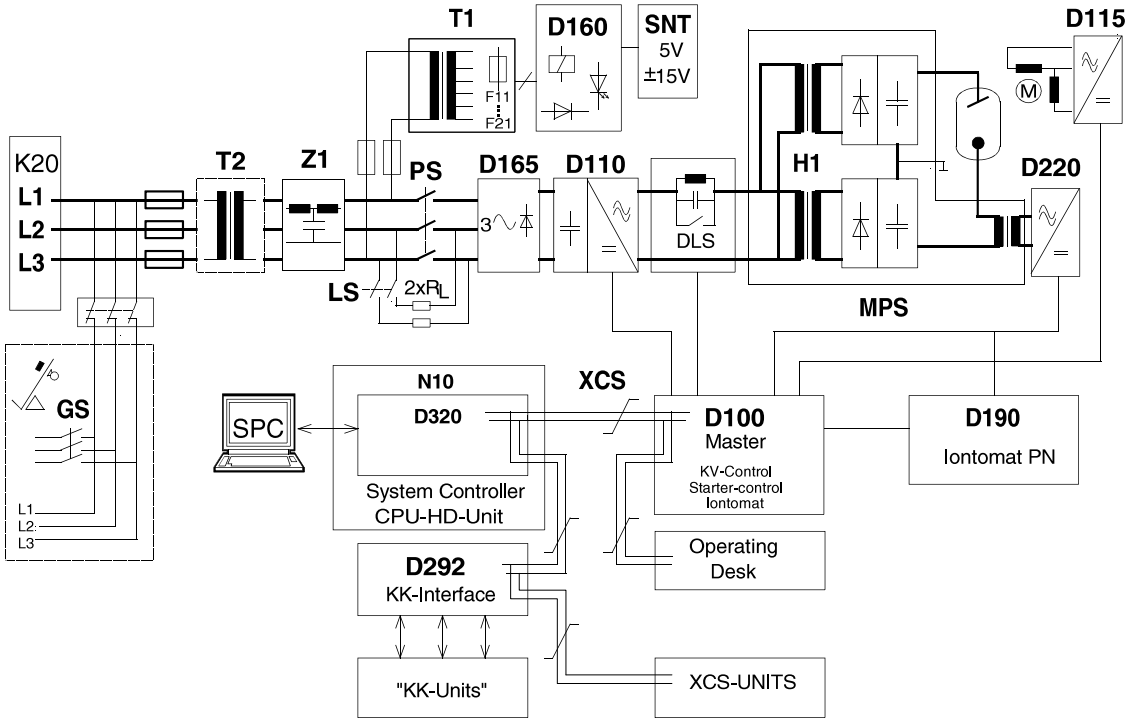

Fig. 5:

D115 (Rotating-anode Starting Unit)

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

Op. Mode	Drive Frequency	Rot. Speed
continuous Fluoroscopy	30 Hz	approx. 1000 min $^{-1}$
pulsed Fluoroscopy	70 Hz	approx. 3000 min $^{-1}$
Radiography	70 Hz	approx. 3000 min $^{-1}$
Radiography	180 Hz	approx. 9000 min $^{-1}$

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

Three-phase current is used for 30Hz and 70Hz drive frequencies with **all** X-ray tubes.

The starter unit is also set up for connection of a 3-phase Megalix X-ray tube. The drive frequency is reached in three steps (60 Hz, 120 Hz and 180 Hz) to achieve the brief start-up time of 1.2 st.

The tube selection contactor, phase-shift capacitors and the contactor for connecting the capacitors are mounted on board D115.

NOTE

The phase shifting capacitors are only required with 180 Hz 2-phase stators. They are connected in series in the if "Bixxx/30/52R or Opti 150/../.." tube units are connected.

When operated with the (2-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 3-phase stator or a "Bixxx/30/51" tube can be used.

System wiring diagram

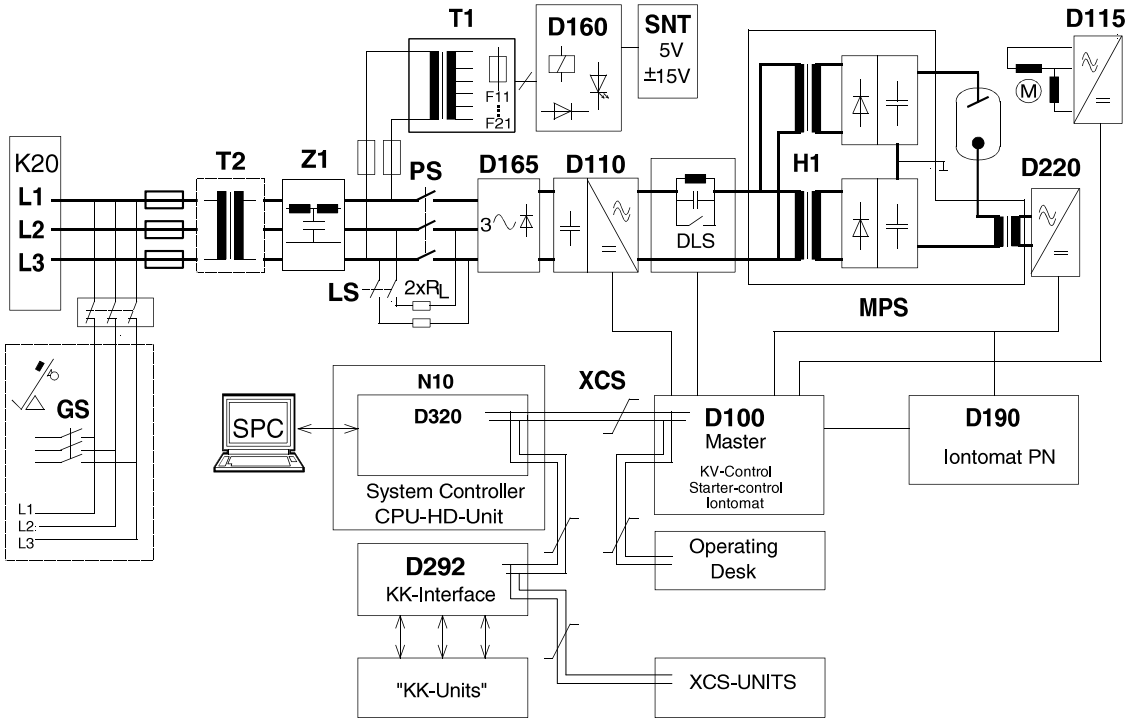

Fig. 6:

D100 (Master)

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

KV Regulator

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

kV Monitor

The kV monitor observes 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$_{nom}$ - 10 kV with delay

(depending on the difference between the nom. and act. values)

Starting Unit Control

The starting unit control supplies the pulse pattern for the six IGBTs of rotating-anode starting unit D115. The drive frequency is set depending on the given type of X-ray tube and operating mode. The run-up of the rotating anode is monitored with the aid of pulses gained from the load current of the starting unit.

VIDEOMED DI Interface

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

mAs Integrator

The tube current measuring circuit (on D220) supplies a voltage proportional to the tube current. This voltage is converted to a frequency which is tracked by a counter (digital integration). The radiation is then switched off when the preset mAs value is reached.

XCS Interface

Communication with other system components such as the diagnostic unit, control console etc. is not linked directly, but rather via the system controller and the XCS serial communication system. The processing of the XCS interfaces is performed by special modules (ARCNET controllers) located in all of the components connected to the XCS.

IONTOMAT

Detector connections, detector adaptation, and a portion of the signal processing for the IONTOMAT automatic exposure control are also on the master component. A max. of 6 detectors can be connected.

Admissible detectors are: 6 mm chamber, 12 mm chamber, HSE, PDA, photomultiplier and FS-B signal.

The D191 adapter is needed to connect a single-pole chamber.

System wiring diagram

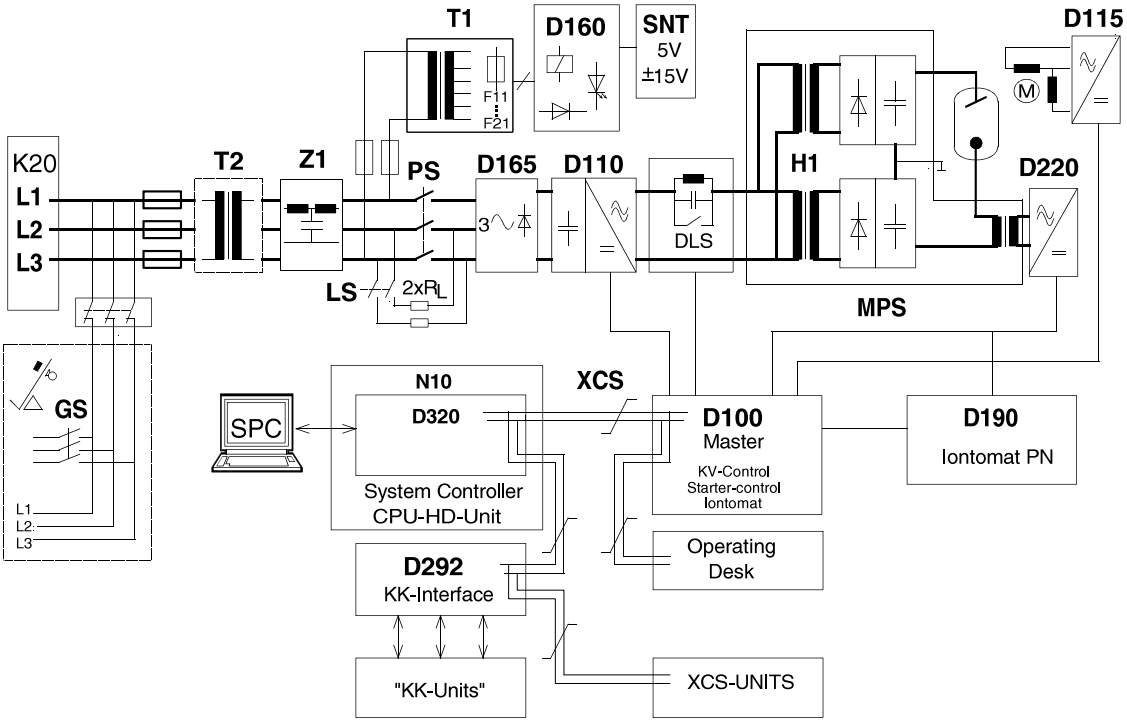

Fig. 7:

D190 (IONTOMAT PN)

For **dose control**, the detector signal is converted into a voltage that is proportional to the dose rate. This voltage is led to the IONTOMAT, appropriately amplified there and converted into a proportional frequency. A counter adds up the pulses and when it reaches a reference value, it terminates the exposure. The dose counter is located on the D190 component; in addition, dose rate processing for the PLANI-IONTOMAT is carried out on the D190. PLANI-IONTOMAT controls the dose rate by means of pulse-width control of the high voltage. When a minimal pulse-width is reached, the high voltage is reduced.

For **dose rate control**, the appropriate detector signal is led to the IONTOMAT and converted into a proportional frequency. This is followed by a measurement of the frequency. A deviation from the nominal value is signaled to the processor system and is used to control the dose rate.

Additional functions are also contained on the D190 component: TV-iris diaphragm control, control of light distributor, I.I. format selection and connection of the trigger signals for DR mode.

System wiring diagram

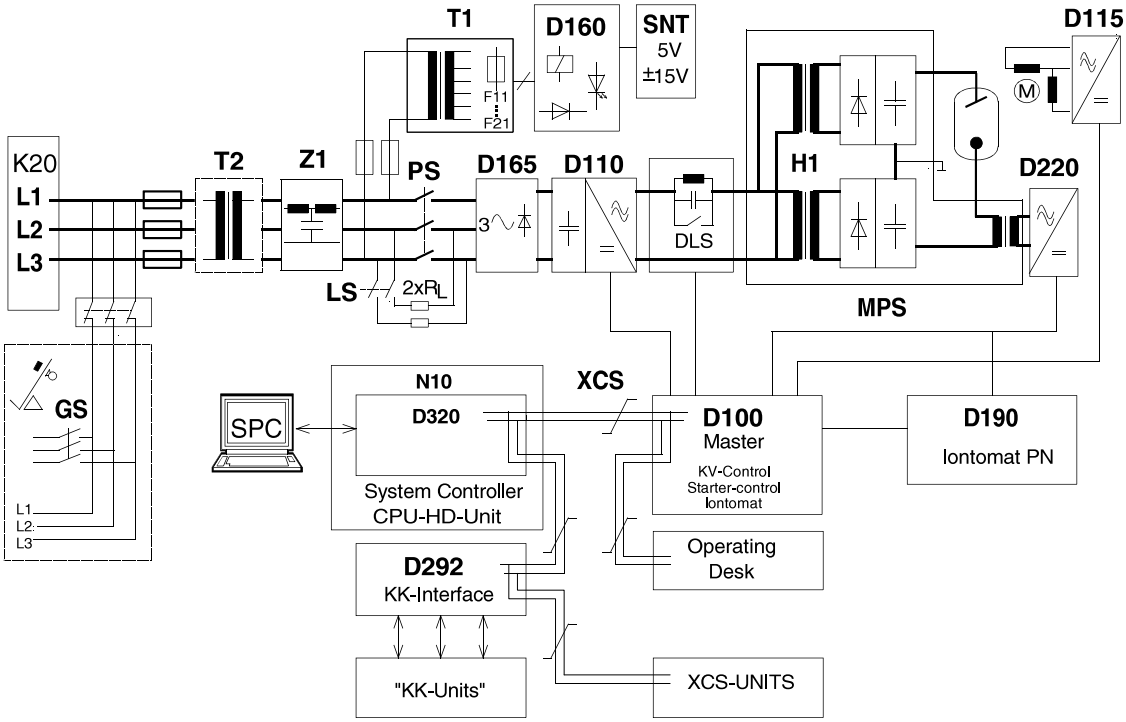

Fig. 8:

D320 (CPU HD Unit; System Controller)

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, control console, KK-Interface; SIRESKOP SX, VIDEOMED SX etc.) are centrally managed or made available to the functional units here. Data transfer is effected via so-called "telegrams" sent by a serial communication system. No direct communication between functional units is possible.The system controller also contains the interface for connecting the Service PC. This PC is used to configure, set, and perform troubleshooting on the entire system.

D292 (AP-XCS KK Interface)

Connection of units which do not have an XCS interface is made over the KK Interface. The KK Interface permits connection of a max. of 4 exposure stations (connectors KK 1B G1/G2, KK 1B G3, KK 1B G4); of these, on unit can be equipped with a plani workstation (connector KK2 G1-G4)

Control Console

The control console is used to switch the entire system on and off, select the desired unit and settings, and display the exposure parameters. System errors are also centrally displayed here.

System wiring diagram

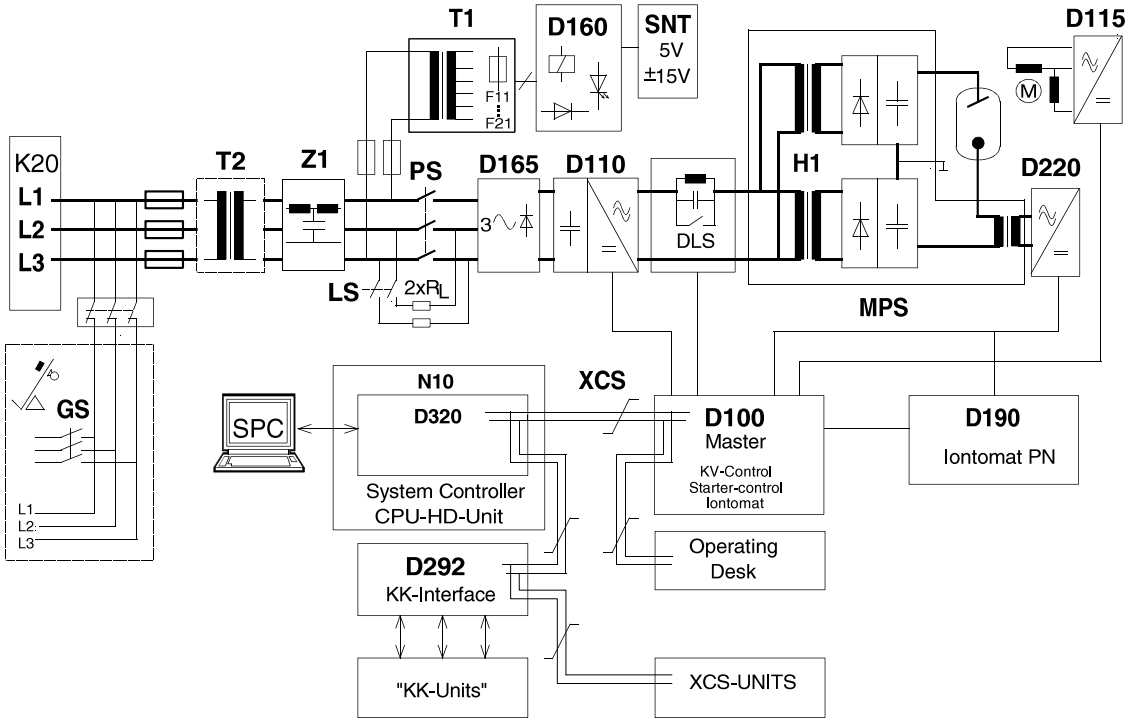

Fig. 9:

XCS Network

The XCS network is a serial communication system between the system controller D200 and the function units such as generator, operating console, VIDEOMED DI, SIRESKOP CX etc. The network is a so-called Local Area Network (LAN) and is based on the ARCNET technology (Attached Resource Computer Network). The transmission protocol is implemented as sequencer in a hardware component. Such a component can be found in all function units connected to the XCS network. The communication control is in the system controller.

The diagram shows the physical connections in the network based on a SIRESKOP SX system. A logical ring structure results from the token-passing procedure (an "invitation to send" is passed from function unit to function unit) specified in the Arcnet protocol; communication, however, only takes place between the system controller and the function unit.

All Chap.	All Pages	Restructuring of document and new layout
Chap. 1		Technical data eliminated
Chap. 2	Page 12	Continuous and pulsed fluoroscopy operating mode added