Orthopantomograph® OP100 D
Orthoceph® OC100 D

Troubleshooting Manual

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INSTRUMENTARIUM imaging

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1 General trouble shooting

Trouble shooting guides listed in this manual are for guidance and they are not intended to be complete and thourough. Parts are identified in the wiring diagram with letter(s) followed by number eg. cable or capasitor (C), fuse (F), lamp (LA), motor (M), switch (S), coiled cable (SC), and connector (X).

1.1 OP100D Does not operate at all

Possible causes:	Check that:
No power or OP100D is not receiving power.	Site's circuit breakers are ok
	Mains cables are connected inside the OP100 and the unit is properly connected to the mains voltage.
	Mains fuses are ok and have the correct rating.
Power switch turned off.	the power on/off switch is at " I " position. Green indicator under the carriage should be lit.
Wrong mains voltage setting.	OP100 mains voltage setting on the Power Supply Board matches the power line.
Problem with secondary voltages.	Fuses of secondary voltages are ok and that individual circuit boards are receiving the power (green LED's).

1.2 No exposure & no error message, but movements ok

Possible causes:	Check
Remote exposure button does not operate.	Signal EXPSW switch and its wiring. Use Sr 74 IOC.
Panel exposure button does not operate.	Signal PNLEXPSW switch and its wiring. Use Sr 74 IOC.
Unit is used in Test mode.	the exposure mode selection in the control panel. Select "A" or "M" instead.
Installation.	the CPU Board jumper X11 or switch S2. Set X11 jumper to OFF or turn S2 to OFF. Exhibition mode is set when exposure lights are on but no buzzer is heard during the exposure.
Problem with CPU signal PREHREL. Sometimes this error does not generate an error message.	the generator and exposure signals. Replace boards if needed.

Possible causes:	Check
Problem with Inverter Board signals KVREF or KVFB. Sometimes this error does not generate an error message.	signals. KVREF signal line broken or KVFB D10 shorted. Replace Inverter Board.

1.3 Exposure ok, but no movements

Possible causes:	Remedy:
Unit is in Installation mode. Pr 68 INS used.	Switch the power off. This will resume normal operation and set Pr 68 INS to “OFF”.
Installation & Service: Unit is in Sr 75 EPS mode.	Press “OK” key. If Sr 75 EPS displayed, then make the test exposures. Set unit back to normal operation, switch jumper X10 back to the user program.

1.4 OP100 D Malfunctions, but no error message

Possible causes:	Remedy:
Problem with CPU EEPROM contents.	Check the EEPROM mounting and function. Set Pr 53 nor to “on”. If this does not help, replace the CPU Board.
Service: CPU Board with sw 1.B4.10 or higher has been replaced with lower software version	Verify the software version.Check if unit has nonlogical values for parameters. Reset factory defaults to the EEPROM: set Pr 53 nor to “on”. Reprogram parameters. See OP100D Configuration Form for details.

NOTE

Note: sw 1.B4.10 uses different EEPROM memory map than the earlier versions. It can “copy” most of earlier sw version parameters - but not vice versa.

1.5 Positioning lights do not operate

Possible causes:	Remedy:
Collimator in CEPH or QA position. No lights	Select the PAN collimator.
Problem with lights and their wiring.	Check the 12 VAC power line wiring, Interface Board and X19 signals.
Problem with pos.panel connectors or lights key(s).	Check the panel keys and wiring, with OT models check both the panels. In CEPH mode check the collimator position - if CEPH - make sure that ear holders are in lateral position.

1.6 Ceph lateral program can’t be selected

Possible causes:	Remedy:
CPU Board doesn’t sense LAT/PA switch changes	Check Ceph LAT-switch function
Overexposed image at the end of CEPH LAT program (no 6)	Check that Ceph LAT-switch senses LAT position - if not - there isn’t soft-tissue compensation in Ceph LAT image.
	Check that nasion potentiometer frequency (caecfrq) is detected by CPU Board

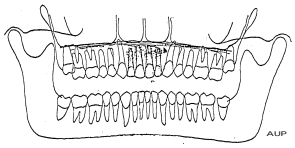
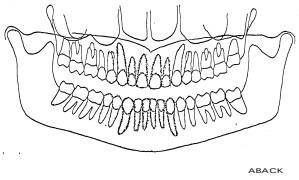
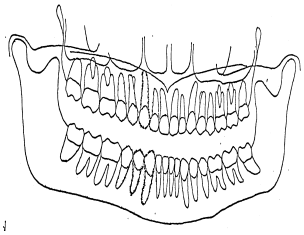
NOTE

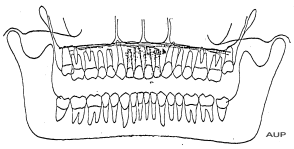
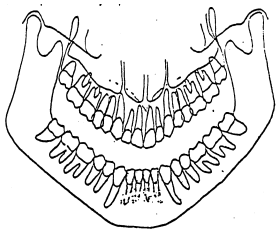
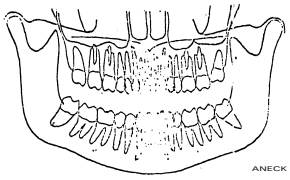
Sw 1.B4.10 is used only in OP100D units with fixed Pan camera. From sw 1.4.11 on the unit can be either OP100D or OC100D with detachable camera(s)

1.7 Problems with diagnostic image quality

High quality images with sharp contrast and good detail present optimum diagnostic information. Images with less quality are usually the result of one or more common problems, which are discussed here.

1.7.1 Patient positioning

Problem	Possible cause	Remedy
Incisors and canines narrow and unsharp. Overshadow in molar and premo-lar areas. Rows of teeth are compressed. 	1 Occlusal correction of focal trough set too far posterior 2 Image layer light not obeyed 3 Bite block was not used	1-2) Check patient positioning with light lines and occlusion correction buttons 3) Insert bite block
Incisors and canines wide and unsharp. Rows of teeth widened. 	1 Occlusal correction of focal trough set too far anterior 2 Image layer light not obeyed 3 Bite block was not used	1-2) Check patient positioning with light lines and occlusion correction buttons 3) Insert bite block
Teeth appear wider on one side and narrower on the op-posite. Ramus widths are different on opposite sides. 	1 Midsagittal line not obeyed 2 Patient's head not in center position	1 Check patient's mid sagittal plane with light line 2 Check that patient's head is centered

Problem	Possible cause	Remedy
The shadow of hard palate is exposed over maxillary molars. Row of teeth has a wavy appearance. TM joints are exposed outward. Image is not “smiling”. Mandible is imaged sharper than maxilla 	Patient head tilted back	Check FH plane
Rows of teeth curved upwards. Mandibular incisors are unsharp. TMJ joints exposed high and are often cut off from the image. Image is “smiling” too much . 	Patient head tilted forward	Check FH plane
Middle area of the image too bright and unsharp. Spine shadow. 	1 Patient’s neck was not stretched 2 kV compensation not used or LOW compensation was used with heavy adult patient 3 Wrong software contrast and brightness settings	1 Stretch patient’s neck 2 Enable or increase kV compensation 3 Adjust contrast and brightness on CliniView
Rows of teeth overexposed.	Tongue was not against the roof of palate	Ask patient to swallow and place tongue against the roof of palate
TMJ’s exposed on different heights on image. Bilateral distortion in molar and premolar regions.	1 Patient tilted to one side 2 Midsagittal light line not obeyed	1-2) Check midsagittal plane and center patient’s head.
Rows of teeth exposed too high. TMJ’s cut off.	1 Chin was not resting on chin support 2 Patient positioned too high	1-2) Check patient positioning and type of bite fork rod

Problem	Possible cause	Remedy
Rows of teeth exposed too low. Mandible not exposed completely to the image.	Chin rest was not used with bite fork	Install chin rest

Possible causes:	Remedy:
Sharp image layer is not correct	See OP100D / OC100D User Manuals for patient positioning details
Overexposed image at the end of CEPH LAT program (no 6)	Check that Ceph LAT-switch senses LAT position - if not - there isn’t soft-tissue compensation in Ceph LAT image.

1.7.2 Image is grainy or noisy

Possible causes:	Remedy:
Not enough dose to achieve diagnostic image i.e. x-ray beam not correctly positioned compared to the camera	Verify that OP100D panoramic beam alignment is ok. Verify that OC100D cephalometric beam alignment is ok
Too low exposure values	Increasing CCO and density settings decreases image noise With sw 1.B4.11 or higher check the AEC offset and density settings Check that the preprogrammed exposure values match to the needs and preferences of the customer
Broken main cable, Inverter Board or Filament Control Board	Check that darkness of the columns in a newly taken Quality Assurance reference image increases stepwise

1.7.3 Image is straiped

Possible causes:	Remedy:
Too high exposure values	Check that your exposure settings are reasonable - overexposure makes image striped in the areas where is little media on the beam.
	Decreasing CCO and density settings decreases the amount of straips in image
	With sw 1.B4.11 or higher check the AEC offset and density settings
	Check that the preprogrammed exposure values match to the needs and preferences of the customer

1.7.4 Image is too dark / light

Possible causes:	Remedy:
Monitor settings are wrong	See monitor and Cliniview user manual for preferred settings Verify that you are using min. 24-bit colour. Less colours makes gray scale changes quantized. For detailed decription see Windows and / or graphics board installation manuals.
Cliniview settings are wrong	See Cliniview user manual for preferred and optimized settings

NOTE

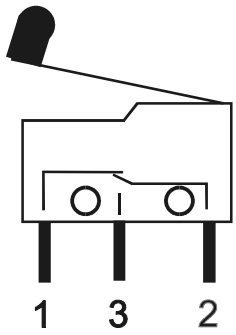
In film systems dose, image contrast and image density are tied together and controlled by CCO and density setting of OP100. Whereas in digital system, dose is controlled by OP100D/OC100d unit and image contast and brightness are controlled by used viewing sw (e.g. CLINIVIEW), PC monitor and graphics board settings

2 Electric trouble shooting

The OP100D has many safety functions and features assuring the safe operation of the equipment. In the event of certain user failures or system malfunction the unit will not produce x-rays and a failure code will be displayed on the control panel.

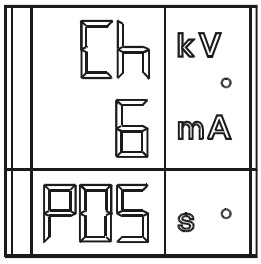
2.1 Microswitches and position indicators

There are 16 microswitches or optocouplers in OC100D models and 13 in OP100D models to detect the position of the various movements of the equipment. All switches are wired to the CPU Board, and the microprocessor reads the status of the switches every 20 ms. The name of the switch is the same as the name of the signal to the microprocessor. Open switch is 5 V, and closed switch is 0 V signal level in CPU Board. Their operation can be checked by using Service Program “Sr 74 IOC”.



2.2 General, failure messages

In case of malfunction, the unit displays a failure message. Various letters and numbers will be displayed in the technique factors display positions next to kV, mA and s. Failure code classification is displayed next to kV. A special failure code number is displayed next to mA with alphanumeric information in the s-display.



kV display

Letters in the kV-display indicate the nature of the failure, whether it is caused by user (eg. wrong collimator selected), environment (eg. low line voltage) or protection in the unit (eg. tubehead too hot), or whether there is a serious defect in the unit, which disables the complete operation (eg. program memory error):

Ch	Check. A failure caused by the user.
Sy	Safety. Temporary malfunction or protection in the unit, caused by the unit or environment. Operation is prohibited or terminated to protect the operator, patient and the unit itself. (Eg. the temperature in the tube head assembly is too high due to intensive use). After the corrective action or the wait time, the unit can be used.

Er	Error. There is a serious defect in the unit, and the operation is therefore prohibited to protect the operator, patient and the unit itself. (Eg. Failure in the CPU Board).

WARNING

If the unit is further used, “er” failure may cause malfunction.

mA display

The mA-display shows the actual numeric failure code. Each failure code has a unique number, to differ one malfunction from another:

kV	**MA**
Ch	1 to 8 (sw 1.2.01) 1 to 9 (sw 1.2.05 ?)
Sy	20 to 31
Er	40 to 46

s display

The exposure time display indicates the alphanumeric short form explanation of the malfunction. This reminds the user or the serviceman of what the actual numeric failure code means, or sometimes numeric information of the malfunction, eg. “PC” for personal computer and “COL” for collimator.

kV	**Time display**
Ch-failure	PC, COL, POS, PSE, rEo, or numbers
Sy-failure	HHo, Inu, FIL, AEC, EEP, Por, PoC, PoL, PoH, PoU, or numbers
Er-failure	CPU, FIL, InP, Pay

Failure code resetting

Ch failure codes can be reset by correcting the reason for the failure code (eg. changing collimator position).

Ch and **Sy** failures can be reset by pushing any key in the control panel (up-down-right-left-OK) or in the patient positioning panel.

Er failures can not be reset. Switch the unit off and on, to test whether the failure was only temporary.

2.3 Trouble shooting according to failure messages

2.3.1 Ch 1 PC

Problem:	" **Ch 1 PC** " error message is displayed.
Why?	Detector not found.
How is it detected?	Error is generated when user has pressed OP100D or OC100D exposure button and CPU doesn't receive "PC ready" message

Possible causes:	Check or test:	Parts related:
1. No respond from camera because:		
a) The camera (corresponding to the selected imaging program) is not connected.	Check that the ccd-detector is connected to the PAN or CEPH head according to the imaging program selected from the OP100D / OC100D control panel.	Camera / Detector, OP100D / OC100D, control panel
b) PCI Board is not properly installed	Make sure that PCI Board is installed on PC and the driver has recocnized PCI Board. Also check that LINK_OK LED H1 is "ON" on the board.	PC, PCI Board driver, PCI Board
c) Wiring fault (C67: RXD2, TXD2) between the PAN AEC Terminal Board and the OPCPU	Check the wiring and PAN AEC Terminal. If CPU Board is receiving "PC Ready" message LED H4 on the CPU Board is blinking after "start OPD/ OCD image..."-button is pressed in Cliniview.	PAN AEC Terminal Board, CPU Board
d) Missing PERMANENT_+5 V supply voltage from the camera (Terminal Board:H4, Cables C47, C68)	Check that LED H4 on the PAN AEC Terminal is ON. LED tells you if Terminal senses camera connection or in case of fixed PAN head the jumper J1 is installed.	PAN AEC Terminal Board, PAN Connector Board, Camera Connector Board

Possible causes:	Check or test:	Parts related:
2. Image capture not started on CV	Check that you have initialized imaging sequence by pressing “start OPD/ OCD image capturing session” button	Cliniview
3. Fiber optic link NOT OK	Check that LINK_OK LED H1 on PCI Board is ON	PCI Board
a) PC not connected or POWER OFF	Check that PC is ON and Cliniview has been started after powering OP100D / OC100D. Note: If OP100D is switched OFF while Cliniview is ON you must either restart Cliniview or press “Start OPD/ OCD image...”-button	PC, OP100D / OC100D, Cliniview
b) Fault on the fiber optic cable or on the optical connectors	Check LINK_OK LED H1 on PCI Board - it should be ON after Cliniview has been started. If LINK_OK LED is NOT ON make link test procedure.	OP100D / OC100D, PC
4. Gain file problem		
a) Gainfile is not found	Check that your camera’s gainfile is saved under your Instrumentarium Imaging\Cliniview\Dicc\Ortho\Gainfiles\ folder. From Cliniview’s Help - systeminfo/Device verify that Cliniview has recognized the needed gainfile in panoramic or cephalometric imaging.	PC, installation media, gain file media
b) Gainfile does not correspond to the camera	Check that Gainfile number matches to camera / detector number	PC, installation media, gain file media

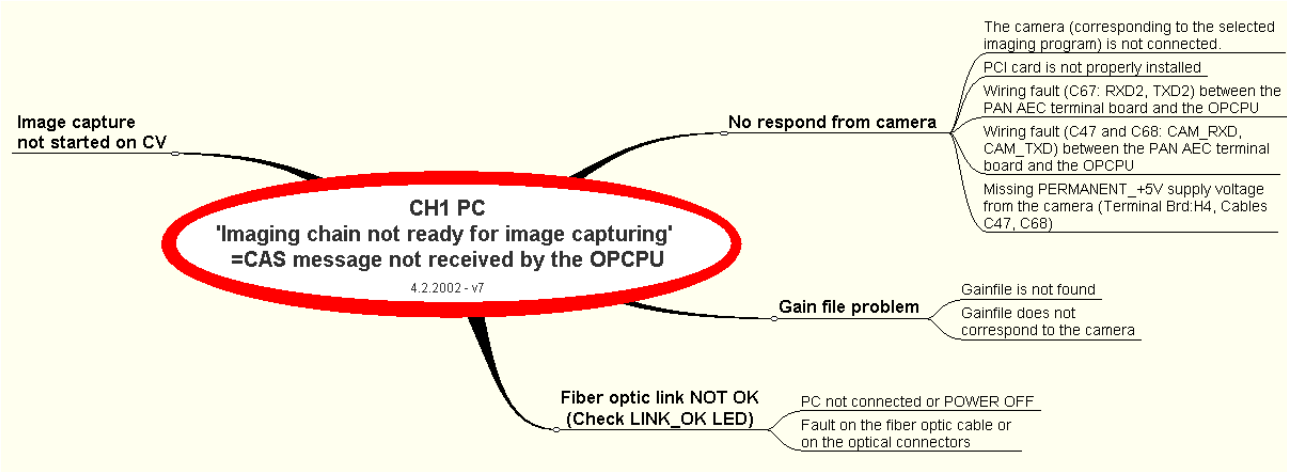


Fig 2.1. Ch 1 PC

2.3.1.1 Fiber test

Terminal Board fiber test

1 Fiber test jumper=ON

2 Connect TXD-RDX test cable

3 LINK_OK led (H4) blinks

PCI-Board fiber test

1 connect TXD_RXD test cable

2 Check Help/About/HWINFO/OP100D

204-DICC_ERROR_NO_TERMINAL-error shoul result.

2.3.2 Ch 3 COL

Problem:	“ Ch 3 COL “ error message is displayed.
Why?	Wrong collimator selected.
How is it detected?	Error is generated when selected program from the control panel doesn’t match to the collimator position.

Possible causes:	Check or test:	Parts related:
Collimator not in PAN position when panoramic (Program 1 to 5 or Program 8 to 9) selected.	Move the collimator to correct position until it “clicks”. - Error should clear. - If not check the microswitch operation.	Collimator and wiring

Possible causes:	Check or test:	Parts related:
Collimator signals are passive in the CPU Board.	Test the microswitch operation: Move the collimator. - If the error stays then check the wiring and microswitch alignment. - Remove THA cover. Visually check that the switches trigger according to the code bar and that switch levers move freely.	Collimator.
	Check the wiring: - Check the connectors and wires for open or broken wire. Use wiring diagram. - Check the wiring order on microswitch.	S31, S32, S33, C62, X113, C67, X6, CPU Board,
	Test the wiring: Use Sr 74 IOC and move the collimator to check that the signal status changes. Follow the Table below. - If the signals do not change or are not correct then use wiring diagram and/or DVM to find the problem.	

S 31 COL1SW	S 32 COL2SW	S 33 COL3SW	S QA COL2SW	COLLIMATOR POSITION
closed	open	open	closed	Quality Assurance collimator
closed	open	open	open	Panoramic collimator
open	closed	open	open	Cephalostat collimator:
open	open	open	open	Novalid collimator

Ch 5 ***

Problem:	**“ Ch 5 *** “ error message is displayed, where ***” are numbers.**
Why?	Line voltage is out of limits.
How is it detected?	Line voltage is derived by using the voltage to frequency (V/F) converter in the Filament Control Board for measuring the +25V supply. Error is generated, if the line voltage is 1) out of limits (110V: 80 - 135, 230V: 180-270) and 2) the exposure is attempted or 3) voltage goes out of limits during the exposure. When occurred, CPU Sr 70 Scr counter #16 is incremented for history data.

Possible cause:	**Remedy:**
Line voltage out of limits.	Wait. Problem is usually occasional. Try again. If the error occured during the exposure, process the film - it may be diagnostical. If the error repeats, check the line voltage. Use Sr 79 SUP or DVM.
Mains voltage selection “230V”at Power Supply Board with 110V line voltage.	Power off. Select correct line voltage setting and mains fuses: - 110 VAC: S1-S4 turned left - 230 VAC: S1-S4 turned right

2.3.3 Ch 6 POS

Problem:	**“ Ch 6 POS “ error message is displayed.**
Why?	System not in Start position or unit has lost the linear movement reference.
How is it detected?	QA: Rotation has to be in right 45? - left 45? sector (ROT1SW, ROT2SW, ROT3SW active). If these conditions are not true, the error is generated and exposure is prevented.

Possible causes:	Check or test:	Parts related:
QA: ⟲ key not pressed prior to the QA procedure.	Press “OK” to clear the message. READY is not lit. Press movement key ⟲. READY is lit.	
⟲ key function defective.	Press the ⟲ key. If the rotating unit does not move, check the key signal from the panel to the CPU. Use Sr 74 IOC.	Positioning panel(s), X48, C10, X7, CPU Board
Possible problem with movements.	Test the movements. Use Sr 80 ro-, Sr 81 Li- programs.	Motors, mechanical friction

2.3.4 Ch 7 rEL

Problem:	“ Ch 7 rEL “ error message is displayed.
Why?	Exposure button prematurely released.
How is it detected?	EXPSW or PNLEXPSW has changed logical state during the exposure cycle. Exposure is terminated and a message displayed.

Possible causes:	Check or test:	Parts related:
Operator has released the exposure button during the exposure.	If the error appeared before the exposure, try again.	
	If the error appeared during radiation, look at the picture on the PC screen, it may have enough information for diagnosis. If not reposition the patient and retake.	

Possible causes:	Check or test:	Parts related:
Problem with exposure switch or switch wiring. Signal PNLEXPSW .	Make several test " T " exposures, use eg. program P1. Press and release repeatively, check that the unit moves accordingly.	Control panel microswitch, control panel, SC3, X105, C9, X1, CPU Board
	Check the wiring from the switch to the CPU. Problem may be intermittent indicating defective switch, wire or contact.	
Problem with remote exposure switch or switch wiring. Signal EXPSW.	Make several test " T " exposures, use eg. program P1. Press and release repeatively, check that the unit moves accordingly.	Remote exposure switch, coiled cable, X103, SC2, X102, C12, X3, CPU Board
	Check the wiring from the switch to the CPU. Problem may be intermittent indicating defective switch, wire or contact.	

2.3.5 Ch 8 PSE

Problem:	" Ch 8 PSE " error message is displayed. Message occurs during power-up sequence and is cleared after few seconds.
Why?	Preventative service reminder after 2000 exposures.
How is it detected?	Pr 59 PSE has been set "on" or reseted "rES" 2000 exposures earlier. Software increments this counter after every exposure.

NOTE

This feature can be disabled when Pr 59 PSE is set to "OFF". This error code has no effect to the unit's normal operation.

Possible cause:	Check or test:
Preventative service reminder after 2000 exposures.	Sw 1.4.10 or higher: Use “Pr 59 PSE” to reset this message.

2.3.6 Ch 9 rEo

Problem:	“ Ch 9 rEo “ error message is displayed.
Why?	Automatic or Manual mode exposure was initiated from control panel, while remote exposure only is allowed.
How is it detected?	PNLEXPSW and EXPSW signals are monitored by software. Unit has been configured with Sr 89 COP, “1 rE” → “on” for remote exposure only mode. PNLEXPSW has changed its logical state during the exposure resulting to an error message. This software feature is supported from sw 1.2.05 and requires hardware from CPU Board version v1.1 (=D15 added). This error message does not come with test “T” mode.

Possible causes:	Check or test:	Parts related:
Exposure was initiated from the control panel, while remote exposure only is allowed.	Press “OK” to clear the message. Use remote exposure.	
Broken D15 on CPU Board, if the exposure was initiated from remote switch. Signal PNLEXPSW = EXPSW.	Unit configured with Sr 89 COP, 1 rE to “on”. Set Sr 89 COP, 1rE to “OFF”. Press the remote exposure switch. If the error disappered, then CPU D15 is defective. For temporary measures leave the unit as is - it can be used from both exposure switches, or replace D15 or CPU Board.	CPU Board, D15

2.3.7 Sy 20 ***

Problem:	" Sy 20 *** " error message is displayed. "***" indicating elapsing waiting time.
Why?	OP100D is not ready for the next exposure.
How is it detected?	Exposure is disabled, if the following exposure would exceed the average power ratings of the x-ray tube or stepping motors. If the exposure switch is pressed, this failure code appears on the display. Countdown of the required wait time (***) is displayed in the time display. When countdown reaches zero, the message is automatically cleared. Occurrence of this error code increments the CPU counter number #17.

Possible cause	Remedy
OP100D is not ready for the next exposure.	Wait until the unit is ready. Elapsing waiting time (***) in seconds in s-display.

2.3.8 Sy 21 HHo

Problem:	" Sy 21 HHo " error message is displayed.
Why?	Tubehead hot. Exposure is disabled as the tubehead assembly (THA) temperature has exceeded 75°C.
How is it detected?	Temperature switch in THA is open, signal TMPFAIL active. A lit LED (H12) on the Filament Control Board indicates active TMPFAIL signal. This error may occur after intensive use, especially if the ambient temperature is high. Message is automatically cleared when the THA temperature has dropped below approximately 60°C. Occurrence of this error code increments the CPU counter number #18.

Possible cause	Check or test	Parts related
OP100D THA is not ready for the next exposure.	Wait until the unit is ready. Relatively long waiting time (typically over half an hour) is needed for the THA to cool down.	
Problem with TMP-FAIL signal or temperature switch (seldom).	Check the signal wiring. Replace parts when needed.	THA, THA - X32, Inverter Board, C15, Filament Board, C67, CPU Board

2.3.9 Sy 22 Arc

Problem:	“ Sy 22 Arc “ error message is displayed.
Why?	Tubehead or generator failure during the exposure cycle.
How is it detected:	TUBEFAIL signal has gone active (high voltage has dropped below reference) five times while KVOK and MAOK signals are active. Error is also generated if KVOK signal is passive while MAOK is active (this condition is ignored during the first 300ms of the exposure). Exposure cycle is terminated. Occurrence of this error code increments the CPU counter number #19. Single occurrence of the TUBEFAIL signal causes a momentary shutdown of the generator, then the exposure continues and the CPU counter number #27 is incremented. This can be seen on film as a narrow unexposed vertical line.

Possible cause	Check or test	Parts related:
Single THA arc.	If the problem happened with patient exposure, look at the picture on PC screen, it may be diagnostical. Verify the kV and mA values used for reference.	
	Try again. Single arcs are normal phenomena in an x-ray tube that occur every now and then. - If no error then ok. - If this error comes frequently, it indicates a worn-out x-ray tube or some other problem in the tube head assembly or related components.	

Possible cause	Check or test	Parts related:
Impurities in the THA oil. Several THA arcs.	Run the THA warming up sequence Sr 76 PUP. - If ok then problem propable occasional. - If not then THA may be defective.	
Wrong preheat calibration value	Check the value in Sr 77 Prh., it should be around “195”. - If not, make the exposure. New value is calibrated.	
Problem with main cable C67. Error occurs and repeats usually at the same rotation place.	Make radiation tests. Use Sr 75 EPS or Pr 68 InS with the option EPS. Make several exposures and rotate by hand: - If the error occurs at one location, check the wiring, replace C67 if needed	
Broken Power Supply Board or capacitor C1 or C2. Error repeats.	Measure rectifier bridge D4, if may be defective. Unit may tolerate low kV/ma exposure, but not high exposure values. Replace D4 or Power Supply Board.	Power Supply Board, C1, C2
Broken tubehead assembly. Error repeats.	Run Sr 76 PUP. - Check if the error comes with low or high kV - Check if the error is related to output power (=kV * mA) -Replace the THA.	THA
Problem with cabling (C4, C67, C15), signal +310VDC & 310V GND	Check the capacitor cable screws C1 & C2 and X22.	C1 & C2, X22, C4
	Main cable X23 - C67 - X30	C67
	Generator cable X37 - C15	C15
Bad mains line wire connection	Check the power plug connection. Unit may tolerate low kV/ma exposure, but not high exposure values.	Mains voltage connection
Broken Inverter Board or fuse F1.	Check the F1 fuse. Replace the Inverter Board	Inverter Board & F1

NOTE

Note that the main cable is referred to as C40 (code 69051) on units before s/n 78272. After that the main cable reference is changed to C67 (code 69088) And this reference is used throughout this manual.

2.3.10 Sy 23 Inu

Problem:	" Sy 23 Inu " error message is displayed.
Why?	Inverter failure. Tube current and voltage are not rising during exposure.
How is it detected?	KVOK and MAOK signals are or go passive (= 0V) during exposure. This error is also generated if TUBEFAIL signal goes active five times while both KVOK and MAOK are passive. Exposure is interrupted and the CPU counter number #20 is incremented.

Possible cause	Check or test	Parts related
No 310VDC on the Inverter Board.	310VDC is indicated by LED H4 on Power Supply Board and LED H1 on Inverter Board	Power Supply Board, Capasitor C1 & C2
Other power supply voltages missing from Inverter Board.	Check the LED's on Inverter and Power Supply Boards. Check the wiring.	Power Supply Board, X27, C67, X35, C15
Fuse F1 on Inverter Board has blown.	Fuse F1 & foils around it.	F1, Inverter Board
Open connector or broken wire. Loose capasitor wire.	Check the generator wiring.	All high voltage parts
Broken Power Supply Board	Replace the board.	Power Supply Board
Broken Inverter Board	Replace the Inverter Board (Broken Tube head assembly) Replace the THA	THA

NOTE

Note that the main cable is referred to as C40 (code 69051) on units before s/n78272. After that the main cable reference is changed to C67 (code 69088) and this reference is used throughout this manual.

2.3.11 Sy 24 FIL

Problem:	" Sy 24 FIL " error message is displayed.
Why?	Filament failure. Tube current not rising during exposure.

Problem:	“ Sy 24 FIL “ error message is displayed.
How is it detected?	During exposure sequence: Tube current is not rising during the exposure. KVOK signal active, but MAOK signal passive during the exposure. This condition is ignored during the first 300ms of the exposure. Exposure is interrupted and the CPU counter number #21 is incremented. During power up sequence: Sy 24 FIL is also generated during power-up sequence if preheat-reference has not been calibrated. Normally this is caused by new EEPROM (ICD 29 in CPU Board) or new CPU Board. Use Sr 77 Prh to calibrate the preheat. If Sy 24 FIL occurs at powerup after calibration of the preheat value, the EEPROM may be defective.

Possible cause	Check or test	Parts related
Broken filament in the x-ray tube (broken THA)	Replace THA .	THA
Missing supply voltages on the Filament Control Board	Check the LED’s & power wiring	, X35, Filament Board
Broken Filament Control Board	Replace the board.	Filament Board
Problem with signals & wiring from Filament Control Board to the THA	Check the generator wiring and boards.	Filament Board, C15, Inverter Board
Wrong preheat calibration value.	Check the value in Sr 77 Prh., it should be around “195”. - If not, make the exposure. New value is calibrated.	
Problem with new CPU or CPU EEPROM.	Fill out the OP100 Configuration Form for setting data. Replace ICD 8 or CPU Board. Reprogram Pr and Sr parameters.	CPU Board, ICD 8

NOTE

Note that the main cable is referred to as C40 (code 69051) on units before s/n78272. After that the main cable reference is changed to C67 (code 69088) and this reference is used throughout this manual.

2.3.12 Sy 26 EEP

Problem:	“ Sy 26 EEP “ error message is displayed.
Why?	EEPROM write failed.
How is it detected?	Software will write to the CPU ICD 8 EEPROM memory the parameter value and read it from the same memory location. Amount of memory write cycles is stored in the CPU counter # 22. If the memory contents has changed indicating a memory problem, an error is generated. See Sr 70 Scr for details.

Possible cause	Check or test	Parts related
CPU Board ICD 8	Check EEPROM mounting. Replace ICD 8 or CPU Board. Reprogram the parameters.	ICD 8, CPU Board

2.3.13 Sy 27 Por

Problem:	“ Sy 27 Por “ error message is displayed.
Why?	Position error: rotation movement failed.
How is it detected?	This error is generated during rotation if the CPU does not receive the correct sequence of ROTSW1 to ROTSW4 signals within a predefined time. CPU assumes that the rotating unit is not rotating and interrupts all movements and exposure.

Possible causes:	Check or test	Parts related
Unit rotates, but microswitches S 11 to S 14 may not operate properly. Signals ROT1SW to ROT4SW.	Use Sr 74 IOC. Test the signals, rotate by hand.	S11 - S14, C11, X9, CPU Board
Problem with motor control. Rotation stepping motor or motor driving circuitry in Interface Board may not operate properly.	Check the control from CPU to Interface Board. Check the motor control red LED’s: all should lit when unit is rotating. Check X16and X17 connections.	Interface Board, X16, CPU Board, X17, M3, X112

Possible causes:	Check or test	Parts related
Problem with motor power. Power Supply F2 blown.	Check F2 on Power Supply Board.	Power Supply Board, F2
Unit rotates, but not enough friction between the drive wheel and friction surface	Clean the friction surface with alcohol. Use Sr 80 ro-. Adjust the spring tension.	

Problem with cephalostat lock under the rotating unit.	Check the cassette holder down position. There should be spacing between the ceph lock and lock wedge when rotating. If not adjust the cassette holder microswitches or check the cassette holder sliding rods.	Cassette holder microswitch & sliding rods, ceph lock
Problem with wiring.	Check the cables and their travel inside the rotating unit.	
TIMER ICD 27 (8254) in CPU Board may not operate	Replace CPU Board	CPU Board
Wrong CPU PAL version. Problem occured with OT upgrade or during service.	If the motor movement is very fast or slow, the PAL version may be wrong. Interface Board & PAL 1.0.0 or 1.1.0 Interface Board OT & PAL 2.0.0 or 2.1.0	CPU PAL
Cassette holder top plastic plugs touching the main support.	Check the spacing, adjust cassette holder microswitches.	Cassette holder microswitch
S/N 70xxx: Rotation limiter bolts are touching the drive disk. Bolts are too long	Check the spacing between, add washers under the limiter bolts when needed. Bolts are M8x30.	Bolts
Unit not properly released after installation.	Check the transportation bolts and rotation limiters.	

2.3.13.1 Rotation movement, principle

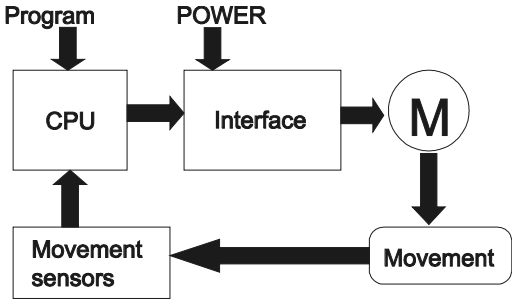


Fig 2.2. Movement control principle

Movement is generated by using a stepping motor M3, gear assembly and a drive wheel, which is forced against a friction surface of the rotation unit. There are mechanical limiters to prevent full 360? rotation and cable twisting. There are four position indicators for the rotating unit. These microswitches are located inside the main support. Rotation angle information comes from a code disk, which is located on the rotation unit, under the main support. Rotational position is indicated by four microswitches (S 11 to S 14) as follows.

The position is expressed in degrees from center position, where tubehead is at it's furthermost position from the column (= 0?). S14 is the innermost microswitch (closest to the rotation axle) in main support and S11 is the outermost switch. The switches code the rotating unit positions as follows (in parenthesis is the input and LED associated with the signal in Sr 74 IOC):

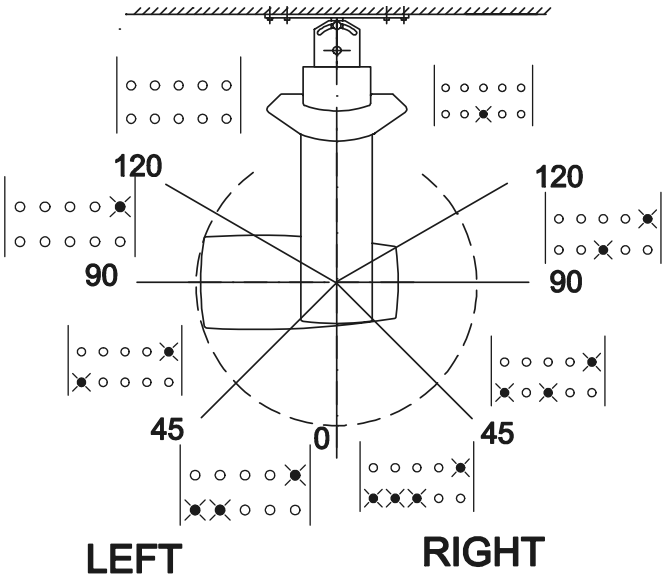


Fig 2.3. Rotation angle reference points with Sr 74 IOC LED states

S 14 ROT4SW (In5 LED8)	S 13 ROT3SW (In5 LED7)	S 12 ROT2SW (In5 LED6)	S 11 ROT1SW (In5 LED5)	TUBEHEAD POSITION
closed	open	open	open	right 120-180°
closed	open	open	closed	right 90-120°
closed	open	closed	closed	right 45-90°

S 14 ROT4SW (In5 LED8)	S 13 ROT3SW (In5 LED7)	S 12 ROT2SW (In5 LED6)	S 11 ROT1SW (In5 LED5)	TUBEHEAD POSITION
closed	closed	closed	closed	right 0-45°
Open	closed	closed	closed	left 45-0°
Open	open	closed	closed	left 90-45°
Open	Open	open	closed	left 120-90°
Open	Open	open	open	left 180-120°

Open microswitch is 5 V, and closed microswitch is 0 V signal level in CPU Board. A lit LED on Sr 74 Ioc indicates a closed microswitch.

2.3.14 Sy 28 CCd

Problem:	" Sy 28 CCd " error message is displayed.
Why?	Imaging chain error during exposure.
How is it detected?	This error is generated if the frequency on the AECFRQ -line is • out of range (0.8 - 655kHz) • lower during exposure than during preheat time.

Possible causes:	Check or test	Parts related
1 Terminal Board does not send the frequency:	Check with Pr68 FRE	
1.1)Fiber optic link NOT OK because of:	Check LINK_OK LEDs on the Terminal Board and on the PCI Board	PAN AEC Terminal Board, CEPH Terminal Board, PCI Board.
1.1.1) PC not connected or POWER OFF	Check PC.	PC, PCI Board
1.1.2) Fault on the fiber optic cable or bad connection	Check that the fiber optic cable connectors are properly connected. Do the link test procedure to the fiber cables.	Fiber cables C41, C50 and C67.

Possible causes:	Check or test	Parts related
1.2) No or interfered image data from the camera caused by:	Monitor the image capture window whether the image appears there during exposure?	
1.2.1) Missing PPOWER (PAN) or CPOWER (CEPH) on Terminal Board	Check that all the supply voltage LEDs are lit on the Camera Supply Board (PAN) or on the CEPH Head Board (CEPH) when the exposure button is pressed.	PAN AEC or CEPH Terminal Board, Camera Supply Board, CEPH Head Board, Cables C63, C67, C50, C52
1.2.2) Missing PIMAGE (PAN) or CIMAGE (CEPH) on Terminal Board	Check that the PIMAGE LED or CIMAGE LED is lit on the corresponding Terminal Board.	PAN AEC or CEPH Terminal Board, CEPH Head Board, Cables C67, C50, C52
1.2.3) Missing PDETCLK (PAN) or CDETCLK (CEPH) on Terminal Board	Measure the frequency between the Terminal Board test points TP5 and TP6 with a multimeter: If a frequency greater than 0 is found during the exposure, the line is working.	PAN AEC or CEPH Terminal Board
1.2.4) Missing supply voltage on the camera	Check A2a. Check cables C51, C63. Check cable C47 (PAN) or C68 (CEPH). Replace Terminal Board. Replace Camera.	Cables C47, C51, C63, C68. PAN AEC or CEPH Terminal Board
1.2.5) Missing image data control signals (SS, VV, H/L and DS)	Check A2d. Replace Terminal Board. Check cable C47 (PAN) or C68 (CEPH). Replace camera.	PAN AEC or CEPH Terminal Board, Camera Supply Board, CEPH Head Board, cable C47 (PAN) or C68 (CEPH). PAN or CEPH Camera.
1.2.6) Missing IMAGE or TDI+/- signals on the PAN camera	Check A2b and A2c. Replace Terminal Board. Replace cable C47 (PAN) or C68 (CEPH). Replace camera	PAN AEC or CEPH Terminal Board, Camera Supply Board, CEPH Head Board, cable C47 (PAN) or C68 (CEPH). PAN or CEPH Camera.

Possible causes:	Check or test	Parts related
1) Fault on the Terminal Board	Replace Terminal Board	PAN AEC or CEPH Terminal Board
2) The AECFRQ does not reach the OPCPU	Check with Pr68 FRE	PAN AEC Terminal Board, CPU Board
2.1) Wiring fault between the Terminal Board and the OPCPU	Check PAECFRQ (PAN) or CAECFRQ and CEPH_AEC (CEPH) lines from the corresponding Terminal Board to the OPCPU Board.	Cables C67, C52 and C50)
2.2) Missing FILT5 from the OPCPU	Check by turning the OP power OFF and back ON whether Er43 and Er44 appear: If not, FILT5 is OK. See Er43 and 44 errors.	
2.3) Fault on the OPCPU Board	Replace the board.	OPCPU Board.
3) The AECFRQ frequency is out of range (0.8 - 655kHz)	Check with Pr68 FRE that during the exposure is within the limits (0.8 - 655kHz).	
3.1)Misadjusted AEC frequency on the PAN AEC Terminal Board	Do the PAN AEC adjustment procedure (see Installation manual).	PAN AEC Terminal Board.
3.2) Fault on the Terminal Board	Check the image quality - if the image is OK (no artifacts) replace the board. Otherwise check also A2a-f.	PAN AEC or CEPH Terminal Board.
3.3) High exposure values with no object on the X-ray field	Check that you have object on the X-ray beam and / or filtration on the primary beam	Pan Sensor and PAN AEC Terminal Board.

NOTE

Note that the main cable is referred to as C40 (code 69051) on units before s/n78272. After that the main cable reference is changed to C67 (code 69088) and this reference is used throughout this manual.

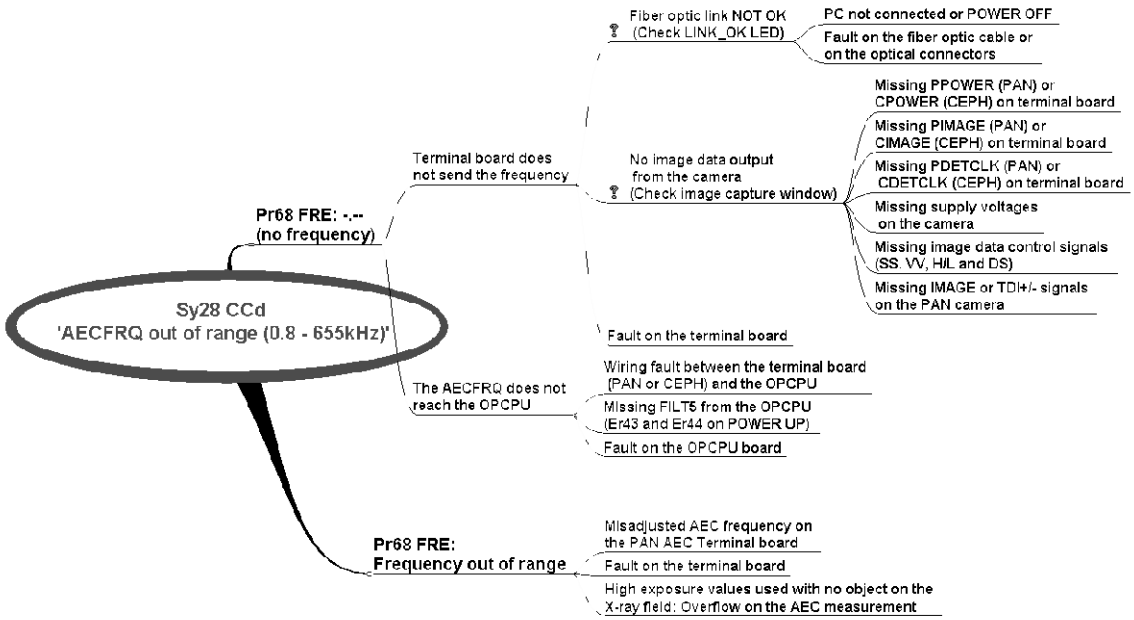
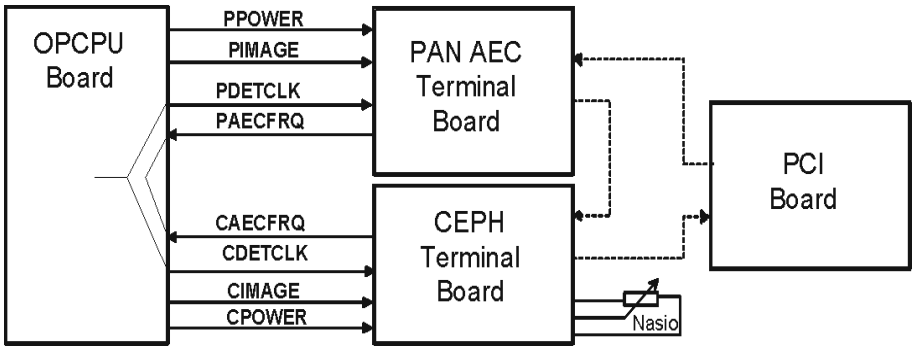


Fig 2.4. Sy 28 CCd

2.3.14.1 AEC Frequency generation, block diagram



- AECFREQ: Frequency generated by the Terminal Board. Requires that
- LINK_OK is active during exposure. On panoramic imaging programs the frequency also relates to the dose measured by the Panoramic camera.
- PPOWER / CPOWER: Enables PAN / CEPH camera supply voltages
- PIMAGE / CIMAGE: PAN / CEPH image acquisition enable
- PDETCLK / CDETCLK: PAN / CEPH detector clock; “scanning speed of the cassette”

2.3.15 Sy 29 PoL

Problem:	**“ Sy 29 PoL “ error message is displayed. Why? Position error: linear movement failed during operation.**
How is it detected?	This error is generated if the CPU does not receive the correct sequence of LINLIMSW and LINMIDSW within a predefined time. Occurs also when LINLIMSW goes active during an exposure cycle (linear movement has reached one of the limit microswitches S16 or S17). CPU assumes that the linear movement is not moving or has reached the movement limits and interrupts all movements and exposure.

Possible causes:	Check or test	Parts related
Linear movement, but microswitches S 15 to S 17 may not operate properly. Signals LIN-MIDSW and LIN-LIMSW.	Use Sr 74 IOC. Test the signals, rotate fly wheel by hand or press switch actuator arms.	S15 - S17, C11, X6, CPU Board
Problem with motor control. Linear stepping motor or motor driving circuitry in Interface Board may not operate properly.	Check the control from CPU to Interface Board. Check the motor control red LED's: all should lit when unit is rotating. Check X16 and X17 connections.	Interface Board, X16, CPU Board, X17, M2, X111
Problem with motor power. Power Supply F2 blown.	Check F2 on Power Supply Board.	Power Supply Board, F2
Friction with linear movement.	Check the movement. Adjust the spring tension. motor axle, fly wheel, linear actuator and linear plate alignment.	
Problem with wiring.	Check the cables and their travel inside the main support. Check that cable bundle is not pressing S16.	
TIMER ICD 27 (8254) in CPU Board may not operate	Replace CPU Board	CPU Board
Wrong CPU PAL version. Problem occured with OT upgrade or during service.	If the motor movement is very fast or slow, the PAL version may be wrong. Interface Board & PAL 1.0.0 or 1.1.0 Interface Board OT & PAL 2.0.0 or 2.1.0	CPU PAL
Unit not properly released after installation.	Check the transportation bolts and rotation limiters.	

2.3.15.1 Linear movement, principle

Movement is generated by using a stepping motor, a linear actuator and a linear plate. There are three position indicators for the linear movement of the

rotating unit. These microswitches are located inside the main support. Notice that S 16 is mounted in mirror orientation compared to S 15 and S 17.

LINLIMSW

Two microswitches (S 17 and S 16) to indicate either end of the linear movement. These limit switches are connected in parallel. S 17 is the reference point to all imaging movements and it is also used to align x-ray tube (and field) for cephalometric imaging. If S 17 is moved or replaced, the panoramic layer and cephalostat beam alignment must be verified and adjusted if needed.

LINMIDSW

S 15 is for the mid position of the linear movement, also indicating front and rear segments of the movement. It is used to set OP100 rotating unit for patient positioning (Programs 1 to 4 and 6 to 9) and it serves as a reference point for TMJ pointer movements in TMJ imaging (Programs 6 to 9) and linear tomography (Programs 11 and 12).

Linear movement position is indicated to CPU Board as follows.

S 16, S 17 LIN-LIMSW In0 LED4	S 15 LINMIDSW In0 LED5	MOVEMENT POSITION (view towards the column)
closed	closed	Front (= column) end
open	closed	Front half
open	open	Rear half
closed	open	Rear end

2.3.16 Sy 30 PoC

Problem:	“ Sy 30 PoC “ error message is displayed.
Why?	Ceph movement positioning error
How is it detected?	Appears if the CEPH linear movement (camera and secondary collimator) arrives to the end limit (CEPHLIM is activated) before the exposure is ended.

Possible causes:	Check or test:	Parts related:
Beam is not correctly aligned: The Beam Alignment Board forces the OPCPU to increase the scan speed for too long period.	Check beam alignment and beam detection functionality	Beam Alignment Board Head Board CPU Board Cabling
Short circuit in CEPHLIM signal (or between CEPHLIM and CEPHMID signals)	Check CEPHLIM and CEPHMID signaling from Movement Detection Board to CPU Board	Movement Detection Board Ceph Straight Conn Board Ceph Terminal Board Head Board CPU Board Cabling
CEPHLIM or CEPHMID are NOT detected within predefined time during positioning movements	Check the CEPHLIM or CEPHLIM signals Check the Movement Detection Board Make sure that the movement isn't jammed due to 1 belt crawling 2 camera head rubbing against the casting or 3 secondary collimator rubbing against the casting 4 the nut of the camera or the secondary collimator axle is jamming	Movement Detection Board Belt Camera head Secondary collimator Inspect the drive nut tightness

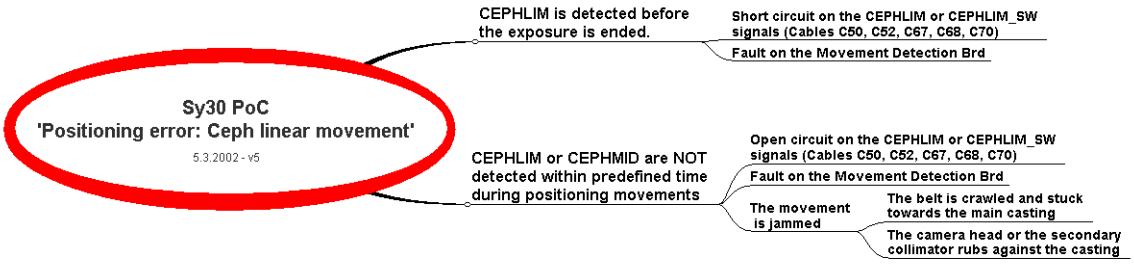


Fig 2.5. Figure 3. Sy 30 PoC

Sr 74IOC in 0:	
Led 2	Led 3

Sr 74IOC in 0:	
LIMSW	MIDSW

2.3.17 Sy 31 PoU

Problem:	" Sy 31 PoU " error message is displayed.
Why?	Position error: vertical carriage movement failed during operation.
How is it detected?	This error is generated if the CPU does not receive the ZLIMSW or ZMIDSW within a predefined time while the carriage motor is running. CPU assumes that the vertical carriage is not moving and interrupts the movement.

Possible causes:	Check or test:	Parts related:
Microswitches. S 4 or S 5 may not operate properly. Signals ZLIMS and ZMIDSW.	Use Sr 74 IOC. Test the signals. Move the carriage by hand. Switches must trigger before mechanical limit.	S4, S5, X117, C11, X9, CPU Board
Problem with motor control. Signals ZENA and ZDIR, Z-MOTOR 1 & 2.	Check the signals and wiring.	CPU Board, X16, Interface Board, X18, C12, X102, SC2, X103, C3, X104, M1
Wall mount assembly too low.	Check the switch operation. Adjust the detent pieces.	Wall mount
Detent pieces. Microswitches trigger in wrong order.	Check the top detent pieces: longer one higher than short one.	Short & long detent piece
No motor power. 12VDC missing. Problem with Interface Board.	Check the Power Supply & Interface Board LED's.	X16, Interface Board, X15, Power Supply Board
Motor operates all the time. Motor or diving circuitry shorted. Positioning panel key problem.	Motor wiring. Interface Board relay. If problem with panel key, it gives first Er 45 INP.	Motor M1, C3, X16, Interface Board
Clutch. Motor operates, but slow or no carriage movement	Check the motor clutch tension. Adjust with 14mm wrench.	Clutch at column top

Possible causes:	Check or test:	Parts related:
Mechanical. Counter weight trims are too many/few or they are touching the column interior. sliding carriage roller movements	Check the amount of trims: OP100 4 smalls & 7 big trims, OC100 4 small & 23big ones.	Trim weights
Mechanical. Problem with sliding carriage rollers.	S/N 70xxx: adjust with shim plates. From S/N 71xxx: adjust the roller slack.	Sliding carriage.

2.3.17.1 Carriage movement, principle

Movement is generated by using a DC motor, gear assembly and pulleys. Vertical carriage and counter weight are connected to pulleys with steel cables.

There are two position indicators for the vertical carriage movement. These microswitches are located inside the rear support assembly, at the rear of the column unit. The height of the vertical carriage is detected by two short detent pieces located in the groove of the column. These pieces are adjusted at the factory so that they will stop the carriage 10 - 20 mm before the mechanical limits.

The height of the cassette holder can be limited by lowering the cassette holder to the half way up position. When this feature is activated, cassette holder is lowered when S4 is actuated by the long detent piece located in the right groove of the column (looking from behind the column). This piece is adjusted at the factory so that the cassette holder always stays below the height of the column. This feature is activated by user program “Pr 56 HLI” -> “on”. Note that the longer detent piece is also used to distinguish the difference between upper and lower limits.

ZLIMSW

One microswitch (S 5) to indicate either end of the vertical carriage movement

ZMIDSW

One microswitch (S 4) to indicate cassette holder height limiting area of vertical carriage movement, also indicating upper limit together with the ZLIMSW-signal.

Vertical movement position is indicated to CPU Board as follows:

S 5 ZLIMSW In5 LED4	S 4 ZMIDSW In5 LED3	CARRIAGE POSITION
closed	Closed	upper limit
open	Closed	upper segment (height limit area)
open	Open	lower segment
closed	Open	Lower limit

2.3.18 Sy 32 PoA

Problem:	“ Sy 32 PoA “ error message is displayed.
Why?	Beam alignment error
How is it detected?	Appears if the middle channel of the Beam Alignment Board does not detect the X-rays (CEPHC doesn’t go active).

Possible cause:	Check or test:	Parts related:
Beam is not correctly aligned	Check beam position and adjust if necessary Check that the beam doesn't hit to the PAN camera Check positioning of the secondary collimator Check adjustment of the CEPH arm: The arm is pivot too much on the column resulting error on the SID	Beam Alignment Board Secondary collimator Pan camera
Beam detection fault	Check sensitivity adjustment of the Beam Alignment Board Check functionality of the Beam Alignment Board Check CEPHC and CEPHCOK (TP16) signals on Head Board Check cabling from Head to CPU and Beam Alignment Board	Beam Alignment Board Head Board Cables
Missing supply voltages from the Beam Alignment Board	Check cpower signal from Head Board (TP22) Verify that the supply voltages +5V (TP32) and -5V (TP29) are present on Beam Alignment Board (LED H4) Check cabling from Head to CPU and Beam Alignment Board	Head Board Beam Alignment Board Cables
Failure on the linear movement	Make linear movement (Sr 81 LI-) and CPU I/O (Sr 74 IOC) tests	Linear motor and microswitches
Failure on the rotation movement	Make rotation movement (Sr 80 ro-) and CPU I/O (Sr 74 IOC) tests	Rotation motor and microswitches
Failure on the CEPH movement	Check that CEPH drive belt doesn't skip teeth Check that lock screw of the secondary collimator drive axle cog doesn't slide Make CEPH movement (Sr 82 CE-) and CPU I/O (Sr 74 IOC) tests	Ceph scan motor and microswitches Secondary collimator drive axle
The user or patient has blocked an exposure movement	Check the patient positioning	

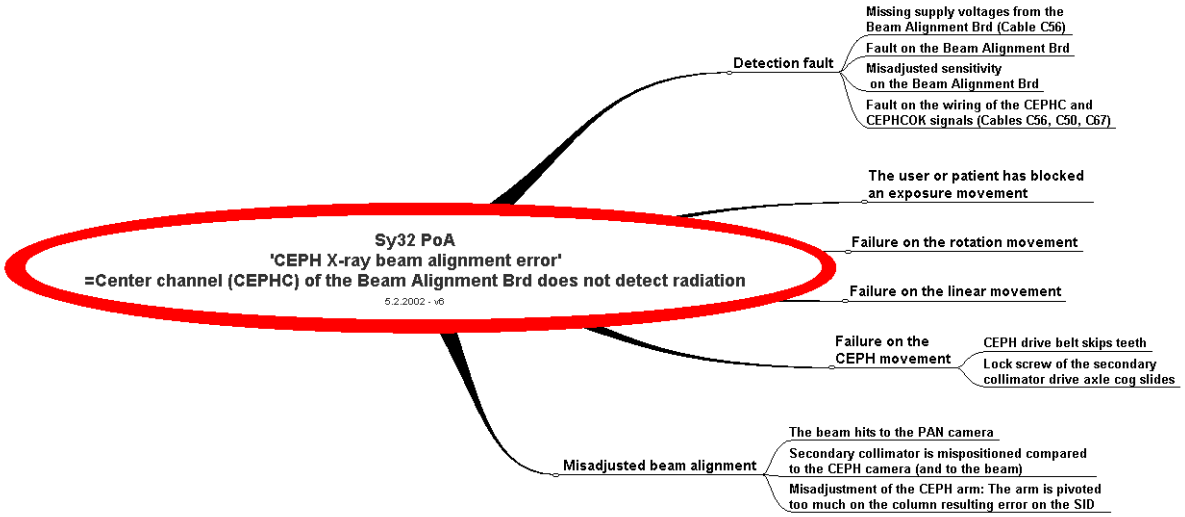


Fig 2.6. Sy 32 PoA

Sr 74 IOC in 4		
Led 5	Led 6	Led 7
CEPHROK	CEPHCOK	CEPHLOK

Ceph beam alignement is status of the singnals on the Beam Alignment Board. It can be verified with the control panel as follows:

1 Enter “Pr 68Ins” and select “nch” using the controlpanel minus, plus and ok buttons.

2 Exit “Pr68 ins” and select cephalometric lateral (P6) or PA (P7) projection imaging program.

3 start exposure and monitor the beam alignment signals.

NOTE

(CEPHLOK, CEPHCOK; CEPHROK) with the 3 center most LEDs of the AEC density scale on the control panel.

2.3.19 Er 40 CPU

Problem:	**“ Er 40 CPU “ error message is displayed.**
Why?	CPU error: CPU processing failure
How is it detected?	Software has detected internal CPU RAM failure.

Possible cause:	Parts related:	Check or test:
CPU processing failure. Processor circuit ICD 31 may be defective.	Switch off. Try again. If error comes again, replace the CPU Board.	CPU Board.

2.3.20 Er 41 CPU

Problem:	" Er 41 CPU " error message is displayed.
Why?	CPU error:RAM check failure
How is it detected?	Softare has detected external RAM failure.

Possible cause:	Check or test:	Parts related:
Problem with RAM write and read operation. RAM circuit ICD 30 in CPU Board may be defective.	Switch off. Try again. If error comes again, replace the CPU Board.	CPU Board.

2.3.21 Er 42 CPU

Problem:	" Er 42 CPU " error message is displayed.
Why?	CPU error: EPROM check-sum failure.
How is it detected?	EPROM check-sum is verified at power up. If the calculated check-sum varies from the written check-sum in the EEPROM, an error is generated indicating a memory problem.

Possible cause:	Check or test:	Parts related:
Problem with EEPROM circuit. ICD 28 or 29 may be defective.	Replace the circuit. Use only those obtained from the manufacturer. Try again. If error, replace the CPU Board.	EEPROM, CPU Board

Possible cause:	Check or test:	Parts related:
Problem with CPU Board.	Try again. If error, replace the CPU Board.	CPU Board

2.3.22 Er 43 ***

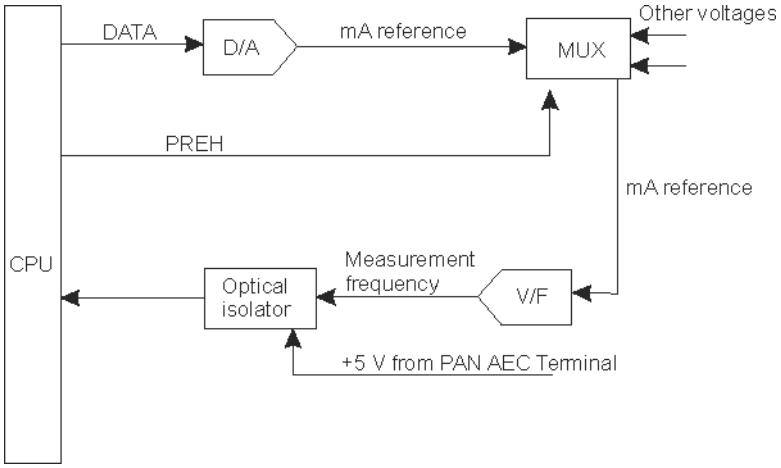
Problem:	" Er 43 *** " error message is displayed. "***" is a number.
Why?	Wrong line voltage selection. Approximate measured line voltage (***) is shown in time display.
How is it detected?	CPU monitors the line voltage switch signal "MAINS" from Power SupplyBoard. Switch is in incorrect position. This error is generated during power up sequence if the line voltage (derived from the +25V supply) is under 160 volts for 230V selection or over 160 volts for 110V selection.

NOTE

When the unit is connected to 230V line with 110V settings, fuses normally blow before this error is displayed.

Possible cause:	Check or test:	Parts related:
Line voltage switch in wrong position.	Check all four switches in Power Supply Board: they must be switched to the same position, left or right, depending on the nominal line voltage: 110 Vac: S1-S4 turned left 230 Vac: S1-S4 turned right	Power Supply Board
Incorrect position of 110/230 switch may cause serious damage to the electrical circuits.	If the replacement of Power Supply Board did not help, replace the CPU Board.	
Filament Control Board not operating, or not connected to CPU Board (signal MAFRQ).	Check the wiring. Replace the board.	

2.3.22.1 Filament Control Board self check principle



1 CPU sets maximum mA reference.

2 CPU activates PREH signal to connect mA reference to the V/F-converter.

3 CPU measures the frequency coming from the V/F-converter. If the frequency is not high enough, Er 44 FIL is displayed.

2.3.23 Er 44 FIL

Problem:	**“ Er 44 FIL “ error message is displayed.**
Why?	FILAMENT: Tube head preheating circuit not operating
How is it detected?	During the power up sequence the CPU checks the operation of the D/A-converter in the Filament Control Board by monitoring signal MAFRQ while connecting the output of the D/A-converter to the input of the V/F-converter (this connection is made when PREH is active and PREHREL is inactive). If the feedback from V/F-converter does not correspond to data written to the D/A-converter Er 44 FIL is generated and the operation of the unit is prevented.

Possible cause:	**Check or test:**	**Parts related:**
Broken Filament Control Board.	Replace Board	
Problem with MAFRQ signal at powerup.	MAFRQ signal is fed to the CPU via an optoisolator (ICD34 on CPU Board) that receives the operating voltage from the AEC Board (voltage FILT5, derived from the +5V on the PAN AEC Terminal).	

Possible cause:	Check or test:	Parts related:
Problem with wiring	Power - CPU - Filament - PAN AEC	C67, X4, X38
Problem with operating voltages. Signal FILT5.	Check Filament control Board, or PAN AEC Terminal Board +5V signal.	
Broken CPU Board. Optoisolator. Wire.	Replace CPU Board.	
Power Supply Board switches SW1-SW4 in incorrect position. Error message sometimes barely seen.	Power off. Check the switch positions. Check the main fuses.	Power Supply Board

2.3.24 Er 45 InP

Problem:	“ Er 45 InP “ error message is displayed.
Why?	Input error: keyboard or exposure button failure.
How is it detected?	This error is generated if the CPU detects that 1) any position panel or 2) ceph panel claslit button or 3) control panel button other than the OK-switch or 4) one of the exposure switches is pressed (active) during the power-up sequence.

Possible cause:	Check or test:	Parts related:
One of the control panel keys (up-right-down-left) pressed or short-circuited	Power off. Disconnect coiled cable X105 or C9 X1. Power on. If error then check C9 or other input signals. Use Sr 74 IOC.	Control panel, SC3, X105, C9, X1, CPU Board
Exposure switch pressed or short-circuited on control panel. Signal PNLEXPSW.	Power off. Select PAN collimator. Disconnect coiled cable X105. Power on. Check if the occlusion adjustment led is blinking: - If it is blinking then error is with the control panel. Check switch,C9 or other input signals. Use Sr 74 IOC.	

Possible cause:	Check or test:	Parts related:
Remote exposure switch pressed or short-circuited. Signal EXPSW.	Power off. Disconnect remote cable. Power on. - If error then check signal wiring. Use Sr 74 IOC.	Switch, X103, SC2, X102, C12, X3
One of the positioning panel keys pressed or short-circuited.	Power off. Disconnect panel cables. Power on. If error then check wiring or other input signals. Use Sr 74 IOC.	Positioning panel, X47L/R, X48L/R, C10, X7
Claslit key pressed or short-circuited.	Power off. Disconnect ceph up/down panel cable X251. Power on. If error then check the wiring. Use Sr 74 IOC.	Up/Down panel, X251, X234, X236, X8 C50, X67
Installation: connectors X102 and X117 under the lower shelf are incorrectly connected.	Check the connection.	X102, X117

2.3.25 Er 46 PAy

Problem:	“ Er 46 PAY “ error message is displayed after power-up.
Why?	The number of allowed exposures for equipment leasing and testing purposes has been exceeded.
How is it detected?	Limited free exposures feature was used for equipment leasing or customer trial purposes and a programmed limit (from 1 to 990 exposures) has been reached. d OP100 doesn’t allow more exposures and the unit cannot be used.

Possible cause:	Check or test:
All OP100 operations have been halted by software.	See Service program Sr 71 PAy for details. Increase the limit or disable this feature.

2.4 Indicators and test points

Led-indicators

All LED indicators can be identified from the schematics and printed circuit boards by the name of the signal and the component number of the LED: eg. LED for +5 V voltage in the CPU Board is marked “H1 +5 V”.

All supply voltages are indicated by green LED’s, and the most important or critical signals are indicated by red LED’s in the printed circuit boards.

NOTE

In the CPU Board the 2 green LEDs, H3 (TXD1) and H4 (TXD2), are only lit when the RS-232c serial link is used.

NOTE

In the Inverter Board the 2 green LED’s, H1 (+310V) and H7 (+25VREL) are not lit during standby. The operating voltages indicated by these LEDs are present only during the exposure cycle.

NOTE

In the stand-by mode the PCI Board LED H1, the PAN AEC Board LED H4 and the Ceph Terminal Board LED H4 are either on or off depending on powering order of the imaging chain components (i.e. PC and OP100D / OC100D). LEDs will be activated by the “take image” button on Cliniview.

NOTE

Beam Alignment Board LEDs H1-H3 will be activated when X-ray beam is on the corresponding beam detecting channel. H2 LED must be active for whole imaging sequence

When the LED is lit, it means that the supply voltage is available or that the signal is active.

Board	LED	LED, Unit ready	LED, During exposure
Filament	green H1-H4 red H7 red H8-H11 red H12	On Off Off Off	On On, during preheat time On On, if tubehead too hot
Power Supply	green H5-H8 red H1,H2	On Off	On H1 on and H2 on after delay

Board	LED	LED, Unit ready	LED, During exposure
CPU (69089)	green H1 red H2 green H3 green H4	On Off Off On (blinking)	On Off Off Off
Inverter	green H1,H5 green H7 red H8-H11 red H2,H3 red H4,H6	On Off Off Off Off	On On On On On
Interface (60166)	green H13-H16 red H1-H8 red H9-H12	On Off Off	On On Off
PCI (60187)	green H1 green H3-H4 red H2,H5	On On Off	On On Off *During exposures with panoramic imaging programs.*
Camera Supply (6019)	green H1 green H2 green H3 green H4 green H5 green H6 green H7 green H8 green H9	Off Off Off Off Off Off On On On	On On On On On On On On On
Pan AEC Terminal	green H1 green H2 red H3 green H4 green H5 green H6 green H7 red H8 green H9-H10	On On Off On Off On On Off Off	On On Off *During exposures with panoramic imaging programs.* On On, after delay On On Off On
Ceph Head	Green H1 Red H2-H3 Green H4 Red H5-H6 green H7 green H8 green H9 green H10 green H11 green H12 green H13	On Off On Off Off Off Off Off On Off Off	On On On On On On On On On On On *H2, H3, H7, H8, H9, H10, H12 and H13 are **on** only during cephalostat exposures.*

Board	LED	LED, Unit ready	LED, During exposure
Ceph Terminal	green H1 green H2 red H3 green H4 green H5 green H6 green H7 red H8 green H9	On On Off On or Off Off On On/Off Off On	On On Off On On, after delay On On Off On *H4, H5, H6 are **on** only during cephalostat exposures.*
Beam Alignment	H1 H2 H3 H4	Off Off Off Off	Off or On On Off or On On

2.4.1 Test points

All test points can be identified from the schematics and printed circuit boards by the name of the signal and the TP number: eg. the test point for PROJLIT signal in the Interface Board is marked “TP1 PROJLIT”.

LIST OF INDICATORS AND TEST POINTS

POWER SUPPLY Board (60113)			
LED	**SIGNAL**	**TEST POINT**	**SIGNAL**
H1	RG1	TP1	+310VDC
H2	RG2	TP2	+155VDC
H5	+34V	TP3	310V GND
H6	+25V	TP5	110/230VAC
H7	-25V	TP6	110/230VAC
H8	12VAC	TP7	RG2
		TP8	RG1
		TP9	+34V
		TP10	+25V
LA1	LINE	TP11	-25V
LA2	310V	TP12	12VAC
		TP13	GND

CPU Board(69089)			
LED	**SIGNAL**	**TEST POINT**	**SIGNAL**
H1	+5V	TP1	LINDIR
H2	RESET	TP2	LINENA
H3	TXD1	TP3	CASDIR
H4	TXD2	TP4	CASENA
		TP5	ROTENA
		TP6	ROTDIR
		TP7	XENA
		TP8	XDIR
		TP9	ZENA
		TP10	ZDIR
		TP11	VIDEOENA
		TP12	VIDEOLIT
		TP13	LINCLK
		TP14	CAS-,PDET-OR CDETCLK

CPU Board(69089)			
LED	**SIGNAL**	**TEST POINT**	**SIGNAL**
		TP15	ROTCLK
		TP16	CEPHCLK
		TP17	+5V
		TP18	EXPENA
		TP19	RG2
		TP20	RG1
		TP21	PREH
		TP22	PREHREL
		TP23	GND
		TP25	AECFRQ
		TP26	MAFRQ

INTERFACE Board (60166)			
LED	**SIGNAL**	**TEST POINT**	**SIGNAL**
H1-H4	ROT MOTOR DRIVE PULSES	TP1	ROTENA
H5-H8	LIN MOTOR DRIVE PULSES	TP2	ROTDIR
H9-H12	CAS MOTOR DRIVE PULSES	TP3	ROTCLK
H13	+34V	TP4	LINENA
H14	+15V	TP5	LINDIR
H15	+5V	TP6	LINCLK
H16	12VAC	TP7	CASENA
		TP8	CASDIR
		TP9	CASCLK
		TP10	+34V
		TP11	+15V
		TP12	+5V
		TP13	RACK MOTOR1

INTERFACE Board (60166)			
LED	**SIGNAL**	**TEST POINT**	**SIGNAL**
		TP14	RACK MOTOR2
		TP15	Z-MOTOR2
		TP16	Z-MOTOR1
		TP17	ZENA
		TP18	ZDIR
		TP19	RACKENA
		TP20	RACKDIR
		TP21	PROJLIT
		TP22	XRAYLIT
		TP23	LASLIT
		TP24	GND
		TP25	GND
		TP26	GND
		TP27	12VAC
		TP28	12VACGND

PCI Board (60187)			
LED	**SIGNAL**	**TEST POINT**	**SIGNAL**
H1	LINK_OK	TP1	VCC(RXD)
H2	EPROM FAIL-URE (red)	TP2	AGND
H3	+3.3V	TP3	GND
H4	+5V	TP4	RD32
H5	LOCAL RESET (red)	TP5	RCLK5
		TP6	GND
		TP7	VCC(TXD)
		TP8	COPPER_TEST-
		TP9	COPPER_TEST+
		TP10	/ECLin

PCI Board (60187)			
LED	**SIGNAL**	**TEST POINT**	**SIGNAL**
		TP11	ECLin
		TP12	VCC(TTL)
		TP13	OUTA-
		TP14	+3.3V
		TP15	RCLK16
		TP16	/RD16
		TP17	OUTA+
		TP18	+5V
		TP19	+2.5V
		TP20	DATA_IN0
		TP21	DATA_IN1
		TP22	DATA_IN2
		TP23	DATA_IN3
		TP24	DATA_IN4
		TP25	DATA_IN5
		TP26	DATA_IN6
		TP27	DATA_IN7
		TP28	3.3V

INVERTER Board (60115)			
LED	**SIGNAL**	**TEST POINT**	**SIGNAL**
H1	310V	TP1	310V GND / T3-T4 and T7-T8 SOURCE
H2	BRIDGE CURRENT	TP2	+310VDC / T1-T2 and T5-T6 DRAIN
H3	BRIDGE CURRENT	TP3	T1-T2 SOURCE and T3-T4 DRAIN
H4	KVOK	TP4	T5-T6 SOURCE and T7-T8 DRAIN

INVERTER Board (60115)			
LED	**SIGNAL**	**TEST POINT**	**SIGNAL**
H5	+15V	TP5	T1 GATE VOLTAGE
H6	EXPENA	TP6	T2 GATE VOLTAGE
H7	+25V (THROUGH RELAY)	TP7	T3 GATE VOLTAGE
H8	PULSE A (FET DRIVE PULSES)	TP8	T4 GATE VOLTAGE
H9	PULSE A (FET DRIVE PULSES)	TP9	T5 GATE VOLTAGE
H10	PULSE B (FET DRIVE PULSES)	TP10	T6 GATE VOLTAGE
H11	PULSE B (FET DRIVE PULSES)	TP11	T7 GATE VOLTAGE
		TP12	T8 GATE VOLTAGE
		TP13	PULSE A
		TP14	SHUTDOWN
		TP15	PULSE B
		TP16	GND
		TP17	GND
		TP18	KVFB
		TP19	KVREF
		TP20	VCO FREQ
		TP21	TF2 SE1
		TP22	TF1 SE1
		TP23	TF1 SE2
		TP24	TF2 SE2

FILAMENT Board (60114)			
LED	**SIGNAL**	**TEST POINT**	**SIGNAL**
H1	+25V	TP1	GND
H2	+15V	TP2	MAFB
H3	+34V	TP4	MAREF
H4	-15V	TP5	PREH
H5	MAOK	TP6	PREHREL
H6	PREHREL	TP7	EXPENA
H7	PREH	TP8	-15V
H8-H9	PULSE1 (FIL-AMENT PULSES)	TP9	+15V
H10-H11	PULSE2 (FIL-AMENT PULSES)	TP10	+25V
H12	TEMPFAIL	TP11	+34V
		TP13	GND

CAMERA POWER SUPPLY Board (60157)			
LED	**SIGNAL**	**TEST POINT**	**SIGNAL**
H1	+5V	TP1	0V
H2	-5V	TP2	+5V (VCC)
H3	+5V	TP3	-5V (VSN)
H4	-18V	TP4	+5V (VSP)
H5	+18V	TP5	-18V (VAN)
H6	+26V	TP6	+18V (VAP)
H7	+3.3V (perma-nent)	TP7	26V (VDD)
H8	+5V (perma-nent)	TP8	+5.7V
H9	+34V (perma-nent)	TP9	+3.3V
		TP10	34V

PAN AEC TERMINAL Board (60247)			
LED	**SIGNAL**	**TEST POINT**	**SIGNAL**
H1		TP1	TXD_TO CAMERA_TTL
H2	PLD IO +3.3V	TP2	CAM +5V
H3	EPROM FAIL-URE	TP3	+5.7V
H4		TP4	CAM_SHDN
H5	IMAGE	TP5	TDI (CLOCK PULSES)
H6	+5V	TP6	GND
H7	LINK_OK	TP7	PLD CORE +2.5V
H8	RESET	TP8	+3.3V
H9	AEC VCC +15V	TP9	PLD IO +3.3V
H10	AEC VCC -15V	TP10	DAC_OUT (AFTER 1.STAGE GAIN)
		TP11	AEC VCC +15V
		TP12	PPOWER
		TP13	+3.3V
		TP14	NOT DEFINED
		TP15	NOT DEFINED
		TP16	NOT DEFINED
		TP17	AEC VCC -15V
		TP18	NOT DEFINED
		TP19	SPARE2
		TP20	NOT DEFINED
		TP21	NOT DEFINED
		TP22	
		TP23	NOT DEFINED
		TP24	NOT DEFINED
		TP25	

PAN AEC TERMINAL Board (60247)			
LED	**SIGNAL**	**TEST POINT**	**SIGNAL**
		TP26	LOOP_5V
		TP27	LOOP_SENSE
		TP28	SPARE1
		TP29	+5V
		TP30	
		TP31	DAC_OUT
		TP32	CAM_RXD2
		TP33	CAM_RXD1
		TP34	VV
		TP35	INVERTED IMAGE
		TP36	SS
		TP37	H/L
		TP38	DS
		TP39	IMAGE5
		TP40	IMAGE4
		TP41	
		TP42	
		TP43	VCC (RXD)
		TP44	ECL_IN
		TP45	ECL_IN
		TP46	COPPER_TEST+
		TP47	COPPER_TEST-
		TP48	OUT
		TP49	OUT
		TP50	VCC (ECL-TTL)
		TP51	
		TP52	FOUT
		TP53	PIMAGE
		TP54	IMAGE1

PAN AEC TERMINAL Board (60247)			
LED	**SIGNAL**	**TEST POINT**	**SIGNAL**
		TP55	IMAGE0
		TP56	VCC (TXD)
		TP57	AEC VCC +15V
		TP58	
		TP59	
		TP60	GND
		TP61	
		TP62	VIN (U/F CONV.)

CEPH HEAD Board (60243)			
LED	**SIGNAL**	**TEST POINT**	**SIGNAL**
H1	+34V (permanent)	TP1	CLASLIT
H2	SCAN1 MOTOR DRIVE PULSES	TP2	CEPHENA
H3	SCAN2 MOTOR DRIVE PULSES	TP3	CEPHDIR
H4	+5V (permanent)	TP4	NOT USED
H5	SCAN3 MOTOR DRIVE PULSES	TP5	CEPHCLK
H6	SCAN4 MOTOR DRIVE PULSES	TP6	CEPHLIM
H7	+18V (VAP)	TP7	GND (CPU)
H8	-5V (VSN)	TP8	CAECFRQ
H9	+26 (VDD)	TP9	CEPHMID

CEPH HEAD Board (60243)			
LED	**SIGNAL**	**TEST POINT**	**SIGNAL**
H10	+5V (VSP)	TP10	NOT USED (CPU_RXD)
H11	+6.1V (permanent)	TP11	+5V (CPU)
H12	-18V (VAN)	TP12	CPROJTRIG
H13	+5V (VCC)	TP13	
		TP14	NOT USED (DATA_FROM_CPU)
		TP15	LAT/PA
		TP16	
		TP17	+34V
		TP18	CPOWER
		TP19	NOT USED (CPU_TXD)
		TP20	CEPHDOWN
		TP21	CCLOCK
		TP22	CIMAGE
		TP23	CEPHUP
		TP24	GND
		TP25	CPROJTRIG_SW
		TP26	GND
		TP27	+5V
		TP28	+18V (VAP)
		TP29	-5V (VSN)
		TP30	+26V (VDD)
		TP31	GND
		TP32	+5V (VSP)
		TP33	+6.1V
		TP34	-18V (VAN)
		TP35	GND
		TP36	+5V (VCC)

BEAM ALIGNMENT Board (60249)			
LED	**SIGNAL**	**TEST POINT**	**SIGNAL**
H1	CEPHL	TP1	GND
H2	CEPHC		
H3	CEPHR		
H4	+5V		

CEPH TERMINAL Board (60191)			
LED	**SIGNAL**	**TEST POINT**	**SIGNAL**
H1	+2.5V	TP1	TXD_TO_CAM_TTL
H2	+3.3V	TP2	CAM+5V
H3	EPROM FAILURE (red)	TP3	6.1V
H4	CAM+5V	TP4	CAM_SHDN
H5	CIMAGE	TP5	TDI (CLOCK PULSES)
H6	+5V	TP6	GND
H7	LINK_OK	TP7	PLD CORE 2.5V
H8	RESET (red)	TP8	+5V
H9	+2V	TP9	PLD IO +3.3V
		TP10	SPARE2
		TP11	SPARE1
		TP12	CPOWER
		TP13	CAECFRQ
		TP14	NOT DEFINED
		TP15	NOT DEFINED
		TP16	NOT DEFINED
		TP17	NOT DEFINED
		TP18	NOT DEFINED
		TP19	NOT DEFINED
		TP20	NOT DEFINED
		TP21	NOT DEFINED

CEPH TERMINAL Board (60191)			
LED	**SIGNAL**	**TEST POINT**	**SIGNAL**
		TP22	NOT DEFINED
		TP23	NOT DEFINED
		TP24	NOT DEFINED
		TP25	NASIO REF. VOLTAGE +2V
		TP26	LOOP_+5V
		TP27	LOOP_SENSE
		TP28	SPARE3
		TP29	+5V
		TP30	NOT DEFINED1
		TP31	NOT DEFINED
		TP32	CAM RXD2
		TP33	CAM RXD1
		TP34	VV
		TP35	INVERTED IMAGE
		TP36	SS
		TP37	H/L
		TP38	DS
		TP39	IMAGE5
		TP40	IMAGE4
		TP41	IMAGE3
		TP42	IMAGE2
		TP43	VCC(RXD)
		TP44	ECL_IN
		TP45	ECL_IN
		TP46	COPPER_TEST+
		TP47	COPPER_TEST-
		TP48	OUT
		TP49	OUT

CEPH TERMINAL Board (60191)			
LED	**SIGNAL**	**TEST POINT**	**SIGNAL**
		TP50	VCC(ECL-TTL)
		TP51	EN_NASIO_FRQ
		TP52	NASIO_FRQ
		TP53	CIMAGE
		TP54	IMAGE1
		TP55	IMAGE0
		TP56	VCC(TXD)
		TP57	+1V
		TP58	NASIO_POSITION_SLIDE
		TP59	+2V
		TP60	GND

NOTES:

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