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Installation Guide
For
UD 150L-30 EX/FX

Contents

1. General information

- Component location

  Before starting the installation, locate all major components and PCBs in the generator. Following three figures is the illustration for component location.

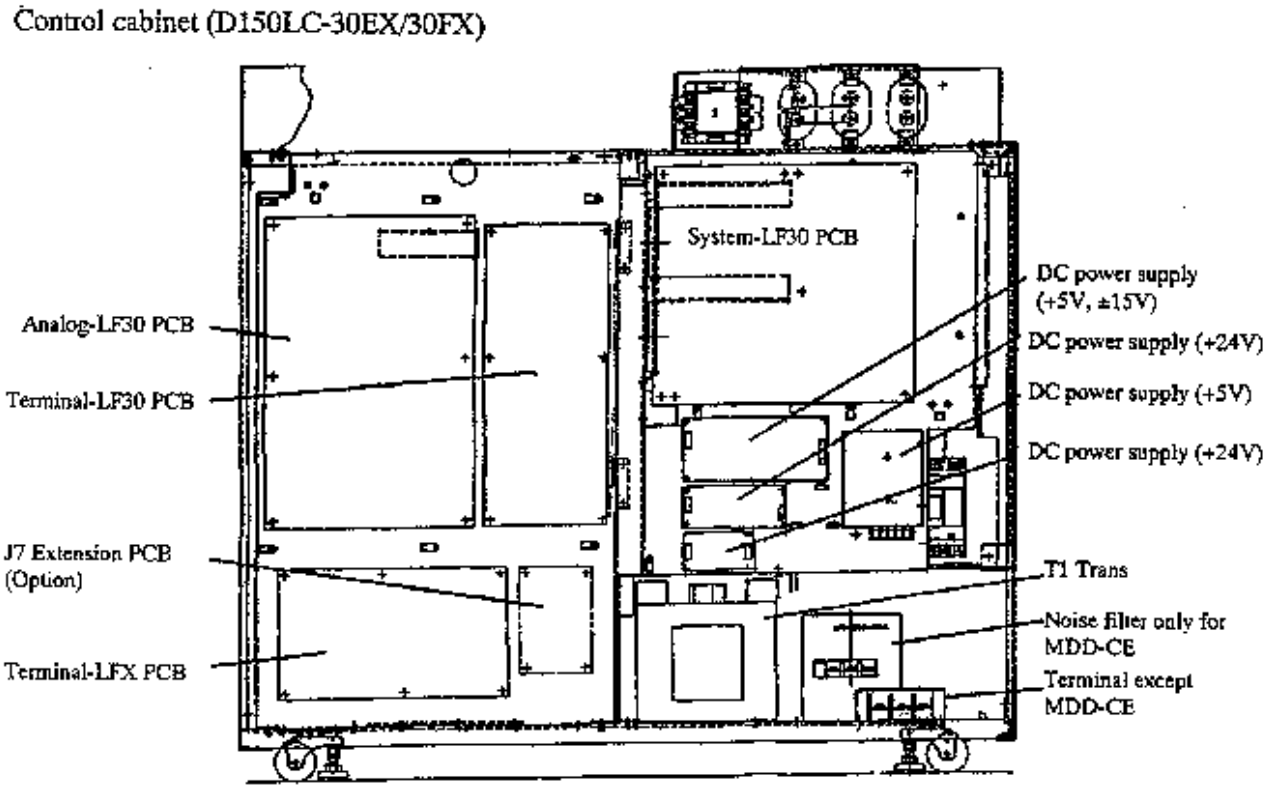


Figure 1-1 Front View of UD150L-30/FX

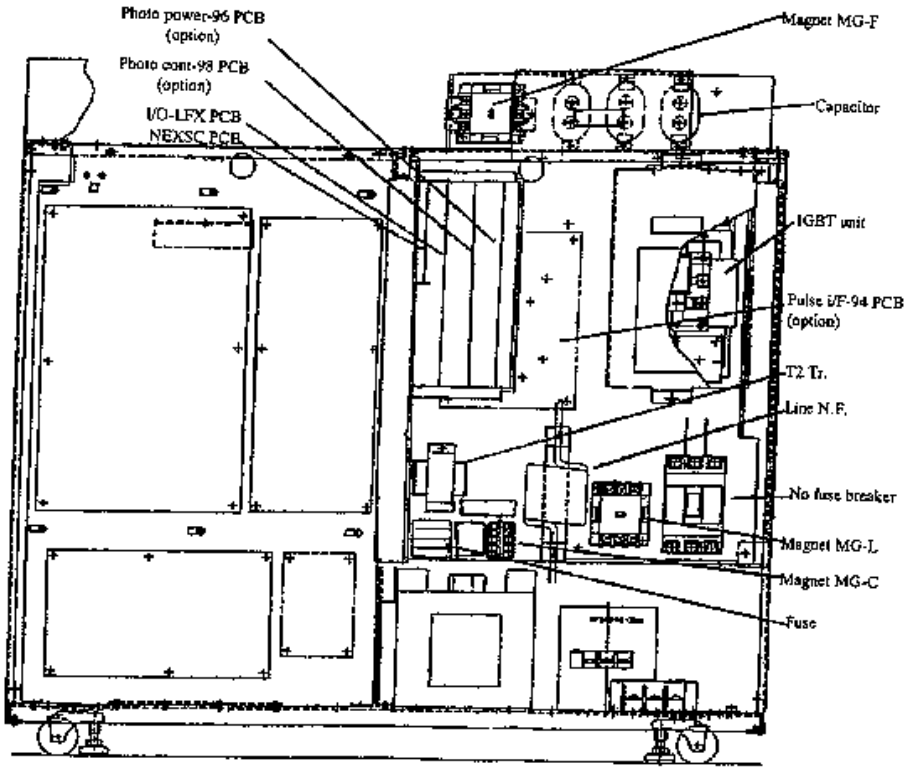


Figure 1-2 Front view of UD150L-30/FX (open swing panel)

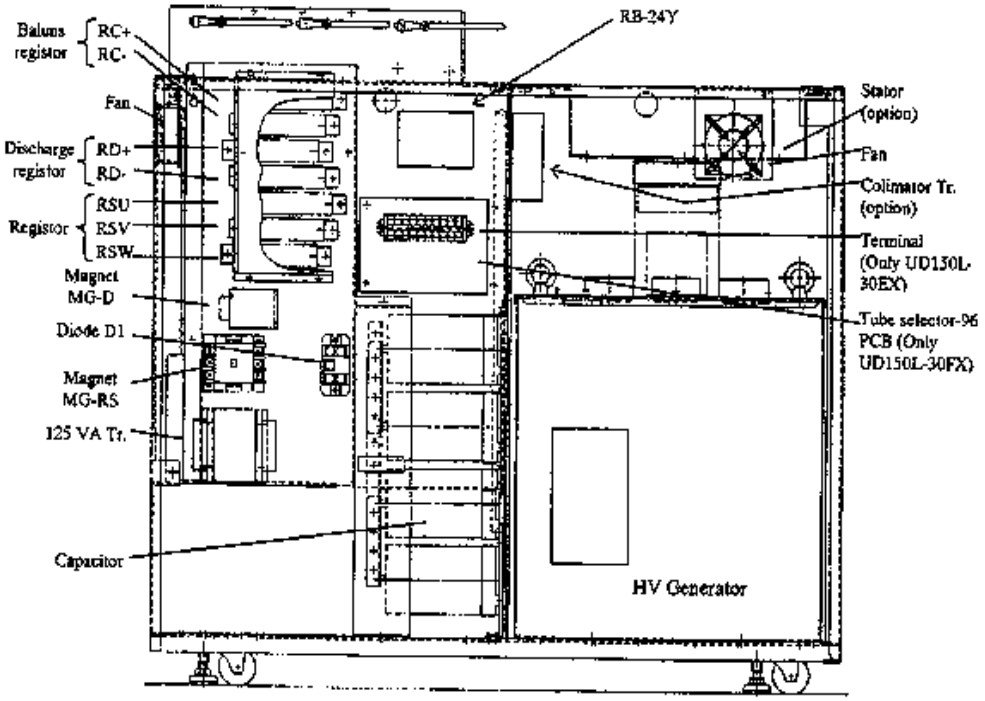


Figure 1-3 Back view of UD150L-30/FX

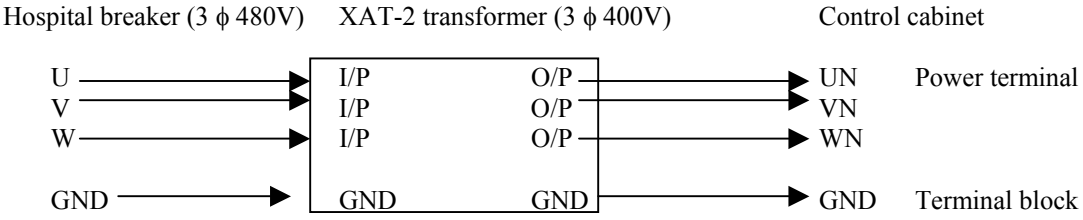
2. Connection of the system

2.1 Power transformers

- A step down transformer, (XAT-2) is normally shipped together with this generator for installation. This transformer can provide proper power input for UD150L-30 FX/EX generator, YSF/RS table system, HMS/AID high-speed starter, and other peripheral accessories.
- There are two other transformers in UD150L-30 FX/EX generator are power related, T1 and T2 transformer. It is necessary to change taps for these two transformers according to the supplied input from XAT-2 before proceeding.
  (1) T1 transformer,
  For example, if the incoming power is three-phase 400V from XAT-2, connect AIN-0 to –A200 and AIN-2 to A200.
  (2) T2 transformer,
  Connect T2-0 to –200 and T2-2 to 200 base on the same assumption as (1).

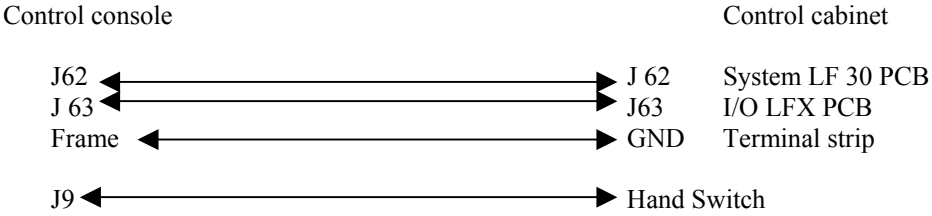
2.2 Cable connection

- Power cable



Note: Only ground one end of the shielding on the three-phase power cable to prevent ground loop from happening. Refer to Fig. 2.4.3 in the installation manual.

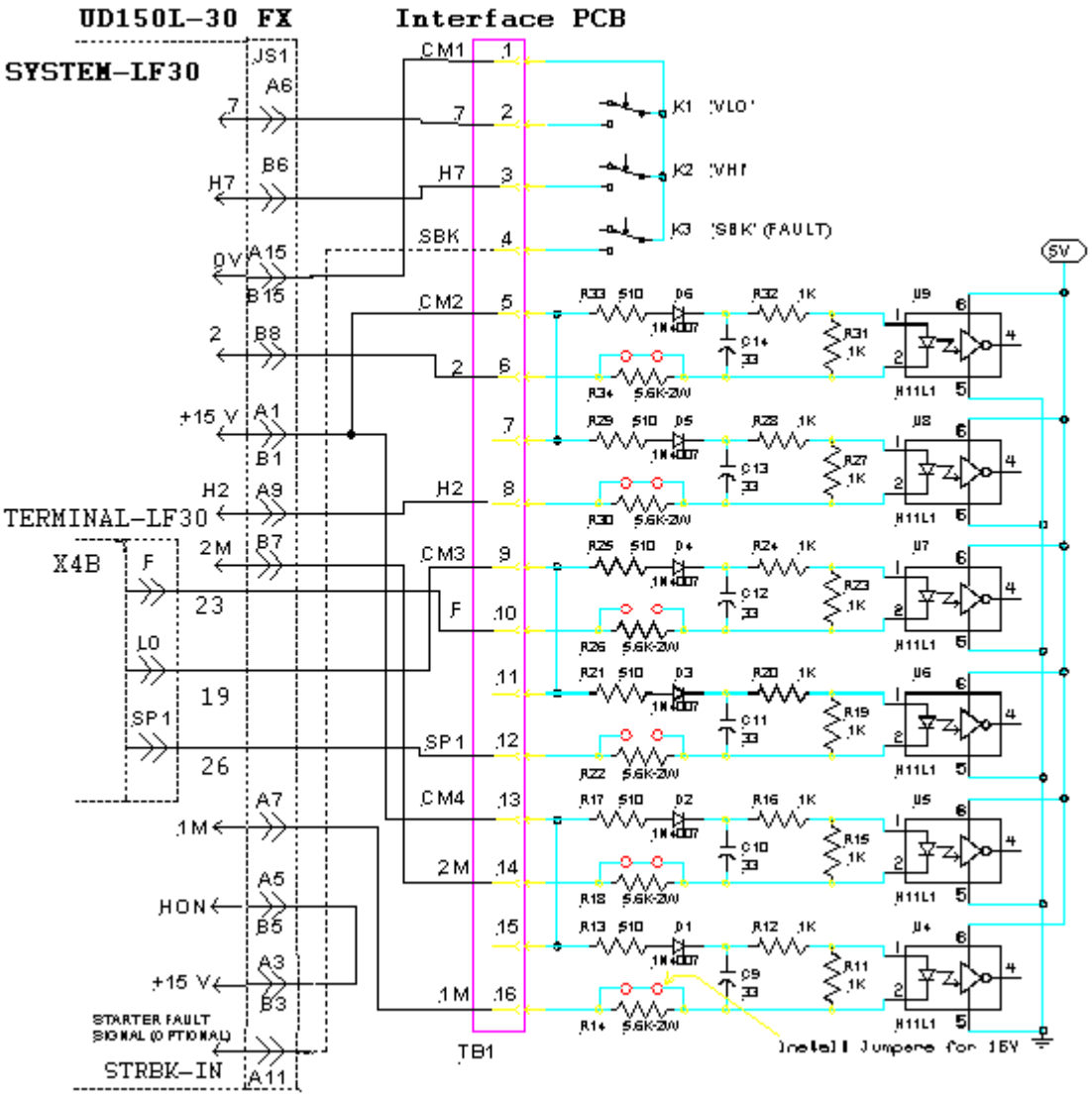
- Control console



- High speed starter (HMS or AID)

Connect JS1 cable between SYSTEM-LF 30 PCB and high speed starter by using JS1 connector kit in the accessory package shipped with this generator.
Following table is the description of the signal used for high speed starter

Signal	Meaning	Signal	Meaning
2	Normal speed rotation	1M	Tube 1 selection
7	High speed rotation	2M	Tube 2 selection
H2	Normal speed confirmation	SBK	Starter fault signal
H7	High speed confirmation	CM1	Return for 7, H7, and SBK (0V DC)
F	Fluoro tube rotation	CM2	Return for 2 and H2 (+15V DC)
SP1	Spot film	CM3	Return for F and SP1 (L0)
		CM4	Return for 1M and 2M (+15V DC)

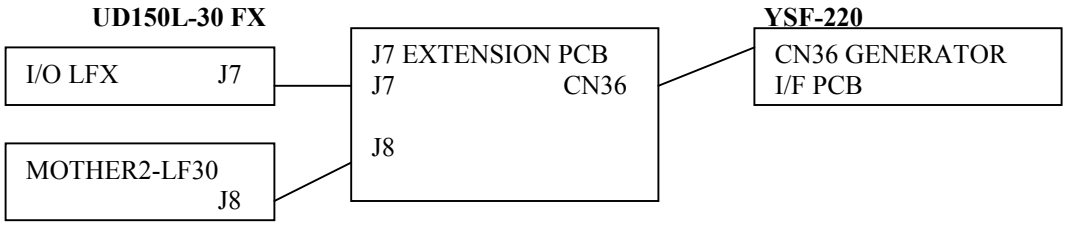


The procedures to set up or programming the starter can be found in the installation and service manual of HMS-3. Follow the instruction in Section 6 on page 11. (X-ray tube must be connected to perform setup mode.)

- Table power

  If a SHIMADZU table is to be installed, connect 3 ϕ 200 V from XAT-2 step down transformer to the power input terminal block for table.

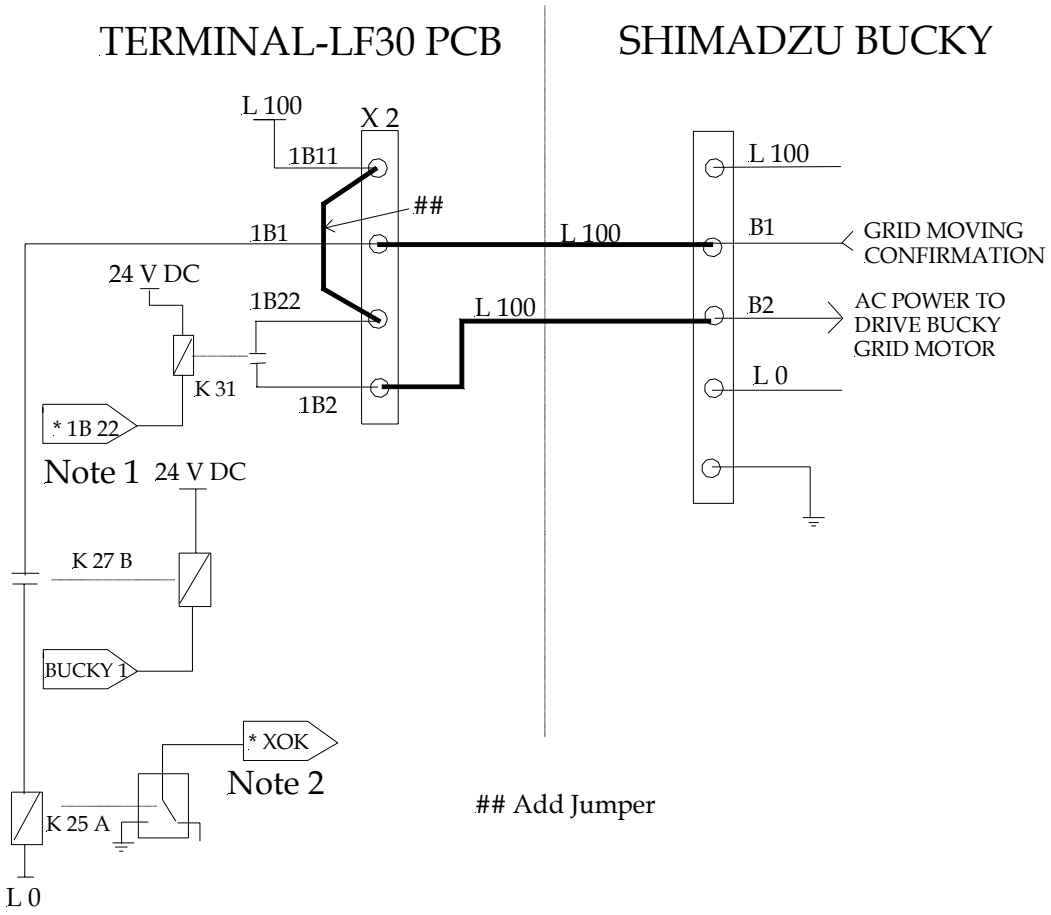
- Table interface with generator



- Bucky connection

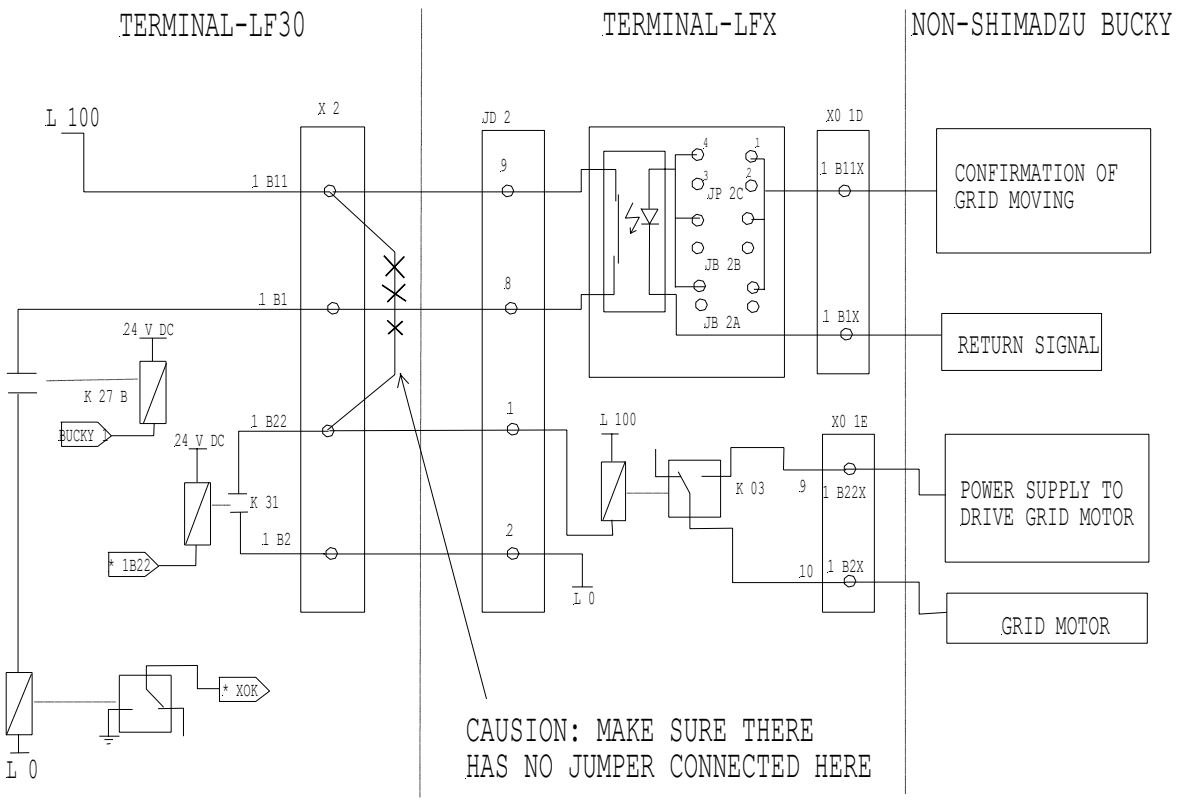
CAUTION: If UD150L30-FX is equipped only with SHIMADZU Bucky, YOU MUST DISCONNECT CABLES between TERMINAL-LF30 and TERMINAL LFX PCB. This includes 1B11, 1B1, 1B22, 1B2, 2B11, 2B1, 2B22, and 2B2 terminals on TERMINAL-LF30 PCB. Tape all disconnected terminals separately and secure them with other cables. Then connect Bucky cable directly to TERMINAL-LF30 PCB as stated below. Fail to disconnect the cable between these two boards will damage TERMINAL-LF30 PCB.

CONNECTION OF SHIMADZU BUCKY SYSTEM



Note 1: *1B22 is a DC signal within TERMINAL-LF30 PCB. When selecting Bucky1, 1B22 is at DC ground. However, 1B22 at terminal X2 is a AC 100 volt power supply to drive grid motor in Bucky. DO NOT mix these two signals by adding any extra jumpers for trouble shooting purpose.
Note 2: *XOK is the signal to turn on X-ray. Can be found in SYSTEM-LF30 PCB print 10/18. (M74A pin 2)

CONNECTION OF NON-SHIMADZU BUCKY SYSTEM



- Change jumper positions according to the voltage on 1 B11X.

  JP 2C: AC 100-125 V JP 2B: DC 24 V JP 2A: DC 12 V

  Jumper position of JP 2A, JP 2B, and JP 2C depends on the voltage of from 1 B11X, grid confirmation signal provided by the Bucky system. If Bucky provide a 24 V DC signal to 1 B11X, when grid is moving, install JP 2B to 1-4 position, and JP 2C, JP 2A to 2-3 position. Then connect 1 B1X to 24 V DC ground. Make sure only one jumper is installed on 1-4 position and the other two on 2-3 position.

- Connection of I. I. Mag. mode selection signal

  I.I. Mag. mode signal is connected via a new cable, I.I. View-field switching cable (P/N 532-15191) provided for this generator. This cable connects between JSK terminal on TERMINAL-LF30 PCB and IS connector attached to I.I. (Refer to Circuit diagram SYSTEM-LF30 15/18)

  UD150L-30/FX YSF series table

  TERMINAL-LF30 PCB GENERATOR I/F PCB

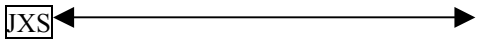
  JSK ◄——————————► IS ◄——► J9C

  View-field switching cable Adapter

- I.I. mode signal for under table collimator

  UD150L-30/FX — YSF series table

  TERMINAL-LF30 PCB — GENERATOR I/F PCB

- I.I. Mag. Mode selection output

  TERMINAL-LF30 PCB has several terminals for I.I. Mag. mode output selection. These terminals are IF0, IF1, IF2, IF3, and IF4. Mag. mode output is to provide interface for Digital products. IF signals are routed through the onboard relay contacts.

TERMINAL-LF30 PCB		INFIMED or CAMTRONICS
Common (DC24V)	[IF0]	Common
Non-Mag.	[IF1]	
Mag1	[IF2]	Mag 1
Mag2	[IF3]	Mag 2
Mag3	[IF4]	Mag 3

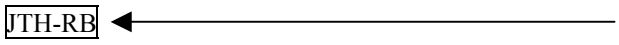
  Note: Same signal names used to be the I.I. Mag. mode selection input to the previous models of the X-ray Generators. With new UD150L-30/FX, these signal names are used for the output.

- I.I. cable connection

  New cable connector is provided to improve the installation quality.

  UD150L-30/FX — I.I.

  TERMINAL-LF30 PCB — POWER SUPPLY

- PMT cable from I.I.

  When using photomultiplier tube for digital exposure (IFG technique) and fluoro IBS regulation, connect PMT cable for I.I. as the following table.

PH POWER-96 PCB	**Phototimer signal cable**
M1	M1 (-HV)
M2, M3 (common)	M2, M3
M4	M4 (Signal)
E	E

- Fluoro IBS signal connection, case 1

  In case of using PMT to regulate Fluoro IBS, add a jumper between CP6 on PH-POWER PCB to TV7 on ANALOG-LF30 PCB (X1 pin3).

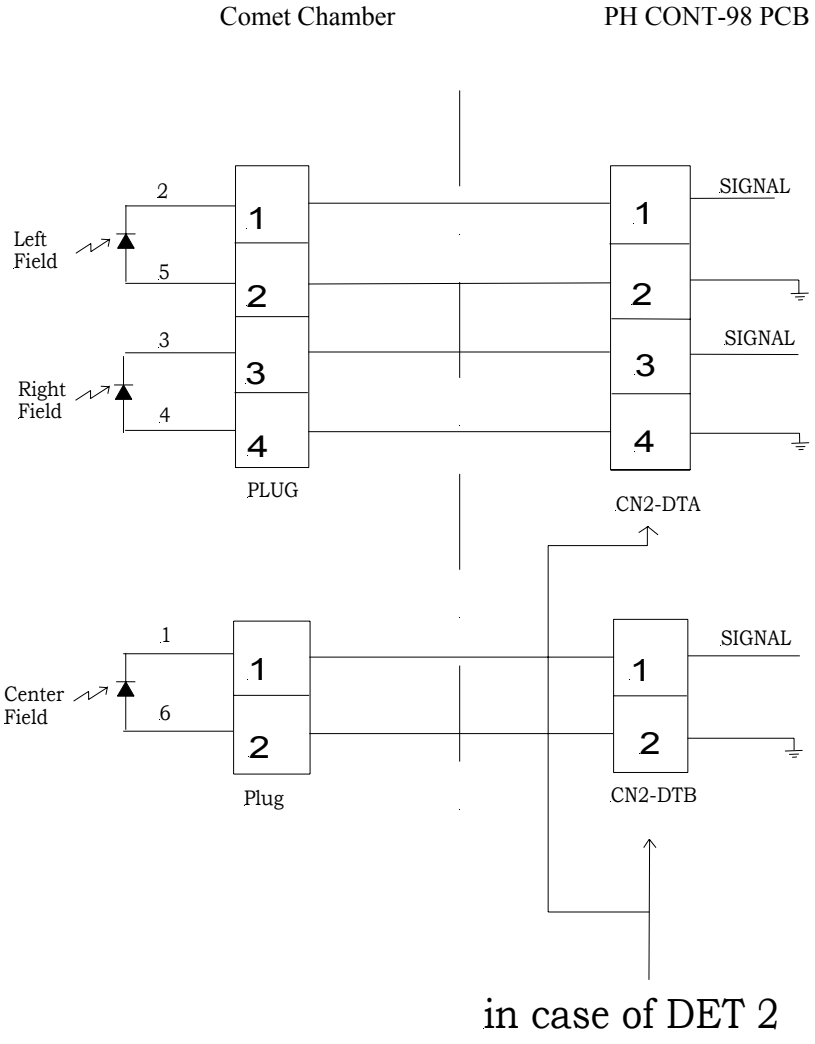
- Fluoro IBS signal connection, case 2

  When using TV signal to regulate fluoro IBS, a shielded co-axial cable should be connected from TV camera to ANALOG-LF30 PCB.

UD150L-30/FX		**TV system**	
ANALOG-LF30 PCB	TV 7	IBS signal	Shielded cable
	TV 2	0 V	

- Photo timing connection

- For SHIMADZU Bucky with SPT photo timing connection, check the installation manual section 6.2.
- If you programmed the Comet Chambers to Detector 2, follow the stated below diagram for connection.



You can change the connection anyway you like. Just make sure the connection stay in the same group. For example,
CN1-DTA and CN1-DTB are for Detector 1
CN3-DTA and CN3-DTB are for Detector 3

Setting
Change the position of SW1 to ON position according to the position where Comet Chamber is connected.
For example, if Comet was connected to DET2, set SW1-3 to ON.

SW1-2	SW1-3	SW1-4
DET1	DET2	DET3

Adjustments

	Left	Center	Right	Short Time	Long Time *
DET1	R58	R64	R61	R22	R21
DET2	R56	R62	R59	R22	R86
DET3	R57	R63	R60	R22	R87

* SW2: LTC ON

3. Settings and adjustments

3.1 Settings

- NEXSC PCB

  SW1 Reset switch

  SW2

1	2	3	4	5	6	7	8
OFF	ON OFF *	OFF	ON	ON OFF *	ON OFF *	OFF	ON OFF *

  SW2-2 ON For UD150L-30EX
  SW2-2 OFF For UD150L-30FX
  SW2-5 ON Display measured values
  SW2-5 OFF Normal position
  SW2-6 ON Serial port communication available
  SW2-6 OFF Normal position
  SW2-8 ON Initial setting mode
  SW2-8 OFF Normal position

  SW3

1	2	3	4	5	6	7	8
ON OFF *	OFF	OFF	OFF	ON OFF *	ON * OFF	ON * OFF	ON OFF *

  SW3-1ON Initialize this PCB, use with SW2-8
  SW3-1 OFF Normal position
  SW3-8 ON For FVR mode adjustments
  SW3-8 OFF Normal position

  Note: SW3-5, SW3-6 and SW3-7 are available only if SW2-6 is ON. SW2-6 provides the serial port function of NEXSC PCB.

  SW3-5 ON Initialize SRAM when SW2-6 is OFF
  SW3-5 OFF Normal position
  SW3-5 ON Download data to PC when SW2-6 is ON
  SW3-5 OFF Upload data from PC
  SW3-6 ON Serial port at 9600 bps, 8 bits, non-parity, stop bit 1
  SW3-6 OFF Serial port at 38600 bps, 8 bits, non-parity, stop bit 1
  SW3-7 ON Normal use for operating terminal
  SW3-7 OFF Download/upload mode

- SYSTEM-LF30 PCB

  SW1 PREP
  SW2 X-ray (RAD)
  SW3-1 ON When using SHIMADZU CCD camera
  SW3-1 OFF When using other camera
  SW3-2 ON
  SW3-2 OFF

- ANALOG-LF30 PCB

  SLIDE SWITCH: S1 Normally on S side

  SW2

1	2	3	4
OFF	On	ON	OFF

- PH POWER-96 PCB

  SLIDE SWITCH

S7	S8	S9	S10
PM	INT	ON	AUTO
Photo pick up type	Int or Ext Setting for Ba comp	LTC on/off	PMT HV setting mode

  SW5

1	2	3	4	5	6
OFF	OFF	OFF	OFF	OFF	OFF

- PH CONT-98 PCB

  SLIDE SWITCH: S2 LTC ON

  SW1

1	2	3	4	5	6	7	8
OFF	OFF*	OFF*	OFF*	OFF	OFF	OFF	OFF

  * SW1-2: DET1 OFF or control SW1-3: DET2 SW1-4: DET3

- TERMINAL-LF 30 PCB

  Jumper between terminal block X1-5 and X1-6 (DOOR 1 and DOOR 2)
  If there was no door safety switch, make jumper on DOOR1 and DOOR2.

3.2 Adjustments

3.2.1 First power on

Before power on, confirm the following
The input voltage UN, VN, and WN at the control cabinet side should be 3 ϕ AC 400 volt. If you don't have this voltage as the input to control cabinet, check the internal 3 ϕ taps in XAT-2 transformer.
Check taps on T1 and T2 transformer. According to UN, VN and WN, T1 and T2 should be connected as follow,

(1) T1 transformer,
Connect AIN-0 to –A200 and AIN-2 to A200.

(2) T2 transformer,
Connect T2-0 to –200 and T2-2 to 200.

Disconnect JM2 (135V AC) on ANALOG-LF30 PCB, so that no power will supply to filaments.

3.2.2 Power ON check up

- Check all DC and AC power according to the table below.

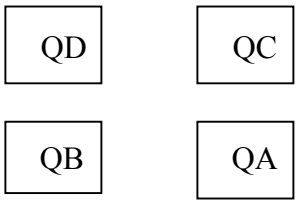
Name	Measuring point	Voltage	Note
T2 transformer	10LA-0LA	10.5V ± 1V	
	100LB-0LB	105V ± 10V	
T1 transformer	L100-L0	AC 105V ± 5V	Without Load
	L125-L0	AC 130V ± 10V	
	A125-A0	AC 125V ± 5V	
	A200-A0	AC 200V ± 15V	
	135C-0C	AC 142V ± 10V	
	20T-0T	AC 21V ± 2V	
DC power supply	J73/J74 4-7	DC +5V ± 50mV	PS1
	J73/J74 2-5	DC +15V ± 400mV	PS1
	J73/J74 6-5	DC -15V ± 400mV	PS1
	J75 1-4	DC +24V ± 600mV	PS2

- Make sure MG-RS is activated. If not, turn power off immediately, and manually push the button on MG-RS to see if that was a mechanical jam. Also, check the cable connection on it. Fire accident could happen if this is not working.
- Check to see if the charging voltage on VC+ and VC- (ANALOG-LF30 CP72 and CP73) is within range. (±10%) (3 ϕ 400 V input power to generator will results the charging voltage on VC+ and VC- approximately to be 560V) If not, you need to check the power line and XAT-2 again.
- Perform IGBT Gate check as the following and make necessary adjustments before conducting X-ray. (Please check this part after you finish initial settings)

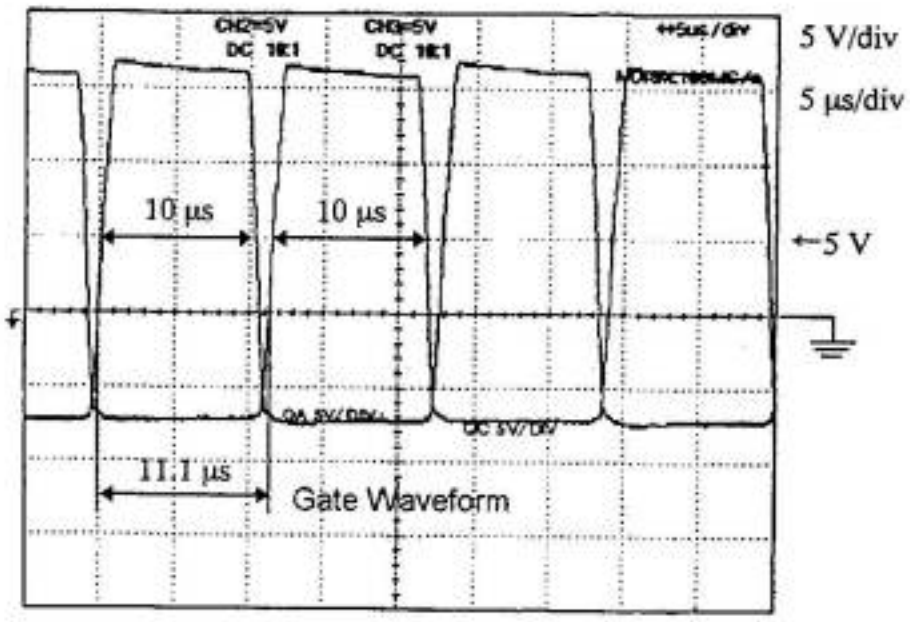
  Procedures:

  1) Power off generator and wait about 5-10 seconds.
  2) Measure VC+ and VC- with DVM to insure the charging voltage were all discharged.
  3) Disconnect J202 and J203 on ANALOG-LF30 PCB to disable MG-L and MG-RS.
  4) Add jumper between CP42 CVP1 and GND test point on ANALOG-LF30 PCB. Add another jumper between the cathode side of D27 and CP58 +15V. (Connection Diagram ANALOG-LF30 9/27) Add another jumper between CP52 CHECK1 and CP56 CHECK2 on ANALOG-LF30 PCB.
  5) Connect oscilloscope channel one to CP1 E and CP2 G on GATE DRIVER-99 PCB mounted on IGBT-QA.(Probe signal on CP2, ground on CP1)
  6) Connect scope channel two the same as channel one on IGBT-QC. (Float ground on channel two probe to prevent ground loop)
  7) Set amplitude 5V and time 5 μ sec. per division for both channels on the scope. Place the ground for both channels at the center of screen as well.
  8) Turn on power of generator and select General Radiographic Mode. Then set 100 kV, 100 mA, and 2.5 sec.
  9) Make an exposure and wait about 0.1 to 1 second until the X-ray operation reach to its steady state.
  10) Observe the waveforms and make the following adjustments if necessary.
  11) Adjust VR12 PULSE ADJ on ANALOG-LF30 PCB so that the pulse width is 10.0 ± 0.5 μ sec. at 5 V level. Also, check the phase difference is 11.1 ± 0.5 μ sec. at 0 V level. The positive peak voltage is less than 20 V and flat level is at 15 V or a little higher. The negative flat level is about –6 V. Repeat step 9) and 11) several times for the best results you can achieve. (Compare the waveform with the attached waveform.)

12) Switch both probes to IGBT-QB and IGBT-QD side for the same purpose. Adjust VR12 on ANALOG-LF30 again if necessary. Reconnect J202, J203 and remove all jumpers for normal operation.



IGBT layout



Sample Waveform

- Reset everything back to normal condition.

3.2.3 Initial setting

- System initialization
  It is recommended to perform system initialization for new installation and when PROMs were replaced. All information in PROMs will set to default after initialization.
  Procedures:
  Set S2-8 and S3-1 on NEXSC PCB to ON position.
  Turn power on.
  Make sure "INI.MENU" has started up. Press initial setting end key "CALCULATE" will show on screen. Then "CALCULATE END" appears about 10 seconds later.
  End of initialization.

- Initial settings (Appendix E for reference)
  Following is the general procedures for initial settings. Different installation could have different tube combination, device rating, and special accessories. Please check Installation Manual section 3.2 for this part.
  Turn on S2-8 on NEXSC PCB.
  Go through the following mode base on the components for installation.
  General Mode
  Tube data mode
  Non standard tube mode (must program this mode for non-SHIMADZU tubes. Contact SMS for tube data)
  Option mode

3.2.4 Verification and calibration

- Seasoning X-ray tubes
  Select FVF (section below) mode to perform seasoning U.T. tube.
  Turn off IBS. Connect D.V.M. to CP 38 on ANALOG-LF30 PCB and adjust R1 so that the reading is 2V$\pm$0.1V. (pre-heat value)
  Turn off SW2-2 on ANALOG-LF-30 PCB. Set fluoro 50 KV manually. Turn on x-ray. Adjust FVF on the console to obtain tube current 1mA$\pm$0.2mA.
  Keep fluoroing for 10 minutes. Increase KV at the rate of 10 KV/min.
  When seasoning O.T. tube, increase 10 KV each time started from 80 KV until reaching max. KV.
  Select large focus, 0.1 second, and 320 mA. Make x-ray at the rate of one exposure per minute. Repeat the same technique twice. (refer the section below for radiographic tube current adjustments)

- FVR mode calibration (Radiographic tube current calibration)
  Turn power off. Set SW2-5 and SW3-8 to ON position on NEXSC PCB. Turn SW2-2 OFF on ANALOG-LF30 PCB. Connect oscilloscope to CP54 TmA and CP3 TKV on ANALOG-LF30 PCB. (5V/100KV, 1V/200mA)
  Turn power on. LCD screen will display “FVR Set Mode”.
  Select the tube, focus, and mA station to be calibrated. Set exposure time to 32 msec.
  Adjust IF value after each exposure. For example, 4.35V of IF reading means 4.35A provided to filament. (refer to Installation Manual 3.6.3)
  Compare the actual reading on the control panel with the reading from oscilloscope.
  Record the IF values in the following chart.
  Make a copy of this chart for the second tube adjustments.

Tube #		IF Value					
Focus	mA	40KV	60KV	80KV	100KV	125KV	150KV
S							
L							

- FVF mode calibration
  1) First, you need to set mA curve at ANALOG-LF30 PCB first before you adjust FVF, Fluoro filament heating. Refer to Appendix F and page 18/27 of ANALOG-LF30 connection diagram.
  2) Turn off S2-2 on ANALOG-LF30 PCB to disable tube current feedback. (Make sure to turn it ON after you finish this calibration)
  3) Connect a DVM at FmA3, CP79 at ANALOG-LF30 PCB. Set DC reading for DVM.
  4) Turn on generator power and turn off IBS. In FVR mode, press Page Down key to enter FVF Set Mode.
  5) Set fluoro KV to 50 and make x-ray. By pressing "+" or "-" key will change FVF setting.
  6) Observe the reading of DVM and the mA reading on the operator panel. By changing FVF setting, to match the reading on the panel with FmA3.
  7) Record the FVF data by pressing the WRITE key.
  8) Repeat the same procedure for other KV stations, i.e., 60, 80, 90, 100, 110, and 115.
  9) Record FVF value in the following table.

	FKV						
	50	60	80	90	100	110	(115)
FmA	0.3	0.5					
FVF							

Note: For high KV exposures, make sure you close the collimator shutters to protect the I.I. and camera.

- Flash circuit (heating) adjustments
  This adjustment is only needed for a FX (two tubes) model, i.e., when FSP, IFG, or XDR are used.
  Select large focal spot. Turn on fluoro about several seconds, then turn on spot.
  Observe the waveform at CP84 on ANALOG-LF30 PCB. Adjust VR17, FLL, to obtain a flat waveform. Check other mA stations for the same purpose.
  Conduct the same test for small focal spot, adjust VR18, FLS, if necessary.

- IBS adjustments
  First, set the maximum fluoro KV. Make a jumper between CP52, CHECK1, and CP56, CHECK2, at ANALOG-LF30 PCB. Disconnect J202 at the same PCB. By, doing this, no high voltage will apply to the tube.
  Connect a D.V.M. to CP 27 FKVA and GND at ANALOG-LF30 PCB. Select IBS ON. Turn on fluoro, adjust VR 11 FKV MAX at ANALOG-LF30 PCB until 115 KV is displayed on the control console. At the same time, check the reading on D.V.M. for 5.75 V. (1V/20KV)
  Turn power off. Connect everything back. Set the probe to check table top maximum dose. If 115 KV results the maximum dose more than 10R/min, you need to repeat the same procedure for a lower KV setting.
  Second, adjust the IBS response on ANALOG-LF30 PCB by adjusting VR10, IBS RES.
  When fluoro is on, move a 2mm copper plate in and out the field quick. If you see fluctuation of the brightness on monitor, change VR 10 position. Try several times until the best results cab be obtained.

3.2.5 PC connection

- Software maintenance and troubleshooting is possible for this generator. It has the capability to communicate with PC computer via NEXSC PCB and RS-232 port. Download and upload the information stored in the PROMs, such as initial settings, calibration data, and APR info, to PC can be useful for service. Error message can be obtained through PC connection.
- Necessary Parts for this purpose are
  PC with WIN95, WIN98, or WIN NT installed.
  9 pin female to female null modem cable
- Detail procedures can be found in the Installation Manual Section 12.

4. Appendix

A. Mandatory modification

- Modification of SYSTEM-LF30 PCB is mandatory for the following version
  SYSTEM-LF 30 BOARD (501-79573) B or earlier Rev.
  SYSTEM-LF 30 ASSY (501-79752) D or earlier Rev.
  If you have Rev. E or after, there is no need for you to perform this modification.

- Symptom
  M96 IC and DM7 diode pack on SYSTEM-LF30 PCB gets hot and burned out.
  Photo Timer does not work.

- Cause
  When SYSTEM-LF 30 PCB connects to J7 EXTENSION PCB of YSF table, +12 V DC or +15 V DC is supplied through J8 pin B10 from table to SYSTEM-LF 30 PCB due to two unnecessary trace on SYSTEM-LF 30 PCB. As a result, DM7 pin 2 and M96A pin 18 (*KBO) is always at logic high and both components finally get burned out.

- Modification procedures

  Cut the two traces on the solder side of SYSTEM-LF 30 PCB as described in figure 1.2-1 and figure 1.2-2 below. Also, make a label of this modification and stick it on the machine.

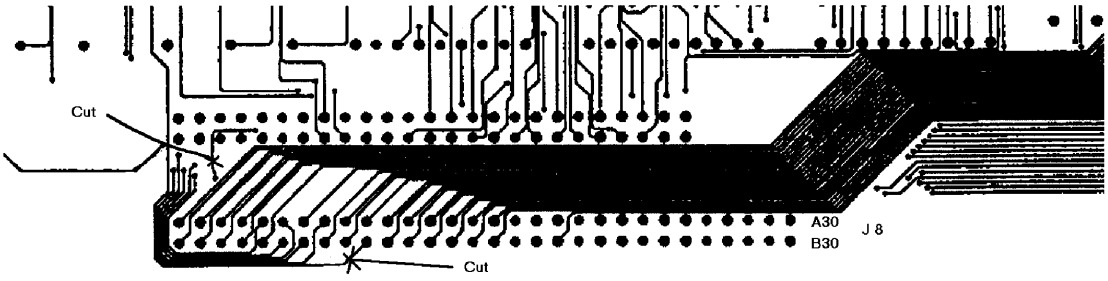


Figure A-1 The position of the traces to cut on SYSTEM-LF 30 PCB solders side

J8 on SYSTEM-LF 30 PCB

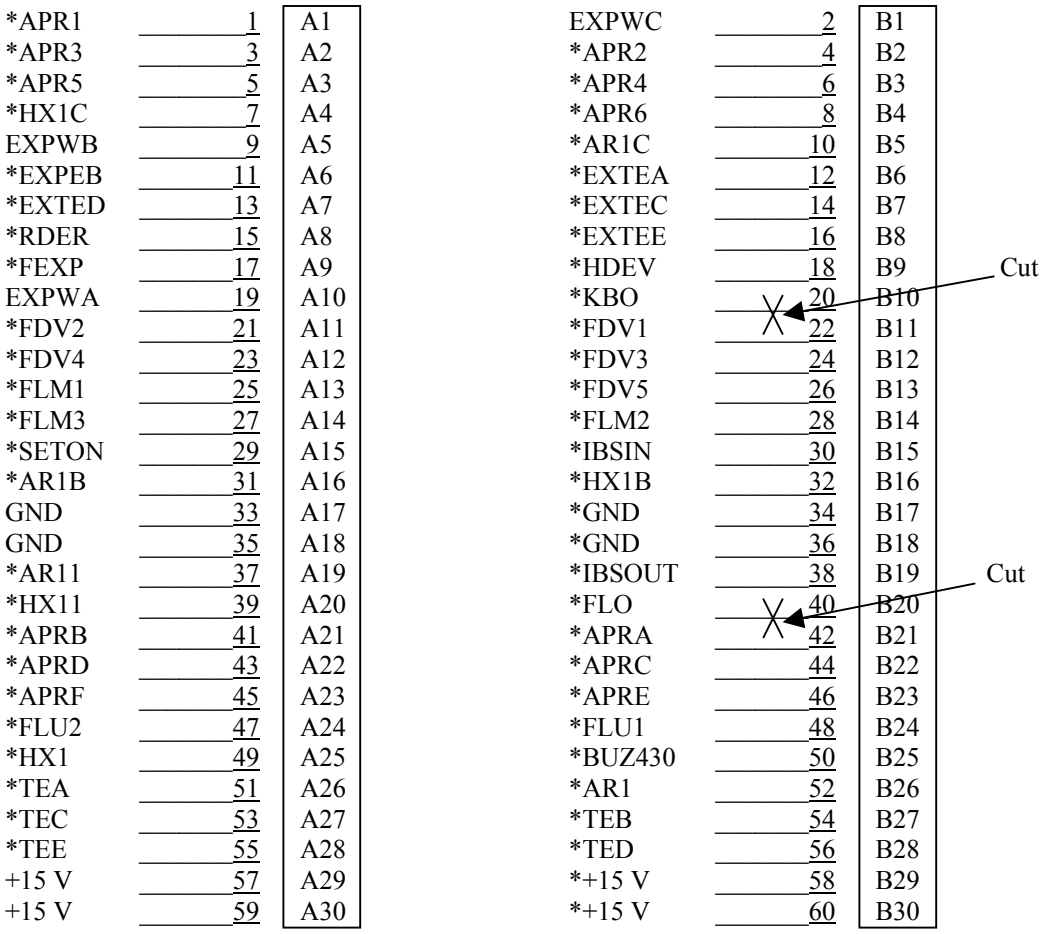


Figure A-2 Wiring information on J8 connector of SYSTEM-LF 30 PCB

B. List of error message

Code	Meaning	Explanation	Reference Circuit
F1	Power Down	DC –15 V malfunction	SYSTEM-LF30 13/18
F2	Charge Voltage Over	Charging Voltage abnormal	ANALOG-LF30 9/27
F3	Filament Current Over	Heating of filament abnormal	ANALOG-LF30 17/27
F4	PKV Over	Set KV over	ANALOG-LF30 9/27
F5	TKV Over	Measured KV out of range	ANALOG-LF30 8/27
F6	Starter Defective	Starter malfunction	N/A
F7	Line Voltage Over	Power line supply out of range	ANALOG-LF30 22/27
F8	HV Tank not connected	J112 HV Tank loose connection	ANALOG-LF30 25/27
F9	RAD over current	Measured mA out of range	ANALOG-LF30 19/27
F10	Fluoro over current	Fl mA out of range >10mA	ANALOG-LF30 20/27

Code	Meaning	Explanation
L1	mAs Over	MAs over 800 mAs
L2	mAs Too Small	MAs is less than 0.5 mAs
L3	Emission Over	Tube Current Emission Over
L4	Generator Load Over	Techniques setting over 50 kW
L5	mAs value too high	Lower down mAs settings
L6	KV too high	Set KV too high
L7	Tube Over Load	Load is over tube rating

Code	Meaning	Explanation
H1	HU Over Predict	RAD Condition Exceeds Allowable HU
H2	HU Fully Stored	Accumulated Heat Reach Max
H3	Thermal Switch Open	Thermal Switch Open On Tube

Code	Meaning	Explanation
L8	Door open	Door Safety Switch Open
L9	FL Optical Device Error	Device Error Optical
L10	RAD Optical device Error	Device Error Optical

C. List of Potentiometers

ANALOG-LF30 PCB

NO.	NAME	PURPOSE	CHECK PIN	INSTALLATION
VR1	KV+ ADJ	Adjust for KV level (+)	Meter	Not Required
VR2	WF ADJ+	Adjust for KV reponse (+)	Meter	Not Required
VR3	WF ADJ-	Adjust for KV reponse (-)	Meter	Not Required
VR4	KV- ADJ	Adjust for KV level (-)	Meter	Not Required
VR5	IMF	Adjust IF meter	IF meter	Not Required
VR6	LmA60KV ADJ	Adjust KV @ 60KV in low current	Meter	Not Required
VR7	F.60 KV ADJ	Adjust FL KV @ 60KV	Meter	Not Required
VR8	F. GAIN ADJ	Adjust FL KV	Meter	Not Required
VR9	LmA GAIN ADJ	Adjust KV in low current	Meter	Not Required
VR10	IBS RES	IBS response speed	CP27	Check Required
VR11	FKV MAX	IBS maximum tube voltage	CP27	Check Required
VR12	PULSE ADJ	Adjust IGBT pulse width	CP16/CP17	Not Required
VR13	+DV	+ voltage circuit (0~+15V)	CP35	Not Required
VR14	-DV	- voltage circuit (0~-15V)	CP34	Not Required
VR15	VP1 ADJ	Charging voltage detecting signal+	CP41	Not Required
VR16	VP2 ADJ	Charging voltage detecting signal-	CP40	Not Required
VR17	FLL	Heating current (LG)	CP19	Check Required
VR18	FLS	Heating current (SM)	CP19	Check Required
VR19	PRMA ADJ	RAD tube current (A/D)	CP70	Not Required
VR20	PRKV ADJ	RAD tube voltage (A/D)	CP69	Not Required
VR21	Unused	N/A	N/A	N/A
VR22	VF ADJ	Frequency for IGBT driving	CP64	Not Required
VR23	FBRES	Tube voltage feedback response	CP63	Check Required
VR24	VP COM	Adjust charging voltage correction	CP46	Check Required
VR25	VS	Adjust VS	CP67	Not Required
VR26	VN	Adjust VN	CP68	Not Required
VR27	B	FL tube current setting	CP79	Check Required
VR28	LV SIG ADJ	Adjust line detecting signal	CP55	Not Required
VR29	C	FL tube current setting	CP79	Check Required
VR30	E	FL tube current setting	CP79	Check Required
VR31	D	FL tube current setting	CP79	Check Required
VR32	F	FL tube current setting	CP79	Check Required
VR33	G	FL tube current setting	CP79	Check Required
VR34	A	FL tube current setting	CP79	Check Required
VR35	OFFSET ADJ	Adjust measured tube current	Meter and CP84	Not Required
VR36	FmA ADJ	Adjust FL tube current	Meter and CP76	Not Required
VR37	MAM ADJ	Adjust tube current	Meter and CP84	Not Required
R1	R1	Adjustment for LG pre-heat	IF meter	Not Required

SYSTEM-LF30 PCB

NO.	NAME	PURPOSE	CHECK PIN	INSTALLATION
VR1	N/A	N/A	N/A	N/A
VR2	Photo-S	Ref V(4V/SEN=L,D=0 @90KV)	CP7	Not Required
VR3	PH-HVS	PMT (1V/-100V)	CP6	Not Required
VR4	LMT	Filament heating limit (5V/5A)	CP5	Not Required
VR5	FVF	FVF (5V/5A)	CP4	Not Required
VR6	GAIN	GAIN (for photocell)	OP amp A4-1	Photocell required
VR7	STC	Short time for photocell	OP amp A4-1	Photocell required
VR8	FVR	FVR (5V/5A)	CP11	Not Required
VR9	FKV	Adjust (5V/100KV)	CP8	Not Required
VR10	RmA	Adjust (5V/1000mA)	CP10	Not Required
VR11	RKV	Adjust (5V/100KV)	CP9	Not Required
VR12	TKV	Actual KV (5V/100KV)	CP3 ANALOG	Not Required
VR13	TmA	Actual mA (1V/200mA)	CP54 ANALOG	Not Required

SHEET PANEL-30FX PCB

NO.	NAME	PURPOSE	CHECK PIN	INSTALLATION
VR1	BZ 1	Pi Buzzer sound adjustment	Hearing	Required
VR2	BZ 2	Bu Buzzer sound adjustment	Hearing	Required
VR3	Contrast	Contrast	Visual	Required
VR4	Brightness	Brightness	Visual	Required

PH POWER-96 PCB

NO.	NAME	PURPOSE	CHECK PIN	INSTALLATION
VR1	OFF SET	Adjust offset of OP AMP	CP1	Required
VR2	S.T. COMP	Adjust correction in a short time	Film Density	Required
VR3	MIN	Min FL KV in pulse IBS	CP3	Required in pulse
VR4	MAX	Max Fl KV in pulse IBS	CP2	Required in pulse
VR5	PUL IBS RESP	Pulse FL IBS response	CP5	Required in pulse
VR6	PH HV SET ADJ	Photo high voltage level (1V/-100V)	CP9/CP17	Not Required
VR7	SAMPLE RESP	Adjust the sample response	N/A	Required in pulse
VR8	BA OUT	BA comp ON/OFF difference Adj	CP24	Not Required
VR9	DET1	Adjust high voltage in det1	CP30	Required direct PT
VR10	DET2	Adjust high voltage in det2	CP31	Required direct PT
VR11	DET3	Adjust high voltage in det3	CP32	Required direct PT
VR12	DET4	Adjust high voltage in det4	CP33	Required direct PT
VR13	DET3-3	Individual HV adjustment	CP34	Required direct PT
VR14	DET3-2	Individual HV adjustment	CP35	Required direct PT
VR15	DET3-1	Individual HV adjustment	CP36	Required direct PT
VR16	DET2-3	Individual HV adjustment	CP37	Required direct PT
VR17	DET2-2	Individual HV adjustment	CP38	Required direct PT
VR18	DET2-1	Individual HV adjustment	CP39	Required direct PT
VR19	DET1-3	Individual HV adjustment	CP40	Required direct PT
VR20	DET1-2	Individual HV adjustment	CP41	Required direct PT
VR21	DET1-1	Individual HV adjustment	CP42	Required direct PT
VR22	IFG	HV adjustment for IFG mode	CP17	Not Required
VR23	FSP	HV adjustment for FSP mode	CP17	Not Required
VR24	F	Adjust for BA comp	CP17	Not Required
VR25	LTC	Correction for long time	CP29	Required

PH CONT-96 PCB

NO.	NAME	PURPOSE	CHECK PIN	INSTALLATION
VR21	LTC DET1	Correct DET1 long time	Film Density	Required
VR22	N/A	Perform correction for short time	Film Density	Required
VR86	LTC DET2	Correct DET2 long time	Film Density	Required
VR87	LTC DET3	Correct DET3 long time	Film Density	Required
VR39	N/A	Correct short time	Film Density	Required
VR42	N/A	Correct short time	Film Density	Required
VR43	N/A	Correct short time	Film Density	Required
VR48	N/A	Correct short time	Film Density	Required
VR56	N/A	Correct light receive area for photocell	Actual photo-up time	Required (photocell)
VR57	N/A	Correct light receive area for photocell	Actual photo-up time	Required (photocell)
VR58	N/A	Correct light receive area for photocell	Actual photo-up time	Required (photocell)
VR59	N/A	Correct light receive area for photocell	Actual photo-up time	Required (photocell)
VR60	N/A	Correct light receive area for photocell	Actual photo-up time	Required (photocell)
VR61	N/A	Correct light receive area for photocell	Actual photo-up time	Required (photocell)
VR62	N/A	Correct light receive area for photocell	Actual photo-up time	Required (photocell)
VR63	N/A	Correct light receive area for photocell	Actual photo-up time	Required (photocell)
VR64	N/A	Correct light receive area for photocell	Actual photo-up time	Required (photocell)
VR65	N/A	Adjust the offset	A16 pin 6	Required
VR66	N/A	Adjust the offset	A17 pin 6	Required
VR67	N/A	Adjust the offset	A18 pin 6	Required
VR68	N/A	Adjust the offset	A19 pin 6	Required

Note: When PMT is installed, set R56 and R64 fully CCW.

D. List of LEDs

ANALOG-LF30 PCB

NO.	Color	Name	Meaning when ON
LED1	Red	TOV	Measured tube voltage over
LED2	Red	TUN	Measured tube current over
LED3	Red	PKO	Setting tube voltage over
LED4	Red	CHO	Primary charge over
LED5	Green	OKF	Filament heating OK
LED6	Red	VC-	Primary charge (-)
LED7	Red	VC+	Primary charge (+)
LED8	Red	LVOVER	Power supply voltage under/over
LED9	Red	IFO	Filament over
LED10	Red	ROC	Radiographic tube current over
LED11	Green	STAN-BY	Main power supply ON
LED12	Green	MGRS	MG-RS ON
LED13	Green	MGL	MG-L ON
LED14	Green	MGFL	MG-F ON

SYSTEM-LF30 PCB

NO.	Color	Name	Meaning when ON
LED1	Red	HX	Hand switch EXP operation
LED2	Red	IPOF	Phototiming time up signal
LED3	Red	AR	Hand switch PREP operation
LED4	Red	G. OPEN	GATE OPEN signal
LED5	Red	KEYIN	Sheet key is pressed
LED6	Red	KC	PREP condition
LED7	----	EXP	Unused

NEXSC PCB

NO.	Color	Name	Meaning when ON
LED1	7 SEG		Status display
LED2	7SEG		Status display
LED3	Red	----	Lit in IRQ
LED4	Red	----	Lit in IRQ
LED5	Red	----	Lit in IRQ
LED6	Red	----	Lit in IRQ

PH POWER-96 PCB

NO.	Color	Name	Meaning when ON
D201	Red	HV ON	Photomultiplier high voltage ON
D202	Red	X-RAY ON	X-RAY ON
D203	Red	PT UP	Output photo timer shut down signal
D204	Red	DET4	Selecting DET4
D205	Green	DET3	Selecting DET3
D206	Green	DET2	Selecting DET2
D207	Green	DET1	Selecting DET1
D208	Green	FD1	Select first field
D209	Green	FD2	Select second field
D210	Green	FD3	Select third field

PH CONT-96 PCB

NO.	Color	Name	Meaning when ON
LED1	Green	IP OFF	Output phototimer shut down signal
LED2	Green	DET2	Selecting DET2
LED3	Green	DET3	Selecting DET3

I/O 2-96 PCB

NO.	Color	Name	Meaning when ON
LED1	Red	CLK1.5	N/A

E. Initial Settings (recommend settings, not mandatory)

Initial Setting for UD150L-30 FX/EX

General Mode										
Page#1	Max. Tube Voltage		Allowable Tube Current		Supply Frequency					
	150 kV		334 mA		60 Hz		For UD150L30 FX/EX			
Page#2	Allowable Tube Voltage		Max. Tube Current		Safety Factor					
	80 kV		630 mA		99 %		For UD150L30 FX/EX			
Page#3	Min. Rating		Charge							
	50 kW		800 WS		60 Hz		For UD150L30 FX/EX			
Page#4	Tech		Tech Code	Tech System	Photo Code	#	Photo Field	Photo Detect	Fluoro System	Pulse Fluoro	Tube#
	GR	Tec1	1	1	0	0	0	0	0	OFF	1
	BU1	Tec2	2	2	3	0	3	1	0	OFF	1
	BU2	Tec3	5	3	3	0	3	2	0	OFF	1
	FSP	Tec4	11	7	3	0	1	3	1	ON (o)	2
	IFG	Tec5	12	8	1	0	0	0	1	ON (o)	2
	other		0	0	0	0	0	0	0	OFF	*

Tube Data Mode	
Tube #1	
	See Tube Data on SHIMADZU Web Site
Tube #2	
	See Tube Data on SHIMADZU Web Site

Ext. Tube Data Mode	
E1	
	See Tube Data on SHIMADZU Web Site
E2	
	See Tube Data on SHIMADZU Web Site

Option Mode						
Page#1	Not Used	PH-Backup	Not Used	Max. FkV	TV System	Mem. Mode
	0	0	5	110 kV	E	0 or 1
Page#2			Ba. Comp	FSP I.I.	Plani Mode	FL timer mode
			0	1	0	2
Page#3	Swing Speed	Swing Degree	Exp. Time	TOMO I/F		
	1	0	01	1		

Just for reference, not mandatory

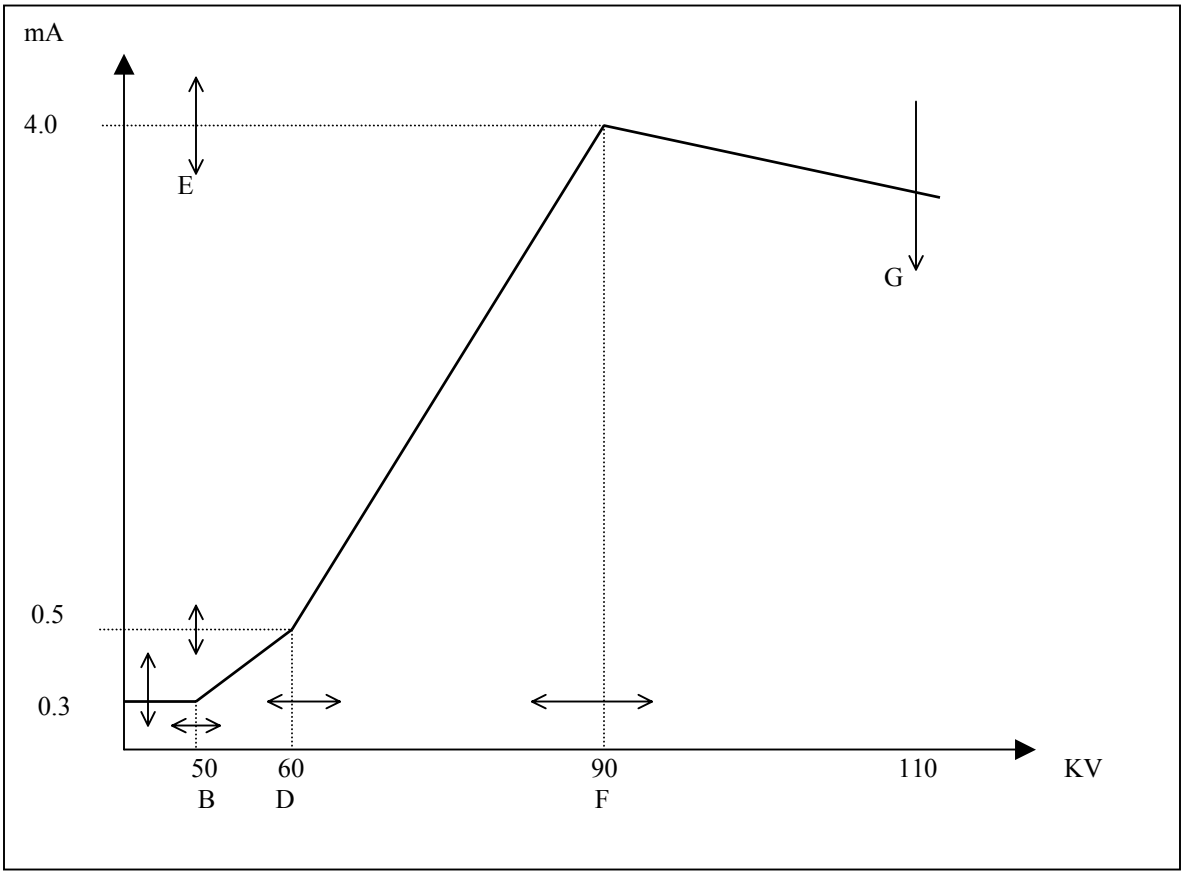
F. Fluoro mA curve setting (ANALOG-LF30 PCB)

At ANALOG-LF30 PCB, adjust the following potentiometers to achieve the mA curve as shown in the figure.

A	VR 34	to increase/decrease the mA level, under 50 KV	Set to 0.3 mA
B	VR 27	to change the first knee point for mA	Set to 50 KV
C	VR 29	to increase/decrease the mA level, 50-60 KV	Set to 0.5 mA
D	VR 31	to change the second knee point for mA	Set to 60 KV
E	VR 30	to increase/decrease the mA level, 60-90 KV	Set to 4.0 mA
F	VR 32	to change the third knee point for mA	Set to 90 KV
G	VR 33	to set the mA to match the maximum dose	10 R/min

Procedures:

1. Power OFF generator.
2. Connect DVM to FmA3 @ ANALOG-LF30 PCB, using DC reading.
3. Turn OFF S2-2 @ ANALOG-LF30 PCB. Set FVR mode for calibration.
4. Turn ON generator. Select Fluoro and FVF mode. Turn OFF IBS.
5. On the panel, set manual Fluoro KV to 50 KV. Adjust VR34 so that the DVM reads 0.3 V. (No need to turn on fluoro)
6. Perform all adjustments as the following figure.
7. Power OFF generator. Turn ON S2-2 @ ANALOG-LF30 PCB.



G. Tube data for RAD60 and RAD56

X-ray tube data for Nonstandard Tube Data Mode

X-ray Tube Type /Focus size	Type	Large focus	Small focus
	RAD-60 HS	**1.2 mm**	**0.6 mm**
Anode rotation	**High speed rotation**		
Maximum KV	150 KV		
Minimum KV	40 KV		
HU load factor	90 %		
CINE load factor	90 %		

HU cooling curve		HU(KHU)		Time (min)	
	1	400		0	
	2	260		1	
	3	200		3	
	4	150		10	
	5	0		40	

Emission characteristic		Large focus		Small focus	
		KV	mA	KV	mA
	1	40	470	40	220
	2	50	580	50	340
	3	60	800	60	400
	4	80	940	80	450
	5	0	0	0	0

Short time raiting		Large focus		Small focus		
		KV	mA	KV	mA	Sec
	1	150	750	150	260	0.01
	2	110	1000	110	350	0.03
	3	110	900	100	350	0.1
	4	100	800	150	200	0.3
	5	100	500	80	300	1
	6	100	300	90	190	3
	7	70	200	100	100	10
	8	0	0	0	0	20
	9	0	0	0	0	50

If max		Large focus	Small focus
		5.5 A	5.2 A

mA position(Recommended)		Large focus(mA)	Small focus(mA)
	1	630	250
	2	500	200
	3	400	160

	4	320	100	
	5	250	80	
	6	200	50	

	Large focus(mA)	Small focus(mA)
Maximum mA	800	320
Minimum mA	10	10

X-ray tube data for Nonstandard Tube Data Mode

X-ray Tube Type /Focus size	Type	Large focus	Small focus
	RAD-60	**1.2 mm**	**0.6 mm**
Anode rotation	**High speed rotation**		
Maximum KV	150 KV		
Minimum KV	40 KV		
HU load factor	90 %		
CINE load factor	90 %		

HU cooling curve		HU(KHU)		Time (min)	
	1	400		0	
	2	260		1	
	3	200		3	
	4	150		10	
	5	0		40	

Emission characteristic		Large focus		Small focus		
		KV	mA	KV	mA	
	1	40	470	40	220	
	2	50	580	50	340	
	3	60	800	60	400	
	4	80	940	80	450	
	5	0	0	0	0	

Short time raiting		Large focus		Small focus		
		KV	mA	KV	mA	Sec
	1	110	580	100	225	0.01
	2	110	570	100	225	0.03
	3	110	540	100	220	0.1
	4	100	500	100	200	0.3
	5	100	360	80	220	1
	6	80	300	80	160	3
	7	80	270	80	100	10
	8	0	0	0	0	20
	9	0	0	0	0	50

If max		Large focus	Small focus	
		5.5 A	5.2 A	

mA position(Recommended)		Large focus(mA)	Small focus(mA)	
	1	630	250	
	2	500	200	
	3	400	160	
	4	320	100	
	5	250	80	
	6	200	50	

	Large focus(mA)	Small focus(mA)
Maximum mA	800	320
Minimum mA	10	10

X-ray tube data for Nonstandard Tube Data Mode

X-ray Tube Type /Focus size	Type		Large focus		Small focus	
	RAD-56		**1.2 mm**		**0.6 mm**	
Anode rotation	**High speed rotation**					
Maximum KV	150 KV					
Minimum KV	40 KV					
HU load factor	90 %					
CINE load factor	90 %					
HU cooling curve		HU(KHU)		Time (min)		
	1	400		0		
	2	260		1		
	3	200		3		
	4	150		10		
	5	0		40		
Emission characteristic		Large focus		Small focus		
		KV	mA	KV	mA	
	1	40	420	40	120	
	2	50	600	50	160	
	3	60	800	60	200	
	4	80	940	80	230	
	5	0	0	0	0	
Short time raiting		Large focus		Small focus		
		KV	mA	KV	mA	Sec
	1	110	500	100	195	0.01
	2	110	500	100	190	0.03
	3	110	470	100	180	0.1
	4	110	400	100	170	0.3
	5	80	400	100	150	1
	6	80	250	80	130	3
	7	80	130	80	80	10
	8	0	0	0	0	20
	9	0	0	0	0	50
If max		Large focus		Small focus		
		5.5	A	4.8	A	
mA position(Recommended)		Large focus(mA)		Small focus(mA)		
	1	630		250		
	2	500		200		
	3	400		160		

	4	320	100	
	5	250	80	
	6	200	50	

	Large focus(mA)	Small focus(mA)
Maximum mA	800	320
Minimum mA	10	10

X-ray tube data for Nonstandard Tube Data Mode

X-ray Tube Type /Focus size	Type	Large focus	Small focus
	RAD-56 HS	**1.2 mm**	**0.6 mm**
Anode rotation	**High speed rotation**		
Maximum KV	150 KV		
Minimum KV	40 KV		
HU load factor	90 %		
CINE load factor	90 %		

HU cooling curve

	HU(KHU)	Time (min)
1	400	0
2	260	1
3	200	3
4	150	10
5	0	40

Emission characteristic

	Large focus		Small focus	
	KV	mA	KV	mA
1	40	420	40	120
2	50	600	50	160
3	60	800	60	200
4	80	940	80	230
5	0	0	0	0

Short time raiting

	Large focus		Small focus		
	KV	mA	KV	mA	Sec
1	110	880	100	330	0.01
2	125	750	110	300	0.03
3	100	850	100	310	0.1
4	100	690	100	270	0.3
5	80	530	70	290	1
6	125	200	70	200	3
7	60	200	90	85	10
8	0	0	0	0	20
9	0	0	0	0	50

If max

Large focus	Small focus
5.5 A	4.8 A

mA position(Recommended)

	Large focus(mA)	Small focus(mA)
1	630	250
2	500	200
3	400	160
4	320	100
5	250	80
6	200	50

	Large focus(mA)	Small focus(mA)
Maximum mA	800	320
Minimum mA	10	10

For more information about non-standard X-ray tube, check SHIMADZU service Web Site.
At www1.shimadzumed.com/ccc

History of Revision:

REVISION B (Change from A)

Add 1. FmA curve adjustments
2. Example for Initial Settings
3. Tube data for RAD 56 and RAD 60

Change 1. Diode position for COMET chamber in the illustrated figure