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DISC

Diagnostic Imaging Specialists Corp

Instruction Manual for DISC QA Mamchex Meter

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Using the QA Mamchex

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Section 1: Theory of Operation (two operating modes)

QA Mode

The QA Mamchex measures the X-ray exposure at the imaging plane and calculates the following values:

1. MamLU (Mammo Light Units): This value is directly proportional to the light produced by the CR mammo imaging plate when scanned by laser light in the plate reader.
2. Relative Speed: Establishes a relationship between typical mammo film screen operating speeds and CR mammo operating speeds (20,000/MamLU; note: typical mammo film/screen systems operate within a range of 100 to 180 speed).

Dosimeter Mode

The QA Mamchex meter accurately calculates and displays dosimeter values (mR & uGy) at three NIST traceable techniques.

1. Mo/Mo 25 (25 kVp, Mo/Mo anode/filter combination and no added filtration (Fuji).
2. Mo/Mo 25X (25 kVp, Mo/Mo anode/filter combination with 2 mm Al added filtration at the tube.
3. Mo/Mo 28X (28 kVp, Mo/Mo anode/filter combination with 2 mm Al added filtration at the tube (Carestream/Kodak).

Section 2: QA Mode

Operating Instructions

1. To turn on meter: press and release “Power/Reset” LCD displays operating mode.
2. To select operating mode: Press and release “Power/Reset” to toggle through operating modes until desired operating mode appears on LCD. Select QA Mode and wait 10 seconds to lock in this mode.
3. Check battery level: If level is “Low”, plug in charger for at least ½ hr.
4. To make meter ready for exposure: Press and release “Power/Reset”. LCD now displays “Ready for Exposure”. Take an exposure and LCD displays the MamLU and Speed values. (Note: When LCD displays “Ready for Exposure”, to go back to “Waiting for Reset”, press and release “Power/Reset”).
5. To turn meter off: Press and hold “Power/Reset” until LCD displays “Power Down”, then release “Power/Reset”. (Note: if meter is not used for 10 minutes, it will turn off).

NOTE: The following procedures assume that the X-Ray machine and Plate Reader have been calibrated and ‘calibration reference values’ have been established; to establish ‘calibration reference values’, follow the procedures below just after the X-Ray machine and Reader have been calibrated.

Attenuation Matching the Mamchex Cassette to Imaging Cassette

In order for the Mamchex cassette to ‘look’ the same to your Automatic Exposure Control (AEC) as your CR imaging cassette, the Mamchex Cassette has to be ‘attenuation matched’ to your imaging cassette!

1. Technique: Use large focus; 25 kVp; large 2 mm Aluminum filter (provided) on Table Top; Turn AEC ‘On’ and select ‘0’ density setting; Mo/Mo selection.
2. Insert your imaging cassette into the Bucky and make an exposure; observe mAs.
3. Insert Mamchex cassette into the Bucky and make an exposure; if the mAs does not ‘match’ that made with the imaging cassette in step 2, pull out drawer from Mamchex cassette and ‘add’ or ‘remove’ aluminum ‘shims’ (use paper shims for minor adjustment) and make exposures until mAs ‘matches’ that of the imaging cassette +/- 5%.
4. Push the drawer with ‘shims’ back into cassette and lock.

Checking X-Ray System Calibration Drift (one shot)

NOTE: Make sure that the QA Mamchex cassette is attenuation matched to the imaging cassette!

1. Insert Mamchex cassette into Bucky (make sure Mamchex LCD indicates “Ready for Exposure”).
2. Place the large 2 mm Aluminum filter (provided) on Table Top and ‘open’ light/radiation field to size of cassette.
3. Technique: Large focus; 27 kVp; AEC to ‘ON’; ‘0’ density setting; Mo/Mo.
4. Make exposure, observe MamLU value from LCD and enter it into data sheet provided (hard copy or excel) and plot value on MamLU graph provided.
5. Observe mAs value from X-ray machine and enter value into data sheet and plot value on mAs graph(or Excel template). Remove Mamchex cassette.
6. If X-ray machine AEC calibration has not drifted, the MamLU value will not change from day-to-day; if X-ray tube output has not drifted, the mAs value will not change from day-to-day.

Checking Plate Reader Calibration Drift (2 shots)

1. Place Mamchex cassette on Table Top. Make sure LCD indicates “Ready for Exposure”.
2. Place the large 2 mm Aluminum filter (provided) on top of Mamchex cassette and centre light/radiation field to Aluminum filter/Mamchex cassette.
3. Select Manual Mode on X-Ray machine.
4. Select 27 kVp, Mo/Mo anode filter on X-Ray machine (this kVp and anode/filter will always be used for this X-ray machine for future tests).
5. Select 20 mAs on X-Ray machine.
6. Make an exposure and read MamLU value. If MamLU value is not between 100.0 to 102.0, adjust mAs until MamLU is 102.0 or slightly higher; If MamLU is greater than 102.0, add ‘sealed paper filters’(provided) and try again until MamLU is between 100.0 and 102.0. (This filtration will be used for future tests).
7. Once ‘reference exposure’ technique has been achieved in Step 6, replace Mamchex cassette with freshly erased CR “test” imaging cassette. Position Aluminum and paper filters used in Step 6 on top of test cassette.

8. Make exposure using 'reference technique' established in Step 6.
9. Wait 10 minutes and process 'Imaging Plate' in 'Reader' using appropriate before processing 'flat field' corrected image menu.
10. Read and record exposure indicator value from plate reader on Data Sheet(provided) and plot value on reader graph.
11. If plate reader calibration has not changed, exposure indicator value will not change from week-to-week.

Checking AEC for "breast thickness" and 'kVp' Tracking

Make sure that the QA Mamchex cassette is attenuation matched to the "test" imaging cassette.

1. Place 'Electronic Cassette' in Bucky & select AEC 'mode'; '0' density. Select desired kVp unless kVp is selected automatically. Position AEC 'sensor' 2 cm from chest wall.
2. Select desired 'phantom material thickness' and place phantom on breast support top. Collimate light/radiation field to size of phantom. Use breast equivalent phantom of minimum size: 15 x 15 cm (6"x 6")
3. Make exposures and record 'MamLU' values as 'phantom thickness' changes.
4. Select desired 'kVp', if possible, and hold 'phantom thickness' constant.
5. Make exposures and record 'MamLU' values as 'kVp' changes.

Analyzing the Results:

NOTE: Mammographic CR AEC systems can be calibrated for one of three possible outcomes.

1. Screen/film calibration where the MamLU increases as 'breast thickness' increases (this calibration includes 'compensation' for film 'reciprocity failure')
2. Constant EI value where the 'light output' from the CR imaging plate remains constant as 'breast thickness' and 'kVp' varies. MamLU should stay constant +/- 10%.
3. Increasing MamLU with 'breast thickness' where the 'light output' from the CR imaging plate increases to maintain the appropriate (EUREF) Contrast to Noise Ratio (CNR).

Section 3: Dosimeter Mode

The QA Mamchex meter accurately calculates and displays dosimeter values at three specific NIST Mammographic techniques:

1. Mo/Mo 25 (Fuji): 25 kVp; Mo/Mo anode/ filter; no added filtration
2. Mo/Mo 25X: 25 kVp; Mo/Mo anode/filter; 2 mm Al filter @ tube
3. Mo/Mo 28X (Carestream/Kodak): 28 kVp; Mo/Mo anode/filter; 2 mm Al filter @ tube

Operating Instructions: Plate reader calibration assessment

1. Turn meter “On” by pressing “Power/Reset”
2. Press on “Power/Reset” to toggle through the operating modes until desired NIST Dosimeter Mode is displayed; wait 10 seconds to lock in this mode.
3. LCD displays “Waiting for Reset”
4. Press “Power/Reset” and LCD displays “Ready for Exposure”
5. Make exposure using the NIST technique selected (use small 2mm Al filter supplied with QA Mamchex for the 25X and 28X NIST techniques).
6. LCD displays dosimeter values for selected NIST technique.

NOTE: The QA Mamchex can be used by service engineers to re-calibrate the plate reader’s exposure indicator values (S#, EI#) to manufacturers specifications. QA personnel use the QA Mamchex to establish relationships between exposure indicator values and manufacturers recommended dosimeter values.

Section 4: Specifications

X-ray energy dependence: Simulates relative light output of Photostimulatable Phosphor Plate (PSP) within +/- 3% over kVp range of 22 to 30kVp and a patient equivalent thickness range of 2 to 8 cm (within specified operating rates).

Digital range: Mammographic Light Units; MamLU : 0 to 5000

Minimum MamLU Rate: 35 / sec (approx 3.5 mR/sec entrance exposure rate)

Maximum MamLU Rate: 25000/sec (approx 2500 mR/sec entrance exposure rate)

Power On/Off: Manual switch

Controls: Pressure sensitive reset switch to reset microprocessor & LCD display

Functions: Measures MamLU (Mammo AEC#); Calculates Relative Speed, Calculates Dosimeter values at three NIST traceable mammographic beam conditions.

Power requirements: Built-in NiMH rechargeable battery pack (9.6 V)

Typical battery life between charging: Greater than 15 hrs.

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

L-Shaped Bracket included for 24 x 30 Bucky

AC/DC Adapter: Input: 120 to 220 VAC; Output: 15VDC @ 1.3 Amp

Electronic Cassette:

Dimensions: 18 x 24 cm

Weight: 3.9 lb (1.8 kg)

Software: Microsoft Excel CD,

Carestream Reader Datasheet

Hospital/Clinic:

Reader Mfg: **Carestream**

Reader ID:

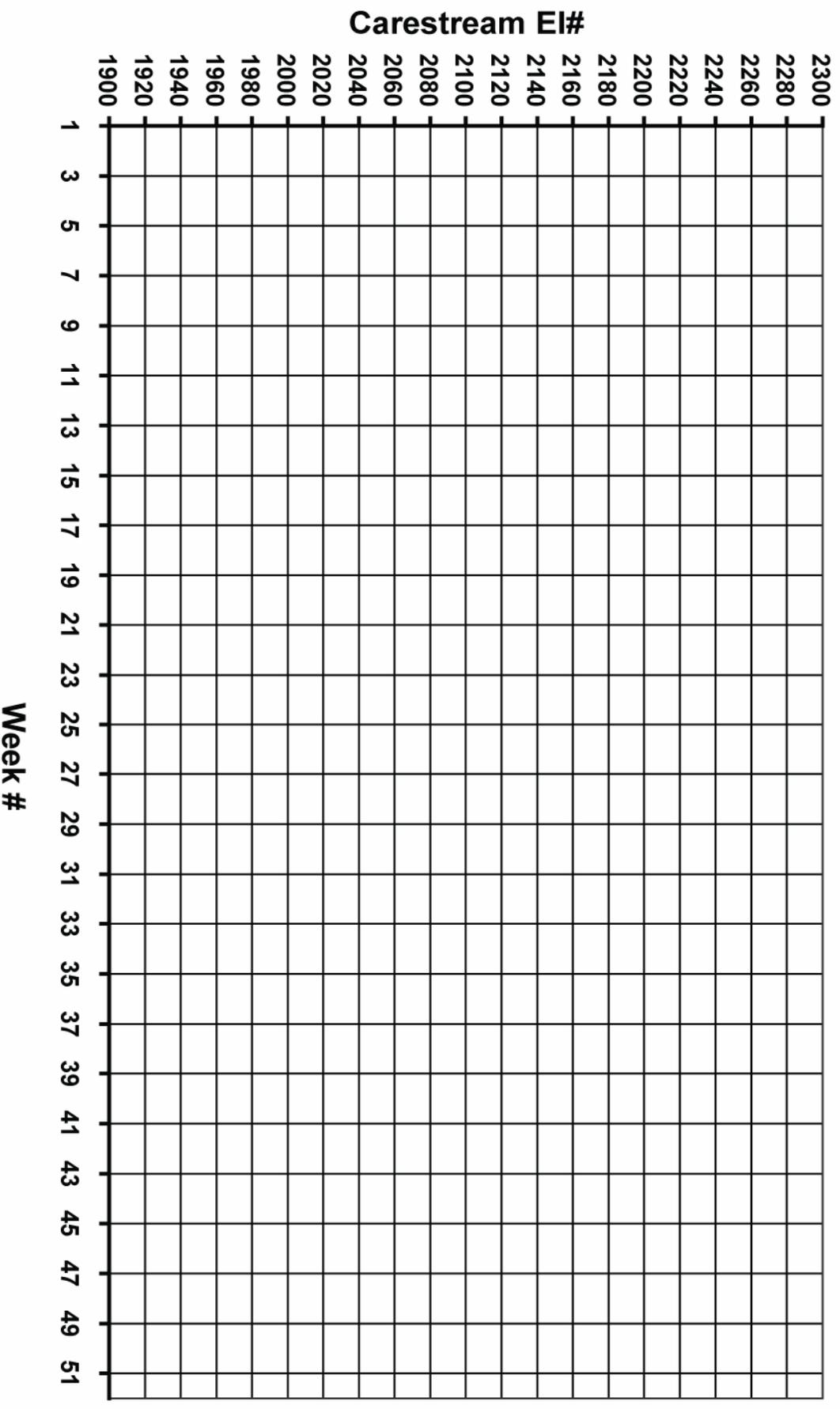
Week #	Date	MamLU	Reader EI#		Week #	Date	MamLU	Reader EI#
1					27			
2					28			
3					29			
4					30			
5					31			
6					32			
7					33			
8					34			
9					35			
10					36			
11					37			
12					38			
13					39			
14					40			
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16					42			
17					43			
18					44			
19					45			
20					46			
21					47			
22					48			
23					49			
24					50			
25					51			
26					52			

Carestream Reader Graph

Hospital/Clinic:

Reader Mfg:

Reader ID:



Fuji Reader Datasheet

Hospital/Clinic:

Reader Mfg: **Fuji**

Reader ID:

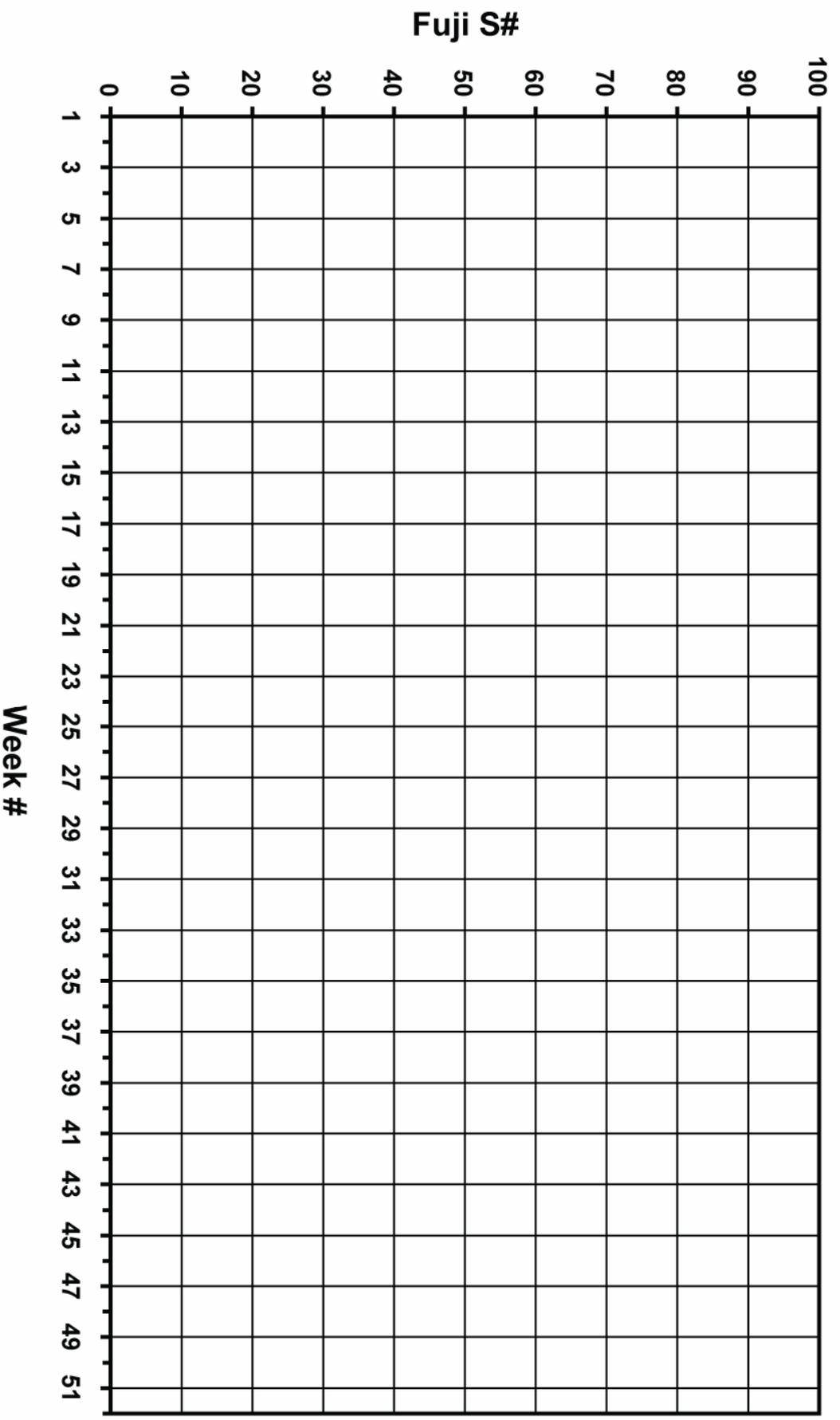
Week #	Date	MamLU	Reader S#		Week #	Date	MamLU	Reader S#
1					27			
2					28			
3					29			
4					30			
5					31			
6					32			
7					33			
8					34			
9					35			
10					36			
11					37			
12					38			
13					39			
14					40			
15					41			
16					42			
17					43			
18					44			
19					45			
20					46			
21					47			
22					48			
23					49			
24					50			
25					51			
26					52			

Fuji Reader Graph

Hospital/Clinic: _____

Reader Mfg: _____ **Fuji** _____

Reader ID: _____



MamLU and mAs Datasheet

Hospital/Clinic:

Room #:

Bucky ID:

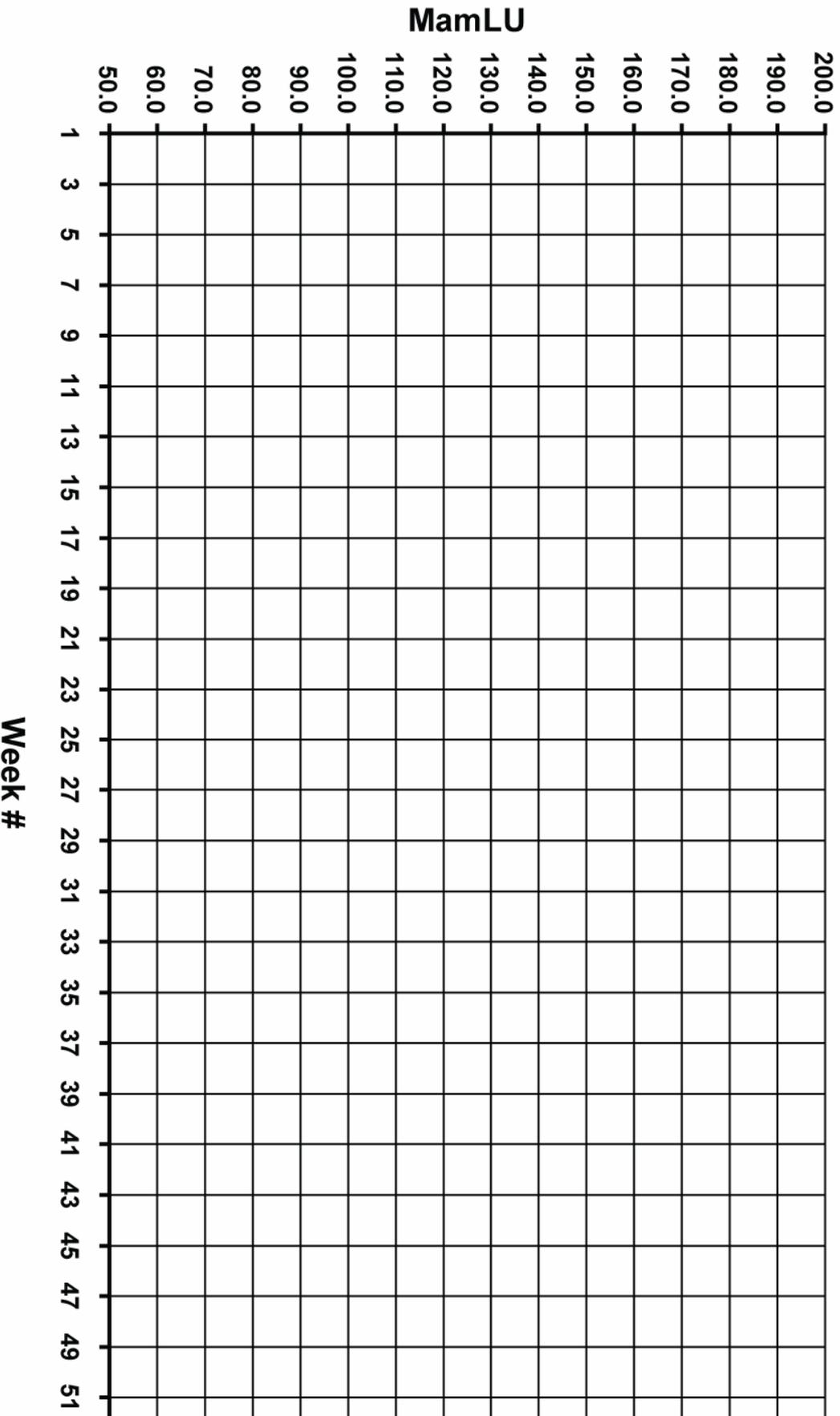
Week #	Date	MamLU	mAs		Week #	Date	MamLU	mAs
1					27			
2					28			
3					29			
4					30			
5					31			
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25					51			
26					52			

MamLU Graph

Hospital/Clinic:

Room ID:

Bucky ID:



LIMITED WARRANTY

QA Mamchex 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.