

MANUAL-1

[FOR USER'S]

DONGMUN HIGH FREQUENCY GENERATOR
DIG SERIES (FOR 1-TUBE)



DONGMUN CO., LTD

NOTICE 1

1. Thank you for purchasing DIG SERIES(For 1-Tube), Dongmun High Frequency Generator for X-ray radiographic systems.
2. This manual is designed to ensure correct use and operation of DIG-Series HFG. Please read all the lines thoroughly before you use the generator.
3. The responsibility about the use of medical apparatus and management of maintenance is in a user's side. No responsibility is taken by Dongmun for any infringement of patients or other rights of the third parties which may result from the use of this manual.
4. Incorrect use and operation exceeding described conditions in this manual may occur damage of the device and shorten its life. Particular attention must be paid to all the warnings, cautions and notes incorporated herein.
5. Always keep the manual at hand for your reference.

NOTICE 2

1. This equipment should be used only by the legally qualified persons and practitioners
 2. For the safe installation
 - a. Please avoid wet and humid locations.
 - b. Install the product where there is no adverse effect from pressure, temperature, humidity, ventilation, dust, sulfur and other air pollutants.
 - c. Protect the product from slope, vibration, and shock.
 - d. Do not install the product where chemicals are stored or gases are generated.
-

- e. Check the frequency, voltage, and current of power supply.
- f. Check the earth ground power about the electric discharge and polarity.

3. Before the operation of the machine

- a. Examine contact of switch, polarity, dial setting, and display, and check if the product properly operates.
- b. Check the safety of the ground power connections.
- c. Check the correctness and safety of the cable and plug connections.
- d. Be careful that mixed use of the machine may give wrong diagnostic results and damages to the device.
- e. Check the exterior circuits, which occur direct physical contact to the patient.
- f. Check the earth ground power about the electric discharge and polarity.

4. During the operation of the machine

- a. Do not exceed the designated time for diagnosis and cures.
- b. Monitor the conditions of device and influence on the patient.
- c. When you find any troubles about generators or patients, stop the operation of the machine and take appropriate measures for the safety of the patient.
- d. Be careful that the patient should not touch the device.

5. After the operation of the machine

- a. Turn off the power of the machine after returning the operation switches and scales to the original position in accordance with the prescribed regulation.
- b. Do not pull out the plugs and lines with compelling forces and it can hurt the connections.
- c. For the safe storage and installation
- d. Please avoid wet and humid locations.
- e. Install the product where there is no adverse effect from pressure, temperature, humidity, ventilation, dust, sulfur and other air pollutants.
- f. Protect the product from slope, vibration, and shock.
- g. Do not install the product where chemicals are stored or gases are generated.

6. If the device is broken, mark proper description and ask repairs to the engineer.

7. Do not modify the machine.

8. Inspections and maintenance

- a. All device and parts should be checked on the regular basis.
-

- b. If you operate the device after long period of non-use, check the safety and conditions of the machine.
- 9. Operate the machine in correct ways according to the manuals.
- 10. Be careful about following cautions
 - a. Wear the lead apron in order to prevent the x-ray irradiation.
 - b. Regular inspection should be executed about leakage dose and irradiation meter.
 - c. Be careful about the x-ray exposures.
 - d. Do not exceed the maximum weight for the x-ray tables.

NOTICE FOR THE OPERATION 1

- 1. If you find any troubles about the conditions of patients or machine, stop the operation and take appropriate measures.
- 2. For the need of emergency power cut-off, use the power switch on the operation panel. Do not randomly cut off the power during operation.
- 3. Be careful about using the exposure and hand switches on the operation panel. You can make exposures anytime under normal conditions.

NOTICE FOR THE OPERATION 2

- 1. As this device is not protective against exposure, do not use combustible or blasting gases such as narcotic drugs, oxygen and hydrogen near the working locations.
 - 2. Do not use the machine during the warning signs of the earthquake. As well, the security of the machine must be checked after the occurrence of the earthquake.
 - 3. In case any troubles happen to the machine, turn off the power and mark appropriate sign such as "Do not use this machine" and ask repairs to the engineers.
 - 4. Regular inspection is required to the device and ask any questions to the sales division of the Dongmun.
-

OTHER NOTICE AND ADVISES

1. Power on and off

Do not turn off the machine for 30 seconds after turning on the power. Please wait at least 30 seconds for the resupply of the power.

2. Regarding the operation environment

a. X-ray room

Practitioners should take enough cares for the release of the x-rays out of the x-ray room. This device is designed to be protective against humidity and dust. However, if you use the machine at the place with high humidity and dust, it can shorten the life of electronic insult and grow rust on the metal parts.

b. Do not leave the machine exposed to the strong direct sunlight.

3. Exposure of the x-rays

a. Be careful about using the exposure and hand switches on the operation panel. You can make exposures anytime under normal conditions.

b. Take enough cares in order not to make excessive radiation on the same body locations.

4. Each cable has enough length and flexibility but do not bend the cable forcibly.






DANGEROUS

Do not use the machine with following equipment.

*The equipment, which release electronic waves such as mobile phone, radios, wireless toys, and etc. The officials in hospital ought to give enough advises and education for the operator of the machine, doctors, patient and other the third parties.

SYMBOLS AND TERMS

The following symbols will be used in this manual: their meanings and applications are described further below.

 DANGER	It warns of the conditions and situations, if not taken over or avoided, that cause heavy damages to people and even the death.
 WARNING	It warns of the conditions and situations, if not taken over or avoided, that could cause heavy damages to people or cause unrepeatable damages to the equipment.
 CAUTION	It warns of the conditions and situations, if not taken over or avoided, that could cause damages to people, or to the equipment.

WAIVER CLAUSE

Poskom do not take responsibility for the following causes for damage and repairs.

1. Any installation, movement, modification and repairs by other engineering services, which was not designated by Dongmun.
2. Troubles and causes to our machine incurred by other equipment.
3. Any troubles and defects by the use of other parts, which is not designated and recommended by Dongmun.
4. Damages or accident caused by the disobedience to the cautions and regulations in user's manual.
5. Troubles and damages created by inappropriate environment prescribed in this manual regarding use of the powers, installation and working places.
6. Any defects and causes occurred by natural calamity such as fire, earthquake, windfall and thunders.
7. Accident and damage happened by the use beyond the original purpose of the machine.
8. Diagnosis for the patient should be under the doctor's responsibility. Dongmun do not take responsible for the conditions and results of the medical prescriptions.

SCOPE AND PERIOD OF WARRENTY

1. All Dongmun products are guaranteed warranty of 1(one) year for any disorder or discrepancy occurred from normal use and operation of product.
2. Service fee is charged for the following cases.
 - Malfunctioning after the period of warranty
 - Disorder caused by fire, earthquake, or lightening
 - Inappropriate movement or negligence of product
 - Disorder from repair or reconstruction by other than Poskom service agent or other designated ones.
3. Note that defects not related to the main functions of the product are not eligible for this warranty.
4. Requirements for Service
 - a. Stop using the product when a problem is found, and check the manual for a solution.
 - b. Turn off the product before service request, and check the model number, serial number, the date of purchase before calling the service center.
5. Defects or depreciation in appearance is not eligible for refund or change.
6. Dongmun is not responsible for indirect damage related to the use of products.
7. Dongmun is not responsible for injury or damage after the end of warranty period.
8. All detailed adaptability warranties and other warranties are subjected to this statement.

SECTION 1.

COMPOSITION/SPECIFICATION

1.1. COMPOSITION

The electric composition block diagram of DIG-Series is shown in Fig 2-1.

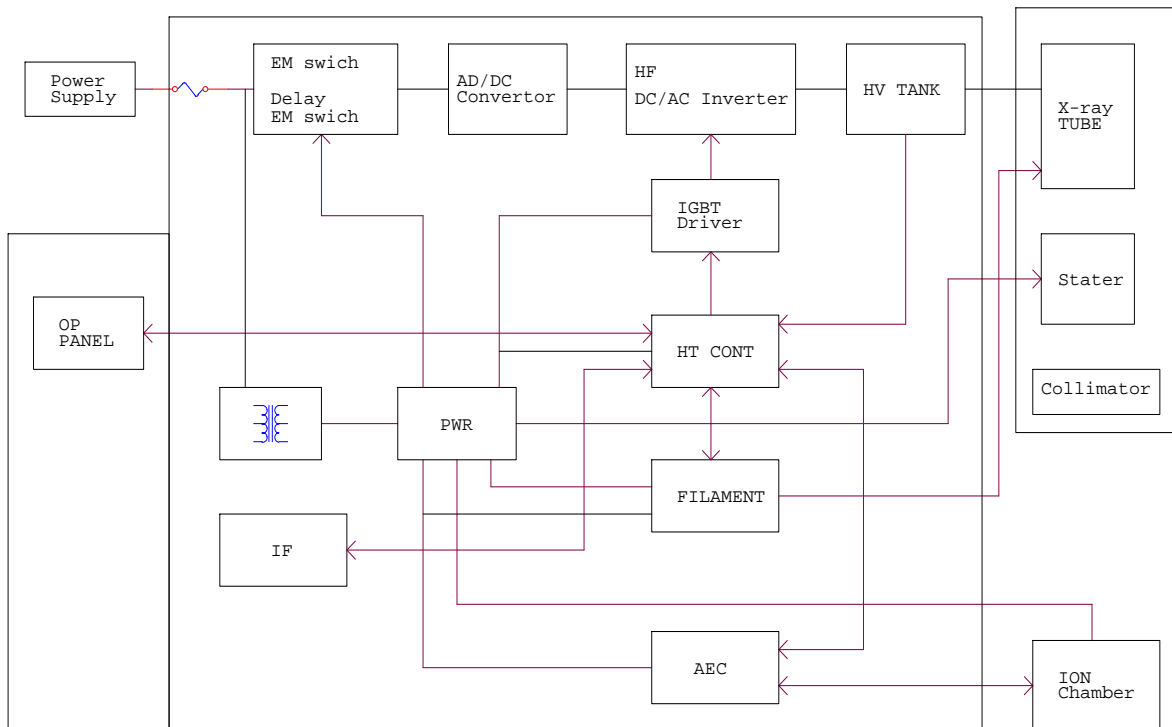


Fig 1-1 COMPOSITION OF THE HFG

AC input voltage is converted into DC voltage by a single-phase all wave rectifier circuit. This DC voltage is inverted in high-frequency voltage of about 20kHz by IGBT inverter.

The high-frequency voltage is converted into the 40 (+20kV/-20kV) to 125kV (+62.5kV/-62.5kV) DC high voltage by a high-voltage transformer and the multi-voltage rectifier circuit. This DC high voltage is supplied to an X-ray tube through a high-voltage cable, and PWM INV controls this X-ray tube voltage. Modulating the Filament voltage controls the tube current.

The operation panel can operate selection in each mode of operation and control, selection and setting of conditions. These operation conditions are transmitted by the communication system from OP-CONT to HT-CONT.

HT-CONT controls the output of a high-voltage generator according to the

instructions from OP-CONT.

The flow of the control signal of X-ray exposure is shown in the following Fig 1-2.

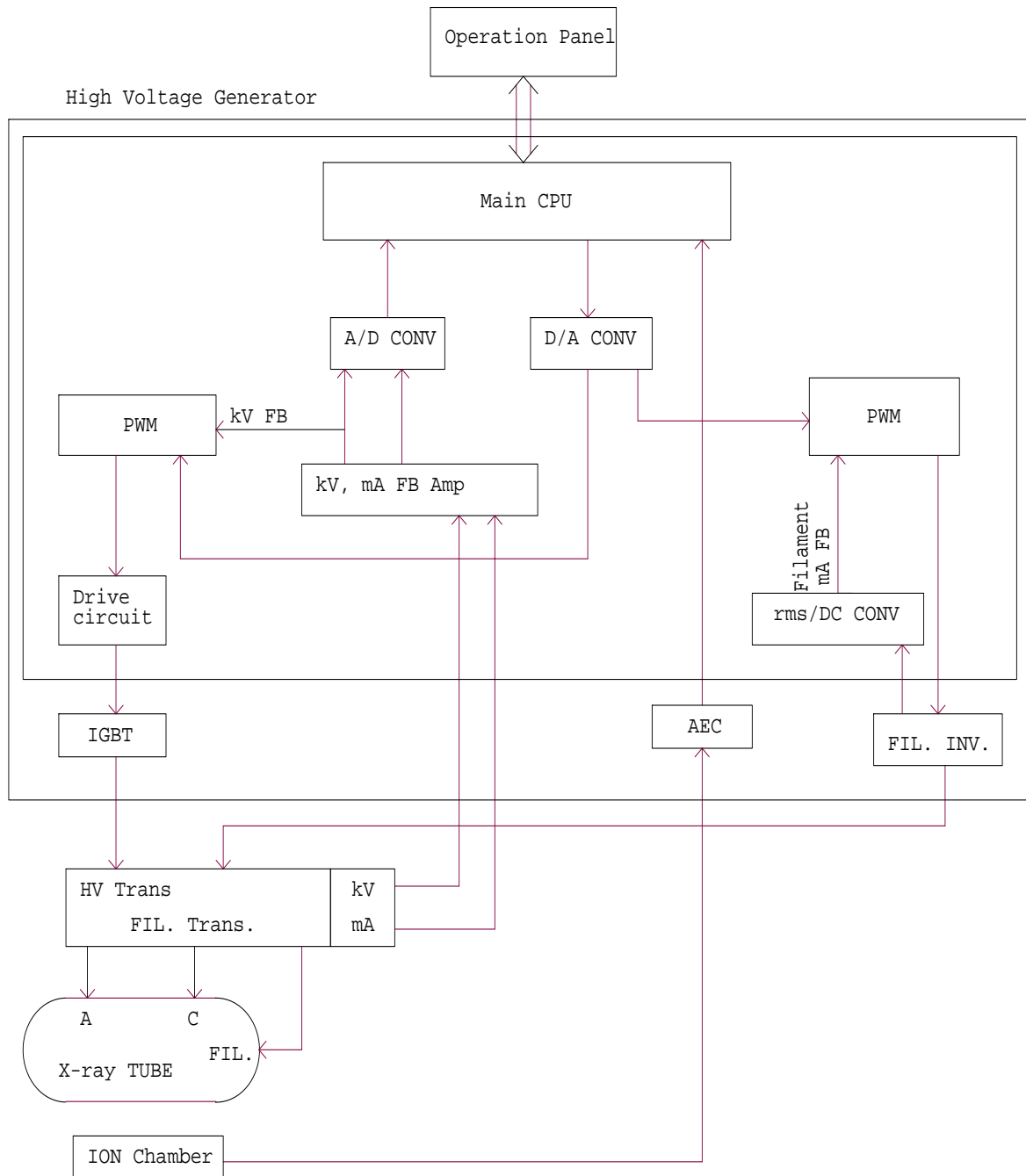


Fig 1-2 CONTROL SIGNAL OF X-RAY EXPOSURE

1-2. SPECIFICATION

1	Rating Output	DIG-325 DIG-525 DIG-650 DIG-1150	32kW 40KW 50kW 80KW
2	Tube Voltage kV	Radiography Fluoroscopy	40-150kV (1kV STEP) 40-125kV (1kV STEP)
3	Tube Current mA	Radiography Fluoroscopy	10, 12.5, 16, 20, 25, 32, 40, 50, 63, 80, 100, 125, 160 mA (small focus) 200, 250, 320, 400, 500, 630, 800 mA (large focus) 0.1~4.0 mA (0.1mA Step)
4	kV Accuracy	±10%	
5	mA Accuracy	±15%	
6	Timer Range	0.001 sec – 10 sec (38 step) 0.003 sec ~ 6 sec (PXR-161 Only)	
7	mAs Range	DIG-325 DIG-525 DIG-650 DIG-1150	0.1 mAs ~ 630 mAs 0.1 mAs ~ 630 mAs 0.1 mAs ~ 800 mAs 0.1 mAs ~ 999 mAs
8	mAs Accuracy	20mAs or more: Less than 15% Less than 20mAs: Less than 20%	
9	Display Method	LED digital indication	
10	Setting Method	Sheet Push Switch	
11	Self-diagnostic Function	Error Code Indication	
12	Technique Selection	Manual, APR, AEC	
13	APR	216 exam techniques	
14	AEC (Option)	Ionization Chamber 5 (Option)	
15	Display (OP Panel)		
	kV	3 Digit LED	
	mA	3 Digit LED	
	mAs	4 Digit LED (change into sec)	
	Time	4 Digit LED (change into mAs)	
	Selection/setting	LED (36)	
	Alarm	LED (2)	
16	Weight	62 kg	
	Operation Panel	2 kg	

1-3. ELECTRICAL REQUIREMENT

Model	1-Tube DIG Series
Line Nominal Voltage	1 phase 200V/220V/240V
Automatic Line Compensation Range	$\pm 10\%$
Frequency	50 Hz / 60 Hz
Line Impedance	Less than 0.12
Grounding conditions	Based on the local regulation

1-4. PROPER ENVIRONMENT

A. Avoid following places for the normal operation and safe storage.

- a. Where the equipment is exposed to water vapor.
- b. Where the equipment is exposed to direct sunlight.
- c. Where the equipment is exposed to dust.
- d. Where the equipment is exposed to high humidity.
- e. Where there is a ventilation problem.
- f. Where the equipment is exposed to salty atmosphere.
- g. Where the equipment is exposed to chemicals or gas.

B. Keep away from the place with strong vibration and maintain proper environment and conditions.

***Operation Environment**

Temperature range	10°C ~ 40°C,
Relative Humidity Range	30% ~ 75% RH
Others	No Direct Sunlight No combustible and corrosive gases

C. For safe storage and transportation, you must keep following range of temperature, humidity and atmosphere.

***Environment for Storage and Transportation**

Temperature range	-25°C ~ +60°C
Relative Humidity Range	10% ~ 95% RH
Air Pressure	700hPa ~ 1060hPa
Others	No corrosive gases

SECTION 2

DISPLAY/FUNTION

2-1. STRUCTURES AND SIZE

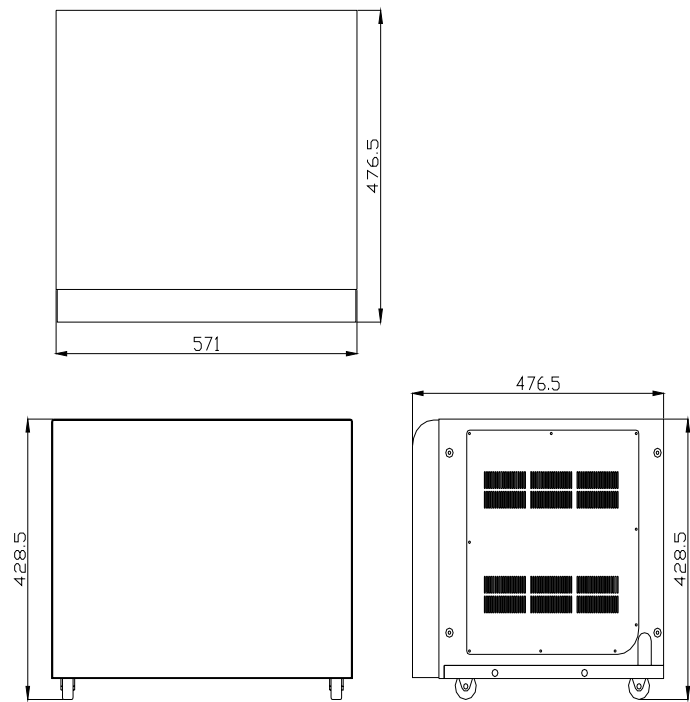


fig. 2-1 STRUCTURE AND FIGURES (16kW ~ 50kW)

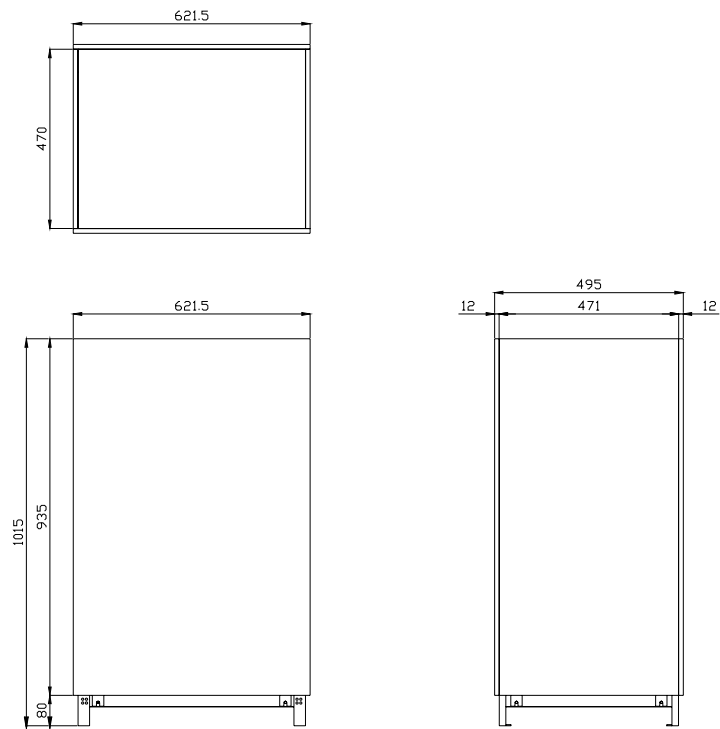


fig. 2-2 STRUCTURE AND FIGURES (50kW & 80kW 3Phase)

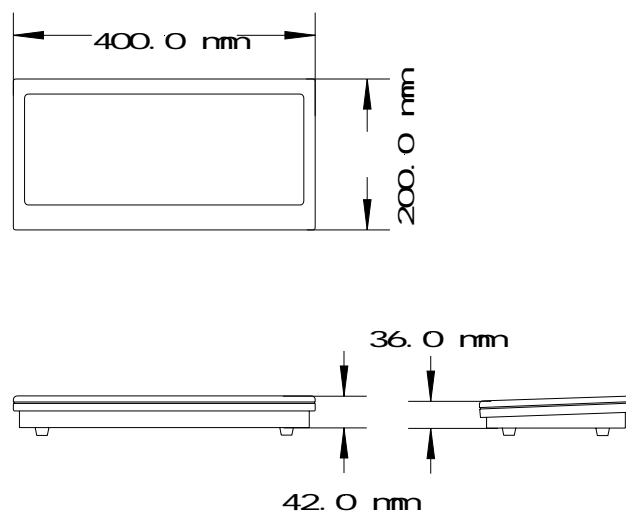


fig.2-3 CONFIGURATION OF OPERATION PANEL

2-2. OPERATION PANEL

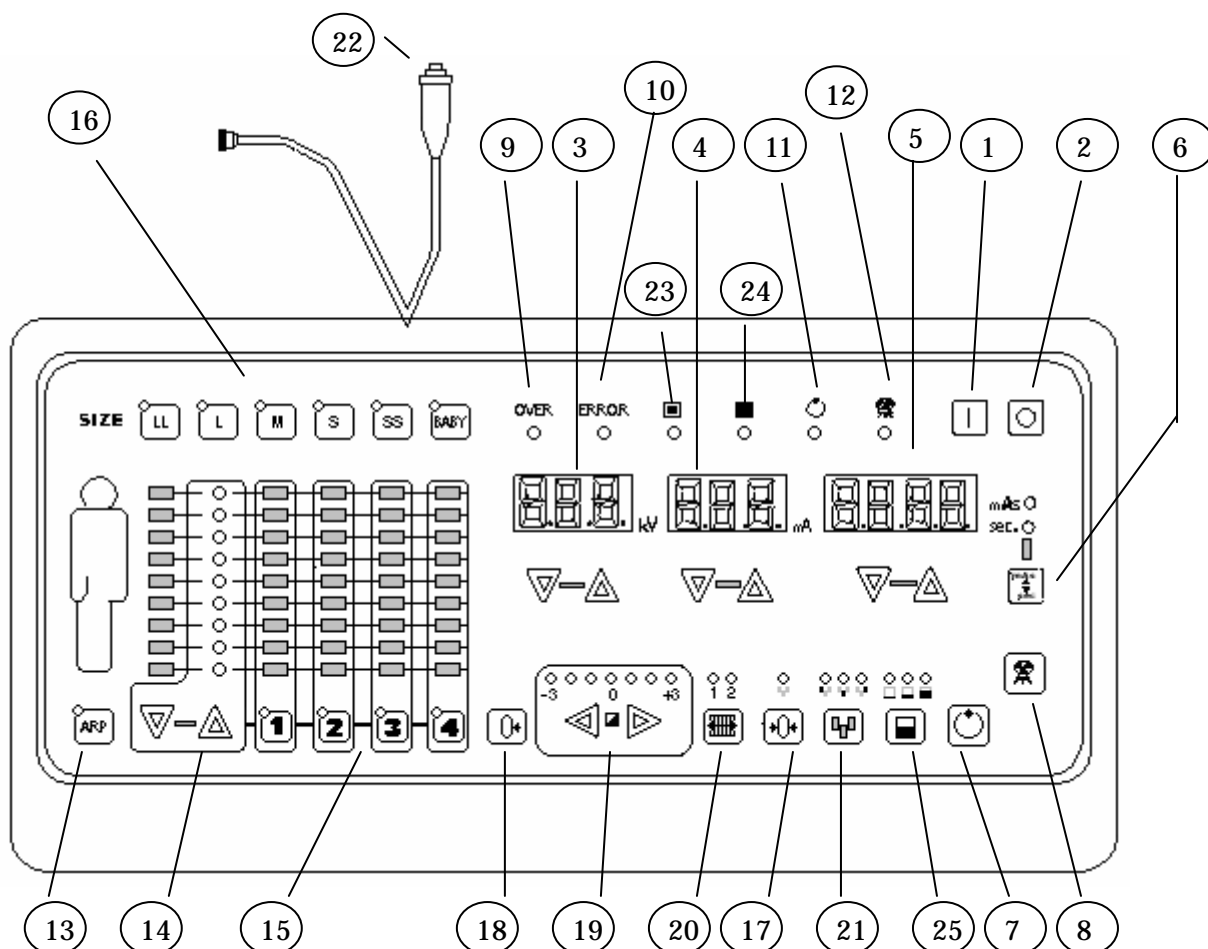


Fig 2-4 Operation Panel

1	Power on switch	14	APR exposure region selection/display
2	Power on switch	15	APR exposure direction selection
3	kV Display Segment	16	Patient size selection and memory
4	kV Setting Switch	17	AEC Reset/ mode display
5	mAs/sec Setting Switch	18	Backup release switch
6	mAs/sec Setting Switch	19	Density setting/display switch
7	X-ray Exposure Ready Switch	20	Bucky selection/display
8	X-ray Exposure Switch	21	AEC mode and field selection switch
9	"OVER" Display (Red)	22	X-ray exposure hand switch
10	"ERROR" Display (Red)	23	Small focus display
11	X-ray Exposure ready sign	24	Large focus display
12	X-ray Exposure Display (Yellow)	25	AEC film/screen combination selection
13	APR Menu Selection Switch		

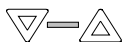
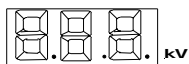
- (1)  Power On Switch



Turn on the power of generator.

- (2)  Power Off Switch

Turn off the power of generator.

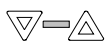
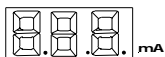
- (3) kV Setting/Display Segment





 Button increases the kV value of tube voltage whereas  decreases kV.

If you keep buttons pressed, the value of KV will be increased or decreased continuously.

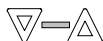
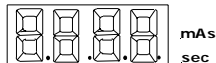
- (4) mA Setting/Display Segment




 Button increases the mA value of tube voltage whereas  decreases mA.

If you keep buttons pressed, the value of mA will be increased or decreased continuously.

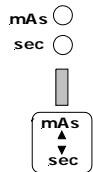
- (5) mAs/Sec Setting/Display Segment



 Button increases the mAs/sec value of tube voltage whereas 

decreases mAs/sec. If you keep the button pressed, the value of mAs/sec will be increased or decreased continuously.

(6) mAs/Sec Selection Switch



The mAs or sec radiography mode is selected.

The selected radiography mode is displayed with LED.

(7) X-ray Exposure Ready Switch



It circulates the rotor and controls the heat of the filament that makes ready actions for the x-ray exposure.

(8) X-ray Exposure switch



Press the exposure switch after the ready sign is lighted on.

(9) "Over" LED (Red)

The over LED is lighted on when the exposure conditions exceeds the normal standards. You cannot make exposure while the over LED is lighted on.

(10) "Error" Indication (Red)

The LED is lighted in case of errors.

(11) X-ray Exposure Ready LED (Green)

The exposure ready sign is lighted on when it is at the ready condition.

(12) X-ray Exposure LED (Yellow)

The X-ray exposure sign is lighted on during the X-ray exposure.

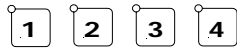
(13) APR Mode Setting Switch

It operates the on/off of the APR mode.

(14) APR Exposure Region Selection/Display switch

It operates the selection of exposure regions and the selected location will be displayed on the LED.

(15) APR Exposure Direction Setting Switch



It operates the selection of exposure directions the selected direction will be displayed on the LED.

(16) Patient Size Selection and Memory Switch



It operates the selections of patient size. The selected size will be displayed on the segment. Save the changed APR conditions by pressing the size switches.

*You can set the exposure conditions (kV, mA and mAs/sec) by selecting the exposure regions, direction and patient size. Each condition can be changed and stored by the exposure size switch.

(17) AEC Reset/Mode Display Switch



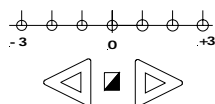
If the x-ray exposure is closed early by the AEC backup timer, the AEC mode LED will blink off and the buzzer sounds. The next exposure is forbidden until the reset switch is pushed.

(18) Backup Release Switch



Release the back-up conditions.

(19) Density Setting/Display Switch (AEC/APR mode)



It selects the density level of the exposure and increases or decreases the mAs/sec under the APR mode.

(20) Bucky Selection/Display



Select and display BUCKY1 (table) and BUCKY 2(stand).

(21) AEC Mode and Field Selection Switch



It selects the field on the AEC mode. Each LED represents the physical location of irradiation detector and the combination of designated field is available.

(22) X-ray Exposure Hand Switch

It circulates the rotor and controls the heat of the filament that makes ready actions for the x-ray exposure. Press the exposure switch after the ready sign is lighted on. Please touch off from the button after the LED is lighted on.

(23) Small Focus Display (Green LED)

It is displayed when the small focus is selected.

(24) Large Focus Display (Green LED)



It is displayed when the large focus is selected.

(25) Film/Screen Combination Selection


It operates the adjustment of kVp and divided by low speed, medium speed and high speed (200, 400, 800)

SECTION 3


OPERATION/EXPOSURE


3-1. POWER ON & OFF

1. Power-on Switch

- a. Press the  Power on switch.
- b. If the power is turned on, initial condition of equipment will be checked.
- c. During the checking actions, "-" mark will be displayed on kV, mA, and mAs/sec display segment.
- d. After the check, it displays radiographic conditions.
- e. Radiographic conditions display the final status of the previous operation.

2. Power-off Switch

- a. Press the  Power off switch.
- b. Please turn off the power supply except the time of use.

 CAUTION	Do not turn on and off the power of the equipment continuously except emergent cases. Have the interval of 30 seconds or more between ON-OFF operations of a power supply.
--	---

3-2. SELECTION OF THE RADIOGRAPHY METHOD

There are radiography modes shown below in this equipment.

a. Manual radiography mode

Radiography conditions are performed by manual setup.

b. APR radiography mode

You can select the radiography region; direction and patient size on the control panel and make x-ray exposure with automatically set radiography conditions.

Each radiography conditions can be changed and saved.

c. AEC radiography mode

It helps to produce the optimal images by AEC (Automatic Exposure Control Option) Menu selection.

3-3 SETTING MANUAL RADIOGRAPHY

1. Select the manual radiography mode

Check if the APR mode or AEC mode are chosen. If they are selected in APR or AEC mode, please press APR or AEC setting switch, and release the setup conditions.

2. Setting tube voltage "kV"

Set up the tube voltage with "kV" setting switch.

Setting range: 40kV – 125 or 150kV (1kv step)

3. Setting tube current "mA"

Set up the tube current with "mA" setting switch.

Setting range:

10、12.5、16、20、25、32、40、50、

63、80、100、125、160 mA (Small Focus)

200、250、320、400、500、630、800、999 mA (Large Focus)

Model	mA Range	Remark
DIG-325	10~400mA	
DIG-525	10~500mA	
DIG-650	10~630(800)mA	
DIG-1150	10~999mA	

4. Setting the radiography mode (mAs/sec radiography)

Select the radiography mode with mAs/sec selection switch (display).

"sec" radiography makes x-ray exposure by set-up time

"mAs" radiography makes x-ray exposure by the setup time of current.

-A setup of mAs value in "mAs" mode

-mAs value is chosen with the mAs/sec setting switch.

Setting range : 0.1 mAs ~ 800 mAs

Step : 0.1、0.2、0.3、0.4、0.5、0.6、0.8、

1.0、1.3、1.6、2.0、2.5、3.2、4.0、5.0、6.3、8.0、10、12.5、

16, 20, 25, 32, 40, 50, 63, 80, 100, 125, 160, 200, 250, 320, 400, 500, 630, 800, 999 mAs


Model	mAs Range	Remark
DIG-325	0.1~630mAs	
DIG-525	0.1~630mAs	
DIG-650	0.1~800mAs	
DIG-1150	0.1~999mAs	

-A setup of sec value in "sec" mode

-Sec Value is chosen with the mAs/sec [5] setting switch.

Setting range : 0.001 sec 10 sec

Step : 0.001, 0.002, 0.003, 0.004, 0.005, 0.006, 0.008, 0.010, 0.013, 0.016, 0.020, 0.025, 0.032, 0.040, 0.050, 0.063, 0.080, 0.100, 0.125, 0.160, 0.200, 0.250, 0.320, 0.400, 0.500, 0.630, 0.800, 1.00, 1.25, 1.60, 2.00, 2.50, 3.20, 4.00, 5.00, 6.30, 8.00, 10.00 sec

 NOTICE	<p><u>About "OVER" display of radiography conditions</u></p> <p>When set-up radiography condition "kV", "mA", and "mAs or sec" exceeds the permissible value of equipment, OVER sign lights up.</p> <p>X-ray exposure is prohibited when the over sign is turned on. Please reset the appropriate radiography conditions.</p>
---	---

Model	sec Range	Remark
DIG-325	0.001~10 sec	
DIG-525	0.001~10 sec	
DIG-650	0.001~10 sec	
DIG-1150	0.001~10 sec	

3-4. SETTING APR

1. Selection of APR mode

Choose APR mode with the (13) APR selection switch and the LED displaying APR mode will be lighted on the upper left of the OP panel.

2. Selection of Radiography Regions

Choose the radiography regions with (14) radiography region selection switch and you can move the LED display with up/down button. The available option is 9.

3. Selection of Radiography Directions

Choose the radiography directions with (15) radiography direction switch out of 4 options.

4. Selection of the Radiograph Size

Choose the radiography size with (16) patient size selection switch out of 6 options, [LL] [L] [M] [S] [SS] [BABY].

*The radiography condition will be selected after the selection of the radiography symbol, radiography region, and radiography method.
As well the order for the selection will not be changed.

5. Selection of the Density

Adjust the mAs/sec settings with the density switch.

Increase the conditions of mAs/sec if the Density is +1 ~ +3.


Increase the conditions of mAs/sec if the Density is -1 ~ -3.

6. Change of the Radiography Conditions

You can change the selected radiography conditions with the same method of the 3-3 manual radiography condition setting. The over LED can be lighted from time to time when the radiography conditions are changed. Please be careful about the setting of the radiography conditions since the x-ray exposure is prohibited under the case.

7. Memory of the Changed Radiography Conditions

You can save the conditions changed above. The method for store is pressing the selected switch for 2 seconds until the buzzer sounds.

 CAUTION	Memory of the changed Radiography condition Be careful that other radiography conditions can be selected if you choose the selected radiography size switch. You cannot save the memory while the over LED is lighted and when the density setting is not 0.
--	---

3-5. AEC RADIOGRAPHY

1) Selection of AEC radiography mode

In order to use AEC mode, the DIP S/W 5 of operation panel should be turned on.
When DIP S/W 5 is turned off: AEC mode is not available.

2) Switch [17] is the AEC mode selection switch.

Ion-chamber is chosen with switch [18] after you select the AEC mode with switch [17].

3) The selection of density in the AEC mode can adjust the level of x-ray exposure levels.

4) "Ready" action is not operated if the bucky and field are not chosen after the AEC mode selection.

3-6. RADIOGRAPHY

1. Photography Preparation

After setting up radiography conditions, assemble the cassette equipped with the film on the x-ray table.

If the X-ray irradiation field lamp switch attached to the variable X-ray beam-limiting device is pushed, the lamp will be lighted up. X-ray irradiation field is adjusted with a radiography position, and radiography preparation is ended.

2. X-ray Radiography Using Operation Panel

- 1) Press the X-ray exposure preparation switch. Ready LED will be lighted on when all preparation work is completed.
- 2) If you press the x-ray preparation switch and exposure switch at the same time, the x-ray shooting will be started.
- 3) X-rays exposure LED will be lighted on and the buzzer sounds during the exposure.

3. X-ray Radiography Using Hand-Switch

- 1) Press the hand switch one time and make it at ready condition. The x-ray ready LED will be lighted on when it is prepared to make exposure.
- 2) When the equipment is ready to make exposure, press the hand switch again and the x-ray shooting is started.
- 3) During exposure, the exposure LED will be lighted on and the buzzer sounds.
- 4) If the X-ray exposure LED is turned off or buzzer does not sound, it means the radiography work is completed. Then, you can stop pressing the hand switch.
- 5) If you touched out and stopped x-ray shooting during exposure, the check code will be displayed.



CAUTION

If you touch out from the hand switch during exposure, the x-ray shooting is stopped and you cannot get clear pictures. Please touch off your hand after the x-ray exposure signs and the buzzer sound are turned off except the case you want to stop the x-ray exposure urgently

**CAUTION**

You cannot make radiography while the over LED is lighted on. Change the conditions for the radiography in those cases.

SECTION 4

TROUBLES

4-1. ERROR CODE AND CHECK CODE

In case any problems happen during the operation of the device, they will be indicated on the kV/mA segment.

A. Error Code

The error code is displayed when problems, such as abnormalities, occur to the equipment. While the error code is displayed, radiography operation is forbidden for safety. A power supply should be switched off and on again and an error code will be cleared. If the problem of equipment is not solved at the time of the power-supply re-switched on, the error code will be displayed again.

Since it is the failure of equipment when an unusual state is not recovered, please inform the service section of our company or our agent.

B. Check Code

Unlike an error code, a check code is the warning sign when wrong operations are applied by the user. X-ray radiography operation is forbidden for the safety during the check code. The way to release a check code is pressing the WR switch for 2 seconds. CH01 will be released if thermal switch is off during the re-supply of the power.

ERROR CODE LIST

Error Code	DESCRIPTION	ACTION
Err 01	CHARGE MONITOR ERROR (HT-CONT)	RESUPPLY OF THE POWER
Err 02	OVER TIME ERROR (OP PANEL) AT STAND BY	
Err 03	READY-OUT SIGNAL ERROR AT SAND BY	
Err 04	X-RAY OUT SIGNAL ERROR AT STAND BY	
Err 05	READY SWITCH INPUT ERROR AT STAND BY	
Err 06	X-RAY SWITCH INPUT ERROR AT STAND BY	
Err 07	HAND SWITCH INPUT ERROR AT STAND BY	
Err 08	HAND SWITCH X-RAY INPUT ERROR AT STAND BY	
Err 09	ROTOR DETECTER SIGNAL AT STANDBY	
Err 10	FILLAMENT CURRENT DETECTER ERROR AT STANDBY	
Err 11	'kV FEEDBACK ERROR AT STANDBY	
Err 12	'mA FEEDBACK ERROR AT STANDBY	
Err 13	ROTOR DETECTER ERROR AT EXPOSURE	
Err 14	FILLAMENT CUREENT DETECTER ERROR AT EXPOSURE	
Err 15	'kV FEEDBACK ERROR DETECTER ERROR AT EXPOSURE	
Err 16	'mA FEEDBACK DETECTIVE ERROR EXPOSURE	
Err 17	NOT DEFINED	
Err 18	X-RAY TIME OVER IN SEC MODE	
Err 19	X-RAY TIME OVER IN mAs MODE	
Err 20	X-RAY TIME OVER IN AEC MODE	
Err 21	HV INTERLOCK ERROR	
Err 22	IGBT FEEDBACK ERROR	
Err 23	'kV FEEDBACK OVER DETECTER ERROR AT EXPOSURE	
Err 24	'mA FEEDBACK OVER DETECTER ERROR AT EXPOSURE	
Err 25	NO ZERO-CROSS OR NO INPUT	
Err 26	ZERO-CROSS OVER OR WRONG INPUT FREQUENCY	
Err 27	BUCKY 1 OK SIGNAL ERROR (HT-CONT)	
Err 28	BUCKY 2 OK SIGNAL ERROR (HT-CONT)	
Err 29	AEC A/D DATA-IN ERROR (HT-CONT)	
Err 30	AEC A/D DATA-IN ERROR (HT-CONT) AT NON-EXPOSURE	
Err 31	I/F BOARD CONDITION ERROR	
Err 32	AEC BOARD CONDITION ERROR	
Err 33	SMALL-FOCUS SELECTION ERROR (HT-CONT)	
Err 34	LARGE-FOCUS SELECTION ERROR (HT-CONT)	

CHECK CODE LIST

CHECK CODE	DESCRIPTION	Measure
Ch 01	TUBE THERMOSTAT OPERATION	Reset
Ch 02	When another switch is pushed during exposure	Release by "WR" switch
Ch 03	When ready switch on OP PANEL is detached during exposure	
Ch 04	When X-RAY switch on OP PANEL is detached during exposure	
Ch 05	When a hand switch (ready) is detached during exposure	
Ch 06	When a hand switch (X-RAY) is detached during exposure	Power-supply re-switch
Ch 07	Shortage of power-supply capacity for exposure	
Ch 08	Simultaneous exposure prohibition	Reset
Ch 09	Warning to X-rays room door opening	
Ch 10	AEC Level Error	

* CH01 is will be released if the TUBE terminal switch is off, in case resupply of the power.

SECTION 5

MAINTANENCE

5-1. MAINTANANCE AND PERIODIC OPERATOR

Maintenance has check menus carried out daily by the user and periodic inspection by technical service engineers who completed special training programs on the repair of the generator.

User checks items based on " Daily Checking Items by the operator " and should keep data records.

The following checks and maintenance procedures, together with the suggested intervals, are the manufacturer's recommendation for most effective Periodical Maintenance schedule for this generator.

Exclusively service personnel specifically trained on medical X-ray generator must perform service tasks here described.

The first periodic maintenance service should be performed six (6) months after installation, and the subsequent service every twelve (12) months.

When a trouble and a poor part are discovered, please stop use of equipments, turn off a power supply, and contact a near service station.

5-2. DAILY CHECKING ITEMS BY THE OPERATOR

Check following items according to the regular inspection plans.

Please refer to the daily inspection method regarding the way of checking.



CAUTION

In order to avoid the danger of an electroshock, please do not remove the cover of equipment by any means.

Only the expertise person who received training performs the check and repair accompanied by removal of a cover.

Check item	INTERVAL		
	Daily	Weekly	Monthly
Air Conditioner			
Temperature and Humidity			
Operation Panel			
Radiographic Condition			
Radiation field lamp			
Warning light in use			

5-3. WAYS OF DAILY CHECKING (CHEKING MENUS)

Please check clear environment inside the operation room and x-ray room.

The system is designed to operate with normal conditions under following environment. Please keep following temperature and humidity.

◆ The recommended operating environment is follow.

Temperature : +10 - +35

Relative humidity: 45 - 85 %, 45~65 % (X-ray room)



CAUTION

In the environment with a rapid change of temperature and humidity, it is easy to generate dew condensation. Installation of an air conditioner is recommended.



CAUTION

The ingredient that makes silver etc. sulfurate may be contained in the exhaust gas of an automatic development machine. Please install the independent air conditioner.

◆ Operation Panel

Please check whether each switch of an operation panel lights up.

When you clean the surface of an operation panel, it should be wiped with the soft and fine cloth. When using a cleaner, it is made to contain in cloth and is used.



CAUTION

Don't blow a liquid upon the operation panel directly. It goes into the inside of equipment from a crevice, and becomes the cause of failure.

◆ The check of radiographic condition

Before the commencement of work, trial radiography is performed and film density, unevenness, and etc. are checked.

◆ Radiation field lamp

It confirms whether a radiation field lamp lights up before the commencement of work.

◆ Warning light in use

It confirms whether warning light in use switch on before the commencement of work.

In this record paper, results of check are filled and kept.

DAILY CHECK RECORD

Type/Name : _____

X-ray Room No. : _____

Date : _____

Performed by : _____

Check item	Interval		Result Good/No Good
	Daily	Weekly	
Air Conditioner			
Temperature and Humidity			
Operation Panel			
Radiographic Condition			
Radiation field lamp			
Warning light in use			

Memo :

5-4. PERIODIC INSPECTION

It is a check report by the expertise person. The periodic inspection is performed according to this item.

DIG-550 HF Check Report

Approval by a user

S/N : _____ Date : _____

S/S : _____ Performed by : _____

Client name:		Address:	
Installation date:	Check classification		
Last-time checked date:			

Check Table (1/2)

No	Check item	Result	No	Check item	Result
1	Appearance of equipment		15	Condition of tube busing	
2	Warning light in use		16	Tube cable check	
3	Installation situation		17	Isolation resistance	
4	Operation of each switch		18	Input voltage of power supply	
5	Wiring connection		19	Sequential operation at Power ON/OFF	
6	Lighting state of each lamp		20	Check inside AC power-supply voltage	
7	Digital display			* Collimator : 12V	
8	Check of fuses			* Warning light : 100V	
9	High-voltage cable and Bushing check for High-voltage tank and X-ray tube		21	Check inside DC power-supply voltage	
10	Quantity of insulated oil			* Main Capacitor bank	
11	Bolting of bushing			* Filament board voltage	
12	Focal roughness			* PWR board voltage	
13	Rotation sound of Rotor			TP1 = +24 V	
				TP3 = +12 V	
				TP5 = +5 V	

14	Exchange grease for High-voltage cable / Bushing			TP6 = -12V	
----	--	--	--	------------	--

Check Table (2/2)

No	Check item	Result	No	Check item	Result
22	Check of calibration data at the time of installation		26	Pre-heat adjustment of Filament	
23	Voltage at the time of constant rotation of Rotor _____ V		27	Opening-and-closing condition of Collimator	
24	Tube voltage check and adjustment		28	I luminance of Collimator lamp	
25	Tube current check and adjustment		29	Light field and Radiation field	
			30	AEC adjustment (option)	

* Sign and Result of maintenance

Sign	Result	Sign	Result	Sign	Result
V	Normal.	T	Tighten	M	Measurement
A	Adjusting	E	Replacement	S	Data Store
R	Repair	C	Cleaning		
F	Supplement	O	Oiling		

Memo:

Used Measuring Instrument

Measuring Instrument	Maker/Model/S.N.	Term of validity
DVM		
'mAs meter		
Non-invasive kV meter		
'mA meter		

Scope		
-------	--	--