

SIEMENS

POLYDOROS LX 30/50

AX

Troubleshooting Guide

POLYDOROS LX

PL LX

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

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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

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Safety Information

NOTE

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

NOTE

All kV, mAs and tube current values are stated in these instructions with $\pm 5\%$ 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

Designation:

Faulty Init Data

Description:

Incorrect or too many init data received. This error is generated when an init block with incorrect data is received. All following init data will then trigger this error, even if these data are not incorrect. Remedy: Reconfigure or again select all fluoro curves.

Error 001**Designation:**

Start of a service session.

Description:

- The Service PC has successfully contacted the XCU.
- Not an error; for information only.
- This error appears in the error log under the Number 41 from 240 (XCU).

Error 002

Designation:

End of a service session.

Description:

- The Service PC has ended contact with the XCU.
- Not an error; for information only.
- This error appears in the error log under the Number 42 from 240 (XCU).

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 installedThe terminal connector has Part No.: 3157174.
- 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 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.

Possible 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)
- PROM D100.J32 (for D100 Part No.: 11 71 169)
- D100

Error 119

Designation:

Heating circuit timeout

Description:

Communication between the D220 heating circuit and the D100 master takes place over the serial interface (MPS, D100.X1.28, D220.X1.28)

If an interrupt of communication between the D100 and D220 takes place, error 119 is sent out by the D100.

Possible Causes of Error and Remedies:

- Serial interface interrupted, check →
- D100, D220 defective, replace →
- Arcing tube
- H1 high voltage transformer
- Check how the cables are laid (shielding)
- Check the ground wires, all ground wire connections provided by the manufacturer must be connected.
- Check the firmware version.
- Check the 5V power supply on the SNT, D160 and D220.
 - Measure at the SNT X2.6 (5V) switch power supply versus X2.3 (0V), set approx. 5.1V (max. 5.2V).
 - On the D160. Measure X31 (5V) versus X28, the voltage drop versus the SNT should be less than 20mV.
 - Measure on D220.X18.A1 (5V) versus X15, the voltage drop versus the SNT should be less than 150mV.
 - If the voltage drop on the D220 is more than 150mV, check the following plug-in connections: SNT.X2, D160.X11, D160.X13, D100.X13, D100.X1, D220.X1.
 - If the X1 ribbon cable between D100 and D220 is causing the voltage drop, replace it with a new one with Part No. 7463677.
- Observe the generator Overview Wiring Diagram for lamps and LEDs in the power cabinet.
- Ignore error 119 if the red LED (D220) is blinking and no firmware is loaded; perform a → download.

Error 120

Designation:

NAK when sending to the heating circuit

Description:

Communication between the D220 heating circuit and the D100 master takes place over the serial interface (MPS, D100.X1.28, D220.X1.28)

With communication errors between the D100 and D220, error 120 is triggered.

Possible Causes of Error and Remedies:

- Serial interface interrupted, check →
- D100, D220 defective, replace →
- Arcing tube
- Check how the cables are laid (shielding)
- Check the ground wires, all ground wire connections provided by the manufacturer must be connected.
- Check the firmware version.
- Check the 5V power supply on the SNT, D160 and D220.
 - Measure at the SNT X2.6 (5V) switch power supply versus X2.3 (0V), set approx. 5.1V (max. 5.2V).
 - On the D160. Measure X31 (5V) versus X28, the voltage drop versus the SNT should be less than 20mV.
 - Measure on D220.X18.A1 (5V) versus X15, the voltage drop versus the SNT should be less than 150mV.
 - If the voltage drop on the D220 is more than 150mV, check the following plug-in connections: SNT.X2, D160.X11, D160.X13, D100.X13, D100.X1, D220.X1.
 - If the X1 ribbon cable between D100 and D2209 is causing the voltage drop, replace it with a new one with Part No. 7463677.
- Observe the generator Overview Wiring Diagram for lamps and LEDs in the power cabinet.
- Ignore error 120 if the red LED (D220) is blinking and no firmware is loaded; perform a → download.

Error 121

Designation:

NAK when receiving from the heating circuit

Description:

Communication between the D220 heating circuit and the D100 master takes place over the serial interface (MPS, D100.X1.28, D220.X1.28)

With communication errors between the D100 and D220, error 121 is triggered.

Possible Causes of Error and Remedies:

- Serial interface interrupted, check →
- D100, D220 defective, replace →
- Arcing tube
- Check how the cables are laid (shielding)
- Check the ground wires, all ground wire connections provided by the manufacturer must be connected.
- Check the firmware version.
- Check the 5V power supply on the SNT, D160 and D220.
 - Measure at the SNT X2.6 (5V) switch power supply versus X2.3 (0V), set approx. 5.1V (max. 5.2V).
 - On the D160. Measure X31 (5V) versus X28, the voltage drop versus the SNT should be less than 20mV.
 - Measure on D220.X18.A1 (5V) versus X15, the voltage drop versus the SNT should be less than 150mV.
 - If the voltage drop on the D220 is more than 150mV, check the following plug-in connections: SNT.X2, D160.X11, D160.X13, D100.X13, D100.X1, D220.X1.
 - If the X1 ribbon cable between D100 and D220 is causing the voltage drop, replace it with a new one with Part No. 7463677.
- Observe the generator Overview Wiring Diagram for lamps and LEDs in the power cabinet.
- Ignore error 121 if the red LED (D220) is blinking and no firmware is loaded; perform a → download.

Error 122

Designation:

Buffer overrun when receiving from the heating circuit

Description:

Communication between the D220 heating circuit and the D100 master takes place over the serial interface (MPS, D100.X1.28, D220.X1.28)

With communication errors between the D100 and D220, error 122 is triggered.

Possible Causes of Error and Remedies:

- Serial interface interrupted, check →
- D100, D220 defective, replace →
- Arcing tube
- Check how the cables are laid (shielding)
- Check the ground wires, all ground wire connections provided by the manufacturer must be connected.
- Check the firmware version.
- Check the 5V power supply on the SNT, D160 and D220.
 - Measure at the SNT X2.6 (5V) switch power supply versus X2.3 (0V), set approx. 5.1V (max. 5.2V).
 - On the D160. Measure X31 (5V) versus X28, the voltage drop versus the SNT should be less than 20mV.
 - Measure on D220.X18.A1 (5V) versus X15, the voltage drop versus the SNT should be less than 150mV.
 - If the voltage drop on the D220 is more than 150mV, check the following plug-in connections: SNT.X2, D160.X11, D160.X13, D100.X13, D100.X1, D220.X1.
 - If the X1 ribbon cable between D100 and D220 is causing the voltage drop, replace it with a new one with Part No. 7463677.
- Observe the generator Overview Wiring Diagram for lamps and LEDs in the power cabinet.
- Ignore error 122 if the red LED (D220) is blinking and no firmware is loaded; perform a → download.

Error 123

Designation:

Incorrect response from the heating circuit

Description:

Communication between the D220 heating circuit and the D100 master takes place over the serial interface (MPS, D100.X1.28, D220.X1.28)

With communication errors between the D100 and D220, error 123 is triggered.

Possible Causes of Error and Remedies:

- Serial interface interrupted -> check
- D100, D220 defective, replace →
- Arcing tube
- Check how the cables are laid (shielding)
- Check the ground wires, all ground wire connections provided by the manufacturer must be connected.
- Check the firmware version.
- Check the 5V power supply on the SNT, D160 and D220.
 - Measure at the SNT X2.6 (5V) switch power supply versus X2.3 (0V), set approx. 5.1V (max. 5.2V).
 - On the D160. Measure X31 (5V) versus X28, the voltage drop versus the SNT should be less than 20mV.
 - Measure on D220.X18.A1 (5V) versus X15, the voltage drop versus the SNT should be less than 150mV.
 - If the voltage drop on the D220 is more than 150mV, check the following plug-in connections: SNT.X2, D160.X11, D160.X13, D100.X13, D100.X1, D220.X1.
 - If the X1 ribbon cable between D100 and D220 is causing the voltage drop, replace it with a new one with Part No. 7463677.
- Observe the generator Overview Wiring Diagram for lamps and LEDs in the power cabinet.
- Ignore error 123 if the red LED (D220) is blinking and no firmware is loaded; perform a → download.

Error 125

Meaning:

Timeout lontomat

Possible causes and action:

- Check cabling from D100 to lontomat or replace cable

Error 401

Designation:

ADC timeout ADC from the heating circuit

Description:

A/D converter in the heating circuit not converting

Possible Causes of Error and Remedies:

- Check the 5V power supply on the SNT, D160 and D220.
 - Measure at the SNT X2.6 (5V) switch power supply versus X2.3 (0V), set approx. 5.1V (max. 5.2V).
 - On the D160. Measure X31 (5V) versus X28, the voltage drop versus the SNT should be less than 20mV.
 - Measure on D220.X18.A1 (5V) versus X15, the voltage drop versus the SNT should be less than 150mV.
 - If the voltage drop on the D220 is more than 150mV, check the following plug-in connections: SNT.X2, D160.X11, D160.X13, D100.X13, D100.X1, D220.X1.
 - If the X1 ribbon cable between D100 and D2209 is causing the voltage drop, replace it with a new one with Part No. 7463677.
- If the voltage is within tolerance: Replace the D220 board

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, measure $230V \pm 10\%$.
- 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 ($\pm 15\%$)
 3. AP2 test point 52 = 24V ($\pm 15\%$)
- Check filament transformer primary winding ($R < 1\text{Ohm}$, 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 ($\pm 10\%$)
 - V65 = +15V ($\pm 10\%$)
 - V64 = +15V ($\pm 10\%$)
 - X19/A8 = +24V ($\pm 15\%$)
- Replace D220

Error 413

Meaning:

Tube current nominal value too 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 primary winding ($R < 1\text{Ohm}$, transformation ratio 32:9)

Error 425

Meaning:

-15V ($\pm 10\%$) is less than -12V on D220

Possible causes and action:

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

Error 426

Meaning:

15V analog ($\pm 10\%$) is less than 12V on D220

Possible causes and action:

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

Error 427

Meaning:

15V digital ($\pm 10\%$) is less than 12V on D220.

Possible causes and action:

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

Error 428

Meaning:

24V ($\pm 15\%$) is less than 20V on D220

Possible causes and action:

- Check voltage on D220.X19.A8 24V ($\pm 15\%$)
- Check connection to D100 (lead X1.21, X1.38-40)
- Check voltage on D160:
 - D160.X13/14 = 24V ($\pm 15\%$)
 - 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.
- A defective heating circuit fan (24 V power supply) above the D220 can be the cause for dropping below the 24 V monitoring.

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 $R < 1\text{Ohm}$, 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 $R < 1\text{Ohm}$, 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 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 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 dose 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 600

Meaning:

+15V ($\pm 10\%$) faulty

Possible causes and action:

- 5V $\pm 0,2$ V 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~ ($\pm 10\%$), 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~ ($\pm 10\%$), 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 does 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~ ($\pm 10\%$) at 50 Hz
 - 29V~ ($\pm 10\%$) at 60 Hz
- Check contactor acknowledgment PSU at D100.X5.25 24V~ ($\pm 10\%$)
- 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 D160 defective
 - replace D160
- Check cable from D100.X5 to D160.X5
- Check actuation of the LS contactor A2, A1
 - 24V~ ($\pm 10\%$) at 50 Hz
 - 29V~ ($\pm 10\%$) at 60 Hz
- Check contactor acknowledgment LSU at D100.X5.27 or D160.X3.9 24V~ ($\pm 15\%$).
- Contactor sticks or jams.

Error 604

Designation:

Intermediate circuit voltage (UZ) < 400V.

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

Caution! Direct voltage

Description:

- During initialization:
 - The charge breaker is switched on by the D160. After 5 sec., the status of the intermediate circuit is inquired (assuming there was a charge breaker response). If the intermediate circuit voltage is too low (< 400V), error 604 is triggered.
- During operation:
 - If the intermediate circuit voltage drops during operation, error 604 is also triggered.

Possible Causes of Error and Remedies:

- Phase missing, intermediate circuit is charged too slowly.
- Check the line voltages.
- Check the UZACT signal on D100.X20.17 and X20.19 ($1V \triangleq 50V / UZ_{ACT} = 1.4 \times U_{Line}$)
- Check the ribbon cable from D100.X20 to X115.X20.
- R1, R2 charge resistors defective; replace the resistors.
- With the POLYDOROS LX30/50, Part No. 1170427 from Serial No. 01001 - 03369 with D100, Part No. 1171169, Rev. 08, the connection on the D100 between V133.anode and X20.13 (-15V power supply for D115.J1.4) is missing.

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 ($\pm 15\%$)
 - "RANGE 1" without significance
 - With normal FL ON: measuring range 1 mA;
 - "RANGE 0" X19.A1 = 24V ($\pm 15\%$)
 - "RANGE 0" "OK" X19.A4 = 0V
 - "RANGE 1" X19.A2 = 24V ($\pm 15\%$) 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~ ($\pm 10\%$) at 50 Hz
 - 29V~ ($\pm 10\%$) 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 ($\pm 15\%$)
 - X19.A5 0V
- D100 defective
- D220 defective

Error 633

Meaning:

$U_{IST} > 2\text{kV}$ 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).

NOTE

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, or 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 550V.
- Checking the charging current:
 - Switch the generator OFF.
 - Switch the main switch OFF.
 - Check for no voltage at the line fuses.
 - Disconnect the L1, L2, L3 cables at the PS breaker.
 - Plug in a current converter with 10 Ohm terminal resistance over each cable.
 - Reconnect the cables.
 - Connect the oscilloscope to the current converter over L1, L2, L3.
 - Trigger. Int.
 - Main switch and generator ON
 - The line currents must be the same level in all phases (ensure there is 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: MAACT (IRö ACT) D100/X64 MA_ACT
 - CH2: KVACT D100/X61 kV_ACT
 - Trigger SWR D100/X64
- 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 \triangleq 50A)
 - Trigger: SWR X64, time base 10 μ s
- Generator ON
- In SSW <DIAGNOSTIK> conduct <Inverter Test> and compare measurement results with the following wiring diagrams:

POLYDOROS LX 80:

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

Pos. Signal (1 V \triangleq 100A)

Neg. Signal (1 V \triangleq 100A)

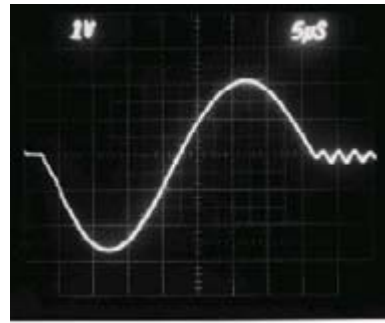
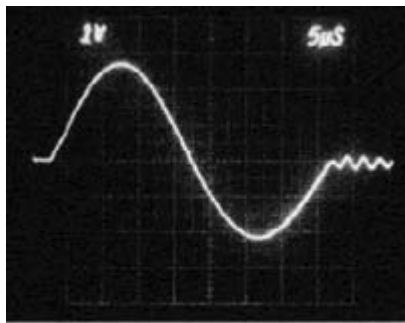


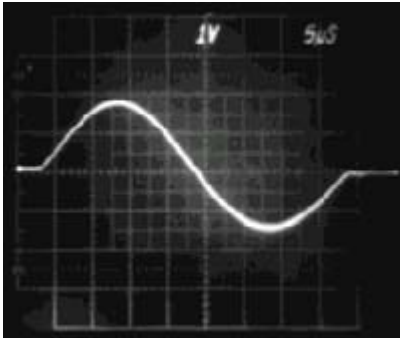
Fig. 1:

- The following requirements are to be checked in both oscillograms:
 - "Forward oscillation" : 270A \pm 10%
 - "Backward oscillation" : 210A \pm 10%

POLYDOROS LX 30/50 and POLYDOROS LX 30/50 Lite:

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

Pos. Signal (1 V $\hat{=}$ 100A)



Neg. Signal (1 V $\hat{=}$ 100A)

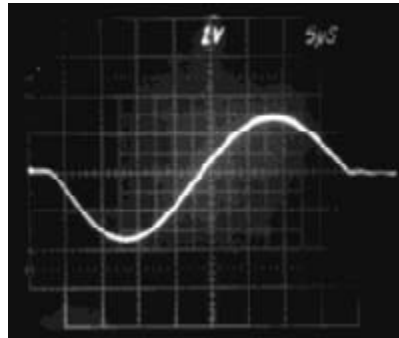


Fig. 2:

- The following requirements are to be checked in both oscillograms :
 - "Forward oscillation" : 180A \pm 10%
 - "Backward oscillation" : 140A \pm 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 X2169-16, Replace D100 in the case of deviation
- If pulses are OK proceed as follows:
 - Replace inverter

4. 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: MAIST (IRö IST) D100/X64 MA_ACT
 - CH2: kVIST 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.

5. Check 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:

- Check the +KV actual value on D220.X18.A7 and D100.X61 "KV+" (see Generator Wiring Diagram, page 15) at both test points: $1V \triangleq 10KV$.
- 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:

- Check the kV actual value on D220.X18.A8 and D100.X61 "kV-" (see Generator Wiring Diagram, page 15) at both test points: $1V \triangleq -10KV$.
- 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:

- +kV actual value on D220. Check X18.A7 and D100.X61 test point "kV+" (see Generator Wiring Diagram, page 15) at both test points: $1V \triangleq 10kV$
- Check ribbon cable between D220.X1 and D100.X1.
- Perform "Diagnostic/Inverter Test"
- Check the oscillation current on D100.X62 "I_LOAD" (1V = 50A) and compare it with the diagram for 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 the minus kV actual value on D220.X18.A8 and D100.X61 "kV-" (see Generator Wiring Diagram, page 15) at both test points: $1V \triangleq -10KV$.
- Check ribbon cable between D220.X1 and D100.X1
- Perform "Diagnostic/Inverter Test"
- Check the oscillation current on D100.X62 "I_LOAD" ($1V \triangleq 50A$) and compare it with the diagram for ERROR 711.
- Check connection screws in the intermediate circuit and inverter
- Measure intermediate circuit voltage at D110.X2 and X1 (X2206-16)
 - $U_{ZACT} = 1.4 \times U_{mains}$
 - 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 LX30/50(Lite)/80:
 - Temperature switch of the tube is connected only for OPT1154/30/50R-100, for all other tube assemblies there is a jumper on D160.X7.1 and 4 for WS1, or D160.X7.2 and 3 for WS2.

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
 - $U_{Z_{ACT}} = 1.4 \times U_{mains}$
 - 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:

During bootup, the current is measured in the primary phase (test point D100.X60 "I_ANL") $1V \triangleq 5A$. The current must be more 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.
 - $U_{ZACT} = 1.4 \times U_{mains}$
 - 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

Designation:

"STRSU" stator breaker response missing

Description:

K3 or K31 / K32 stator breaker (see Wiring Diagram, page 30) has not switched over.

Possible Causes of Error and Remedies:

- K3 or K31 / K32 breaker defective.
- Response interrupted.
- Check signal on the "STRSU" signal on the D100.X20.23.
- Signal OK
- K3 or K31 / K32 ON = 0V
- K3 or K31 / K32 OFF = 24V ($\pm 15\%$)
- Replace the D100.
- Check whether a third workstation is configured and order breaker option, if needed.

Check of “Di Pulses” in XCS Network

Measurements in the XCS Cable Network

Test point D200.X4.1 and 6 with connected connector and opened connector housing or with SUB D 9-pole test adapter, included in the CAN tool kit, Part No. 7559441. The check of “Di pulses” can be performed without measuring directly on the D200.X4 connector.

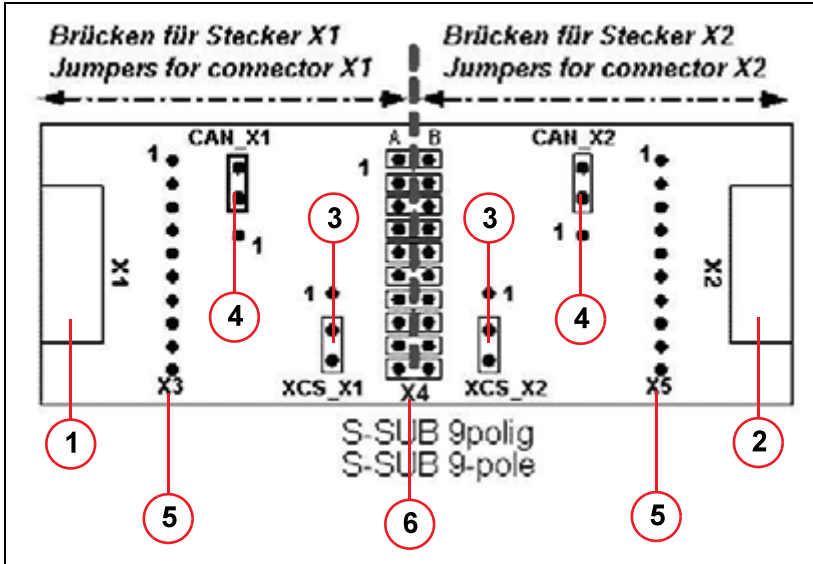


Fig. 3: CAN tool kit test adapter, SUB D, 9-pole

- Pos. 1 X1 connector, SUB D, 9-pole
- Pos. 2 X2 female connector, SUB D, 9-pole
- Pos. 3 XCS_X1 and XCS_X2 terminal resistors, 120 Ohm 1---2 = active / 2--3 = not active
- Pos. 4 CAN_X1 and CAN_X2 terminal resistors, 120 Ohm 1---2 = active / 2--3 = not active
- Pos. 5 X3.1 - 9 test points for connector X1 / X5.1 - 9 = test points for X2 female connector
- Pos. 6 X4.1 - 9 = jumper to implement signal isolation of X1 connector to X2 female connector

Since the XCS network is galvanically separated, connect only test probe 1 and operate the oscilloscope via an isolation transformer.

Shielded twisted pairs are used for data transfer (labeled as Phase A and Phase B in the Wiring Diagram). These cables have a defined impedance and attenuation. Because of this, the amplitude of the transmit signal is somewhat less from a station farther away from the test location. Since all stations send the token cyclically on the line, the adjacent oscillogram is obtained when a passing trigger point is set.

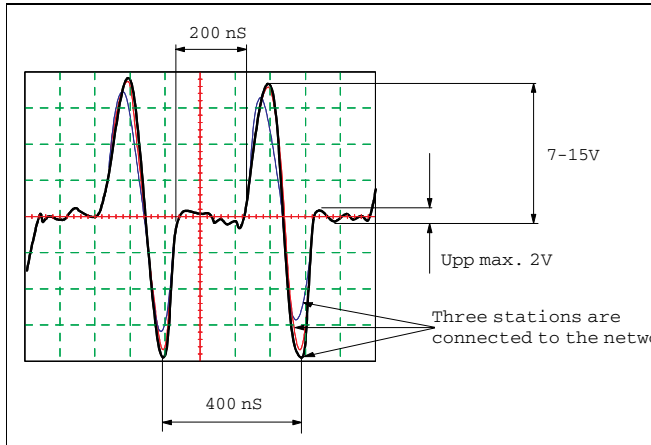


Fig. 4: Reflection-free operation

Measurements in the XCS Cable Network

Test point D320.X4.1 and 6 with connector plugged in and open connector housing. Since the XCS network is galvanically separated, connect only test probe 1 and operate the oscilloscope via an isolation transformer.

Shielded twisted pairs are used for data transfer (labeled as Phase A and Phase B in the Wiring Diagram). These cables have a defined impedance and attenuation. Because of this, the amplitude of the transmit signal is somewhat less from a station farther away from the test location. Since all stations send the token cyclically on the line, the adjacent oscillogram is obtained when a passing trigger point is set.

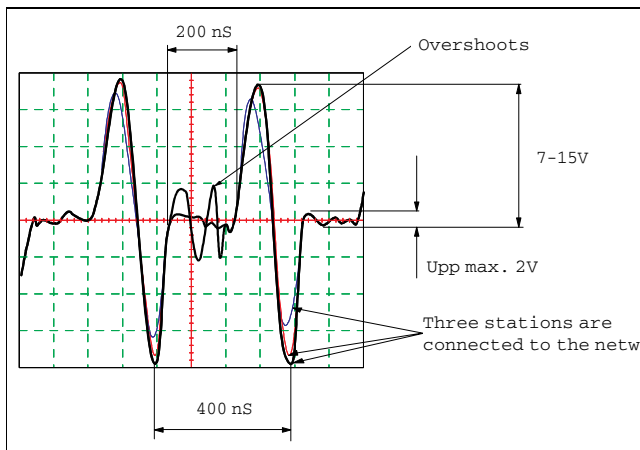


Fig. 5: Reflections in the XCS network

Evaluating the Oscillogram

- The amplitude of the transmit signal should be between 7-15 V.
- The overshoot should be a max. of 2Vpp.

Possible Corrective Measures for Disturbances in the XCS Cable Network

- Check the XCS plug-in connections; Is the shielding correctly clamped? Are cables pinched or damaged?

- Take one XCS component out of the XCS network and terminate it with a terminal resistor. Repeat the measurement of the XCS cable network; if an improvement is found, the XCS cable or the disconnected XCS component can be the cause.
- If disturbances cannot be corrected in the XCS cable network using Corrective Measure 1 or 2, replace the D200.

Chapter	Section	Revision
Trouble-shooting	ERROR 119	Troubleshooting expanded by voltage interrupt of 5V.
Trouble-shooting	ERROR 120	Troubleshooting expanded by voltage interrupt of 5V.
Trouble-shooting	ERROR 121	Troubleshooting expanded by voltage interrupt of 5V.
Trouble-shooting	ERROR 122	Troubleshooting expanded by voltage interrupt of 5V.
Trouble-shooting	ERROR 123	Troubleshooting expanded by voltage interrupt of 5V.
Trouble-shooting	ERROR 401	Troubleshooting expanded by voltage interrupt of 5V.
Trouble-shooting	ERROR 428	Troubleshooting expanded to include fan for heating circuit.
Trouble-shooting	ERROR 604	Troubleshooting expanded by D100, Part No. 1171169, Rev. 08.
Trouble-shooting	XCS Network	Check of Di Pulses in XCS Network added.
Trouble-shooting	ERROR 810	New K31 / K32 stator breakers added.

