Diagnostic Imaging Specialists Corporation
163 St.Malo Street
St. Malo, MB Canada
R0A1T0

Instruction Manual for DISC Wireless AEC6 Mammo

Revision Date: May 31st, 2010

CONTACT INFORMATION:
Phone: *(204) 347 5757*
Fax: *(204) 347 5360*
Email: inquiries@disc-imaging.com
Website: http://www.disc-imaging.com

KONFORMITAETSERKLAERUNG
DECLARATION OF CONFORMITY
DECLARATION DE CONFORMITE

WE,

DIAGNOSTIC IMAGING SPECIALISTS CORPORATION
163 ST. MALO STREET, ST. MALO, MANITOBA
CANADA R0A 1T0

- ***erklaren, dass die Produkte***
- ***declare, that the products***
- ***declarons, que les produits***

DISC AEC-6MW SYSTEM consisting of the following:

Model AEC-6-MCW (Mammographic Wireless Cassette)) equipped with Mitsumi WML-C30XX wireless data transmission system.

Model BU-2071-J: Bluetooth V1.2 USB Adaptor

European Union

Model 07-AEC-6MW: Mammographic Wireless Cassette

- ***auf die sich diese Erklarung bezieht, mit den folgenden Normen ubereinstimmt:***
- ***to which this declaration relates are in conformity with the following standards:***
- ***auquels se referent cette declaration sont conforme a la norme:***

EN61010-1 Safety requirements for electrical equipment for measurement control and laboratory use
Exigences de securite pour de l'equipement electronique afin de controller les mesures et pour l'utilization du laboratoire

- ***Gemass den Bestimmungen der Niederspannungsrichtlinie:***
- ***following the provisions of the low voltage Directive:***
- ***conformement aux dispositions de la Directive basse tension:***

73/23 EWG und 93/68 EWG

Model WML-C30XX Mitsumi wireless transmission system (installed in Mammographic cassette.

To which this declaration relates are in conformity with the following standards:

Directive 1999/5/EG (R&TTE Directive):
EN 300328-2 V1.2.1 (11-2001), Radio Equipment and Systems (RES); Wideband transmission systems; Technical characteristics and test conditions for data transmission equipment operating in the 2,4 GHz ISM band and using spread spectrum modulation techniques. Part 2: Harmonized EN covering essential requirements under article 3(2) of the R&TTE directive.
EN 301489-01 V1.3.1 (09/2oo1), Electromagnetic Compatibility and radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements
EN 301489-17 V1.1.1 (09-2000), Electromagnetic Compatibility and radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for wideband data Hiperlan equipment.

Federal Communications Commission (FCC)

Model: 07-AECMC-CRW (Mammographic Cassette) equipped with Mitsumi: WML-C30XX wireless data transmission system.

"This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation." This device contains FCC-ID P00WML-C30XX

Model BU-2071-J: Bluetooth V1.2 USB Adaptor

"This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation." This device contains FCC-ID QQGBU2071J

US Food and Drug Administration (FDA)

This device is exempt from GMP and QS requirements as part of the 892-Radiographic Devices Exemption: Radiographic Quality Assurance Instruments 892-1940

January 8th, 2007

Wireless Mamchex Installation and Operating Instructions

There are two components that need to be installed for the meter to function and they should be installed in the following order:

Wireless Mamchex Excel Software Installation:

1. Insert the CD Labeled "Wireless Mamchex Excel Software" in the CD ROM drive.

2. If Auto-Run is enabled then the software installation should start automatically. If it doesn't, then click on Start, and then Run, and in the box labeled "Open:" type "x:\Setup.exe" (X refers to the CD ROM drive letter) and hit Enter.

3. Follow the installation instructions to complete the setup.

USB Dongle drivers:

Please refer to the Bluetooth setup guide for instructions on how to install the USB bluetooth dongle drivers.

Introduction

Mammo X-ray generator requirements:

The Mammo X-Ray generators AEC system has to be in good operating condition. The AEC has to be reproducible. Before calibrating the AEC, it is always a good idea to ensure that the kVp and the mA of the Mammo machine are well calibrated. Re-adjusting the kVp or the mAs will cause a shift in the AEC calibration, and you may have to re-calibrate the AEC system after re-adjusting the kVp or mA.

Note: *For the calibration tests, the Mammo machine is only used as a reproducible X-Ray source in order to do variable time sensitometry on the on the Mammo Film / Screen system.*

Steps 1 to 4 in the Mamchex mammo excel spreadsheet can be performed using any available modality on the Mammo machine. The easiest modalities to use are the linear bucky and the mag stand.

In the case of non-bucky, it may be more difficult to position the cassette and it may be more awkward to exchange the disc cassette and the Film / Screen cassette.

In the case of the HTC bucky, the bucky itself limits the available exposure time range especially at shorter exposure times.

Wireless AEC6 Mammo: General Information and Tips

1. ***Mammo Machine's AEC Sensor Positioning***: Position the X-Ray generators AEC Sensor ½" to ¾" from chest wall. This will position the Mammo Machine's AEC Sensor well within the Sensitive Area of the Disc Mamchex cassette.

   NOTE*: If the sensor is positioned too far from the chest wall, part of the sensor may be under the metal case of the Electronic cassette which will yield some undesired results.*

2. ***Positioning of the Phantom:*** The phantom has to be positioned such that it covers the entire sensitive area of the Disc Mamchex cassette(8.5cm x 7.5cm). The smaller the phantom size, the more critical the positioning becomes. Disc recommends a phantom size of 15cm x 15cm or larger if possible. however if you choose to use a smaller phantom such as a 10cm x 12cm phantom, positioning becomes very critical. The diagram below(Figure 1) shows proper positioning.

***TIP:** Once the proper positioning has been achieved, it may be useful to outline the edges of the phantom with tape such that if the phantom is removed it can be easily repositioned.*

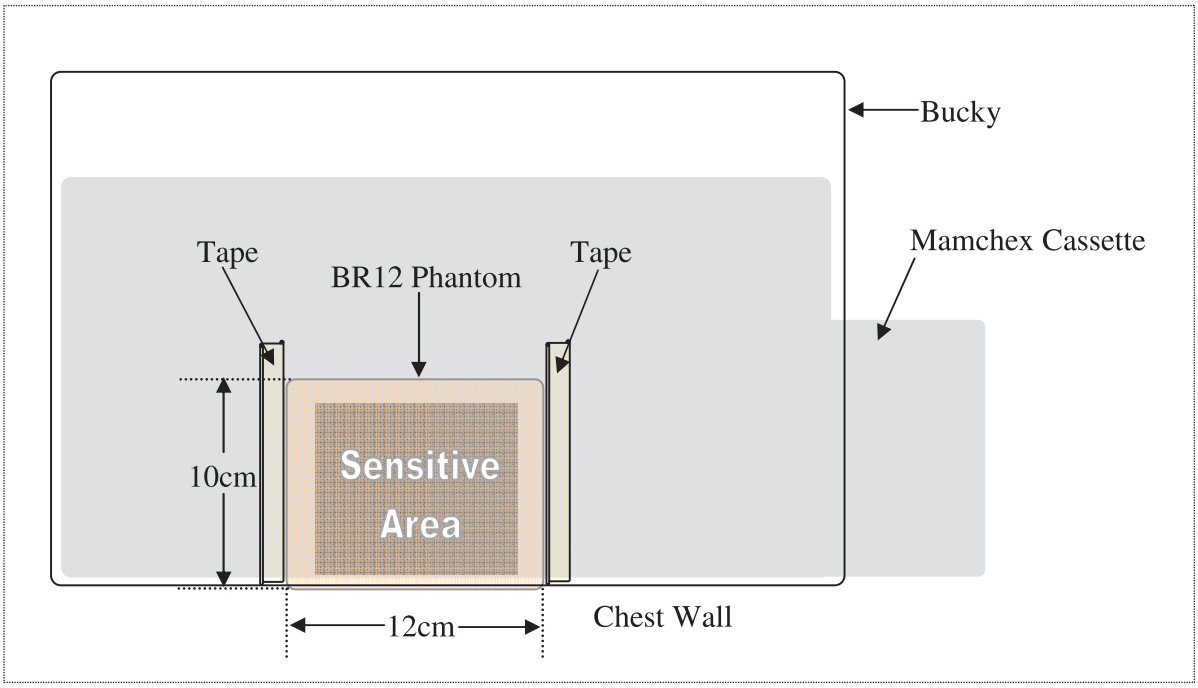


Figure 1

3. ***Choice of Film/Screen test Cassette:*** Choose a test Film/Screen cassette and use only that cassette for the 4 calibration data tests in Step 4. Differences in speed between different cassettes would cause some unwanted errors.

4. ***Choice of Mammo Film:*** The mammographic film used for the 4 calibration points must be from the same box. Differences in sensitivity between films of different emulsion numbers can also cause some unwanted errors.

5. ***Film Optical Density measurements:*** Always measure the film Optical Density at the same location on the Film. Disc recommends measuring in the centre of the film from left to right and approximately 1 ½" in from the chest wall side. This will produce consistent results.

6. ***Processor Fluctuations:*** Before starting the 4 calibration points, ensure that the processor is in good working order. Fluctuations in processor during Calibration Data tests can also introduce unwanted errors.

**TIP: Disc suggests stamping a sensitometric strip on each film before processing them. In doing this, a reference step can be measured and optical density shifts due to processor fluctuations can be monitored and corrected for.*

Procedure for using the HTC Bucky for Steps 1 to 4

Disc recommends using either a Linear Bucky or the Mag Stand to perform Steps 1 to 4 in the Mamchex software, however if you choose to use the HTC Bucky, there is a procedure outlined below which should allow you to successfully use the HTC Bucky.

IMPORTANT: For the entire procedure (Steps 1 to 4) the X-Ray Generator MUST be in fixed mA mode(100mA). Failure to do so will compromise the accuracy of the meter.

NOTE: Steps 1 to 3 can be done in any order you wish, but for the HTC bucky Attenuation Matching should be done first.

Attenuation Matching(Step 3 in software):

In order for the Mamchex Electronic cassette to predict Optical Density, it has to "look" the same as the Film / Screen cassette to the X-Ray generator, therefore the attenuation of the two cassettes should be matched as close as possible. To accomplish this, please follow this simple procedure:

Technique: Use Large Focus, 25kVp, 4cm phantom. Turn AEC "ON" and select "0" density setting.

1. Insert the Test Cassette(loaded with unexposed Mammo test film) into the bucky and make an exposure.

2. Record the mAs from the X-Ray generator on the Excel Spreadsheet in Cell "C43" and press Enter.

   TIP: *It is important to press the Enter key after you've manually recorded data onto the spreadsheet. If you don't, the spreadsheet will be in "Edit Mode" and none of the action buttons on the spreadsheet will appear to work. If this happens either press enter or single click on a different cell.*

3. Disc suggests that you start with the drawer in and 0.1mm Al installed in drawer. Place the Mamchex cassette in the Bucky and make an exposure.

4. Record the mAs value from the X-Ray generator on the Excel spreadsheet in cell "C41". Click on the "Check Absorption" button located next to Step 3 to calculate the difference.

5. If the attenuation of the two cassettes is within 5%, the test status cell(F43) will say "Pass" and turn green and you may continue or if you want you can touch up the attenuation to match even closer.

   TIP: *Pieces of unexposed film cut to the size of the Al filters may be used to fine tune the attenuation of the Mamchex cassette. If possible the attenuation of the Mamchex cassette should be the same, or slightly Higher than the Test cassette. Refer to table 1 for attenuation values for various filter materials.*

6. If the attenuation of the two cassettes isn't within 5% then you will have to remove the drawer located on the front of the Mamchex electronic cassette, and add the appropriate amount of attenuation material to bring the Mamchex Electronic cassettes mAs as close as possible to the Test Cassette's mAs.(Refer to Table 1 below)

7. Once the cassettes are matched as close as possible, you may proceed to kVp Selection Test(Step 1 in software)

Table1- mAs Increase for various Attenuation materials(*Values are approximate)*

Piece of X-ray film:	**2%**
Plastic Drawer:	**7%**
Al Filter(0.1mm):	**18%**
Al Filter(0.2mm):	**35%**

Kvp Selection Test(Step 1 in software):

*****IMPORTANT*****: **When using the HTC Bucky, this step is critical**.

1. Position 4cm of Phantom material on the bucky using "Figure 1" as a reference for proper positioning.

2. Position the compression paddle at least 1cm above the phantom. This prevents the X-Ray generator from going into reduced mA mode.

   NOTE: If the machine goes into reduced mA mode, the calibration data will not be valid and errors will be detected in the data validation process.

3. Set the X-ray generator to 26 kVp, 0 on the Density Selector, Auto-Time, Moly filter.

4. On the Excel spreadsheet in the Mamchex Mammo Software, highlight cell C15 by single clicking on it. An arrow should appear to the right of the cell. Click on the arrow and a

list should appear. Select 26 kVp by clicking on it. If it doesn't say HTC in cell "C19" then change it to HTC.

5. Click on the Reset button located beside Step 1, wait approximately 2 to 3 seconds, or wait till the text in the Excel Status Bar(located in the bottom left corner of the screen) says ready for exposure, then make an exposure and observe the exposure rate(located on the Excel Spreadsheet in Cell "F17").

   NOTE: The goal for this test, when using the HTC Bucky, is to choose a kVp that will yield the rate as close to the lowest permissible rate(80) as possible. Increasing the kVp will increase the rate. Although the Disc Target Rate for this test is 80 to 450, when the HTC bucky is used, choosing a higher exposure rate(ex: 400) could yield an exposure time that is shorter than the HTC bucky would allow, consequently the HTC bucky would terminate the exposure, and not allow the Step 4: Calibration Data Tests to be done.

6. Choose the lowest kVp that will still keep you within the permissible exposure rate range.(80 to 450 with HTC bucky)

Reproducibility Test(Step 2 in software):

NOTE: *The technique that was used for Step 1, will be used for Step 2 and Step 3.*

This step is done to ensure that the X-Ray Generator is reproducible before continuing. To perform this test, simply do the following:

1. Click on the Reset button located beside Step 2 and wait for the Excel Status Bar(*located on the bottom left corner of the screen*) to say "Ready for Exposure".

2. Make an exposure. You will notice a number appears in cell C29. This is the Exposure Rate(AEC# / Exposure Time).

   NOTE*: This number should also match the exposure rate in cell F17 from Step1. If it doesn't closely match, then something in the technique being used is different from Step 1.*

3. Repeat this procedure two more times. Numbers will appear in cells C31 and C33 respectively and the average exposure rate and maximum deviation will be calculated. If the reproducibility of the X-ray generator is within 5%, the Test Status indicator(cell F33) will say PASS and turn Green and you may continue, however if this test fails then measures should be taken to discover the source of the reproducibility failure before continuing.

4. Remove the Mamchex electronic cassette and insert the Test cassette(loaded with unexposed Mammo test film).

5. Take an exposure at 0 density setting, process the film, and measure the O.D. If the measured O.D. is not within the range of 1.4 to 2.0 then you should touch up the AEC calibration of that kV station to an produce an O.D. between 1.7 to 1.9 at the 0 Density Selector position. This is simply to make sure that there is enough range on the Density selector to achieve the Target O.D.'s required in Step 4: Calibration Data Tests.

Calibration Data Tests(Step 4 in Software):

Before your Disc Mamchex Meter can calculate/predict film O.D., you must establish a link between the Disc AEC# and the film O.D.

This Step(Step 4) consists of a total of 8 exposures. Four of them are done with the Mamchex electronic cassette and four are done with the Film/Screen cassette.

Tests 1 and 2 of the calibration data tests(Step 4 in Excel Software) establishes a link between the Disc AEC# and the film O.D. at a high radiation rate(Thin Phantom and short exposure times).

Tests 3 and 4 of the calibration data tests(Step 4 in Excel Software) establishes a link between the Disc AEC# and the Film O.D. at a low radiation rate(Thicker Phantom and long exposure times).

Test1:

Note: *The phantom thickness and kVp should still be the same as in kVp Selection(Step 1 in software).*

The main goal for Test1 is to get a film Optical Density in the range of **1.2 to 1.6**. The only setting that can be changed to obtain the correct O.D. is the Density selector. The Default setting for Test1 is **-1**, but this may have to be changed depending on the state of calibration of the X-Ray generator.

Refer to the Optical Density that was measured earlier in Step 2, #5 to determine what density selector step should be used for Test1 to obtain an O.D. within the range of **1.2 to 1.6**.

Example: If the Optical Density measured in Step2 was 1.9 and the average O.D. increase/decrease per step is 0.2, then you would want to set the machine to -2 to get within the range for this test.

1. Set the density selector to the appropriate step to achieve a density between **1.2 and 1.6**.

2. Insert the Test cassette(loaded with unexposed mammo test film) into the bucky.

3. Take an exposure, develop the film and measure the Optical Density(If necessary, you may refer to the General information and Tips section for O.D. Measurement technique).

4. If the Optical Density isn't within the range of **1.2 to .1.6**, then adjust the density selector accordingly and take another test film and measure it.

5. Once the measured Optical Density is within **1.2 to 1.6**, then enter the Optical Density value in cell "**B59**"on the Excel Spreadsheet and the mAs from the X-Ray generator in cell "**B58**" and then press Enter.

6. Remove the Test cassette and replace it with the Mamchex electronic cassette.

7. Click on the button labeled "**Test1"**, wait till the Excel Status Bar says ready for exposure, and then make an exposure. You will notice that the values for AEC#, Exposure Time and Mult Exp. are filled in automatically for you(Cells B54, B55, and B61 respectively).

8. Enter the mAs observed from the X-Ray Generator in cell "**B57**" and press enter

Test2:

Note: *The phantom thickness and kVp should still be the same as it was in Test1.*

The main goal for Test 2 is to get a film Optical Density in the range of **2.0 to 2.4**. The density selector should be used to obtain the correct O.D. The Default Density selector value for Test 2 is **+2**, but this may have to be changed depending on the state of calibration of the X-Ray generator.

Refer to the Optical Density that was measured in Step 2, #5 to determine what density selector step should be used for Test2 to obtain an O.D. within the range of **2.0 to 2.4**.

Example: If the Optical Density measured in Step2 was 1.9 and assuming an average O.D. increase/decrease per step of 0.2, then you would want to set the machine to +1(~2.1 O.D.) or +2(~2.3 O.D.) to get within the range for this test.

1. Set the density selector to the appropriate step to achieve a density between **2.0 and 2.4**

2. Insert the Test cassette(loaded with unexposed mammo test film) into the bucky.

3. Take an exposure, develop the film and measure the Optical Density.

4. If the Optical Density isn't within the range of **2.0 to 2.4**, then adjust the density selector accordingly and take another test film and read the O.D.

5. Once the measured Optical Density is within **2.0 to 2.4**, then enter the Optical Density value in cell "**C59**"on the Excel Spreadsheet and then enter the mAs from the X-Ray generator in cell "**C58**" and press Enter.

6. Remove the Test cassette and replace it with the Mamchex electronic cassette.

7. Click on the button labeled "**Test2"**, wait till the Excel Status Bar says ready for exposure, and then make an exposure. *You will notice that the values for AEC#, Exposure Time, and Mult Exp are filled in automatically for you(Cells C54, C55, and C61 respectively).*

8. Enter the mAs observed from the X-Ray Generator in cell "**C57**" and press enter

Test3:

NOTE: You must now change the phantom thickness to 5.5cm. Normally the software defaults to 6cm(2cm higher than Tests 1 and 2), but to ensure that the exposure times aren't too long for the HTC bucky, 5.5 cm should be used instead.

The main goal for Test3 is to get a film Optical Density in the range of **1.2 to 1.6**. The density selector must be used to obtain the correct O.D. The default density selector value for Test 3 is **-1**, but this may have to be changed depending on the state of calibration of the X-Ray generator.

If the kV station that was selected in Step1 is well calibrated, then you should be able to use the same density selector setting as in Test1 to obtain the correct O.D.

1. Set the density selector to the appropriate step to achieve a density between **1.2 and 1.6**.

2. Make sure that the phantom is set to **5 ½ cm**.

3. Insert the Test cassette(loaded with unexposed mammo test film) into the bucky.

4. Take an exposure, develop the film and measure the Optical Density(If necessary, you may refer to the General information and Tips section for Measurement technique).

5. If the Optical Density isn't within the range of **2.0 to 2.4**, then adjust the density selector accordingly and take another test film and measure it.

6. Once the measured Optical Density is within **2.0 to 2.4**, then enter the Optical Density value on the Excel Spreadsheet in cell "**E59**"and the mAs from the X-Ray generator in cell "**E58**" and then press Enter.

7. Remove the Test cassette and replace it with the Mamchex electronic cassette.

8. Click on the button labeled "**Test3**", wait till the Excel Status Bar says ready for exposure, and then take an exposure. *You will notice that the values for AEC#, Exposure Time, and Mult Exp are filled in automatically for you(Cells E54, E55, and E61 respectively).*

9. Enter the mAs observed from the X-Ray Generator in cell "**E57**" and press enter

Test4:

Note: *The phantom thickness and kVp should be the same as for Test3.*

The main goal for Test 2 is to get a film Optical Density in the range of **2.0 to 2.4**. The density selector should be used to obtain the correct O.D. The Default Density selector value for Test 4 is **+2**, but this may have to be changed depending on the state of calibration of the X-Ray generator.

If the kV station that you are using is well calibrated, then you should be able to use the same density selector setting as in Test2 to obtain the correct O.D for Test4.

Example: If the optical Density obtained in Test 3 was 1.5 and the Density Selector was set to – 2, then you would need to set the density selector to +1(~2.1 OD) or +2(~2.3 OD) to get you within the range for this test(2.0 to 2.4).

1. Set the density selector to the appropriate step to achieve a density between **2.0 and 2.4**.

2. Insert the Test cassette(loaded with unexposed mammo test film) into the bucky.

3. Take an exposure, develop the film and measure the Optical Density.

4. If the Optical Density isn't within the range of **2.0 to 2.4**, then adjust the density selector accordingly and take another test film and read the O.D.

5. Once the measured Optical Density is within **2.0 to 2.4**, then enter the Optical Density value in cell "**F59**"on the Excel Spreadsheet and then enter the mAs from the X-Ray generator in cell "**F58**" and press Enter.

6. Remove the Test cassette and replace it with the Mamchex Electronic Cassette.

7. Click on the button labeled "**Test4"**, wait till the Excel Status Bar says ready for exposure, and then take an exposure. *You will notice that the values for AEC#, Exposure Time, and Mult Exp are filled in automatically for you(Cells F54, F55, and F61 respectively).*

8. Enter the mAs observed from the X-Ray Generator in cell "**F57**" and press enter

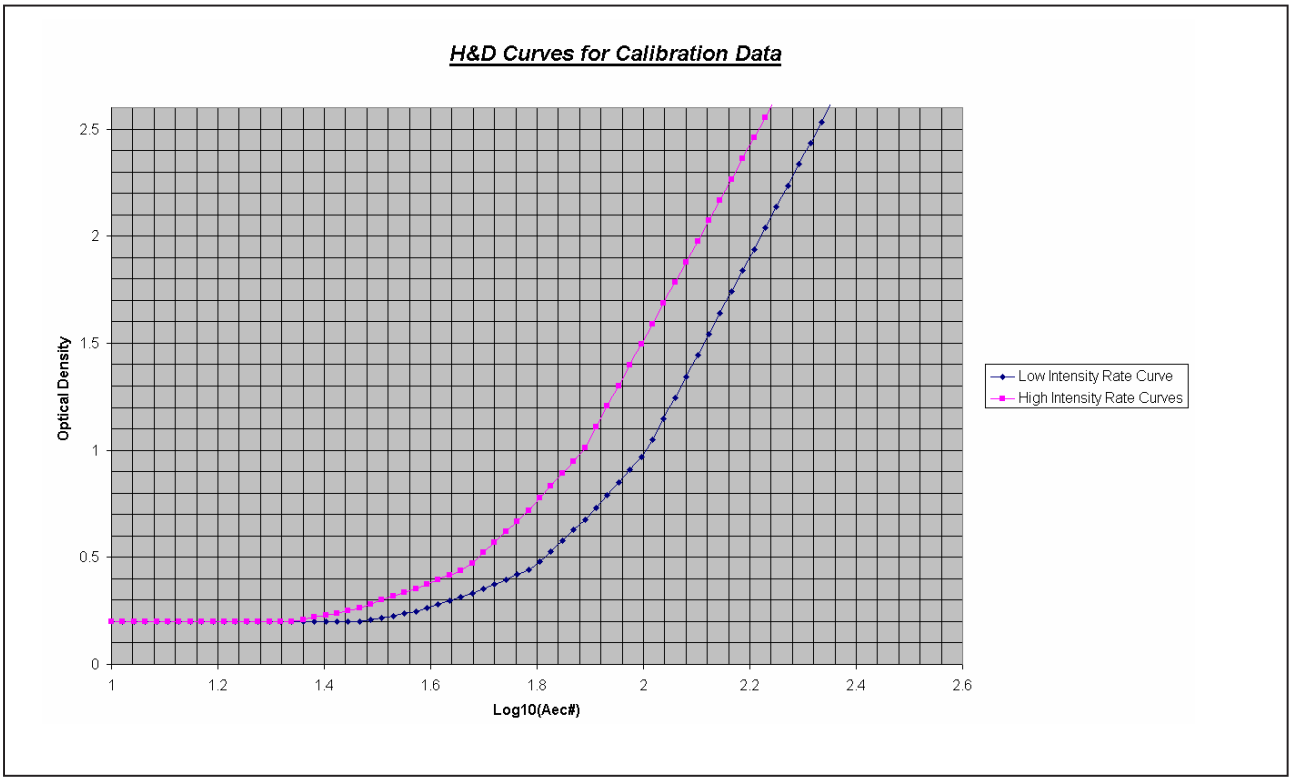
Data Verification:

Once Step 4 is completed, click on the Verify Data button. The Data verification is a procedure that performs calculations and comparisons to trap errors such as exposure rate differences and O.D.'s that aren't within the suggested ranges.

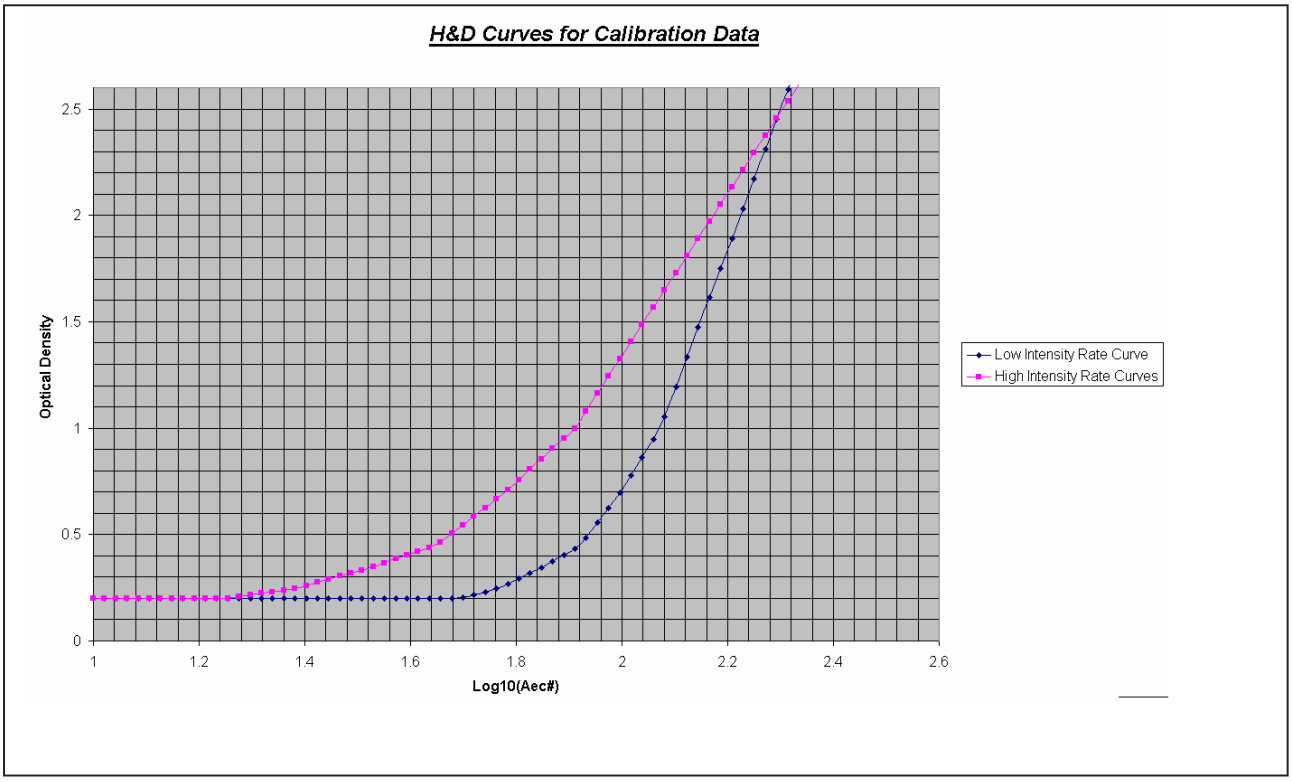
Once the data has been verified, it is suggested to view the H&D curves before proceeding to the OD Meter mode. To view the H&D curves, simply click on the tab on the bottom of the screen that's labeled "H&D curves of calibration data". The curve on the left is the high intensity rate curve, and the curve on the right is the low intensity rate curve. For a good set of calibration data, the two curves should be parallel or separating slightly towards the top of the curves. If the curves cross each other, then there is a problem with the calibration data. The processor may be fluctuating or the optical densities may have been entered incorrectly.

Below are two sets of H&D curves. The first one represents a good set of calibration data, and the second one represents a set of calibration data that has a problem. The lines should be relatively parallel or getting slightly farther apart at the top, but they should never cross each other.

Example of good calibration data curves



Example of calibration data curves with a problem



OD Meter Mode

Once the data verification has been done, and the H&D curves have been verified, the meter is now ready to predict optical density. There are two different O.D. meter modes.

Note: Now would be a good time to save. The file should be named such that it describes where and when the calibration was done to simplify recalling the data later.

1. *O.D. meter mode(simple mode):* The meter functions basically like most handheld meters. When the meter is reset, the previous O.D will disappear and will be replaced by the next exposure. This mode is useful if no written record of each exposure is required.

To use this mode simply click on the O.D. Meter Mode button on the excel spreadsheet labeled "Calibration Data" on the tab. A screen will appear labeled O.D meter mode(simple mode). Click on the Reset button and when the meter is ready for the exposure, make the exposure. The predicted optical density will be displayed along with the AEC#, exposure time, and MExp. MExp stands for Multiple exposures. This number indicates how many exposure segments were seen. For certain X-Ray generators such as the Lorad MIV, there can be as many as 4 or 5 exposure segments due to scout exposures and resetting of the grid.

Note: The O.D meter mode button will only appear after the Data verification has been completed.

2. *O.D. Meter mode with Data storage:* The meter will record the exposure data such as Optical Density, AEC#,Exposure time, and Mexp to a spreadsheet. This mode is useful to keep a record of all the exposures taken.

To use this mode, click on the tab labeled "O.D. Meter Mode" on the bottom of the screen.

In this mode, to reset the meter, highlight(single click) a cell under the O.D. column and press Ctrl + R. Wait till the text in the Excel Status bar says "Ready for Exposure" and then make the exposure. The values for O.D., AEC#, Exposure Time, and Mexp should be filled in automatically.

You may fill in the rest of the values for kVp, Grid, Filter, etc… Highlighting(single click) any of the cells under the F, G, H, I, J, or K columns will display an arrow to the right of the cell. Clicking on this arrow will show a list of available values. Select the value that's indicative of the exposure that was just taken.

Specifications:

X-ray energy dependence: Simulates relative light output of Green Rare Earth Screens within +/- 3% over kVp range of 20 to 32 kVp and a patient equivalent thickness range of 2 to 8 cm (within specified operating rates).

Digital range: Mammo AEC#; 0 to 6553.5

Minimum GRN AEC# Rate: 15.0/sec (approx 1.5 mR/sec cassette exposure rate)

Maximum GRN AEC# Rate: 3000/sec (approx 300 mR/sec entrance exposure rate)

Power On/Off: Manual switch

Controls: Software Reset control.

Functions: Measures Mammo AEC#; Calculates Optical Density Value from Mammo AEC#.

Power requirements: Internal Rechargeable 9.6V batter pack.

Typical battery life: Greater than 15 hrs.

Operating environment: 59 degrees to 95 degrees F (15 to 35 degrees C)

***Electronic Cassette*:**

Dimensions: 10 x 12 x 0.5 inches (24 x 30 x 1.3 cm)
Weight: 3.9 lb (1.8 kg)

Software: Microsoft Excel Template Software CD including Instruction Manual.

LIMITED WARRANTY

Automatic Exposure Control, Wireless version 6, System (AEC6MW System)

This product, except the use, is warranted by Diagnostic Imaging Specialists Corporation (DISC), to the original purchaser to be free from defects in material and workmanship under normal use for a period of one (1) year from the date of purchase. During the warranty period, and upon proof of purchase, the product will be repaired or replaced (with the same or similar model) at our option, without charge for either parts or labor at the DISC factory. The purchaser shall bear all shipping, packing, and insurance costs to the DISC factory. The warranty will not apply to this product if the product has been misused, abused, or altered. Without limiting the foregoing, bending or dropping of unit, broken electrical wires, visible cracking of the product components and/or enclosures are presumed to be defects resulting from misuse or abuse.

NEITHER THIS WARRANTY NOR ANY OTHER WARRANTY EXPRESS OR IMPLIED, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY, SHALL EXTEND BEYOND THE WARRANTY PERIOD. NO RESPONSIBILITY IS ASSUMED FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITING THE SAME TO MATHEMATICAL ACCURACY OR PRECISION OF THE PRODUCT. SOME PROVINCES AND OR STATES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS AND SOME PROVINCES AND OR STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THAT THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY.

This warranty gives the product owner specific legal rights, and the owner may also have other rights which vary from province to province or state to state.