

Section 3

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The ODEL's NAVIGATOR Reference Guide

1 SYSTEM REQUIREMENTS

NAVIGATOR is an ODEL S.p.A. Program that lets the qualified technical service to configure ODEL products such as ENDEAVOUR and PROGRAM HF US X-ray generators.

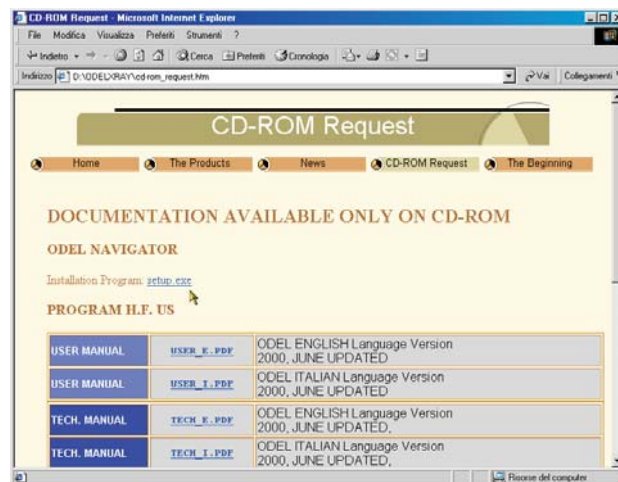
With ODEL's NAVIGATOR is possible to have on a PC-class computer most of the information of an X-ray generator working status.

ODEL's NAVIGATOR run on Microsoft Windows, a little familiarity with this operating system is required. System requirements:

One Pentium-class computer running Windows 95 (NAVIGATOR runs also on Windows 98, 2000, XP).

800x600 pixel screen minimum resolution.

One RS232 Serial Port (the cable for generator connection is provided as an option from ODEL, cable schematics are also published on www.odelxray.com and also on ODEL S.p.A. CD-ROM.



Install the program directly from CD-ROM clicking on "Installation Program: [Subtypes](#)" Follow installation instruction on the screen.

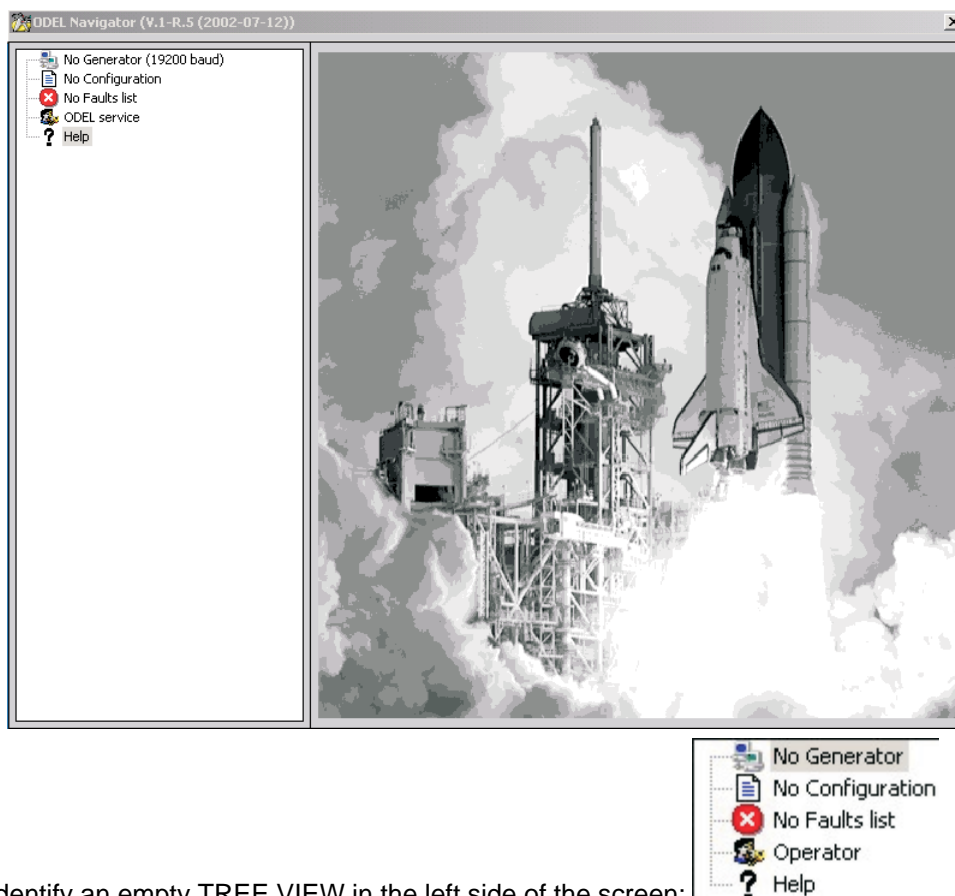
Since the program has been installed, the NAVIGATOR Icon appears on the desktop and in START Menu



Double click on it to start navigating the X-ray generator.....

2 NAVIGATOR's USERS






Since the program is running on the computer appears following screen:



it is possible to identify an empty TREE VIEW in the left side of the screen:

NOTE: RIGHT Clicking on the icons in the tree view it is possible to open the menu of permitted operation..

It is possible to identify the following items:

-  No Generator is the Connection Status Icon: in this case there is no software link between the computer and the generator
-  No Configuration is the Configuration Status Icon: in this case there is no configuration loaded in the computer
-  No Faults list is the generator's fault List Icon: in this case there is no fault lists loaded in the computer
-  Operator is the User Access Privilege: here is Not logged In, this means Standard User with no possibility to modify parameters in the generator.
-  Help This icon stands for IN LINE HELP

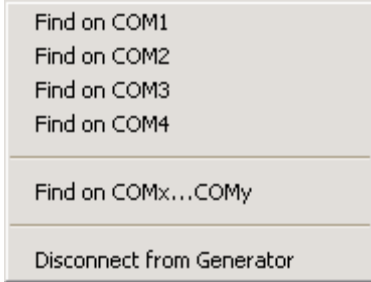
In order to log in as privileged user (Technical Service) you first have to establish a link between computer and generator.

2.1 SOFTWARE LINK



To make the link UP, follow the procedure explained below: Switch on the generator.

Right click on  No Generator


Select the Serial Communication Port in which is plugged the cable to link the generators in

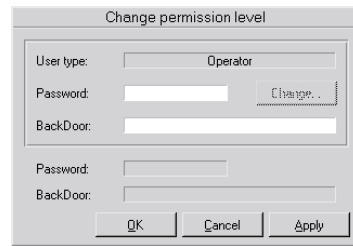


window, or, if unknown, select

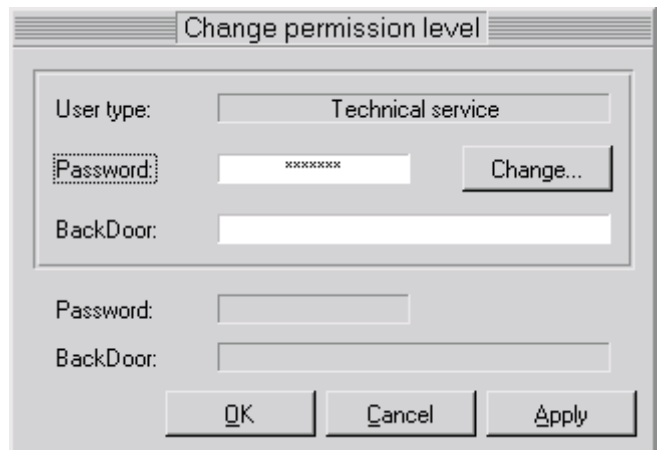
The icon  No Generator when the link is up will become  Endeavour (Appl.) in case of R306.34, R306.35 or R306.36 generator.

2.2 USER LOGIN

To login as Technical service Click on  Operator, then in equipment password in control.



window input the



If the password is correct the User type is changed in having the possibility to change parameters in the generator.

NOTE: ENDEAVOUR generator's default factory password in **1234567**

A Technical Service user can change the password to protect the configuration from unauthorized access, simply pressing **Change...** inserting and confirming the new password in



window.

NOTE: CONTACT ODEL if the password is lost.

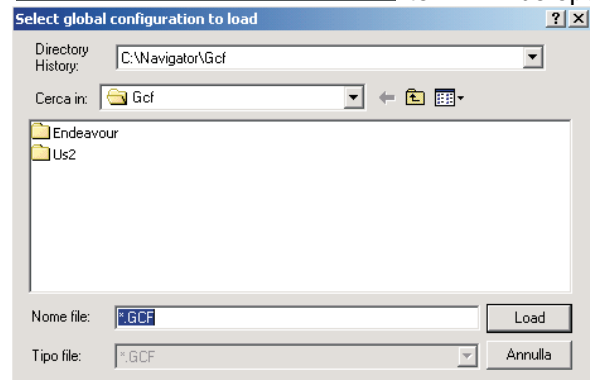
3 GENERATOR's GLOBAL CONFIGURATION FILE ITEM

After the Link is Up, (see previous paragraph), both Operator and Technical service can download the Configuration from the Generator:

Right click on No Configuration.

If the link is not established the only possibility is to read a configuration from file clicking on

Read configuration from file item. Will be opened a FILE SELECTOR DIALOG BOX

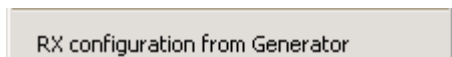


where it is possible to load a pre-saved configuration.

In case the link is UP, the Right Click facilities are



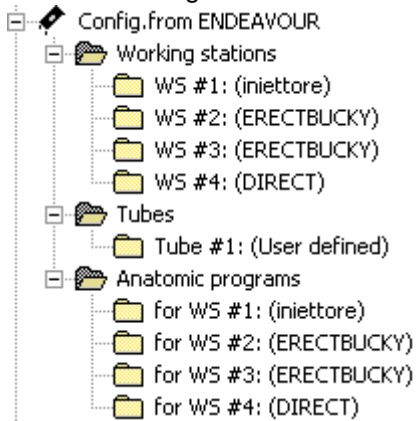
Select Item



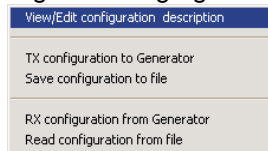
and DIALOG BOX will come.

The PROGRESS BAR informs you on the download process progress.

When the configuration is successfully downloaded, the TREE VIEW looks like



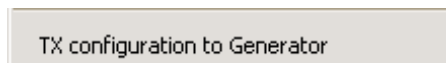
Right Clicking again on  **Config.from ENDEAVOUR** further items are added in the



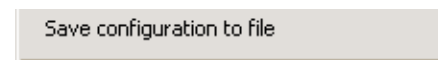
MENU:



Lets technical Service User to type a text memo of description for the configuration to be saved on disk.



Transmits actual configuration FROM computer TO generator.



Save on file Actual configuration: a FILE SELECTOR DIALOG BOX is opened.



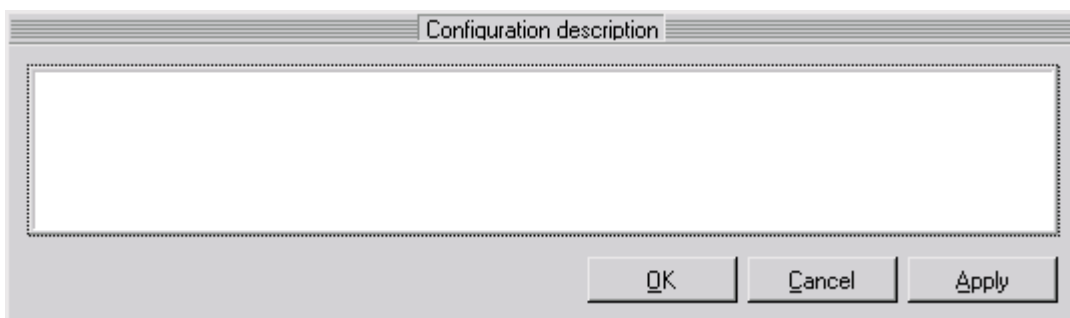
Receive configuration FROM generator TO computer.



Read a file CFG containing a generator configuration: a FILE SELECTOR DIALOG BOX is opened. CURRENT CONFIGURATION INSIDE COMPUTER WILL BE OVER WITTEN.

3.1 Viewing or Editing the Configuration description

Right click on  **Config.from ENDEAVOUR** icon and select  menu item.



The CONFIGURATION DESCRIPTION DIALOG BOX appears and it is possible to save up to 000 characters of text description for current configuration ON FILE: in the generator that description IS NOT SAVED.

3.2 Transmitting a Configuration to the Generator

NOTE: only for Technical

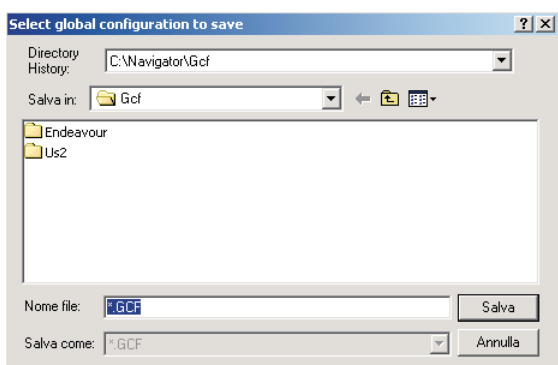
Right click on Config.from ENDEAVOUR icon and select menu item.



The PROGRESS BAR WINDOW and the configuration is transmitted to generator when the progress bar is 100% red. The window automatically closes at the end of transmission.

3.3 Saving a Configuration to File

Right click on Config.from ENDEAVOUR icon and select menu item.

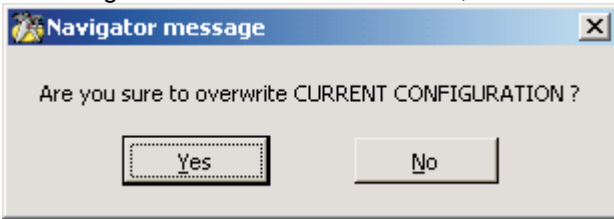


The FILE SELECTOR DIALOG BOX lets a Technical User to save a received and/or modified configuration in a computer file.

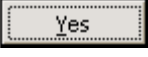
3.4 Loading a Configuration from File

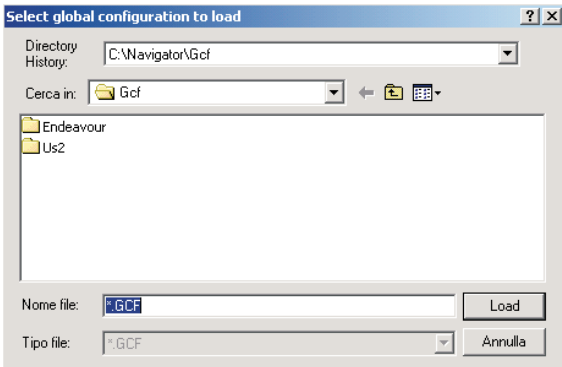
Right click on Config.from ENDEAVOUR icon and select menu item.

If a configuration has been read before, or downloaded from generator,



CONFIRMATION WINDOW will appear.

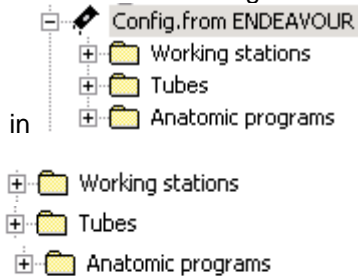
After confirming the operation (click on ) the



FILE SELECTOR DIALOG BOX will let you navigate in the file system to retrieve a *.GCF file that stands for Global Configuration File.

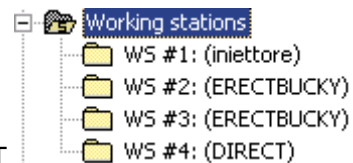
4 GLOBAL CONFIGURATION SUB-ITEMS

Since a Global Configuration is loaded from a file, or Downloaded from a generator connected via Serial Interface,



GENERATOR'S GLOBAL CONFIGURATION FILE ITEM appears 3 SUB-ITEMS:

- Working stations Work station Configuration Parameters
- Tubes Tube/s Configuration and Calibration Parameters
- Anatomic programs Anatomical Programs Management.

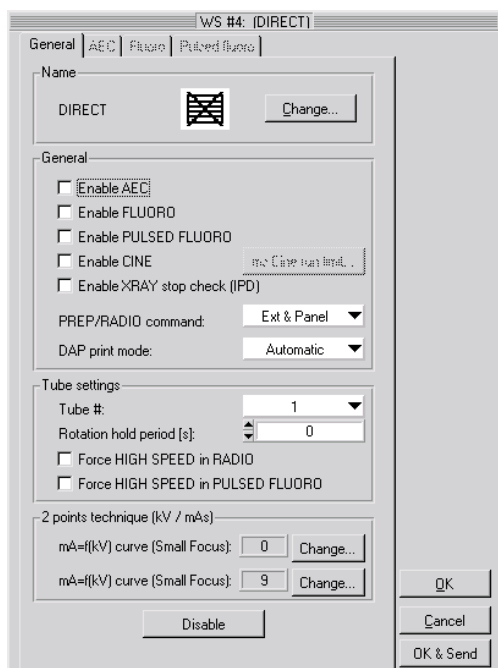


Clicking on a Sub-Item  it is possible to OPEN IT

NOTE: In an ENDEAVOUR generator there are: 4 PROGRAMMABLE WORK STATION
1 PROGRAMMABLE TUBE
4 PROGRAMMABLE PROGRAMS BANK

4.1 WORK STATION CONFIGURATION

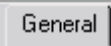

Click on one of the four  work station selector to modify the parameters.

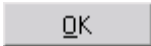



The WORK STATION PARAMETERS DIALOG BOX is open.

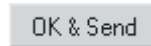
Depending of the generator model connected there are present selectable option.

The Work Station options are summarized in  TABS.

NOTE: A NORMAL ( TAB) can be selected, a GHOSTED ( tab) cannot be selected. This is depending on the type of generator and the permitted options.

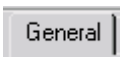
Left clicking on  KEY will save the changes in LOCAL (computer) configuration (save NOT ON DISK, in memory).

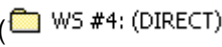
Left clicking on  KEY will delete all the changes in LOCAL (computer) configuration.

Left clicking on  KEY will save the changes in LOCAL configuration AND transmits changes to the Generator.

4.1.1 Configuring the GENERAL WORK STATION PARAMETERS

Every work station has general parameters to be set-up.

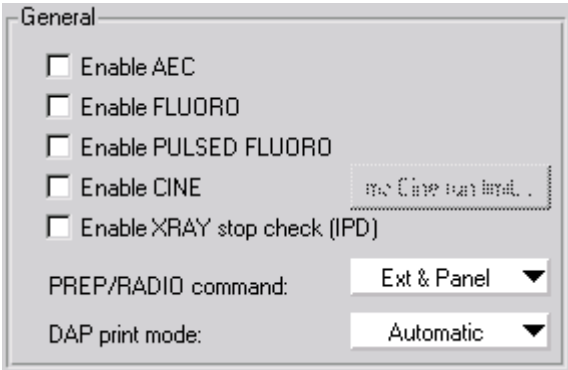
The general parameters are shown in  TAB of the WORK STATION PARAMETERS DIALOG BOX.

Click on the Work Station Item you want to modify ( for example).

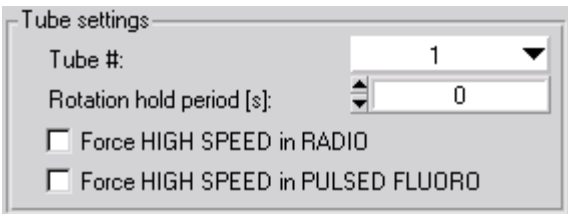
Modifiable parameters follow:



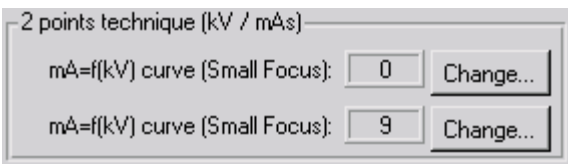
Work Station Name and Icon



Work Station Executive Options



Work Station Associated Tube

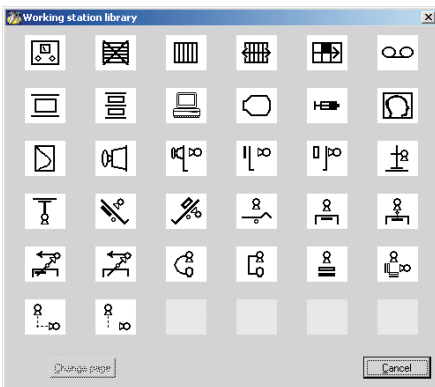


Work Station Two point Technique mAs Curve

Changing the Icon of a Work Station

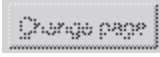


Press key in the group to access the



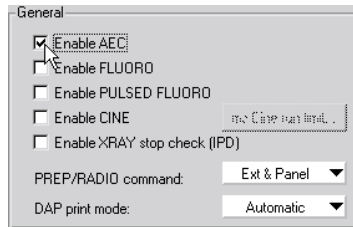
WORK STATION NAME and ICON SELECTOR WINDOW.

Press one of the several icons enabled in the windows to select the icon that will appear on the ENDEAVOUR control console, or the relative name in the PROGRAM US control console.

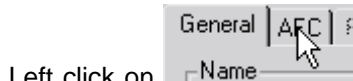
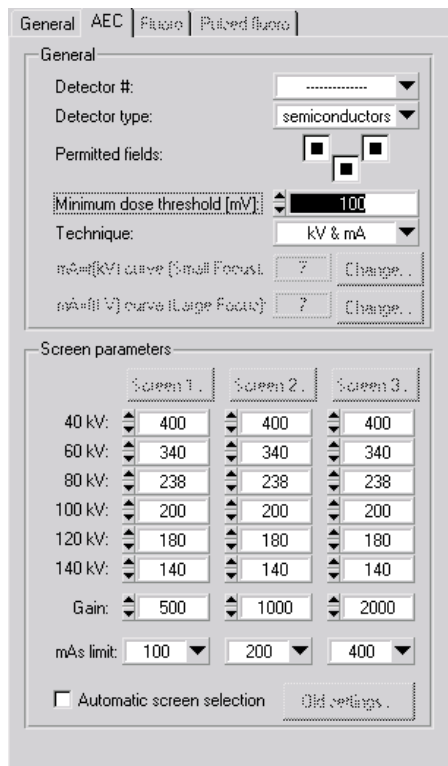
If more than 36 icons are present, it is possible to press  key, otherwise, as in the example, is ghosted.

Changing the Work Station's Executive: A.E.C. OPTION

Enable the check-mark left clicking in General panel as per following picture



Suddenly the AEC TAB is selectable



Left click on (AEC TAB) will open

AEC PANEL, select the

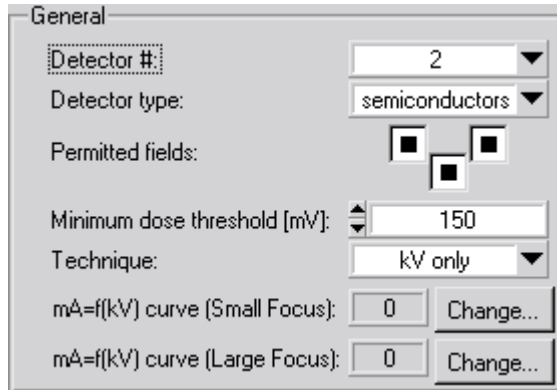
detector number pulling down the detector window:




NOTE: enabling in general window the AEC and NOT selecting the detector number, the AEC will be automatically deselected.

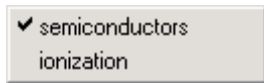
NOTE: on ENDEAVOUR generator, the detector can be 1 or 2, on PROGRAM H.F. US the detector number can be selected from 1, 2 or 3.

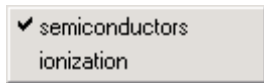
Configuring the AUTOMATIC EXPOSURE CONTROL



DETECTOR TYPE - (Only on ENDEAVOUR generator)

Can be chosen the detector type pulling down the window on the right .



Selectable options are  for Semiconductor chamber type and Ionizing Chamber type. **NOTE:** Be sure that the correct daughter board have to be inserted in MCU.

PERMITTED FIELDS

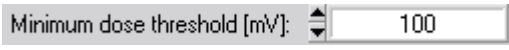
It is possible to assign the dominants configuration on the detector simply by enabling or disabling the dominants in



Example



MINIMUM DOSE THRESHOLD

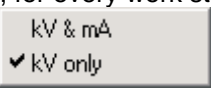
Input the value of minimum dose expressed in converted mV in  control.

A value of dose converted less than 100mV will alarm the generator (Alarm n. 141 DEXP - Expose meter Dose Low).

NOTE: A value of 0 (Zero) means NO CONTROL. Values depend on electrical noise coupled on the AEC cable. An average value of 100mV can be a good starting point.

TECHNIQUE

It is possible, for every work station, to select the AEC technique to be use.

Options are  that stands for:

kV & mA

-2 Points Technique (on the control console kV and mA are freely selectable and AEC controls the timer).

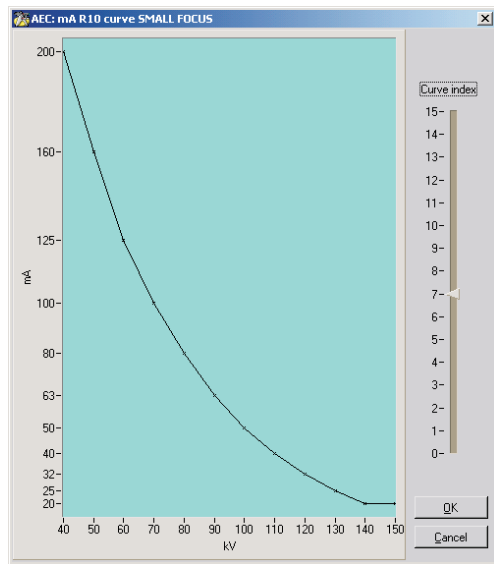
kV only

-1 Point Technique (on the control console only kV is freely selectable, mA are computed within an installation selectable slope and AEC controls the timer).

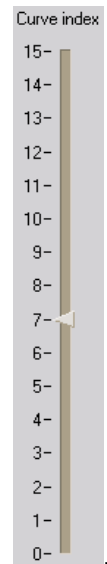
1 POINT TECHNIQUE range on High Voltage Current

Selecting **kV only** a mA/kV curve index has to be chosen in options DIFFERENT from ZERO:
 mA=f(kV) curve (Small Focus): 0 Change...
 mA=f(kV) curve (Large Focus): 0 Change... deghosted

Left clicking **Change...** KEY either on Small or Large focus it is possible through



WINDOW to select the right curve with

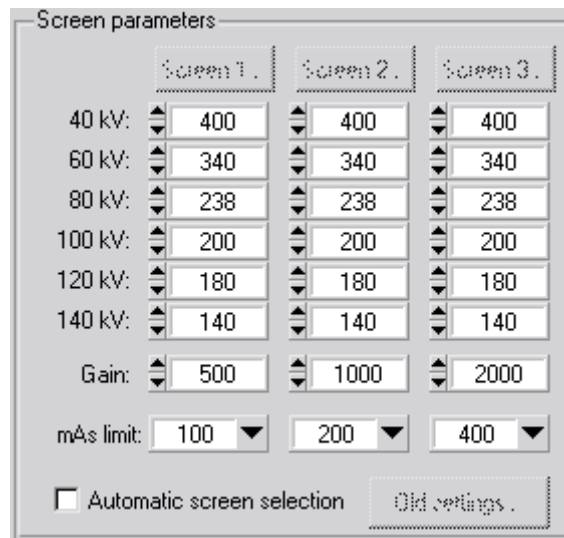


The index depends on the load characteristics of the tube, and the timing required to make a radiography in a specific context:

Lower index will be conservative in term of tube current (i.e. the filament will be less stressed) but the average radiography duration will be high. - Not recommended for high density radiography due to low dose on detector and enfant radiography -

Higher index will be filament-stressing but the average radiography duration will be low. - Not recommended for low density radiographs due to detector saturation.

A good compromise for standard tubes is curve index 6..7 for both filaments, if on small filament high current are allowed.



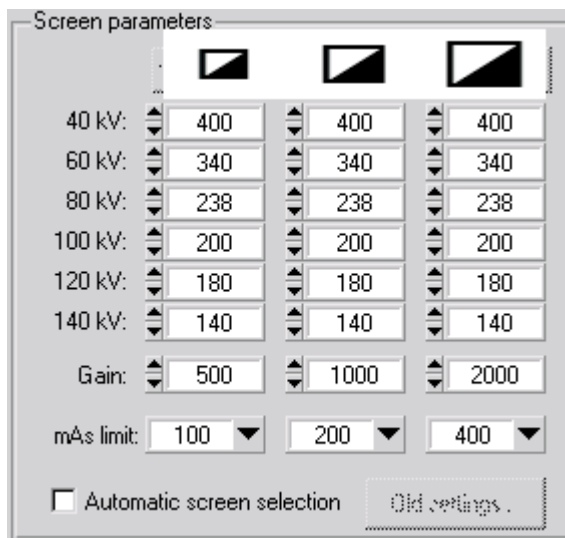
AEC SCREEN PARAMETERS:

It is possible to select on the control console up to 3 film/screen combinations using



keys.

In particular:



Screen 1 is the FAST film/screen combination
 Screen 2 is the NORMAL film/screen combination
 Screen 3 is the SLOW film/screen combination

Ghosted keys are for old software revision compatibility, and not used on ENDEAVOUR Generator.

The indexes from 40 kV to 140 kV represents the linearize and compensation over the kV range of the physical detector reply. It should not be changed.



represents the DARKNESS of the final radiography. Lower values mean lighter radiography (less dose). Higher values means darker radiography (more dose). The value, in constant load technique, is LINEAR; this means that doubling the value, will double the time of exposure, this will double the dose on the film. Value 10..16000.

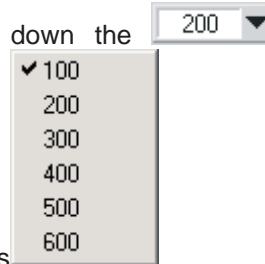
NOTE: The value depends basically on screen/film combination,

filters before detectors and detector type. Start exposing at 1000, than decide if the darkness is enough or it should be under/over exposed and the percentage of under/over exposition; apply this percentage (the dose will be reduced/increase linear) to the relevant value and expose again.

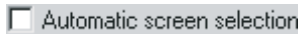


Represents for every screen/film combination, the maximum value of mAs allowed for a single exposure.

Values are selected pulling down the 200 menu and



selectable from following values

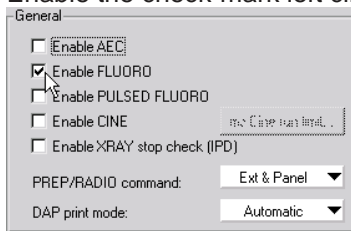


Represents the FACTORY DEFAULT value.

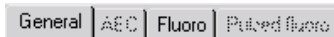
Use it to restore a known situation, in case the compensation curve has been changed and gives no-sense reply.

Changing the Work Station's Executive: FLUOROSCOPY Option

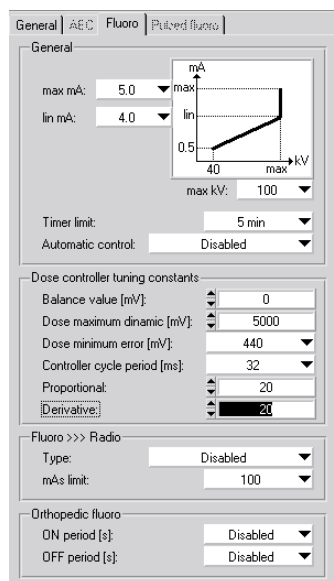
Enable the check-mark left clicking in General TAB panel as per following picture



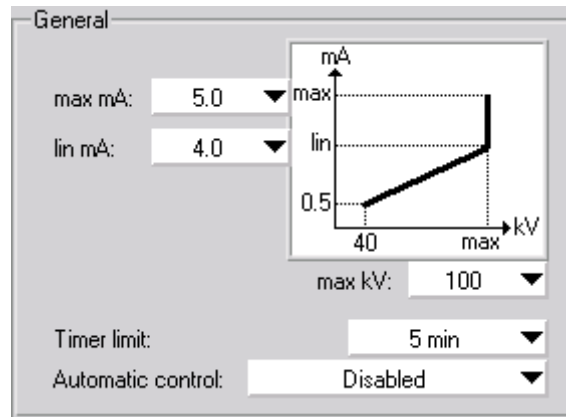
suddenly the FLUOROSCOPY TAB is selectable



Left click on Fluoro TAB to open the FLUOROSCOPY PARAMETERS PANEL



FLUOROSCOPY PARAMETERS:



GENERAL PARAMETERS

Configure the fluoroscopy kV/mA chain as per tube characteristics and installation characteristics:

max mA: 5.0 ▼

Is the maximum value of high voltage current in continuous mode

- 2.0
- 2.5
- 3.0
- 4.0
- ✓ 5.0
- 6.0
- 7.0
- 8.0

Allowed value follows:

lin mA: 4.0 ▼

Is the high voltage current value reached after a linear progression at the maximum of high voltage, starting from 40kV-0.5mA.

- 2.0
- 2.5
- 3.0
- ✓ 4.0
- 5.0
- 6.0
- 7.0
- 8.0

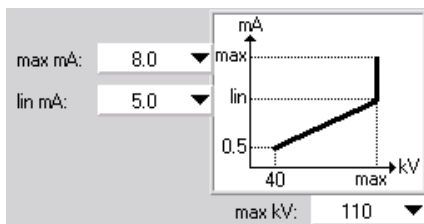
Allowed value follows:

max kV: 100 ▼

Is the maximum value of high voltage permitted in Continuous Mode.

- ✓ 100
- 110
- 120

Allowed value follows:



EXAMPLE: In this example the continuous fluoroscopy chained parameters starts from 40kV@0.5mA, increase with linear low (60kV@1.78mA - 80kV@3.7mA - 100kV@4.35mA) up to a maximum value of 110kV @ 5mA, than, high voltage remains fixed at 100kV and high voltage current increase up to 8mA .

Timer limit: 5 min ▼

OPTION available only in PROGRAM H.F. US Generator, Allowed

90 min
 5 min

values are and represents the maximum cumulated time per patient before a reset needed.

In ENDEAVOUR class generator, the restriction are:
No more than 10' continuously fluoroscopy switched ON

Automatic control: Disabled ▼

Sets the way to adjust the point of correct dose.

Depending on the devices used to close the fluoroscopy chain (control electronics, monitor, ...) the selectable options are

Disabled
 by digital input
 by analog dose input

by digital input

by analog dose input

NOT OPERATING (Only for ENEAVOUR)

The control is made via differential analog input (iec+,iec-). The control parameters in analog dose input need the definition of the input type and voltage range, the dose balance value and the way to reach and maintain that value in timing terms as described in next paragraph.

ANALOG FLUOROSCOPY DOSE CONTROLLER

Dose controller tuning constants

Balance value [mV]: 0

Dose dead band [mV]: 5

Controller cycle period [ms]: 32

Proportional coefficient: 20

Read dose from... IEC analog input

Invert kV direction

Balance value [mV]: 0

Is the Dose equilibrium point in term of darkness on the fluoroscopy monitor. Values are expressed in mV (bipolar input signal voltage), ⇒ Use a phantom and a dosimeter and tune the balance to get the desired average dose. If you don't have a dosimeter, look at the monitor to determinate the right value of image darkness.

Dose dead band [mV]: 5

Is the value of absolute interval across the Balance value, in which no kV variation take place to prevent control oscillations.

It depends on the amplitude of the **Balance value** input signal and the residual electrical noise level in the installation.

Controller cycle period [ms]:

Is the interval between two consecutive adjustment decision. It determinates the velocity of control algorithm, and affects the stability of the system. As higher this value as slower the control speed. As lower this value as nervous and oscillations critical the control. A balance between those two parameters (speed of control and oscillation) have to be found directly on the installation.

- 16
- 24
- ✓ 32
- 48
- 64
- 88
- 112
- 136
- 168
- 200

Values can be chose between items.

Proportional coefficient:

The balance control and the dynamic of the controller are managed by a numeric PID controller with Integral coefficient fixed. This is the Proportional coefficient and determinate the amplitude of the changes of the output value (in term speed of control cycle, it acts like a controller gain). As high the value as fast and nervous the algorithm works, balanced value should be found to do not introduce auto oscillations.

Read dose from...

It allows to choose the Dose input (IEC or IEP), but on the ENDEAVOUR generator must be always selected IEC.

IEC analog input
 IEP analog input

IEP NOT OPERATING (only for ENDEAVOUR)

Invert kV direction

Enable Invert kV direction if the automatic regulation is always done to the max or min kV values.

FLUOROSCOPY TO RADIOGRAPHY PARAMETERS TRANSFER

Fluoro >>> Radio
Type:
mAs limit:

This section provides a way to implement the ZERO Points Technique: The fluoroscopy in automatic fluoroscopy dose control will drive the fluoroscopy High Voltage value to the correct one, the transfer table selected here will make the rest, i.e. Will transfer a value of kV and mA to radiography controlled via AEC.



Pulling down this menu is possible to select one of the

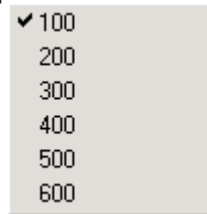


various way to transfer parameters

The way selected depends on the kind of exam and the organ under exam, so it is a faculty of technical service to setup the best item in the table.



It is possible to limit the mAs transfer selecting one of the items in the pull down menu of this option, from the



following table:

ORTHOPEDIC FLUOROSCOPY



It is possible to use the persistence of the Brilliance Intensifier an the Persistence of the Fluoroscopy Monitor to make a pseudo-pulse fluoroscopy where higher signal/noise ratio is required, like in orthopedic medicine. The pulses are described in term of repetitive ON period and OFF period.



Appropriate values of those two parameters (ON and OFF Pulse Time) should be choose from directly on the field looking directly the monitor.

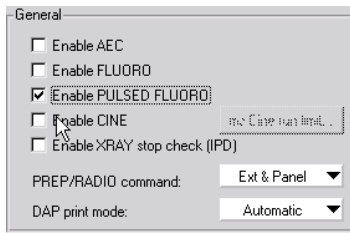
NOTE: Timing is expressed in seconds.

Hi value of max mA: 8.0 are recommended.

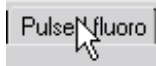
Changing the Work Station's Executive: PULSED FLUOROSCOPY Option

NOTE: Not allowed in ENDEAVOUR - R series

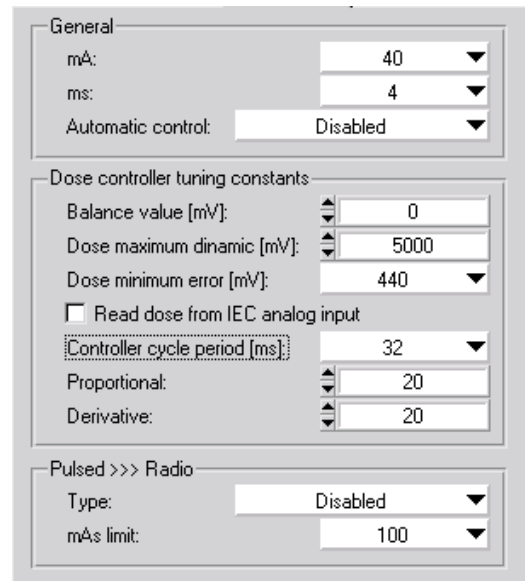
Enable the check-mark left clicking in General panel as per following picture



suddenly the PULSED FLUOROSCOPY TAB is selectable



Left click on **Pulsed fluoro** TAB to open the PULSED FLUOROSCOPY PARAMETERS PANEL.



PULSED FLUOROSCOPY PARAMETERS:

GENERAL PARAMETERS

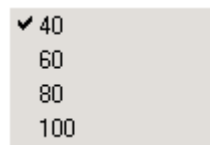
Configure the main pulse characteristics with following parameters.

In most cases the parameters depends on the digital device connected (pulse time, pulse dose) and dose limits. Select the right pulse time for digital device connected than select the high voltage current form best image contrast in accordance with dose limits.



Sets the High Voltage Pulse Current.

Pull down the menu and pick an item of the following table:



Sets the Pulse duration.

Pull down the menu and pick an item of the following table

- ✓ 4
- 6
- 8
- 10
- 12
- 14
- 16

Automatic control: Disabled

Sets the way to adjust the point of correct dose. Depending on the devices used to close the fluoroscopy chain (control electronics, monitor, ...) the selectable options are

- ✓ Disabled
- by digital input
- by analog dose input

by digital input

The control is made with two digital input: UP to increase 1 kV DOWN to decrease 1kV **NOTE:** If both signal are active, no changes take place.

by analog dose input

The control is made via two differential analog input. The control parameters in analog dose input need the definition of the input type and voltage range, the dose balance value and the way to reach and maintain that value in timing terms as described in next paragraph.

Dose controller tuning constants

| | |
|--|------|
| Balance value [mV]: | 0 |
| Dose maximum dynamic [mV]: | 5000 |
| Dose minimum error [mV]: | 440 |
| <input type="checkbox"/> Read dose from IEC analog input | |
| Controller cycle period [ms]: | 32 |
| Proportional: | 20 |
| Derivative: | 20 |

ANALOG PULSED FLUOROSCOPY DOSE CONTROLLER

Refer to previous ANALOG FLUOROSCOPY DOSE CONTROLLER.

NOTE: Default input channel for analog dose is signal **iep**, In Read dose from IEC analog input checkmark must be unchecked. If there is only one dose signal for both FLUOROSCOPY and PULSE FLUOROSCOPY, the signal have to be connected to **iec** input and the software configuration have to be changed to Read dose from IEC analog input .

PULSED FLUOROSCOPY TO RADIOGRAPHY PARAMETERS TRANSFER

Fluoro >>> Radio

| | |
|------------|----------|
| Type: | Disabled |
| mAs limit: | 100 |

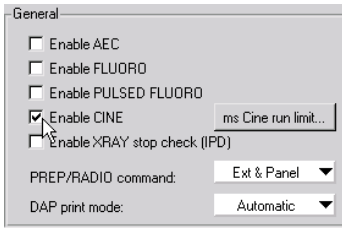
Refer to previous ANALOG FLUOROSCOPY TO RADIOGRAPHY PARAMETERS TRANSFER.

Changing the Work Station's Executive: CINE-RADIOGRAPHY Option

NOTE: Not allowed in ENDEAVOUR - R series

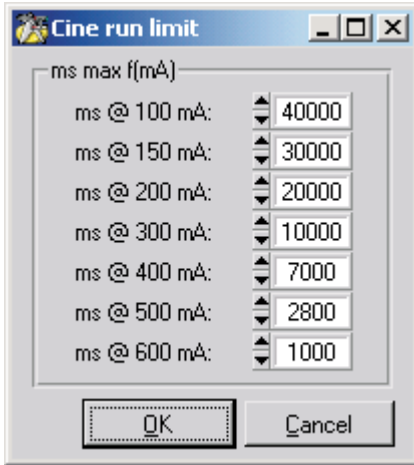
CINE-RADIOGRAPHY limits basically depends on thermal load characteristics. Carefully read the X-ray tube thermal load characteristics in order to input the correct values

Enable the check-mark left clicking in General panel as per following picture



suddenly the **ms Cine run limit...** KEY will turn in a non ghosted form.

Pressing **ms Cine run limit...** it is possible to set the time limit for CINE sequence using the following menu



Characteristic curve is build inserting ms values at different tube current load.

Changing the Work Station's Executive: ENABLING X-RAY FORCED EXTINCTION EXTERNAL INPUT Option

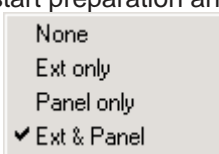
On PROGRAM H.F. US series of X-ray generators it is possible to force X-ray extinction from an external accessory connecting a signal to IPD input on the general terminal board.

In Enable XRAY stop check (IPD) state, IPD acts as default, in Enable XRAY stop check (IPD) IPD signal must be closed to interface zero to permit X-ray emission.

Changing the Work Station's Executive: ENABLING X-RAY COMMAND SOURCE Option

It is possible to select the source of X-ray command from several options.

Use PREP/RADIO command: control to select where are the input to give the generator the command to start preparation and exposure.



Pull down the MENU and select one of the following option:

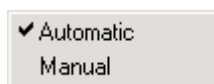
| | |
|---|--|
| <input type="text" value="None"/> | NO X-ray command source: Work Station unable to expose. |
| <input type="text" value="Ext only"/> | ONLY Input on General Terminal Board will command the exposure |
| <input type="text" value="Panel only"/> | ONLY the keys on the Control Console will command the exposure |
| <input checked="" type="text" value="Ext & Panel"/> | BOTH Input on General Terminal Board and keys on the Control Console will command the exposure |

Changing the Work Station's Executive: ENABLING AUTOMATIC DATA PRINT Option


In ENDEAVOUR series of X-ray generator, the printer is connected to the Control Console, and the print process is managed directly on the Control Console.

In PROGRAM H.F. US series of X-ray generator, the printer is connected on the front DB9 connector on MPU, the print process is managed on the Control Console, and there is an AUTOMATIC PRINT-OUT after at the end of the RUN SEQUENCE.

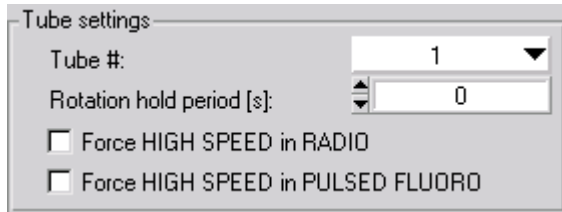
The configuration parameter for this option is



The options are selected pulling down the and represent:

| | |
|---|--|
| <input checked="" type="text" value="Automatic"/> | Automatic Print at the end of a run sequence (i.e. Every time one or more exposure succeeded and the preparation key is released). |
| <input type="text" value="Manual"/> | Print on demand pressing the  KEY on PROGRAM H.F. US Control Console. |

4.1.2 Configuring the GENERAL WORK STATION PARAMETERS - TUBE SETTINGS



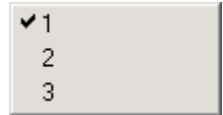
The TUBE SETTINGS PANEL let configure the number of tube with which the work station is associated and the way the tube have to work.

TUBE SELECTOR



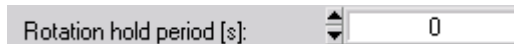
In ENDEAVOUR series of X-ray generator, the tube selectable for each work station is n. 1.

In PROGRAM H.F. US series of X-ray generator with 3 tubes transformer option, it is possible to associate one of



the 3 possible tube pulling down the '1' menu and selecting one of the item from the menu.

TUBE ROTATION HOLD TIME



It determinate the time the tube have to keep on turning after the preparation key or the fluoroscopy foot-switch are released. The hold period is expressed in seconds.

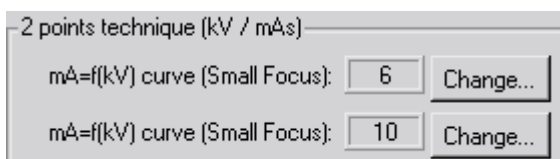
HIGH SPEED ENFORCE

If the generator has been provided with NORMAL/HIGH SPEED STARTER option, DEPENDING ON THE LOAD THE NORMAL OR HIGH SPEED IS AUTOMATICALLY SELECTED.

In some exams technique, for example where the single exposure is low load, but the exams provides a lot of exposures in a short time, it is necessary to FIX the high speed to have more chance to enlarge the exam duration. Is possible, checking Force HIGH SPEED in RADIO this item to force High Speed even if the radiography load is low.

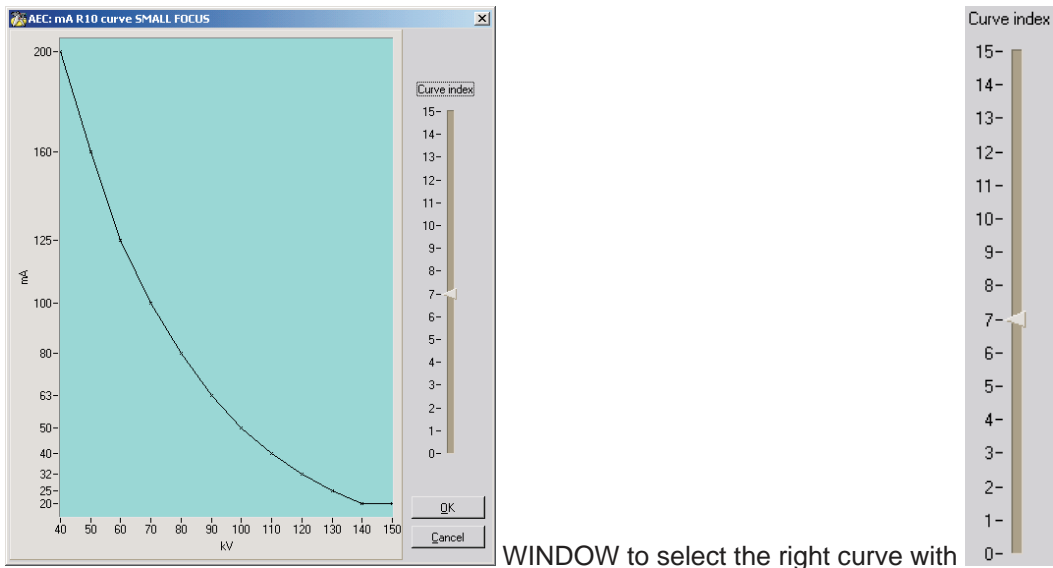
- Force HIGH SPEED in RADIO The speed is automatically computed depending on next radiography load
- Force HIGH SPEED in RADIO The speed is always forced to 180Hz (11000 rpm)
- Force HIGH SPEED in PULSED FLUORO Pulse fluoroscopy rotation set to 60Hz (3600 rpm)
- Force HIGH SPEED in PULSED FLUORO The speed is always forced to 180Hz (11000 rpm)

4.1.3 Configuring the GENERAL WORK STATION PARAMETERS - TWO POINTS TECHNIQUE CURVE SELECTION



The TWO POINTS TECHNIQUE PANEL let configure the generator working in 2 points technique (kV / mAs) selecting for each focus, the curve to use to compute mA.

Left clicking **Change...** KEY either on Small or Large focus it is possible through



WINDOW to select the right curve with

The index depends on the load characteristics of the tube, and the timing required to make a radiography in a specific context.

Lower index will be conservative in term of tube current (i.e. the filament will be less stressed) but the average radiography duration will be high for high mAs pre-set on the Control Console.

Higher index will be filament-stressing but the average radiography duration will be low even for high mAs.

A good compromise for standard tubes is curve index is:

mA=f(kV) curve (Small Focus):

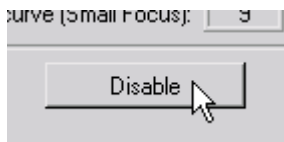
filament stress, i.e. no more than 160mA on Small focus.

mA=f(kV) curve (Small Focus):

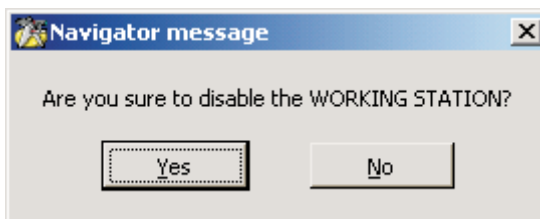
Up to 70kV means full power with maximal tube current, i.e. high performances

4.1.4 Configuring the GENERAL WORK STATION PARAMETERS - DISABLING THE WORK STATION

This option is available only on ENDEAVOUR series of X-ray generators.



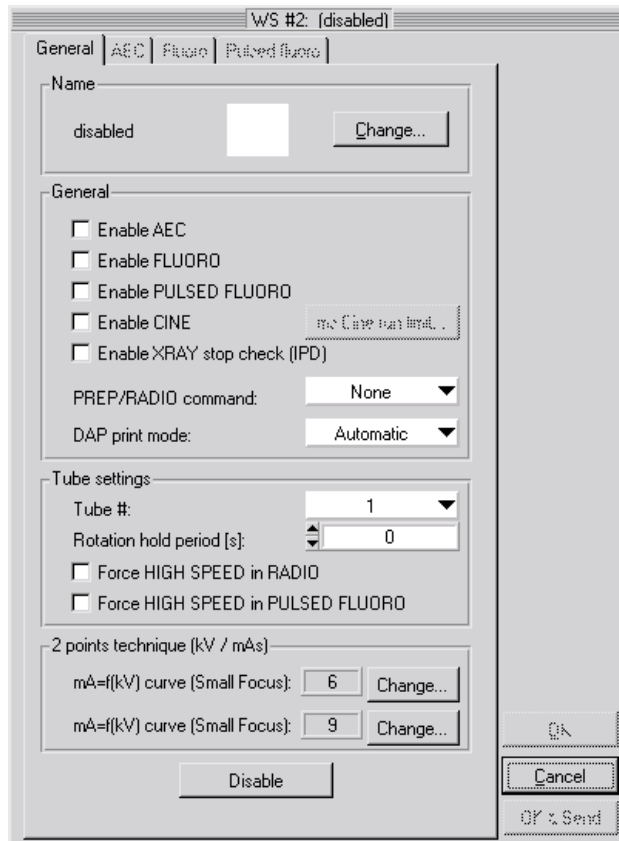
Clicking on **Disable** key is excluded the possibility to select the work station on the control console, the key will not appears on the control console and the anatomical programs will not reference that work station.



Be sure to click on **Yes** KEY on **Disable** KEY is pressed.


DIALOG BOX after the

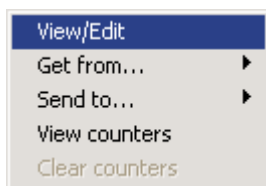
In this case the Work station Panel will look like



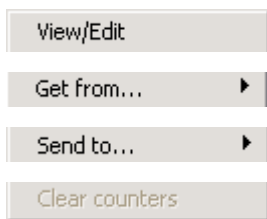
4.2 X-RAY TUBE CONFIGURATION

NOTE: The same notice are applicable also on Program HF U.S. in case of tube n. 2 or tube n. 3

Right click on  to enter in Tube Configuration.



Available options are



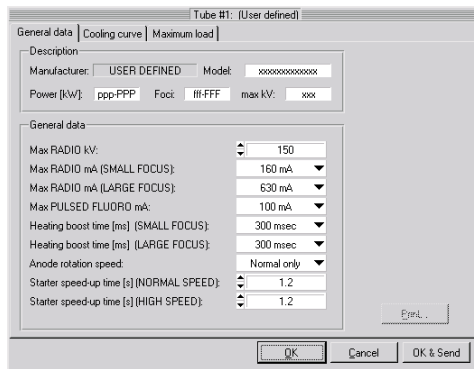
Open a tube configuration window (also left clicking)

Load from Generator or Computer Hard Disk a tube in NAVIGATOR program

Save a tube from NAVIGATOR program to Generator or Computer hard disk

ODEL reserved option

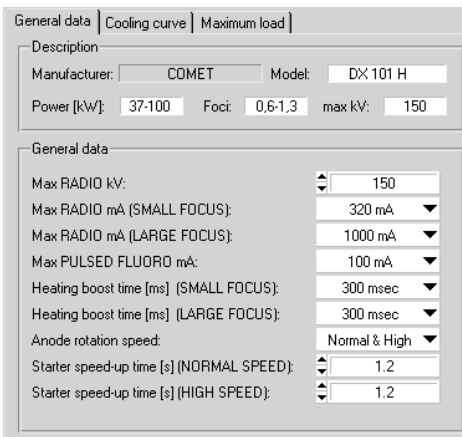
4.2.1 VIEWING / MODIFYING A TUBE IN NAVIGATOR



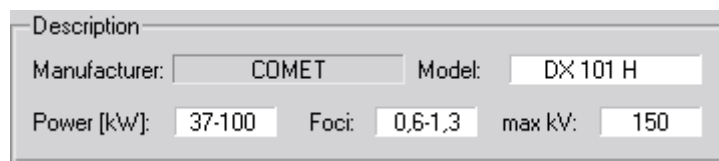
Left click on **View/Edit** a window will open.

3 panels are available for a single tube: **General data** | **Cooling curve** | **Maximum load**

4.2.2 GENERAL TUBE DATA PANEL



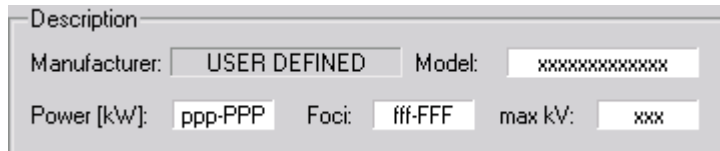
The GENERAL TUBE DATA PANEL is divided into two section:



TUBE DESCRIPTION

Tube description includes Manufacturer name, Tube model, power expressed in kW, size of foci in mm and maximum voltage.

Since a modification is made tube data are overwritten and new Description panel will be



| General data | |
|---|---------------|
| Max RADIO kV: | 150 |
| Max RADIO mA (SMALL FOCUS): | 320 mA |
| Max RADIO mA (LARGE FOCUS): | 1000 mA |
| Max PULSED FLUORO mA: | 100 mA |
| Heating boost time [ms] (SMALL FOCUS): | 300 msec |
| Heating boost time [ms] (LARGE FOCUS): | 300 msec |
| Anode rotation speed: | Normal & High |
| Starter speed-up time [s] (NORMAL SPEED): | 1.2 |
| Starter speed-up time [s] (HIGH SPEED): | 1.2 |

TUNE GENERAL DATA

Max RADIO kV: 150

Max RADIO mA (SMALL FOCUS): 160 mA

Max RADIO mA (LARGE FOCUS): 630 mA

The maximum value of High Voltage permitted on tube and selectable on the control console. From 40 to 150.
Limit this value if the tube have discharge problem on high kV.

Maximal High Voltage Current limitation on tube is automatically limited on maximum load computation in function of the high voltage and time selected.

Nevertheless for filament safe purpose it is possible to limit the maximum value of High Voltage Current on Small Filament.

| |
|----------|
| ----- |
| 100 mA |
| 125 mA |
| ✓ 160 mA |
| 200 mA |
| 250 mA |
| 320 mA |

Permitted values are where ----- stands for Tube Maximum Load limitation.

Current limitation depends on Tube. Characteristics and should be reduced when discharge at high power occurs.

Maximal High Voltage Current limitation on tube is automatically limited on maximum load computation in function of the high voltage and time selected. Nevertheless for filament safe purpose it is possible to limit the maximum value of High Voltage Current on Large Filament. Permitted

-
- 100 mA
- 125 mA
- 160 mA
- 200 mA
- 250 mA
- 320 mA
- 400 mA
- 500 mA
- ✓ 630 mA
- 800 mA
- 1000 mA

value are ----- where ----- stands for Tube Maximum Load limitation. Current limitation depends on Tube Characteristics and should be reduced when discharge at high power occurs.

Max PULSED FLUORO mA: 100 mA ▼

Again, for tube safe purpose it is possible to limit the High Voltage Current in Pulse Fluoroscopy Mode in accordance to

-
- 40 mA
- 60 mA
- 80 mA
- ✓ 100 mA

following items:

Heating boost time [ms] (SMALL FOCUS): 300 msec ▼

To warm up the filament from stand-by to Radiography value in the fastest way possible, during radiography preparation the filament is boosted at maximum of radiography current value for an interval depending on this value. Select the boost

- 0 msec
- 100 msec
- 150 msec
- 200 msec
- 250 msec
- ✓ 300 msec
- 350 msec
- 400 msec
- 450 msec
- 500 msec
- 550 msec
- 600 msec
- 650 msec
- 700 msec
- 750 msec
- 800 msec

time from following item:

NOTE: if there are differences in current from radiography made pressing contemporary preparation and exposure key, and radiography made waiting at least 5 seconds after pressing preparation time,

Heating boost time [ms] (LARGE FOCUS): 300 msec ▼

Anode rotation speed: Normal only ▼

Starter speed-up time [s] (NORMAL SPEED): 1.2

Starter speed-up time [s] (NORMAL SPEED): 1.2

Starter speed-up time [s] (HIGH SPEED): 1.2

the boost time is not sufficient, so grow up this value.

300ms is the suggested value for all the tube tested until now

See previous description for Small Focus.

In case of Normal/High Speed option installed in the generator, it is possible to select the rotating strategy of the tube.

The option is selectable between following

Normal only
 High only
 Normal & High

items:

This option will override, in case of Normal Speed only, every configuration made on the Working Station.

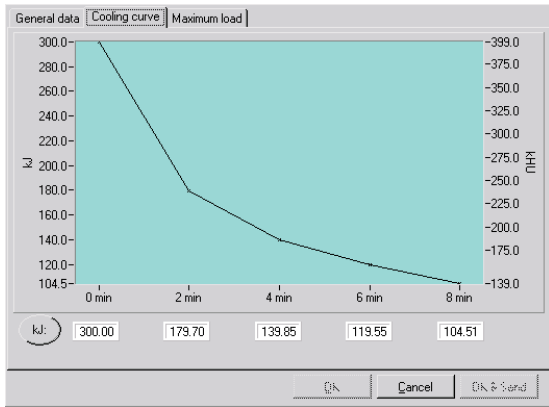
In case of Anode Normal Speed is the acceleration time from zero to normal speed (50/60 Hz) expressed in seconds.


It depends on the tube Rotor and Stator characteristics and the weight of the rotating anode.

In case of Normal/High Speed Starter in Program H.F. US generator this parameters permits to keep the acceleration time longer than the one selected via jumpers on the board, both for normal and high speed


4.2.3 COOLING CURVE


Selecting the cooling curve tab it is possible to enter the cooling curve screen



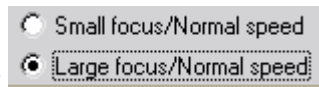
Using the  key it is possible to enter cooling curve either in kJ or in kHU units:

 For kilo Joule

 For kilo Heat Units

To enter the cooling characteristics position the cursor on one of the five characteristic points and left click , than using the numeric keypad enter the value computed on the tube's characteristic sheet as described in the generator's technical manual.

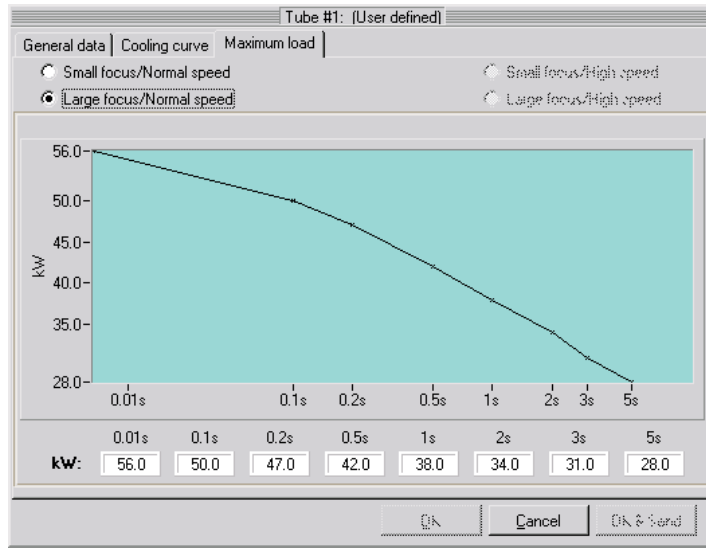
4.2.4 MAXIMUM LOAD



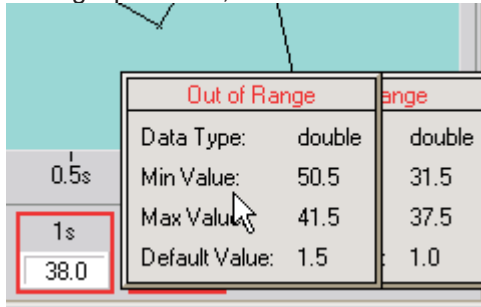
Select the FOCUS and the SPEED of data input left clicking on the descriptor.

NOTE: The curve selected is the RADIO BUTTON dotted, i.e. .

Compute the maximum load for characteristic point using the tube data sheet as described in generator's Technical Manual than enter as per previous paragraph the values left clicking on the value number:

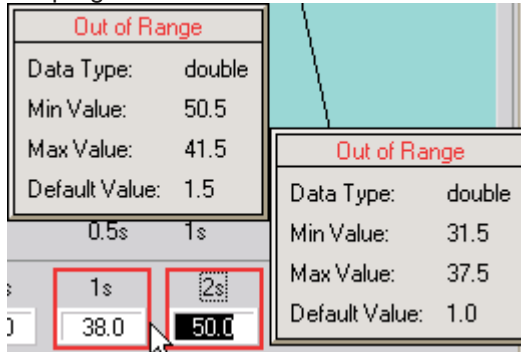


NOTE: In case of wrong input value, the automatic control will inform you that the value is not following a decreasing



curve in this way correct the wrong value, than save the data.

If the error window is hiding the wrong value, as in previous picture example, it is possible to move the windows keeping the mouse clicked on the window and moving the window around the screen:



5 FINE TUNING THE TUBE CALIBRATION

NECESSARY STEPS:

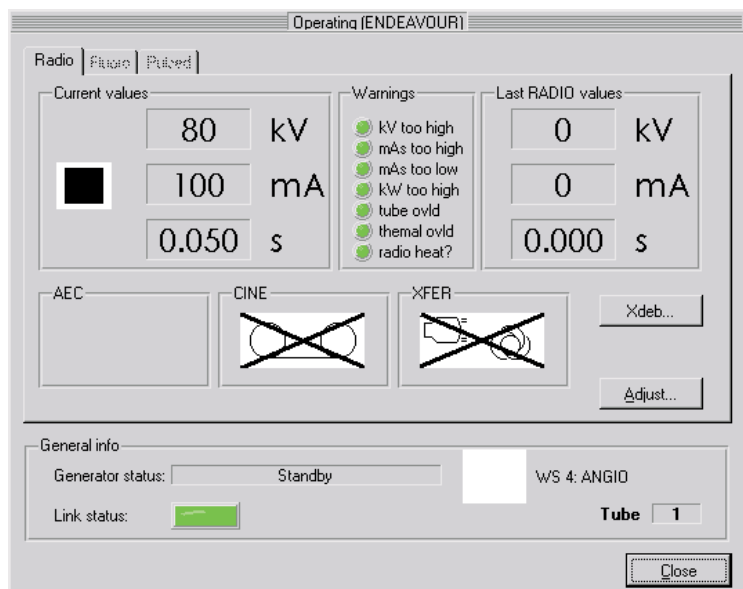
The generator is Switched ON, in Stand-By state.

The OPERATOR is logged in NAVIGATOR as Technical Service operator. The generator's CONFIGURATION has been read.

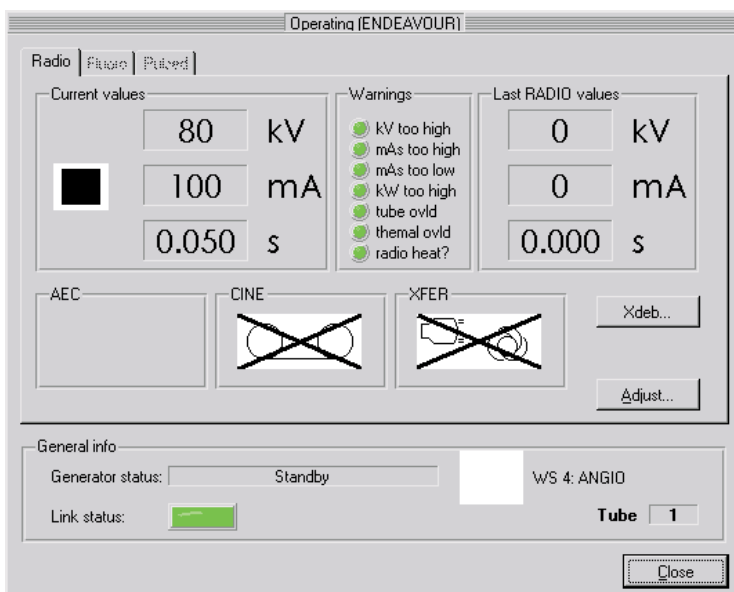
The work station is WS4 (Direct)

NOTE: In case of generator fault, consider the fault, increase of doubt stop the procedure and call Odel technical service.

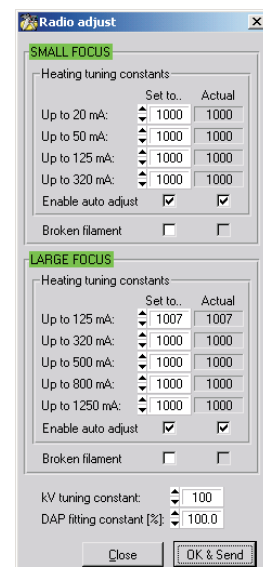
Before any further operation the first thing to do is resetting the alarm on the control console.



Left click on Operating following window open:

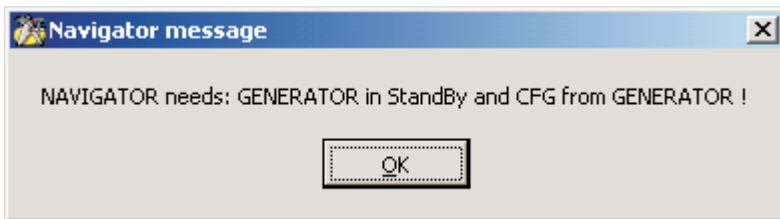


Click on to open the FILAMENT FINE TUNE WINDOW.



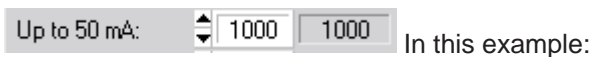
on to open the RADIO

NOTE: if configuration is not uploaded in NAVIGATOR, or generator is not in STAND-BY mode, following Error Dialog Box will appear:



5.1 FOCUS ADJUSTMENT

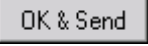
Focus Fine tune section is divided into SMALL FOCUS panel and LARGE FOCUS panel. The fine tuning is divided into several mA steps:



Up to XXXmA means all value of mA lower than XXX, including XXX, and higher than previous tab will be subjected to fine calibration.

SET TO section is the new input value of fine tune: The number is a multiplier, 1000 means ORIGINAL CALIBRATION, value are divided by 1000 and multiplied to current calibration parameters, so, a value below 1000 will move DOWN the calibration, a value above 1000 will move the calibration UP.

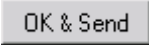
ACTUAL is the current value set in the generator.

To set the new value the pressure of  is needed and the current work station on the control console has to be changed to let the modification be accepted.

5.1.1 Calibration Auto Adjust



If this control is check marked the generator at the end of every exposure will automatically compute the new calibration step and will move previous parameters.

To disable the auto tuning process, remove the checkmark on the control and press .

5.1.2 Broken Filament Information



This item lets the Technical Service operator to inform the generator force the NO SELECTABLE focus; this means that if this control is mark-checked there will not be the possibility to select the specific focus on the control console.

5.2 KV TUNING CONSTANT

kV tuning constant:

This control is a 1/100 multiplier to kV operating parameter, as in previous section, a value below 100 will move DOWN the real kV, a value above 100 will move the real kV UP.

Always press to accept the change.


5.3 DAP FITTING CONSTANT

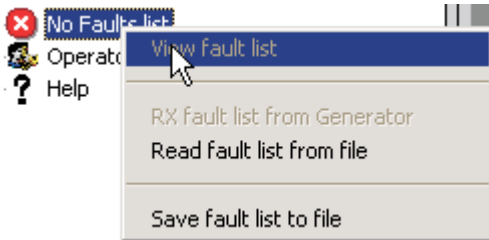
DAP fitting constant [%]:

This value acts as the previous parameter, on Dose Pulse Energy.

VACUTEK DAP chamber is factory calibrated to release 1 mG/cm² per pulse. This value is a 1/100 multilayer of the total amount of pulses recorded.

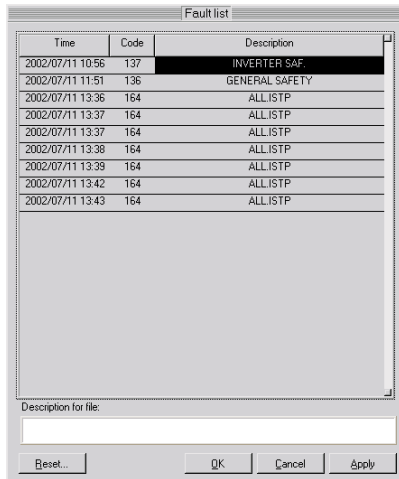
6 FAULT LIST

All Odel Spa Generators keep a track of the errors occurred in a circular buffer accessible via this item: Right clicking on the  No Faults list leaf, it is possible to access following options:



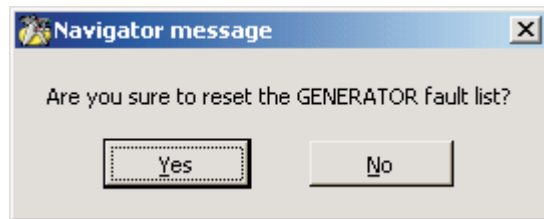
In this menu it is possible to View a loaded fault list, receive a Fault list from the generator while the generator is connected, read a fault list from file and save a fault list to a file for a successive readout or for tracking purpose.

Selecting **RX Fault list from Generator** item or left clicking on the Fault list leaf while the fault list is loaded from the

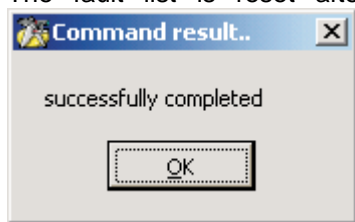


generator, the **Reset...** window is opened.

Here it is possible to associate a description to a particular fault, save the fault list, or reset the generator's fault list using the **Reset...** if the Operator is "Technical Service" logged in.



The fault list is reset after confirming it in



. Window become.

dialog box and

7 RADIOGRAPHY CALIBRATION

PRELIMINARY NOTE: STARTING THIS PROCEDURE MEANS THE ACCEPTANCE OF ALL THE FOLLOWING TERMS

THE CALIBRATION PROCEDURE REACHES THE MAXIMUM LOAD PERMITTED ON TUBE.

BE SURE TO INPUT IN TUBE CHARACTERISTICS THE CORRECT DATA FOR MAXIMUM LOAD.

EXECUTE THIS PROCEDURE IF ANY COMBINATION OF CALIBRATION IN TUBE LIBRARY DO NOT GIVE GOOD RESULTS.

FOLLOWING PROCEDURE MUST ALWAYS BE EXECUTED BY ODEL Spa TRAINED PEOPLE.

FOLLOWING PROCEDURE MUST ALWAYS BE EXECUTED STEP BY STEP.

IN ANY CASE ODEL Spa CANNOT BE CONSIDERED RESPONSIBLE FOR CALIBRATION PROCEDURE IMPROPER USE.

IN CASE OF DOUBT DO NOT PROCEED FURTHER.

7.1 NOTES ON RADIOGRAPHY CALIBRATION

Always refer to tube documentation to characteristics

Before proceeding be sure to have information regarding:

- Tube Speed Capability
- Tube Power in Low Speed on Small Filament
- Tube Power in Low Speed on Large Filament
- Tube Power in High Speed on Small Filament if available
- Tube Power in High Speed on Large Filament if available
- Tube Anode Cooling Characteristics
- Tube Stand-By current for Small Filament
- Tube Stand-By current for Large Filament
- Tube Maximal current on Small Filament
- Tube Maximal current on Large Filament

7.2 PRELIMINARY OPERATIONS

The calibration procedure will not modify the calibration inside the generator until (at the end) you press the



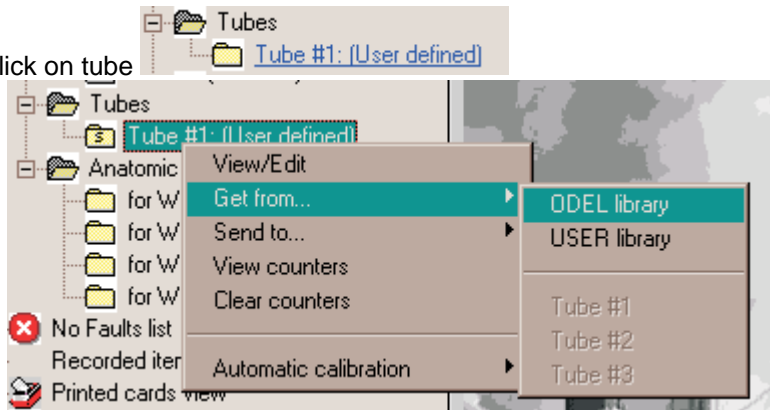
key.

Connect Navigator to the Generator.

Switch on the Generator and press OK on the control console.

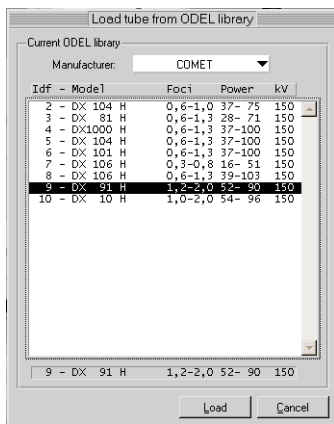
Select work station n. 4 ("NO GRID" or "DIRECT" Radiography)

IN ODEL NAVIGATOR: Right click on tube



and select from ODEL Library a tube similar in term of maximum load to the one under calibration

a tube similar in

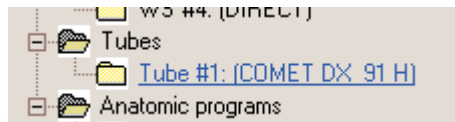


, load it and wait for

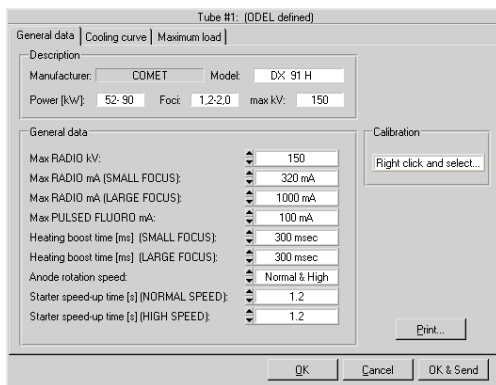


message.

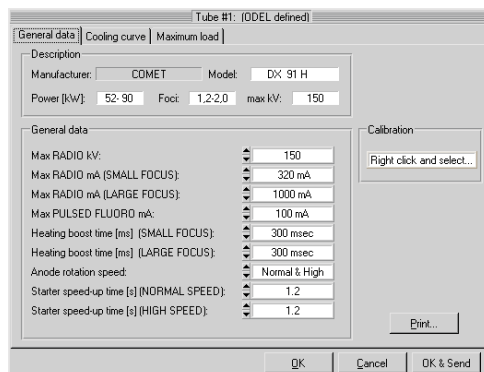
Now Left click on the tube



and check the characteristics window:



In **General data** TAB



FOCUS ON:

items:

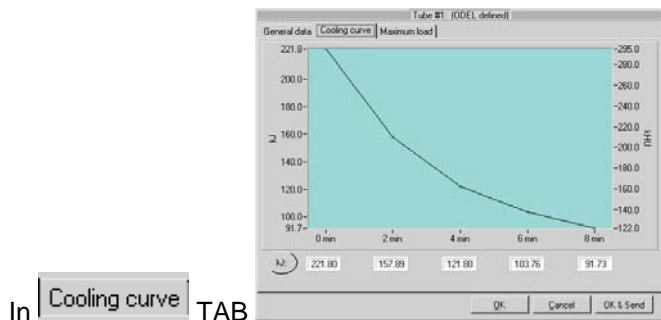
| | |
|-----------------------------|---------|
| Max RADIO kV: | 150 |
| Max RADIO mA (SMALL FOCUS): | 320 mA |
| Max RADIO mA (LARGE FOCUS): | 1000 mA |

Max RADIO mA (SMALL FOCUS): 320 mA

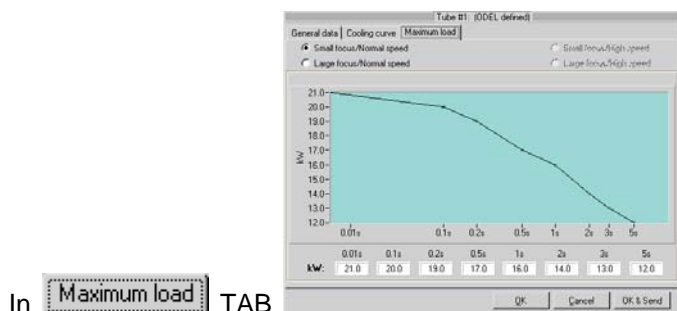
Is the maximum High Voltage Current on SMALL FOCUS during normal work, and also USED AS LIMIT during the calibration procedure; REDUCE IT as per your tube characteristics.

Max RADIO mA (LARGE FOCUS): 1000 mA

Is the maximum High Voltage Current on LARGE FOCUS during normal work, and also USED AS LIMIT during the calibration procedure; REDUCE IT as per your tube characteristics.

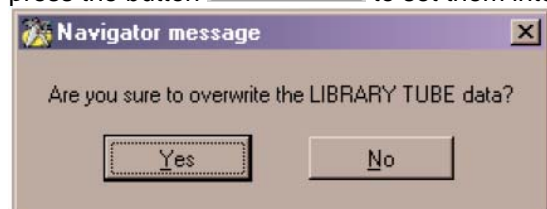


adjust the tube cooling curve characteristics.



adjust the maximum anode power curve for both Small and Large filament in normal speed, and if the High Speed Starter Option is present and the tube can turn in high speed adjust also the maximum anode power curve for both Small and Large filament in high speed.

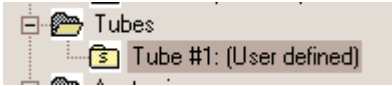
NOTE: Since all the characteristics are set in command bar **OK** **Cancel** **OK & Send** DO NOT press the button **OK & Send** to set them into generator, but simply press **OK** and in window

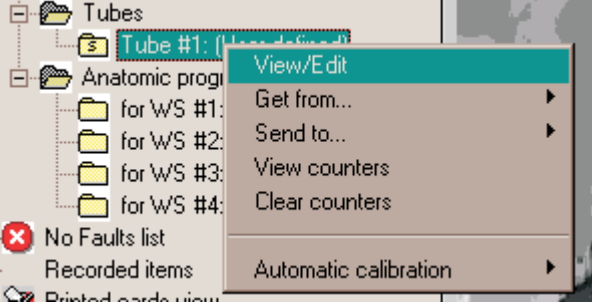




press **Yes** key to confirm locally the modifications.

7.3 STARTING THE CALIBRATION PROCEDURE

On Endeavour series of generator be sure to be in WS4 (Direct).

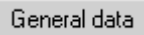
Right click on  tube #1 item in generator configuration Tree, in the item selector

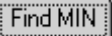
that appear  move on  and select


(left clicking) the focus to be calibrated:  THE SMALL FOCUS P.E.


A new window pops up.

The window contains 4 TABS:

 Is the FIRST tab to be filled, here is possible to setup the filament characteristics and the maximal voltage to be used during the calibration process.

 Is the SECOND tab to be considered, here you can automatically fine tune the minimum filament heating selected in previous tab.

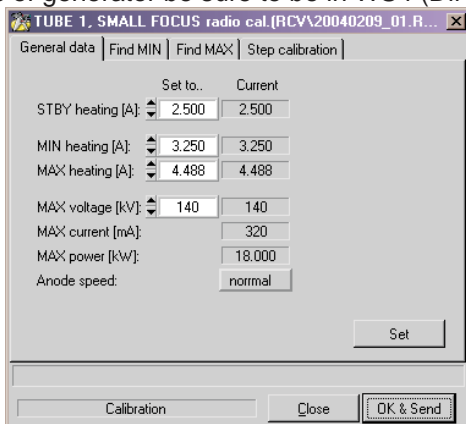
 Is the THIRD tab to be considered, here you can automatically fine tune the maximum filament heating selected in previous tab.

 Is the LAST tab to be used: the real calibration processor.

EVEN IF THE TABS ARE FREELY SELECTABLE, EVERY CHANGE MADE IN FIRST TREE TABS REQUIRE A RE-RUN ON LAST TAB STEPS.

7.3.1 General Data TAB

On Endeavour series of generator be sure to be in WS4 (Direct).

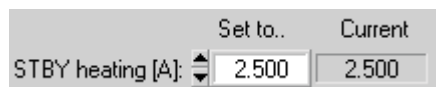


General Data TAB presents the main filament characteristic and the maximum voltage reached during calibration procedure.

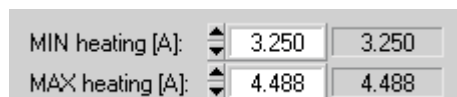
“Set to..” column represents your modification to default data.

“Current” column represents the actual data used in the procedure.

Make your modification then press  key to let the procedure accept the modified data.



STAND-BY heating current depends on tube characteristic: is the filament current during Generator ON state outside preparation or emission state. Read the tube documentation to find out this value. For standard tube, generally is 2,5 Ampere.



MIN and MAX heating current depends on tube characteristic: is the interval in which the tube emits, from the minimum permitted for the specified focus to the maximum permitted related to focus maximum load, calibration anode speed, generator power. Those value must be find out on tube documentation.

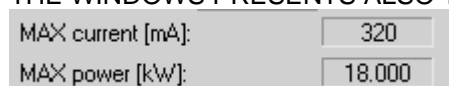
Those values can be automatically adjusted with the steps in following paragraphs.



MAX voltage is the maximal voltage the procedure will reach during calibration

Be sure to set the correct calibration high voltage to prevent tube discharge (Cold, new, heavy used or damaged tube can discharge).

THE WINDOWS PRESENTS ALSO THE MAXIMAL POWER TO BE REACHED:



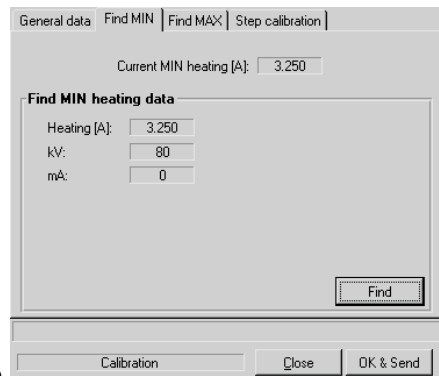
BE SURE OF THE CORRECTNESS and adjust them in tube characteristics as seen in previous chapter



Set the anode speed during calibration: if you have an High Speed Starter Option you can do the calibration steps in High Speed, otherwise in normal speed.

After selected all the parameter press  key to let the procedure accept the modifications made.

7.3.2 Minimum Filament Heating Search



The "Find MIN" Tab is an instrument to adjust automatically the value input in MIN heating [A]: 3.250 parameter in General data Tab.

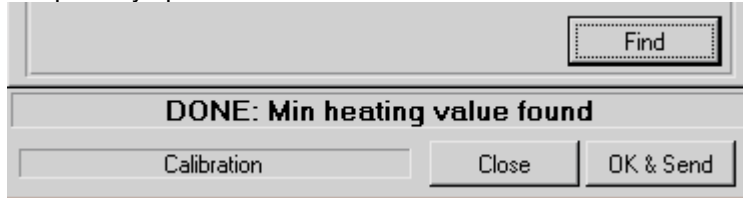


Press **Find** key to start using the instrument.

Navigator, after pressing the "find" key sends the calibration data to generator, than, in the information line will appear the writing **m0) Ready for <PREP & XRAY>**.

Press contemporarily the PREPARATION and the EXPOSURE KEY BUTTON and the control console or on the remote handswitch and let the generator do the rest.

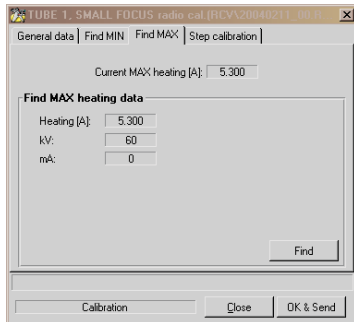
Keep always pressed the PREPARATION and EXPOSURE key until the writing



will appear on the information line.

NOTE: In case of generator fault, consider the fault, in case of doubt stop the procedure and call Odel technical service. Before any further operation the first thing to do is resetting the alarm on the control console.

7.3.3 Maximal Filament Heating Search



The “Find MAX” Tab is an instrument to adjust automatically the value input in MAX heating [A]: 5.300 parameter in General data Tab.

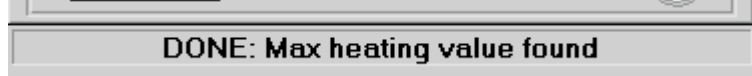


Press Find key to start using the instrument.

Navigator, after pressing the “find“ key sends the calibration data to generator, than, in the information line will appear the writing **m0) Ready for <PREP & XRAY>**

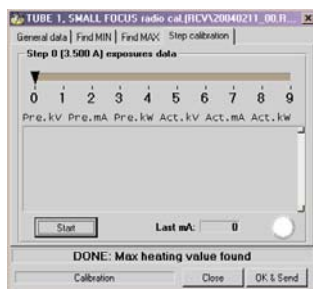
Press contemporarily the PREPARATION and the EXPOSURE KEY BUTTON on the control console or on the remote handswitch and let the generator do the rest.

Keep always pressed the PREPARATION and EXPOSURE key until the writing will appear on the information line



NOTE: In case of generator fault, consider the fault, in case of doubt stop the procedure and call Odel technical service. Before any further operation the first thing to do is resetting the alarm on the control console.

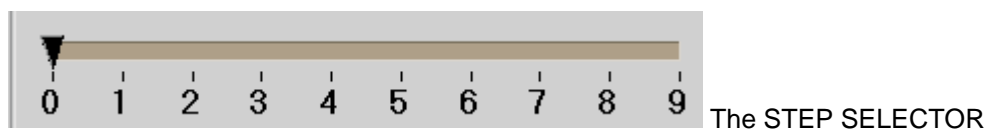
7.3.4 Calibration Steps Window

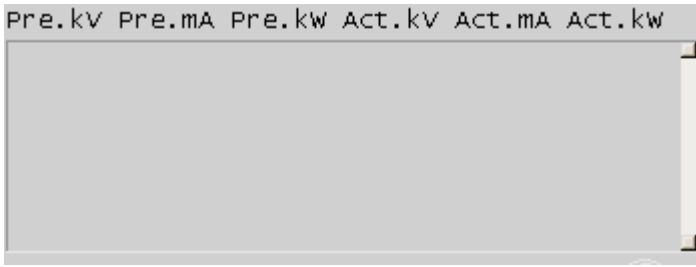


The calibration step window is divided in several sections;

Starting from the top:

Step 0 (3.500 A) exposures data The STEP INFOLINE with Filament Lighting Current





The EXPOSURES SUMMARY window



The START STEP key button



The LAST mA Info Window



The STEP PROGRESS semaphore

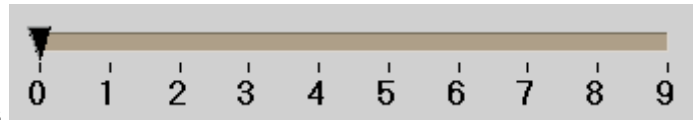


The INFORMATION LINE



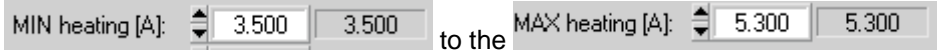
The Calibration to Generator Key buttons.

In detail:



The calibration process is divided into 10 steps

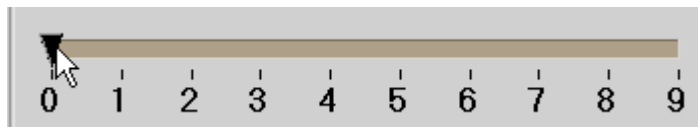
from the



found in previous paragraph.

The single step needs at least 3 radiography to compute the filament lighting coefficients needed to work with the specific tube.

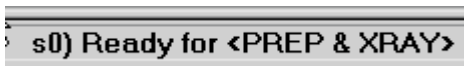
Those coefficients are stored in ODEL Tube Library for the known tube and are adjusted through the Tube Calibration Adjustment Process seen in previous chapters.



Select Step 0



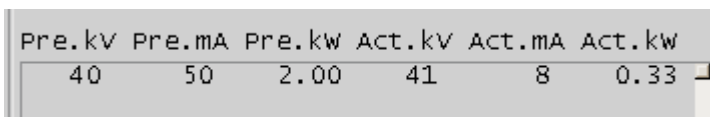
Press **Start** wait for



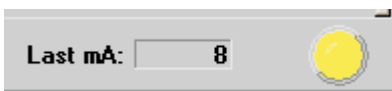
writing in info line then press both PREPARATION and EMISSION KEY.

NOTE: The anode starts rotating when EMISSION KEY is pressed.

As the first exposure is done, this is what's happening on the window:



The summary of the first exposure

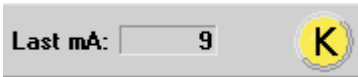


The indicator panel turns Yellow.

Keep the Preparation key and the Exposure key to make further radiography. After 3 exposures have been done this is the situation:

| Pre.kv | Pre.mA | Pre.kw | Act.kv | Act.mA | Act.kw |
|--------|--------|--------|--------|--------|--------|
| 40 | 50 | 2.00 | 41 | 8 | 0.33 |
| 50 | 8 | 0.40 | 50 | 9 | 0.45 |
| 60 | 9 | 0.54 | 61 | 9 | 0.55 |

The summary of exposure.

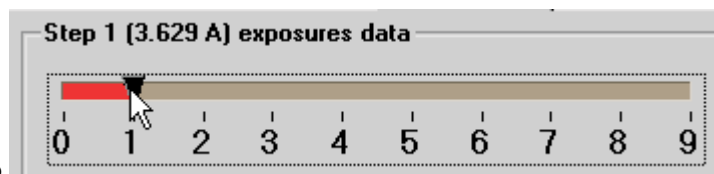
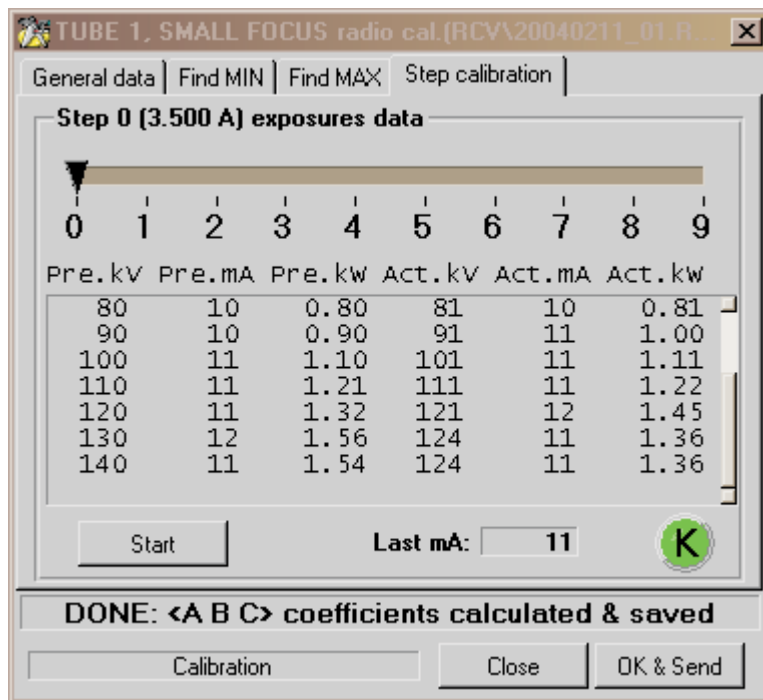


The indicator panel turns Yellow with a "K" inside. This means that the calibration coefficients are being computed.

Keep the Preparation key and the Exposure key to make further radiography.

When:

- 1) The maximal focus power is reached, or
- 2) The maximal tube voltage is reached, or
- 3) The maximal generator power is reached, and
- 4) at least 3 exposure for the single step are done, then the windows turn this way:



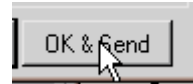
Now it is possible to select the further step

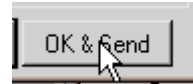
Press  again, then Preparation and Exposure Key...

Up to the last step to have a good calibration at any power output.

If at any time you get an error, try to understand the error code: tube discharge or other causes, then reset the alarm on the control consol and go on with the calibration.

AT THE END OF CALIBRATION PROCESS, TO STORE THE DATA IN THE GENERATOR, PRESS



Repeat the calibration procedure for the Large Focus pressing again  key to confirm the data transmission to the generator.