SIEMENS

POLYDOROS SX 65/80

AX

Troubleshooting Guide

POLYDOROS SX

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Product-specific Remarks

Required Documents

- Generator Wiring Diagram
- Startup instructions

Required Tools and Measurement Equipment

- Standard installation tool kit
- Service PC
- PC connection cable, 5 m 99 00 440

Safety Information

NOTICE

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

Safety Precautions

- Use the power OFF switch on board D 160 to switch off the generator before working on it .

⚠WARNING

Line voltage is still present in transformer T1 and switch-on circuit D 160 when the generator is switched off. After the generator is switched off, approx. 600 V DC for the inverter is still present!

➪ **This is indicated by LEDs V35 and V36 on D110 and LED V89 on D220 goes on. The line voltage decays in approx. 1,5 minutes to 0 V; the LED's go out when the voltage is approx. 30 V.**

- Set the main system switch to OFF to switch off power to all components (generator and connected equipment).
- To avoid unintentional release of high voltage or radiation, switch OFF (S1) SS on the D100 board.

- Install or remove assemblies only with the generator switched off, and in accordance with ESD guidelines.

⚠WARNING **Tests and adjustments that must be made with radiation switched on are indicated by the radiation warning symbol ☢ .**

➪ **Take appropriate radiation protection measures when carrying out such work.**

kV, mAs and tube current tolerances

NOTICE **All kV, mAs and tube current values are stated in these instructions with ± 5% Tolerance.**

Abbreviations and symbols used

ADC	- Analog-digital converter
AP	- Workstation selection
FL	- Fluoroscopy
F0	- Large focal spot filament current
F1	- Small focal spot filament current
HS	- High-voltage cable
HT	- High-voltage generator
IGBT	- Transistor (Insulated-Gate-Bipolar-Transistors)
LS	- Charging contactor
LSR	- Charging contactor relay
MPS	- Serial interface (multiprocessor interface)
M_TK	- Door contact
NAK	- No acknowledgment
N-TU1	- Workstation switchover
OUTA	- Actuation of bridge branch A
OUTB	- Actuation of bridge branch B
PS	- Power contactor
PSU	- Powers contact acknowledgment
PSR	- Power contactor relay
RANGE	- Current range (ON / FL)
R-short	- Jumper short-circuit
ROT	- Rotating anode rotation
SNT	- Switching power supply
STRSU	- Tube assembly switchover in starter
UZ	- Intermediate circuit voltage
WR	- Inverter
ZB	- Exposure preparation

Refer to the generator wiring diagram for further signal names.

Error 000

Meaning:

Invalid Init Data

Description:

At least one init block is wrong. This error will be repeated at each following init block even if the init data of this block are correct. You may try to configure and select all fluoro curves new or configure the complete system from the scratch.

Error 001

Meaning:

Start of Service Session.

Description:

- The Service PC has contacted the XCU.
- No error, for information only.
- This error will be shown as error 41 of AP-ID 240 (XCU) in the errorlog.

Error 002

Meaning:

End of Service Session.

Description:

- The Service PC has terminated the connection to the XCU (logged off).
- No error, for information only.
- This error will be shown as error 42 of AP-ID 240 (XCU) in the errorlog.

Error 003

Meaning:

Start of Remote Service Session.

Description:

- The Service PC has contacted the XCU via Modem.
- No error, for information only.
- This error will be shown as error 46 of AP-ID 240 (XCU) in the errorlog.

Error 004

Meaning:

End of Remote Service Session.

Description:

- The Service PC has terminated the remote connection to the XCU (logged off).
- No error, for information only.
- This error will be shown as error 47 of AP-ID 240 (XCU) in the errorlog.

Error 007

Meaning:

Polydoros is no longer in the XCS-network.

Error 007 is most of the times accompanied by a 1 on the D100 in case of HW defects.

In case of SW-Resets 007 will heal itself.

Description:

The communication between Polydoros and XCU is down.

Possible reason:

- Checking the terminal connectors. At the terminal D320.X3.S and US or D320.X4.S and US, there must be either:
  - 2 terminal connectors installed
  - 1 terminal connector and 1 cable installed
  - 2 cables installed

    The terminal connector has Part No.: 86 06 352
- Cable not connected from XCU to generator
- Cable has a short circuit
- Hybrid-circuit of ARCNET is defective on any XCS component
- SW of a component sends ARCNET Reconfiguration interrupts intermittently
- Watchdog of Polydoros is active
- D100 or power supply defective

Possible causes and action:

- Check cabling for connection and shorts
- Check Hybrids and terminators.
- D100, D200 defect, replace.

Error 051

Meaning:

D100.J15 PROM checksum error (with D100 Part-No.: 37 75 256)

Description:

D100 checks the PROM's check sum during initialization

Possible causes and action:

- PROM D100.J15 defekt (with D100 Part-No.: 37 75 256)
- D100 defect

Error 052

Meaning:

Heating-Error during download

Description:

D220 sends telegram "not acknowledge"

Possible causes and action:

- Repeat filament download
- Replace D220

Error 053

Meaning:

Image intensifier: invalid zoom level

Description:

XCU sends zoom level > 3 to D100

Possible causes and action:

- Check configuration

Error 054

Meaning:

Invalid fluoro data

Description:

Probably the configuration has been modified without turn off/on the generator, so that an unknown fluoro curve has been selected, known to XCU but not yet known to the generator. This might also be due to the fact that MANUAL.kV fluoroscopy is selected in systems supporting pulsed fluoroscopy.

Error 055

Meaning:

Invalid parameters for characteristic kV curve

Description:

XCU sends characteristic kV curve with more than 10 points

Error 056

Meaning:

Invalid exposure mode

Description:

XCU sends request for impermissible mode of operation

Error 057

Meaning:

Fluoro attachment feedback (signal DLR_U) wrong

Description:

With fluoroscopy the activation of the fluoroscopy relay (DLR_) is displayed on the D100.X50.5. This signal comes to D111.X50.5 and activates the relay K1. Through the activated relay contact of K1.1/2 the contactor K6 is activated and the fluoro attachment is added on (see wiring diagram X2206-16). The fluoro attachment feedback (DLR_U) is output via D111.X50.7 to D100.X50.7.

Possible causes and action:

- D100
- D111
- Contactor K6
- Ribbon cable X50

Error 058

Meaning:

Polydoros Host-SW is mismatching the type of generator configured in the XCS configurations-SW. E.g. D100 PROM is LX lite and configured type is LX 80.

Possibe causes and action:

- Configure the correct generator in the XCS service software

Error 077

Meaning:

Timeout exposure release

Description:

HS trigger of image system (ASU) is missing during pulsed fluoroscopy or indirect technique

Possible causes and action:

- Check of HS trigger

Error 100

Meaning:

Invalid task state D100

Description:

The software on the D100 is in an impermissible task state

Possible causes and action:

- PROM D100.J15 (for D100 Part No.: 37 75 256)
- D100

Error 119

Meaning:

Time out filament circuit

Description:

The communikation between filament D220 and master D100 is made via serial link (MPS, D100.X1.28, D220.X1.28)

If an interruption of the communication between D100 and D200 occurs, Error 119 is output by D100.

Possible causes and action:

- Serial interface interrupted → check
- D100, D220 defetive → replace
- Arcing tube
- H1 High tension transformer
- Check screening and shielding of cabling
- Check protective ground wire, all protective ground wire connections intended by the manufacturer must be made.
- Check firmware level.
- Check voltage power supplies +5 V ± 0,2 V (on D100, D160 and D220).
- Check schematics of generator for LED's.
- Ignore error 119, if the red LED (D220) is blinking and no firmware is loaded → perform download

Error 120

Meaning:

No communication vie D220 to D100 via serial line (transmit)

Description:

The communikation between filament D220 and master D100 is made via serial link (MPS, D100.X1.28, D220.X1.28)

In communication errors between D100 and D220, Error 120 is output by D100.

Possible causes and action:

- Serial interface interrupted → check
- D100, D220 defective → replace
- Arcing tube
- Check screening and shielding of cabling
- Check protective ground wire, all protective ground wire connections intended by the manufacturer must be made.
- Check firmware level.
- Check voltage power supplies +5 V ± 0,2 V (on D100, D160 and D220).
- Check schematics of generator for LED's.
- Ignore error 120, if the red LED (D220) is blinking and no firmware is loaded → perform download.

Error 121

Meaning:

No communication vie D220 to D100 via serial line (receive)

Description:

The communikation between filament D220 and master D100 is made via serial link (MPS, D100.X1.28, D220.X1.28)

In communication errors between D100 and D220, Error 121 is output by D100.

Possible causes and action:

- Serial interface interrupted → check
- D100, D220 defective → replace
- Arcing tube
- Check screening and shielding of cabling
- Check protective ground wire, all protective ground wire connections intended by the manufacturer must be made.
- Check firmware level.
- Check voltage power supplies +5 V ± 0,2 V (on D100, D160 and D220).
- Check schematics of generator for LED's.
- Ignore error 121, if the red LED(D220) is blinking and no firmware is loaded → perform download.

Error 122

Meaning:

Buffer overflow in receive queue to filament

Description:

The communikation between filament D220 and master D100 is made via serial link (MPS, D100.X1.28, D220.X1.28)

In communication errors between D100 and D220, Error 122 is output by D100.

Possible causes and action:

- Serial interface interrupted → check
- D100, D220 defective → replace
- Arcing tube
- Check screening and shielding of cabling
- Check protective ground wire, all protective ground wire connections intended by the manufacturer must be made.
- Check firmware level.
- Check voltage power supplies +5 V ± 0,2 V (on D100, D160 and D220).
- Check schematics of generator for LED's.
- Ignore error 122, if the red LED(D220) is blinking and no firmware is loaded → perform download.

Error 123

Meaning:

Invalid answer from filament

Description:

The communikation between filament D220 and master D100 is made via serial link (MPS, D100.X1.28, D220.X1.28)

In communication errors between D100 and D220, Error 123 is output by D100.

Possible causes and action:

- Serial interface interrupted -> check
- D100, D220 defective → replace
- Arcing tube
- Check screening and shielding of cabling
- Check protective ground wire, all protective ground wire connections intended by the manufacturer must be made.
- Check firmware level.
- Check voltage power supplies +5 V ± 0,2 V(on D100, D160 and D220).
- Check schematics of generator for LED's.
- Ignore error 123, if the red LED(D220) is blinking and no firmware is loaded → perform download.

Error 125

Meaning:

Timeout Iontomat

Possible causes and action:

- Check cabling from D100 to Iontomat or replace cable

Error 401

Meaning:

Time-out ADC of filament circuit

Description:

A/D converter in the filament circuit does not convert

Possible causes and action:

- Measure Vcc = +5 V ± 0,2 Volt on D220.X18.A1
- If voltage is within tolerance, replace board D220

Error 402

Meaning:

Minimum filament current

Description:

The minimum filament current (=1/2 nominal value) is monitored in standby.

Possible causes and action:

- Intermediate circuit voltage missing in the filament circuit at X41.7 and X41.10, mearure 230V ± 10%.
- Check fuse F21, D160
- Interruption in the filament path:
  - Check wiring X41 - H1
  - Workstation selected, AP relay in H1 actuated
    1. H1 test point 50 = 0V
    2. Ap 1 test point 51 = 24V (±15%)
    3. AP2 test point 52 = 24V (±15%)
- Check filament transformer primäry winding (R < 1Ohm, transformation ratio 32:9)
- Check filament and high-voltage cable
- If no error is found, replace board D220.

Error 403

Meaning:

Maximum tube current in radiography

Description:

The tube current is exceeded by 50% 100 ms after high voltage ON.

Possible causes and action:

Perform tube adjust

Error 404

Meaning:

Maximum tube current in fluoroscopy

Description:

The tube current is exceeded by 50% 100 ms after high voltage ON

Possible causes and action:

Perform tube adjust

Error 410

Meaning:

Timeout processor

Possible causes and action:

- Check power supply on D220:
  - V66 = -15V (±10%)
  - V65 = +15V (±10%)
  - V64 = +15V (±10%)
  - X19/A8 = +24V (±15%)
- Replace D220

Error 413

Meaning:

Tube current nominal value to large.

Possible causes and action:

- Error in the master → perform system configuration and POLYDOROS adjustment.
- Replace D220

Error 421

Meaning:

Wrong tube current value in fluoroscopy

Possible causes and action:

Error in the master → perform system configuration and POLYDOROS adjustment.

Error 422

Meaning:

Maximum filament current in tube current control

Description:

The tube current control permits a filament current of 1,25 times the max. filament current for 200 ms. If the controller finds no adjustment with max. filament current after this time, a warning is sent to the notice memory.

Possible causes and action:

- Check the filament current with cathotest
- The tube is not adjusted correctly
- The tube emits verly badly
- Perform tube adjust
- Check filament transformer primäry winding (R < 1Ohm, transformation ratio 32:9)

Error 425

Meaning:

-15V (±10%) is less than -12V on D220

Possible causes and action:

- Check voltage at D220.V66 -15V (±10%)
- Check connection to D100 (lead X1.12; X1.38-40)
- Check voltage on D160, Checkpoints:
  - X30 = -15V (±10%)
  - X29 = +15V (±10%)
  - X28 = 0V

Error 426

Meaning:

15V analog (± 10%) is less than 12V on D220

Possible causes and action:

- Check voltage at D220.V65 for +15V (± 10%)
- Check connection to D100 (lead X1.10, X1.38-40)
- Check voltage on D160, Checkpoints:
  - X30 = -15V (± 10%)
  - X29 = +15V (± 10%)
  - X28 = 0V

Error 427

Meaning:

15V digital (± 10%) is less than 12V on D220.

Possible causes and action:

- Check D220.V64 for +15V (± 10%)
- Check connection to D100 (lead X1.22, X1.38-40)
- Check voltage on D160, Checkpoints:
  - X30 = -15V (± 10%)
  - X29 = +15V (± 10%)
  - X28 = 0V

Error 428

Meaning:

24V (± 15%) is less than 20V on D220

Possible causes and action:

- Check voltage on D220.X19.A8 24V (± 15%)
- Check connection to D100 (lead X1.21, X1.38-40)
- Check voltage on D160:
  - D160.X13/14 = 24V (± 15%)
  - D160.X28 = 0V
- It might as well be the case that the power fail signal X1 on D320 is not detected and therefore, each time you switch on, the error is entered into the error log.
- Input check: Remove cable D160.X1 coming from D320. The Hex display on D320 should indicate "F4". If not, D320 is defective.
- Output check: Connect a voltmeter (DC) to D160.X121.2 (power fail) and X121.1; when switching off the generator, voltage should suddenly change from 5 V to 0 V.

Error 433

Meaning:

Current in the filament inverter F0 (large focal spot) too high

Possible causes and action:

- Short circuit in the charging circuit
- Wiring X41, filament transformer, high-voltage cable, filament or D220 defective.
- Eject leads X41.3 and X41.11
  - if error 433 occurs anew after reset, D220 must be replaced
  - if error 402 occurs, D220 is OK
- Check filament transformer. Primary winding R < 1Ohm, transformation ratio 32:9

Error 434

Meaning:

Current in the filament inverter F1 (small focal spot) too high

Possible causes and action:

- Short circuit in the charging circuit
- Wiring X41, filament transformer, high-voltage cable, filament or D220 defective.
- Eject leads X41.9 and X41.12
  - if error 434 occurs anew after reset, D220 must be replaced
  - if error 402 occurs, D220 is OK
- Check filament transformer. Primary winding R < 1Ohm, transformation ratio 32:9

Error 485

Meaning:

Filament download: error when deleting Flash-Prom

Possible causes and action:

- Repeat filament download
- D220

Error 486

Meaning:

Filament download: error in check sum of the Flash-PROM

Possible causes and action:

- Repeat filament download
- D220

Error 487

Meaning:

Filament download: Error by bank switching

Possible causes and action:

- Repeat filament download
- D220

Error 488

Meaning:

Filament download: Error during programming Flash-Proming

Possible causes and action:

- Repeat filament download
- D220

Error 505

Meaning:

Invalid iontomat configuration

Description:

Storage of configuration data into D190 RAM is not possible

Possible causes and action:

- D190

Error 510

Meaning:

Inadmissible IONTOMAT workstation

Description:

After selection of an iontomated operating mode or fluoroscopy, a check is made whether a permissible IONTOMAT workstation has been transferred by the master D100.

In the event of an error, no or a wrong workstation is output.

Possible causes and action:

- Check system configuration
- Are the IONTOMAT workstations correctly programmed?

Error 511

Meaning:

Iontomat: Impermissible film-screen system

Description:

After selecting an iontomatized mode of operation the Iontomat checks whether or not the film-screen system (H, U, D) transferred to it is permissible. If no, several or a wrong film-screen system were transferred, Error 511 is displayed.

Possible causes and action:

- Check system configuration
- D190

Error 512

Meaning:

Iontomat: invalid tomo time selection

Description:

After selecting the Plani-Iontomat mode of operation, the Iontomat checks whether or not the selected tomographic time is permissible. If the transferred tomographic time was too long or too short, Error 512 is displayed.

Possible causes and action:

- Check system configuration
- D190

Error 513

Meaning:

Iontomat: invalid detector

Description:

After selecting a iontomatized mode of operation or fluoroscopy the Iontomat checks whether or not the detector stored in EEPROM is permissible.

Possible causes and action:

- Check system configuration
- D190

Error 515

Meaning:

Iontomat: impermissible plug position

Description:

After selecting a iontomatized mode of operation it is checked whether or not the plug position stored in EEPROM is permissible..

Possible causes and action:

- Check system configuration
- D190

Error 550

Meaning:

Dose monitoring has responded, not enough dose detected after 100 ms

Description:

In an iontomated exposure, the dose counter on D100 is read after 100 ms exposure time. If one half of the necessary does is not reached by the max. exposure time, error 550 is signalled

Possible causes and action:

- Faulty operation (customer):
  - Tube not directed onto selected IONTOMAT chamber
  - Collimator closed
  - Wrong choice of the exposure kV
- Errors:
  - Wrong IONTOMAT workstation programmed, check system configuration
  - No signal from IONTOMAT chamber at measuring point D100.X63 DL_IN
  - Check detector and cabling
  - D100 defective, replace

Error 551

Meaning:

Iontomat: Dose supervision min. for tomo

Description:

This error is similar to error 550 in normal mode. However the dose is not checked after 100 ms, but at the end of the tomo exposure. It can be caused as a follow-up error, if the object to be exposed, requires more mAs, than the generator is allowed to give. E.G. 800 mAs is max mAs. At 1.2 s tomo time max mA would be 666 mA. However the generator may use 800 mA in order to have a reserve for the different angles and projections during the tomo turn. If the object is that thick, that the generator is using 800 mA all the 1.2 sec the 800 mAs will be reached after 1.0 s and the generator will stop X-raying. After 1.2 s it will state, that the dose was too low.

Error 552

Meaning:

Iontomat: Dose supervision max. for tomo

Description:

Dose counter terminates exposure before the tomographic time ends

Possible causes and action:

- Select higher exposure parameters

Error 560

Meaning:

Iontomat: kV value impermissible

Possible causes and action:

- D190

Error 561

Meaning:

Iontomat: invalid max time (>10s)

Possible causes and action:

- D190

Error 562

Meaning:

Iontomat: invalid measuring field

Description:

No scan field selected

Possible causes and action:

- Check system configuration
- D190

Error 563

Meaning:

Iontomat: Invalid fluoro detector (no PDA/MPL or B signal)

Possible causes and action:

- Check system configuration

Error 570

Meaning:

Iontomat: Checksum error detector

Possible causes and action:

- D190

Error 571

Meaning:

Iontomat: Checksum error HUD

Possible causes and action:

- D190

Error 572

Meaning:

Iontomat: Checksum error lead time value

Possible causes and action:

- D190

Error 573

Meaning:

Iontomat: Checksum error voltage correction

Possible causes and action:

- D190

Error 575

Meaning:

Iontomat: Checksum error density correction

Possible causes and action:

- D190

Error 580

Meaning:

Iontomat: bad dose value

Possible causes and action:

- Check system configuration
- D190

Error 581

Meaning:

Iontomat: bad lead time value

Possible causes and action:

- Check system configuration
- D190

Error 582

Meaning:

Iontomat: bad voltage correction

Possible causes and action:

- Check system configuration
- D190

Error 590

Meaning:

Iontomat: mAs value not sent

Possible causes and action:

- Check system configuration
- D190
- D100

Error 591

Meaning:

Iontomat: bad tube AP selection

Possible causes and action:

- Check system configuration

Error 600

Meaning:

+15V (±10%) faulty

Possible causes and action:

- 5V ± 0,2V present?
- Short circuit on board D100, D220, D110
- LED V72 on D160 is not on, replace SNT power pack
- Check voltage on D160.X4.4 and X4.1 230V~ (± 10%), if present replace SNT power pack.

Error 601

Meaning:

-15V faulty

Possible causes and action:

- Short circuit on board D100, D220
- LED V73 on board D160 is not on, replace SNT power pack
- Check voltage on D160.X4.4 and X4.1 230V~ (± 10%), if present replace SNT power pack.

Error 602

Meaning:

Power contactor (PS) not OK.

Description:

- On initialization:
  - D100 switches the power contactor on and wait 0.5s for the acknowledgment. If this noes not occur, Error 602 is output.
- In operation:
  - If the power contactor drops out during operation, Error 602 is also output.

Possible causes and action:

- Drive "Power-" relay defective (D160.K5), i.e. no low signal (0V) PSR at D160.X5.7
  - D100 defective
- If the above named signal OK and the power contactor does not switch, relay K5 on D160 defective
  - replace D160
- Check cable from D100.X5 to D160.X5
- Actuation of the PS contactor A2, A1
  - 24V~ (± 10%) at 50 Hz
  - 29V~ (± 10%) at 60 Hz
- Check contactor acknowledgment PSU at D100.X5.25 24V~ (± 10%)
- Contactor sticks or jams.

Error 603

Meaning:

Charging contactor (LS) not OK

Description:

On initialization: D100 switches the charging contactor closed. There must be an acknowledgment after 5 s, otherwise Error 603 is output.

Possible causes and action:

- Actuation of "charging" relay D160.K4 defective, i.e. no low signal (0V) LSR at D160.X5.5
  - D100 defective
- If the above named signal is OK and K4 does not switch, relay K4 on D160defective
  - replace D160
- Check cable from D100.X5 to D160.X5
- Check actuation of the LS contactor A2, A1
  - 24V~ (± 10%) at 50 Hz
  - 29V~ (± 10%) at 60 Hz
- Check contactor acknowledgment LSU at D100.X5.27 or D160.X3.9 24V~ (± 15%).
- Contactor sticks or jams.

Error 604

Meaning:

Intermediate circuit voltage (UZ) < 400V.

$UZ_{ACT} = 1.4 \times U_{mains}$

Caution! Direct voltage

Description:

- On initialization:
  - The charging contactor is switched in by D160. The status of the intermediate circuit voltage is queried after 5s (provided there has been a charging contactor acknowledgment). At a too low intermediate circuit voltage, (< 400V), Error 604 is output.
- In operation:
  - If the intermediate circuit voltage drops during operation, Error 604 is also output.

Possible causes and action:

- Phase is missing, intermediate circuit is charged too slowly
- Check line voltages
- Check UZ_{ACT} signal at D100.X20.17 and X20.19 (1V $\triangleq$ 50V / $UZ_{ACT} = 1{,}4 \times U_{mains}$)
- Check ribbon cable from D100.X20 to D115.X20
- Charging resistors R1, R2 defective, Replace resistors

Error 605

Meaning:

Intermediate circuit voltage (UZ) > 630V.

$UZ_{ACT} = 1.4 \times U_{mains}$

Caution! Direct voltage

Description:

On initialization: The charging contactor is switched in by D160. The status of the intermediate circuit voltage is queried after 5 s (provided there has been a charging contactor acknowledgment). At a too high intermediate circuit voltage, (> 630 V), Error 605 is output.

Possible causes and action:

- Check line voltages
- Measuring the line resistance
- Check UZ_{ACT} Signal at D100.X20.17 and X20.19 ($UZ_{ACT} = 1{,}4 \times U_{mains}$)
- Check ribbon cable from D100.X20 to D115.X20

Error 606

Meaning:

RANGE Error

Description:

The signals RANGE0 "OK" and RANGE1 "OK" monitor the switchover of the tube current measuring ranges on D220. The corresponding relays are monitored via the RANGE 0, and RANGE 1 signals.

Possible causes and action:

- Check function at SS OFF on D220. Test points: D220.X19.A1, A2 (wiring diagram X2206-18 and 22):
- With ZB ON: measuring range 200 mA;
  - "RANGE 0" X19.A1 = 0V -> "RANGE 0" "OK" X19.A4 = 24V (± 15%)
  - "RANGE 1" without significance
- With normal FL ON: measuring range 1 mA;
  - "RANGE 0" X19.A1 = 24V (± 15%)
  - "RANGE 0" "OK" X19.A4 = 0V
  - "RANGE 1" X19.A2 = 24V (± 15%) DANN: "RANGE 1" "OK" X19.A3 = 0V
- If the "RANGE 0" and "RANGE 1" signals do not agree with the operating mode, there is a fault in the cable X1 to D100 or on D100.
- If the signals "RANGE 0"_OK and "RANGE 1"_OK are wrong with correct actuation, D220 must be replaced.

Error 608

Meaning:

AP contactor not present, oil switch acknowledgment missing.

Possible causes and action:

- Check plug on D160.X44.3-4.
  - 24V~ (± 10%) at 50 Hz
  - 29V~ (± 10%) at 60 Hz

Error 610

Meaning:

Invalid range of tube current (10 mA<I<800 mA).

Description:

This error can be caused by an invalid setting of the tube current in Polydoros Service SW. For LX generators and SX generators it is possible to set the minimum tube current to 1 mA (POLYDOROS SERVICE SW --> ADJUSTMENTS --> GENERATOR PARAMETER). If this is done with generator, using older D100 SW, this error might be caused, especially in Tomography. Set current back to 10 mA.

Error 611

Meaning:

Specified value of tube voltage outside tolerance limits

40 kV<U<150 kV for radiography

40 kV<U<110 kV for fluoroscopy

Possible causes and action:

- SW error

Error 612

Meaning:

Timeout for filament to get ready

Description:

Error can occur if filament error is acknowledged and radiation is released again immediately.

Possible causes and action:

- D220

Error 628

Meaning:

DOOR error, door contact open

Description:

The DOOR (M_TK) signal monitors the door contact. The error is output only if the door is opened with radiation switched on. DOOR = 1: door closed (OK).

Possible causes and action:

- The message line shows "Door open" during standby
- Check the signal path according to drawing X2206-11
- Check the oil pressure switch

Error 629

Meaning:

No AP relay

Acknowledgment: Actuation of the oil switch wrong.

Description:

The N-TU1 "OK" signal monitors the workstation relay switchover.

The workstation relay switchover is actuated by the TU1-N-TU2 signal.

TU1-N-TU2 = 1: tube1 selected = N-TU1-OK = 0

Possible causes and action:

- Check signal path according to wiring diagram X2206-19.
  - D220.X19.A5 reversed to X19.A6 = D220 OK.
  - e.g. API selected
  - X19.A6 24V (± 15%)
  - X19.A5 0V
- D100 defective
- D220 defective

Error 633

Meaning:

U_{IST} > 2kV not OK

Description:

Radiation is present.

There is a blockage. Consequence: LS, PS, oil switch or tube contactor are blocked.

Possible causes and action:

- Actual value sensing D220 (H1) defective.
- Check ribbon cable D220.X1 --- D100.X1
- D100 defective
- High voltage does not decay, no load (tube assembly defective; oil switch (+)side).

NOTICE	**Caution on pulling out the high-voltage cables, first discharge cables.**

Error 650

Meaning:

Invalid tube

Description:

XCU sends impermissible tube assembly workstation to D100

Error 666

Meaning:

Switch S3 (X44) on D100 is in "Service" position

Possible causes and action:

Switch over switch S3 to "Normal".

Error 688

Meaning:

No dose signal from the VIDEOMED DI

Possible causes and action:

- Check connection between VIDEOMED DI and generator.
- VIDEOMED DI defective
- Check image intensifier output
- Remove camera head from image intensifier. Release FL in the Service mode.
  - The image must appear in the image intensifier output window with FL ON.
  - If not, then the I.I. circuit (I.I. voltage supply) is defective.
  - If yes, VIDEOMED DI is defective.
- D100 defective

Error 690

Meaning:

No high voltage trigger signal from ASU of FL TOP or FL Compact to generator

Possible causes and action:

- Check connection between ASU/FL Compact and (SK 111) generator
- ASU defective / FL Compact defective
- Wrong fluoro mode (pulsed instead of continuous)
- D100 defective
- FL Compact takes longer than 1 second to send a trigger pulse after a radiation request.
- 20 mA safety current loop is not closed (or closed too late), when pulsed fluoroscopy starts. For a test actuate service switch S3 and try to provoke error once again. If error does not occur then, 20 mA wiring.

Error 711

Meaning:

Bridge short circuit in the main inverter (current in the inverter too high)

Description:

If more than 3 bridge short circuits occur during an exposure or in fluoroscopy within 3.6 s, of if the current in the inverter is too high, then Error 711 is output.

Possible causes and action:

1. Checking D165

The intermediate circuit voltage is too low, but higher than 400V (400V - 630V), UZ monitoring does not respond (Error 604 with < 400V / Error 605 with > 630V).

- Generator OFF
- Connect instrument to D110 X5, X6
- Generator ON
- Uz must be approx. 550 V.
- Checking the charging current:
  - Generator OFF
  - Main switch OFF
  - Check freedom from voltage at the mains fuses.
  - Disconnect leads L1, L2, L3 at the PS contactor.
  - Fit a current transformer with 10 ohms terminating resistor over each lead.
  - Connect the leads again.
  - Connect oscilloscope to current transformers over L1, L2, L3.
  - Trigger. Int.
  - Main switch and generator ON
  - The mains currents must be the same in all phases (pay attention to symmetry).
- In the case of an error:
  - Look for the error in the phase in which the smallest amplitude is measured (bad connections, burnt contacts)

2. Checking the tube assembly

- Generator OFF
- Connect oscilloscope to the following points:
  - CH1: MA_{IST} ($I_{Rö\,IST}$) D100/X64 MA_ACT
  - CH2: KV_{IST} D100/X61 kV_ACT
  - Trigger D100/X64 SWR
- SS switch on D100 OFF
- Generator ON
- Check trigger.
- SS switch on D100 ON
- Release exposure with 81 kV, 20 mAs, if no error, increase kV stepwise and observe current.

- If step peaks are observed and the generator climbs out with ERROR 711 AP-ID 80 or 119 AP-ID 80. The tube assembly is defective. Replace tube assembly.

3. Checking D110 (inverter)

- Generator OFF
- Connect oscilloscope to following points:
- CH1: D100/X62 I_LOAD (1V ≙ 50A)
- Trigger: X64 SWR time base 10 µs
- Generator ON
- In SSW <DIAGNOSTIK> conduct <Inverter Test> and compare measurement results with the following wiring diagrams:

POLYDOROS SX 65/80:

- The current I load is to be measured with single pulse and fluoro attachment. It must show the following values:

Pos. Signal (500 mV ≙ 50A) Neg. Signal (500 mV ≙ 50A)

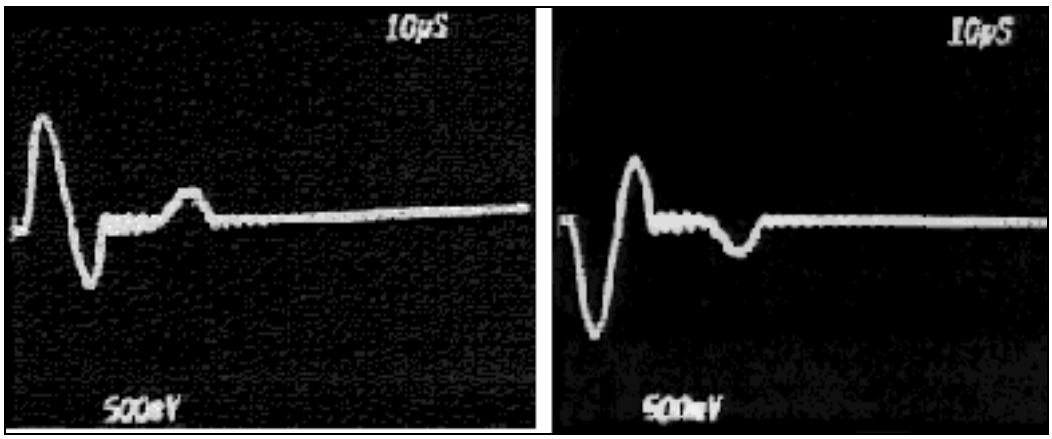

Fig. 1:

- The following requirements are to be checked in both oscillograms :
  - "Forward oscillation" : 120A ± 10%
  - "Backward oscillation" : 50A ± 10%
- On deviations in the amplitude:
- Generator OFF
- Connect oscilloscope to following points:
  - CH1: D100/X60 OUT_A
  - CH2: D100/X60 OUT_B
  - Trigger: D100/X64 SWR
- Switch on D100 OFF
- Generator ON
- Release FL or exposure.

- Compare pulses with diagram X2206/16, replace D100 in the case of deviation
- If pulses are OK proceed as follows:
  - Replace inverter
  - The FL attachment must be adjusted anew after replacement of the inverter.

4. Checking D111 "FL attachment"

- Check contacts of the "K6" contactor.
- Check screw connections.

5. Checking D220 filament board

If ERROR messages 711 and 119 AD-IP 80 occur sporadically, and if no error is found when checking D100, D110, D111, D115, D165 and the tube assembly, D220 can be defective. Perform check as follows:

- Ribbon cable between D100 and D220 must be run in front of the retaining bracket on H1.
- Generator OFF
- Connect oscilloscope to following points:
  - CH1: MA_{ACT} ($I_{Rö\,ACT}$) D100/X64 MA_ACT
  - CH2: kV_{ACT} D100/X61 kV-ACT
  - Trigger: D100/X64 SWR
- SS switch on D100 OFF
- Generator ON
- Check trigger
- SS switch on D100 ON
- Perform measurements with both focal spots.
- Release exposure with 81 kV,32 mAs,100 ms and observe the tube current. If the current wave shape is linear, increase tube current with the mAs button and retain the 100 ms. If a too high current is measured in the measurement, the tube must be adjusted again. If abrupt changes of push factor occur during the setting and if the current can not be adjusted, replace D220.

6. HCheck high-voltage cable

- Check the plug of the HV cable for tracking. If tracking is present, the HV cable must be replaced.
- If there is no tracking on the HV cable, clean the HV plug, replace corona disks and gasket and insert in the tube assembly with silicone oil.
- No corona disks may be used on the transformer side.
- Approx. 10 mm oil must be present in the transformer receptacle.
- The ohmic value of the shielding braid may be 1 Ohm per meter. If there is suspicion the the HV cable is no longer voltage-proof, the HV cable must be replaced.

Error 712

Meaning:

Plus kV_{max} error

Description:

The positive side of the high voltage is monitored for an absolute value of 80 kV.

Display LED D100.V168 "KV MAX+"

Possible causes and action:

- Checking the +KV actual value D220.X18.A7 and D100.X61 "kV+" (see wiring diagram X2206-15) at both test points 1V ≙ 10 kV.
- FL attachment is out of adjustment. Perform adjustment.
- Check ribbon cable between D220.X1 and D100.X1
- kV controller defective, replace D100
- kV actual value sensing on D220 defective
- Tube assembly or high-voltage cable defective
- High-voltage generator defective
- If the tube assembly is replaced, perform tube adjustment.

Error 713

Meaning:

Minus-kV_{max} error

Description:

The negative side of the high voltage is monitored for an absolute value of 80 kV.

Display LED D100.V167 "KV MAX-"

Possible causes and action:

- Checking the -KV actual value D220.X18.A8 and D100.X61 "kV-" (see wiring diagram X2206-15) at both test points 1V ≙ -10 kV
- Check ribbon cable between D220.X1 and D100.X1, kV controller defective
- kV actual value sensing on D220 defective
- Tube assembly or high-voltage cable defective
- High-voltage cable defective
- D100, D220 defective, replace.
- If the tube assembly is replaced, perform tube adjustment".

Error 714

Meaning:

Plus-kV_{min} error

Description:

The plus kV(min) monitoring becomes active if the +kV actual value is more than 10 kV less than the +kV nominal value.

Display LED D100.V166 "kV MIN+"

Possible causes and action:

- Check +KV actual value at D220.X18.A7 or D100.X61 "KV+" (see wiring diagram X2206-15) at both test points 1V $\triangleq$ 10 kV
- Check ribbon cable between D220.X1 and D100.X1.
- Perform "Diagnostic/Inverter Test"
- Check oscillating current on D100. X62 "I_LAST" (1V = 50A) and compare with diagram ERROR 711.
- Check connection screws in the intermediate circuit and inverter.
- Measure intermediate circuit voltage at D110.X2 and X1 (see wiring diagram X2206-16)
  - $UZ_{ACT} = 1.4 \times U_{mains}$
  - Caution! Direct voltage
- Actual value sensing D220 defective
- kV controller defective
- Tube arcing
- High-voltage generator H1 defective
- High-voltage cable OK?
- Filament current too high, perform tube adjust.
- If the tube assembly is replaced, perform tube adjust".

Error 715

Meaning:

Minus-kV_{min} error

Description:

The minus kV_{min} monitoring becomes active if the -kV actual value is more than 10 kV less than the -kV nominal value.

Display LED D100.V165 "kV MIN-"

Possible causes and action:

- Check minus KV actual value at D220.X18.A8 and D100.X61 Meßpunkt "KV-" (see wiring diagram X2206-15) at both test points 1V ≙ -10kV
- Check ribbon cable between D220.X1 and D100.X1
- Perform "Diagnostic/Inverter Test"
- Check oscillating current on D100. X62 "I_LAST" (1V ≙ 50 A) and compare with diagram ERROR 711.
- Check connection screws in the intermediate circuit and inverter
- Measure intermediate circuit voltage at D110.X2 and X1 (X2206-16)
  - $UZ_{ACT} = 1.4 \times U_{mains}$
  - Caution! Direct voltage
- Actual value sensing D220 defective
- kV controller defective
- Tube arcing
- High-voltage generator H1 defective
- High-voltage cable OK?
- Filament current too high, perform tube adjust.

Error 716

Meaning:

Short circuit in main inverter (one incident)

Description:

During an exposure or a fluoro there are in between 3.6 sec ONE inverter short circuit. This will result in under exposed images or in a DR series in a blank image plus an under-exposed one. If the short circuit continues, error 711 will be caused.

Error 800

Meaning:

Temperature switch of tube has been switched

Description:

Tube is too hot, the temperature switch of tube has been switched.

Possible causes and action:

- Tell the user to wait for next exposure until tube has cooled down a bit.
- With POLYDOROS SX65/80:
  - Temperature switch of the tube is only connected for OPTI154/30/50R-100 and MEGALIX tube assemblies, for all other tube assemblies there is a jumper on D160.X61.1 and 2 for AP1, or D160.X62.1 and 2 for AP2, or D160.X63.1 and 2.

Error 803

Meaning:

Bridge short circuit in the rotating anode starter inverter

Description:

A bridge short circuit has occurred in a branch of the inverter.

The "R_KURZ" signal is indicated by the LED's V35 on D100 and V114 on D115.

Possible causes and action:

- Check stator resistances at the tube assembly connection (particulars at 20°)
  - In the 3-phase stator

    0 - I 2.0 - 2.6 ohms

    0 - II 2.0 - 2.6 ohms

  - In the 2-phase stator

    0 - I 13 - 16 ohms

    0 - II 18 - 20 ohms

  - In the (Opti 154...)

    0 - I ca. 10 ohms

    0 - II ca. 10 ohms

- Stator defective?
- Correct stator configured?
- Check activation "AN0 - AN5" of the IGBT modules, from the D100 to the D115 (see wiring diagram X2206-31).
  - POLYDOROS = OFF
  - On D100 switch S2 "ZK" = OFF
  - POLYDOROS = ON
  - Check activation signals "AN0 - AN5" on the D100.X65 with oscilloscope. The individual voltage pulse of the activation signals "AN0 - AN5" should be approximately 13 V. If the activation signals are smaller than 10 V, the D100 is to be replaced.
- D115 defective
- Check phase shifter "Connection 2 phase tube assembly" connection (see wiring diagram X2206-30)
- Test stator cable, disconnect cable at tube assembly and measure with ohmmeter, there must be no connection between the leads I, II, 0.
- Test the currents in the stator leads with a current transformer.

- Measure intermediate circuit voltage at:
  - D115.X6 and X5
  - D110.X6 and X5
  - $UZ_{ACT} = 1.4 \times U_{mains}$
  - Caution! Direct voltage
- Check intermediate circuit voltage connection terminals D165, D110, D115.

Error 804

Meaning:

Invalid tube data

Description:

Error when selecting 2-phase or 3-phase tube assembly or error in nominal speed 5 Hz / 6 Hz

Error 805

Meaning:

No current in the main phase, no rotation (no ROT)

Description:

The current in the main phase is measured during the run-up (test point D100.X60 "I_ANL") 1V ≙ 5A. The current must be greater than 1.5 A.

The error is displayed no ROT, green LED V36 on D100 not on

Possible causes and action:

- Check activation "AN0 - AN5" of the IGBT modules, from the D100 to the D115 (see wiring diagram X2206-31).
  - POLYDOROS = OFF
  - On D100 switch S2 "ZK" = OFF
  - POLYDOROS = ON
  - Check activation signals "AN0 - AN5" on the D100.X65 with oscilloscope. The individual voltage pulse of the activation signals "AN0 - AN5" should be approximately 13 V. If the activation signals are smaller than 10 V, the D100 is to be replaced.
- D115 defective?
- Interruption in the stator cable. Disconnect the cable at the tube assembly and measure ohmically, there must be no connection between the leads I, II, 0.
- Test the currents in the stator leads with a current transformer.
- Measure intermediate circuit voltage at D115.X6 and X5 and on D110.X6 and X5.
  - $UZ_{ACT} = 1.4 \times U_{mains}$
  - Caution! Direct voltage
- Check intermediate circuit voltage connection terminals D165, D110, D115.
- Check stator resistances at the tube assembly connection (at 20° C)
  - In the 3-phase stator

    0 - I 2.0 - 2.6 ohms

    0 - II 2.0 - 2.6 ohms

  - In the 2-phase stator

    0 - I 13 - 16 ohms

    0 - II 18 - 20 ohms

  - In the (Opti 154...)

    0 - I ca. 10 ohms

    0 - II ca. 10 ohms

Error 806

Meaning:

Intermediate circuit is switched off when switching on the generator

Description:

During power-up inspect whether or not the intermediate circuit is switched on. If this is not the case and a liquid bearing X-ray tube is connected to the generator, then this tube will not be accelerated. The system is no longer ready for operation.

Possible causes and action:

- Switch off system, switch on intermediate circuit and switch on system again

Error 810

Meaning:

Stator contactor acknowledgment "SRTRSU" missing

Description:

Stator contactor K3 (wiring diagram X2206-30) not changed over.

Possible causes and action:

- Contactor K3 defective
- Acknowledgment interrupted.
- Check signal on D100.X20.23 "STRSU”.
- Signal OK
- K3 ON = 0V
- K3 OFF = 24V (± 15%)
- Replace D100
- Check whether a third workstation is configured and order contactor attachment, if necessary.

Restructuring of document and new layouted.