

Section 5

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1 Alarm Messages

1.0 Adjustment Alarm Messages

170

kV-mA couples are not enough to calculate the Duty-Cycle.
You must introduce other couples.

138

signal [IST-1], or [IST-2] or [IST-3], depending on the selected tube, is not active, so:
› change over magnet is not supplied

if supplied, signal [IST-1] or [IST-2] or [IST-3] does not come to uP, check path:

⇒ GTB 400 ⇒ pcb 5806 MPU

137

signal [IUB] is not active during preparation, this means that IGBT BRIDGE is no BALANCED
so check for:

- › snubbers
- › IGBTs
- › circuit that makes this control
- › path problem for [IUB] till uP:

⇒ pcb 5800 IGBT driver ⇒ pcb 5803 CCB ⇒ pcb 5806 MPU

135

During preparation [ICF] signal, coming from IINVERTER FILAMENT board is not active, this means that the filament heating has not crossed 2,5 Amp; so look for:

- › problem on inverter filament driver(PCB 5805)
- › problem on [ICF] path from the board to the uP:

⇒ pcb 5805 (inv. fil. driver) ⇒ pcb 5806 MPU

133

during preparation [INS] (or [IHS] if high speed starter with high speed selected) wasn't activated by Anode Starter (PCB 5822 or PCB 5847 or PCB5810 dual speed starter), so:

- › starter problem
- › [INS] or [IHS] path problem:

⇒ pcb 5822 or pcb 5847 or pcb 5810 (starter) ⇒ pcb 5806 MPU

129

more than 20 seconds has left from the start of the preparation without a radiography request

151

uProcessor doesn't succeeded in stopping the exposure:

In order to know if the radiography has been stopped by the CCB il uP looks at signal [IRM] , if this signal falls to zero before a limit time, this means that the exposure was correctly stopped, otherwise high voltage is still present, so:

- › start/stop x-ray signal [OHV] is not arrived to the CCB, check for path:

⇒ pcb 5806 MPU ⇒ pcb 5803 CCB

- › signal [IRM], high voltage on, check for path:

⇒ pcb 5803 CCB ⇒ pcb 5806 MPU

Note: if load is very light (ex. no heating on the filament), H.V. and mA tale is too long and this safety ca trigger.

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GOOD EXPOSURE

131

during preparation uProcessor sets for a filament heating ((olf) or (osf)) and checks the Filament Inverter Driver reply ((ilf) or (isf)) .

If those vales doesn't match uProcessor stops pretaration and comes to an alarm state. so, check for:

- › uP analog output (olf) o (osf) using the indication in the MPU display panel (find out by the switch the right menu). if wrong check for the path:

⇒ pcb 5806 MPU ⇒ pcb 5805 inverter filament driver

- › pcb 5805 fault (inverter filament driver)
- › transmission fault of the feedback signal (ilf) or (isf)

⇒ pcb 5805 inverter filament driver ⇒ pcb 5806 MPU

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Generator main contactor is not closed, uP checks signal [IPW] to verify the closing, this is done by sensing the 540 Vdc on the DC-BAR, if [IPW] is not made active check:

- › the closing of the contactor, this is placed on the front of the block 4 (inverter control board and line supply interfacing), the presence of the voltage on the DC-RAIL (capacitor on the back side of block 4, if all this is correct, check the signal [IPW] path:

⇒ pcb 5811 snubber & service ⇒ pcb 5803 CCB

- › [IPW] is not active, is CCB corectly supplied, so check for:

⇒ pcb 5803 CCB ⇒ pcb 5806 MPU

136

during exposure uProcessor finds signal [IKV] active, this meand that the general fault has triggered, DO NOT RESET the alarm on the control desk and look at the lit red led on the pcb 5803 CCB.

This means:

- › 166 kV overcome

- › 1300 mA overcome
- › current in the inverter bridge has creossed 850 Ampere peak.
- › clock on the CCB is not working

140

during exposure uP finds the kV goes down, signal [IRM] become not active.
Most of the time this means that there was an high voltage discharge, so look for:

- › High Voltage discharge
- › [IRM] path:

⇒ pcb 5803 CCB ⇒ pcb 5806 MPU

139

during exposure the door was opened [IKM-A]

⇒ pcb 5809 CCB ⇒ pcb 5806 MPU

150

real kV has no the value showed on the diplay. During radiography the real kV has undercrossed or overcrossed the indicated from the uProcessor.

Look for:

- › Voltage on the DC-BAR
- › mA breaker value showed on the mA display when the control console is in calibration mode.

Note: every digital signal starting or ending in the inverter has a led that shows its status.
Every analog signal starting or ending from the inverter has a test point in order to measure and to look its waveform on a scope.

1.1 Alarm Messages in Anatomical Selection

Alarm messages give to the user a problem find by the uProcessor during its work, in this case a manual re-set is needed to switch off the alarm.

[THERMAL OVERLD] 152	this alarm can trigger when the heat quantity stored in anode crosses maximum value given by the tube constructor. wait for some minutes till the kHUT has been reduced.
[? HEAT RADIO?] 153	this alarm can trigger if filament heating calculated by the uProcessor exceeds maximum heating value given by the constructor This happens at higher mA value with lower kV value. You must reduce mA value or increase kV value
[FLOURO TIMEOUT]. 156	it can trigger only during fluoroscopy, rappresent the 5 timeout 5 minutes fluoro has left, reset and proceede
[TIME-OUT PREP.] 129	20 seconds has left from preparation request (READY-X-RAY) operator, manteining preparation, has not preseed the x-ray pushbutton. For US interfaced with digital image acquisition system this could happen if the digital system is not ready.
[DOOR SAFETY] 139	One of the controlled room door has been opened during the one exposure or during fluoroscopy. The safety stops the work.
[DIG. FIL. SAF.] 135	selected filament is not lit or only partially lit. signal: [ICF] is not active, check for: - selected filament fault or pcb 5805 inverter filament driver fault - signal path: ⇒ pcb 5805 inverter filament driver ⇔ pcb 5806 MPU
[ANODE SAFETY] 133	during preparation [INS] (or [IHS] if high speed starter with high speed selected) wasn't activated by Anode Starter (PCB 5822 or PCB 5847 or PCB5810 dual speed starter), so: - starter problem
[INS] or [IHS] path problem:	⇒ pcb 5822 or pcb 5847 or pcb 5810 (starter) ⇔ pcb 5806 MPU
[AEC REL SAF.]	exposure was not stopped by A.E.C. (automatic exposure control), if selected, but or by uP because the safety back-up time was reached or the operator has released the radio pushbutton
[AEC DOSE SAF.]	The incident radiation on the samiconductor chamber is lower the minimum required. Check for the correct x-ray data and that the selected chamber is the irradiated chamber.
[FLUORO mA SAF.]	during fluoroscopy uProcessor found that the emission value was too far from the selected one, so was impossible to regulate, so check: - (ifc) measure system, look at mA regulation loop to locate the point on which is possible to have errors. - check H.T. headers to be correctly cleaned, fixed and with enuoght silicon paste H.V. pins must be opened - noise that corrupt current signal (ifc)

[PWS SAFETY]
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Generator main contactor is not closed, uP checks signal [IPW] to verify the closing, this is done by sensing the 540 Vdc on the DC-BAR, if [IPW] is not made active check:
the closing of the contactor, this is placed on the front of the block 4 (inverter control board and line supply interfacing), the presence of the voltage on the DC-RAIL (capacitor on the back side of block 4, if all this is correct, check the signal [IPW] path:

⇒ pcb 5811 snubber & service ⇒ pcb 5803 CCB

[IPW] is not active, is CCB correctly supplied, so check for:

⇒ pcb 5803 CCB ⇒ pcb 5806 MPU .

[INVERTER SAF.]
137

inverter is blocked by this alarm, reset and retry with a new prep.
If the problem is still present check the signal [IUB], unbalanced bridge
Check for:

- Converter fault, IGBT broken, snubber out of service.
- signal path:

⇒ pcb 5800 IGBT driver ⇒ pcb 5803 CCB ⇒ pcb 5806 MPU

[LOW kV SAFETY]
140

during the first part of the exposure (few hundreds of useconds) the high voltage doesn't cross 18 kV so the exposure was terminated by uP.
not active [IRM] signal. check:

- start/stop converter signal [OHT], check its path:

⇒ pcb 5806 MPU ⇒ pcb 5803 CCB

- [IRM] path:

⇒ pcb 5803 CCB ⇒ pcb 5806 MPU

[GENERAL SAFETY]
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more than one condition can trigger this safety, do not reset, check on CCB for red led lit:

- | | |
|--|------------|
| a) system clock failure on CCB | ld20 [CLK] |
| b) primary current has crossed its maximum limit | ld14 [IPO] |
| c) tube current has crossed its maximum limit | ld13 [mAx] |
| d) kV has crossed its maximum limit | ld19 [kVx] |
| e) no supply on IGBT gates | ld18 [PWx] |
| d) during exposure was detected a short circuit | ld17 [SCx] |

To exclude safety that make [IBO] active, check:

JP11	present	exclude > 166kV control
JP12	present	exclude > 1300 mA control
JP14	present	exclude > 950 Amp. bridge control
JP15	present	exclude short circuit control
JP16	present	exclude supply on 5800 control

All those jumper must be opened during normal work.

[mA RADIO SAF.]

during exposure uProcessor found an mA value too far from the selected one, so it stopped the exposure. check:

- (igr) measuring circuit, look at mA regulation loop to locate the point on which is possible to have errors.

- adjustment not correct, adjust the tube.

This could be happen when You change one or more PCB directly connected to the mA regulation and measure, try to adjust trimmers on the CCB to have a right uP mA reading, even if the best is: redo the tube Adjustment.

1.2 Generator Status and Alarms on PCB 5814 Supervisor

STATUS LEDS

LED ACTIVE SENSING, Yellow	blinking with 2 Hz frequency shows operator's waiting for commands status. If LED stops blinking generator must be turn off completely and then turn on (switch Si1 in OFF, wait for 10 seconds and then switch Si1 in ON).
LED GENERATOR ON, Yellow	turned ON when generator is in GENERATOR ON Status, DATA RECEIVE Status, X-RAY ON Status. LED turnsOFF Naturally (when key 'O' on remote control console is pressed or past 1 hour of X-Ray inactivity and JP8 disconnected) or Forced (when safety supervisor board have found an error: see ERROR LEDS).
LED X-RAY ON, Yellow	turned ON when generator is in X-RAY ON Status.
LED RESERVED #1, Yellow	
LED RESERVED #2, Yellow	

ALARM LEDS

LED FILAMENT ERROR		
colour:	Red	
control origin:	FILAMENT INVERTER DRIVER board	
signal:	OBF	
status:	NORMALLY OFF	
control disable:	jumper JP12	
BLINKING IN GENERATOR OFF STATUS		shows safety control exclusion via jumper.
TURNUED ON IN GENERATOR OFF STATUS		shows a problem on filament Inverter driver board noticed during last generator turn on session.
BLINKING IN GENERATOR ON STATUS		shows a problem on filament Inverter driver board noticed during last generator turn on session.
LED MPU WATCH DOG ERROR		
colour:	Red	
control origin:	MASTER PROCESSING UNIT board	
signal:	OSM	
status:	NORMALLY OFF	
control disable:	jumper JP13	
BLINKING IN GENERATOR OFF STATUS		shows safety control exclusion via jumper.
TURNUED ON IN GENERATOR OFF STATUS		shows a problem on MPUA board noticed during last generator turn on session.
BLINKING IN GENERATOR ON STATUS		shows a problem on MPUA board noticed during previous generator turn on session.

LED MPU SWITCH OFF REQUEST

colour: Red
control origin: MASTER PROCESSING UNIT board
signal: OAB
status: NORMALLY OFF
control disable: jumper JP1

BLINKING IN GENERATOR OFF STATUS shows safety control exclusion via jumper.

TURNED ON IN GENERATOR OFF STATUS shows a problem on MPUA board noticed during last generator turn on session.

BLINKING IN GENERATOR ON STATUS shows a problem on MPUA board noticed during previous generator turn on session.

LED POWER LINE TOO LOW

colour: Red
control origin: SAFETY SUPERVISOR board
signal LINE
status: NORMALLY OFF
control disable: not available

TURNED ON IN GENERATOR OFF STATUS shows that was found a critical mains power supply voltage value during last generator on session.

BLINKING IN GENERATOR ON STATUS shows that was found a critical mains power supply voltage value during previous generator on session.

LED BREAKER INTERNAL ERROR

colour: Red
control origin: SAFETY SUPERVISOR board
signals: BRKDR, brkfdbk
status: NORMALLY OFF
control disable: jumper JP14

BLINKING IN GENERATOR OFF STATUS shows safety control exclusion via jumper.

TURNED ON DURING GENERATOR OFF STATUS shows an error in breaker reference generator circuits found noticed during last generator on session.

BLINKING DURING GENERATOR ON STATUS shows an error in breaker reference generator circuits found noticed during previous generator on session.

LED HIGH VOLTAGE CURRENT TOO HIGH

colour: Red
control origin: boards: CONVERTER CONTROL BOARD
MASTER PROCESSING UNIT
signals: icl, ich, OTC, OTD, ICK
status: NORMALLY OFF
control disable: jumper JP14

BLINKING IN GENERATOR OFF STATUS shows safety control exclusion via jumper.

TURNED ON DURING GENERATOR OFF STATUS shows that safety supervisor board has read an high voltage current value too high for expected radiography during last generator on session.

BLINKING DURING GENERATOR ON STATUS	shows that safety supervisor board has read an high voltage current value too high for expected radiography during previous generator on session.
LED HIGH VOLTAGE CURRENT TAIL TOO LONG	
colour:	Red
control origin:	boards: CONVERTER CONTROL BOARD MASTER PROCESSING UNIT
signals:	icl, ich, OTC, OTD, ICK
status:	NORMALLY OFF
control disable:	jumper JP14
BLINKING IN GENERATOR OFF STATUS	shows safety control exclusion via jumper.
TURNED ON DURING GENERATOR OFF STATUS	shows that safety supervisor board has read an high voltage current value too high after a stop X-Ray command from MPUA board during last generator on session.
BLINKING DURING GENERATOR ON STATUS	shows that safety supervisor board has read an high voltage current value too high after a stop X-Ray command from MPUA board during previous generator on session.
LED X-RAY TIME TOO LONG	
colour:	Red
control origin:	MASTER PROCESSING UNIT board
signals:	ORS, OFT
status:	NORMALLY OFF
control disable:	jumper JP15
BLINKING IN GENERATOR OFF STATUS	shows safety control exclusion via jumper.
TURNED ON DURING GENERATOR OFF STATUS	shows that safety supervisor board has read an time of effective X-Ray too long from the one commanded from MPUA board during last generator on session.
BLINKING DURING GENERATOR ON STATUS	shows that safety supervisor board has read an time of effective X-Ray too long from the one commanded from MPUA board during previous generator on session.

