CONVERSION FROM 8800 to 8800PC-EVALUATION & EXPERIENCE

A.E. Miller, B.J. Lawson

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Conversion from 8800 to 8800PC - Evaluation and Experience

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Abstract

Though a final version of the software is pending the 8800PC operating system host computer is a welcomed change from the old Digital (DEC) host computer. The 8800PC host computer uses the Windows NT operating system and has proven to be very user friendly. Descriptive window messages replace the cryptic coding of the DEC host. Though numerous electrical components were replaced, system calibration remained constant. Calibrated Thermoluminescent (TL) output from a randomly selected 8815 field card was measured before and after the upgrade. The % difference, when comparing calibrated output from an upgraded reader to the non upgraded reader, ranged from 0.2 to 3 %. The most disappointing aspect of the upgrade experience was the lag time between hardware installation and software completion.

History

Lockheed Martin, Schenectady purchased two Harshaw/Bicron 8800 systems in 1990. Starting with the first quarter of 1992, the Harshaw 8815 and 8806 Thermoluminescent dosimeter (TLD) card and case combinations became the dosimeter of record for whole body Betas/Gamma and Neutron personnel monitoring, respectively. During the next few years the addition of the 8807 and Doseclip TLD card and case combinations were implemented as the environmental and extremity system of record, respectively.

Though the TLDREMS software has been updated on numerous occasions in the last six years, the 8800 readers had few changes. The technology in the host computer of the 8800 reader was becoming obsolete, with some components no longer being made. In 1996, an order was placed with Bicron to update the 8800 readers to the 8800PCs in 1997. In August of 1997, one of the 8800 readers (Reader 2) broke down with a suspected problem in the host computer. Rather than repair the host computer, the decision was made to wait for the scheduled upgrade. On September 8, 1997 the first 8800 PC in field upgrade performed by Bicron was performed on Reader 2. Reader 1 was upgraded on October 28, 1997.

During the upgrade process the 8800 reader is completely gutted. Numerous new components replace the outdated ones. Two significant concerns were: (1) will the upgrade affect system calibration and (2) will the overall system support all the functions required in the dosimetry program operating procedures. Since the Photomultiplier tubes (PMT) and their voltage setting controls were not changed (these were probably the only two components that weren’t changed) it was expected that system calibration would not be affected. However, the system software was new and a careful evaluation was required to verify procedural compliance.
Comparison Testing

Since the DOELAP Dose Algorithm is used to calculate dose, calibrated TL output is measured in generic units (gU). The following procedure was established to compare the calibrated TL output of a reader before and after the upgrade.

Note: The test is designed to be a before and after comparison of the same reader. However, Reader 2 was inoperable before its upgrade. Therefore, its gU output was compared to Reader 1 (the non-upgraded reader).

Prerequisites:

1. Obtain a subset of calibration cards and one field card recently calibrated (within last 6 months) to the TTP being used in the test.

2. Establish a pre-fade and post-fade time for the irradiation and read. (This is important if the irradiation and read are being performed shortly after the anneal.)

3. Choose an irradiation value and irradiation methodology.

Procedure:

1. Using the subset of calibration cards calibrate the Time Temperature Profile (TTP) being used in the 8800 reader (prior to upgrade) per local procedures and accept the calibration.

2. Anneal the TLD card being used for the test.

3. Wait the appropriate amount of pre-fade time, irradiate the TLD card, wait the appropriate amount of post-fade time, and then read the TLD card applying all calibration factors (i.e., Reader Calibration Factor (RCF) and element correction coefficient (ecc)).

4. Repeat steps 2 and 3 ten times. Complete all reads as soon as possible after calibrating the reader. Calculate the average, sample standard deviation, and relative standard deviation.

5. After the reader is upgraded, perform steps 1-4 of the procedure using the same TLD cards and parameters established in the prerequisites.

Data Analysis

Test parameters: Pre-fade time 5 minutes  
Post-fade time 10 minutes  
Irradiation Value 500 mR  
Irradiation Method Harshaw/Bicron 6610C $^{137}$Cs Irradiator
An acceptance criteria of +/- 6% was established as the maximum acceptable difference between the same channel when comparing the value obtained from the upgraded reader to the non-upgraded reader. As expected, the comparison between Reader 2 upgraded and Reader 1 non-upgraded tended to have % differences slightly higher than Reader 1 compared to itself. However, it met the +/- 6% criteria established for this test.

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1 In a test conducted by Nicron, two readers were calibrated using the same set of calibration cards. One of the readers was then used to calibrate TLDs and establish the test database that would be used by both readers. For a specific set of cards the average calibrated output per channel was compared between the two readers. It was noted in this test that the maximum difference between any two channels for a specific card was +/- 6%.
Trend Analysis

Trend analysis was performed to determine if there are any large discontinuities attributable to the start up of the 8800 PC. Data from the first run electronic QC of every operating day from January 29, 1997 thru January 20, 1998 was used for this evaluation. The categories evaluated were Reference Light, PMT noise, High Voltage Readings, and weekly Reader Calibration Factors.

Figure 3: Reader 1 Trending Data

Reference Light

PMT Noise
Figure 3: Continued

High Voltage

Reader Calibration Factor

Reference Light

Figure 4: Reader 2 Trending Data
Figure 4: Continued

PMT Noise

High Voltage

Reader Calibration Data
The most notable change, indicated in Figures 3 and 4, is the PMT High Voltage for Reader 2. The voltage dropped an average of 0.5%, per channel, when compared to its non-upgraded value. However, there is no significant difference in Reference Light, PMT noise, and Reader Calibration Factor pre- and post-upgrade. Therefore, this small change is not significant. It should also be noted that the PMT High Voltage became more stable in both readers.

Software Review

The upgrade replaced the DEC host computer with a PC using a Microsoft NT operating system. There are many new features that are not available on the DEC host computer. Some of these new features are:

- Real Time PMT Data during the read cycle (e.g., High Voltage, Temperature etc.)
- A History Log which records the most recent commands used.
- Printer capabilities directly from the reader PC.
- The Transport Maintenance commands are listed and can be activated with a double click. This screen also displays current carrousel position, rack position, and various other parameters.

Information displayed in the various windows are easy to read and more descriptive. The new software puts a lot of information at your fingertips that was not easily available, if available at all, in the 8800 system. Another major advantage of the upgrade is that DEC proprietary peripherals are no longer required (e.g., DEC monitors).

The following evaluations are discrepancies/observations that were noted during software testing.

After Reader 2 was upgraded the following software versions were supplied by Bicron:

<table>
<thead>
<tr>
<th>Software</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Host version</td>
<td>26469.000.001</td>
</tr>
<tr>
<td>TLDREMS</td>
<td>23688.020.003</td>
</tr>
</tbody>
</table>

Following is a list of missing functions or software limitations in the above software versions.

1. Inability to perform an Electronic QC.*
2. Controlled Shutdown did not work when the Uninterruptible Power Supply (UPS) was activated.*
3. No audible alarms for error conditions (e.g., Halt Machine Sound Alarm).*
4. TLDREMS did not properly store the channel location if less than 4 elements are used in the TTP (e.g., Evaluated Doseclips use only channel iv, but data was being stored in channel i location).*
5. Program stop location for the rack was inoperable (i.e., would misread a jammed rack as the back of the unload cartridge and try to proceed).
6. Glow Curve printing defaulted to filling in the glow curve.
7. Printer did not page advance when a new group number was started.
8. TLDREMS referred to a start button on the reader monitor to start the read. However, there was no start button on the reader monitor - All reads had to be started from the
When the barcode reader was unable to read the barcode, a separate window would prompt the user for a card id. This window would not time out and allow the read to continue. It would remain on the screen stopping the reader until the user performed some action (i.e. enter a card id, reject the card, or accept a blank id). This function did not require that a card id be entered. Therefore, cards could be read without recording the barcode number.


* - Required by local procedure to be operational prior to using the reader

The next two software updates were received and loaded on September 23, 1997 and October 6, 1997, respectively. At the completion of these updates the software versions were:

- Host version 26469.000.003
- TLDREMS 23688.020.003

This update also included an EPROM change on the transport digital board. Testing of these versions resulted in the following:

1. All of the numbered items, above, were corrected, except #3 and #9.

2. Beep tones were added for missing card ids, end of read, and when errors occur. However, the Halt Machine Sound Alarm error did not have an audible alarm.

3. The Electronic QC was functional, but when the Electronic QC was completed the start button on the reader screen (item #8 above) was missing. It remained missing until the screen was refreshed (e.g., either changing to another window and then returning or by starting a read).

4. The missing card id dialogue box (item #9 above) was enhanced with a time out function. When a card id could not be read and there was no user input, this function would close the missing card id dialogue box, reject the card, and then continue with the read. However, the enhancement still allowed user input of blank card ids. Another noted problem in this enhancement occurred when the reader was unable to read the card id on the last card in a cartridge. After unloading this card the rack would return to the empty load cartridge. Though the rack would not retrieve a card, the reader did not recognize that the rack was empty. The reader would then try to read a card id. When it was unsuccessful, the routine for a missing card id would be initiated. If the user entered a card id or a blank id the reader performed a read cycle on an empty rack.

5. During testing of cards that included .035" thick CaF₂ Phosphor (TLD-200) with a signal of approximately 2uc, a loop error would occur and shut down the reader.

6. When the reader shut down due to error conditions it would not unload the card.
being read. The card would remain under the PMT Tube until rejected at the start of the next read.


Reader 1 was upgraded on October 28, 1997. The software versions of both readers were upgraded at this time and then again on November 12, 1997 to the following versions.

<table>
<thead>
<tr>
<th>Host version</th>
<th>TLDREMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>26469.000.007</td>
<td>23688.020.005</td>
</tr>
</tbody>
</table>

On November 13, 1997, the hard drive in the Host computer in Reader 2 crashed. The cause of the crash could not be determined by Bicron and was assumed to be a manufacturing error. Bicron sent a new Host computer which was installed prior to continuing the software testing.

The following comments apply to the software versions updated on November 12, 1997.

1. All problems noted in items 1-7 have been corrected.
2. The approximate time to read 180 standard Beta/Gamma field cards (i.e., 7776 card) using the recommended TTP is approximately 2 hours.
3. If a card requires a reread and there is a loss of nitrogen just prior to the reread, the reader will unload the card and the rack will cycle between the read position and the unload position until the user intervenes. If the nitrogen is turned back on during this recycling stage the rack will return to the read position, and the reader will apply the last used TTP with no card in the rack and then shutdown.
4. Occasionally during an anneal cycle a window will be displayed showing the message “Value not within Allowable Range”. However, this did not stop the anneal cycle and no data was corrupted.

On February 2, 1998 the host computer software was upgraded. At the time of this report, the software versions in use are:

<table>
<thead>
<tr>
<th>Host version</th>
<th>TLDREMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>26469.000.011</td>
<td>23688.020.005</td>
</tr>
</tbody>
</table>

**Current Software Evaluation/Observations**

The following comments apply to the software versions loaded on February 2, 1998.

**NOTE:** Many of these comments also apply to the earlier versions of the software.

- Cannot start a read with the *Carrousel Control* window opened.
- Cannot start an Electronic QC with the *Carrousel Control* window open. If this occurs
you must use ctrl/X to exit the Electronic QC program on the TLDREMS data PC. Remove the Carrousel Control window on the reader and then start over. NOTE: If a ctrl/break is used to exit the Electronic QC program the final data screen will be corrupted (e.g., incomplete date field). This requires a reboot of the TLDREMS data PC.

- The volume of the alarms on the reader is very low.
- When testing the barcode reader using the Transport Maintenance window, the first card id that is detected by the barcode reader will be displayed in the card id text box. All other subsequent cards will beep as though they have been read, but the card id text box will not be updated.
- If the reader is powered off without first performing a shutdown of the NT operating system, then when power is returned the date on the reader may be wrong. If this occurs the date field in the lower right hand corner of the Glow Curve window will be blank. This may affect communication between the reader and the TLDREMS data PC (i.e., The two will not be able to communicate). All other functions on the reader and data PC work thus making this a difficult problem to find.
- If the screen saver is used it will: (1) Pop on during the read if no mouse or keyboard buttons have been used, and (2) When clearing the screen saver at the completion of reading a card using less than 4 channels, the unused channels will be grayed out.

**Suggestion: Turn off the Screen Saver!**

- A change from the old 8800 reader is at the completion of a read, the data PC will not exit to the comment line. You will no longer be able to exit the acquisition screen with the <return> key. The <return> key will start the reader again. You have to hit the <esc> key to get to the comment line, and then hit <return>.
- There is no longer a warning if the reader has been started and no cards found.
- When you turn the reader on, the PMT tube will need to be booted prior to performing an Electronic QC. The PMT boot can be performed using the rack position commands in the Transport Maintenance window. However, the rack must be normalized prior to using any of these commands. If the rack is not normalized, the reader will not allow any movement of the rack using the Transport Maintenance window. An Electronic QC can still be performed if the PMT is not booted, but the PMT noise values will be 0.0. These 0.0 values will be flagged as being out of range on the final report.
- Cannot use the “START” button on the reader to start an Electronic QC. The “START” button will start a read cycle on the reader. A communication error will follow.
- Cannot start a read using the “START” button when the TLDREMS data PC is still on the comment line. This will cause a communication error. You have to enter a blank comment to ready the TLDREMS data PC for reader input.
- The approximate time to read 180 standard Beta/Gamma field cards using the recommended TTP is approximately 1 hour 16 minutes (~142 cards/hour).
- The Reference Light and PMT noise are now displayed graphically. Some factors affecting the read cycle (e.g., rack speed, reader doors opened or closed, etc.) will have an impact on the displayed graph. Since these graphs were not available on the old 8800, these effects may have gone unnoticed.

If a PMT noise reading is taken after reading a card, the display indicates that the reading was started before the PMT cooled completely. This is illustrated on the graph by the line that displays the TTP (see attachment 1). This software version does not default to allow cooling to 50°C before unloading the card. The reduction in time
between unloading the card and taking a PMT noise reading is the cause of this effect. The average PMT noise readings from calibration reads before and after the latest software update were compared (i.e., PMT noise reading taken after each card read). There was no significant change in the average PMT noise, per channel. Dip switches are available on the transport board if the user wants to adjust the amount of cooling prior to unloading the card.

The Reference Light readings can be affected by room light when the doors to the reader are opened (see attachment 2). This effect is only seen on Reference Light readings that immediately follow PMT noise readings. The cause of this effect is the increased rack speed from PMT noise position to the Reference Light position. When the rack moves from the PMT noise position (read) to the Reference Light position, the shutter is momentarily opened to allow the Reference Light sources under the PMT. This allows a small amount of room light to expose the PMT. This causes a hysteresis effect on the front end of all the channels involved. The amount of this effect is dependant on the reader orientation to the light source. A good practice would be to keep the reader doors closed during any data processing/taking. Figure 5 demonstrates how much this affected the Reference Light readings.

**Figure 5: Reference Light Open vs. Close Door Comparison**

<table>
<thead>
<tr>
<th>Reader 1</th>
<th>Reader 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Channel i</strong></td>
<td><strong>Channel i</strong></td>
</tr>
<tr>
<td>Door Opened</td>
<td>256.3</td>
</tr>
<tr>
<td>Door Closed</td>
<td>258.6</td>
</tr>
<tr>
<td><strong>Channel ii</strong></td>
<td><strong>Channel ii</strong></td>
</tr>
<tr>
<td></td>
<td>340.6</td>
</tr>
<tr>
<td></td>
<td>296.7</td>
</tr>
<tr>
<td><strong>Channel iii</strong></td>
<td><strong>Channel iii</strong></td>
</tr>
<tr>
<td></td>
<td>266.7</td>
</tr>
<tr>
<td></td>
<td>256.6</td>
</tr>
<tr>
<td><strong>Channel iv</strong></td>
<td><strong>Channel iv</strong></td>
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<tr>
<td></td>
<td>5.1</td>
</tr>
<tr>
<td></td>
<td>10.1</td>
</tr>
<tr>
<td><strong>% Difference</strong></td>
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</tr>
<tr>
<td></td>
<td>-0.9</td>
</tr>
<tr>
<td></td>
<td>15.6</td>
</tr>
<tr>
<td></td>
<td>5.1</td>
</tr>
</tbody>
</table>

**Conclusion**

The upgraded 8800PC TLD reader is a welcome change from the older 8800 model. The NT operating system provides a much more user friendly interface, especially when performing maintenance or testing functions. Performance testing of the 8800PC proved satisfactory with both readers meeting the +/- 6% criteria. Trend analysis demonstrated virtually no change in the operating parameters after the upgrade. In fact, the 8800PC demonstrated greater PMT voltage stability. Many software upgrades were needed to bring the first 8800PC into compliance with the operating procedures. Though Reader 2 was upgraded in September 1997, it was not fully utilized until after the October 1997 upgrade. The lag time between hardware installation and software completion was substantial.

The comments in the Current Software Evaluation section are a guide to what upgraded 8800 users can expect. Upgrading to the 8800PC is recommended. The improved host computer improves reader operation and maintenance. New functions such as the history log and real time
PMT data are just a few of the new outstanding features. An improved Transport Maintenance system reduces cryptic DEC codes to a double click. User interface is improved with easy to read and understand windows for operation and error codes. The software is now at the stage where current upgrades should have few problems, if any. The 8800PC upgrade is backward compatible with data files created using the 8800 system. Trend analysis is virtually seamless from the 8800 data.
# PMT Noise

**10-Feb-1998 13:43:29 PMT Noise M8800Pc**

<table>
<thead>
<tr>
<th></th>
<th>i</th>
<th>ii</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.0486 nC</td>
<td>0.1024 nC</td>
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<table>
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<tr>
<th></th>
<th>iiv</th>
<th>iii</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.0225 nA</td>
<td>0.1538 nA</td>
</tr>
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<td></td>
<td>0.0491 nC</td>
<td>0.0299 nC</td>
</tr>
<tr>
<td></td>
<td>0.0238 nA</td>
<td>0.0338 nA</td>
</tr>
</tbody>
</table>

**Attachment 1**
Figure 5:
Reference Light Open vs. Close Door Comparison

<table>
<thead>
<tr>
<th>Reader 1</th>
<th>Reader 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel i</td>
<td>Channel i</td>
</tr>
<tr>
<td>Door Opened</td>
<td>256.3</td>
</tr>
<tr>
<td>Door Closed</td>
<td>258.6</td>
</tr>
<tr>
<td>% Difference</td>
<td>-0.9</td>
</tr>
</tbody>
</table>

Attachment 2
Conversion from

8800 to 8800PC

Evaluation and Experience

Andrew E. Miner
Lockheed Martin, Schenectady
History

- Lockheed Martin, Schenectady purchased two Harshaw/Bicron 8800 systems in 1990.

- Starting with the first quarter of 1992, the Harshaw 8815 and 8806 TLD card and case combinations became the dosimeter of record for whole body Beta/Gamma and Neutron personnel monitoring, respectively.

- In 1996 an order was placed with Bicron to update the 8800 readers to the 8800PCs in 1997.

- In August of 1997 one of the 8800 readers (Reader 2) broke down with a suspected problem in the host computer.

- On September 8, 1997 the first 8800 PC in field upgrade performed by Bicron was performed on Reader 2. Reader 1 was upgraded on October 28, 1997.
Concerns

• Will the upgrade affect system calibration?

• Will the overall system support all of the functions required in the dosimetry program operating procedures?
Comparison Test

- Calibrated TL output is measured in generic units (gU)

- Prerequisites:
  1. Obtain a subset of calibration cards and one field card recently calibrated (within last 6 months) to the TTP being used in the test.
  2. Establish a pre-fade and post-fade time for the irradiation and read.
  3. Choose an irradiation value and irradiation methodology.

- Procedure:
  1. Using the subset of calibration cards calibrate the TTP to be used.
  2. Anneal the TLD card being used for the test.
  3. Wait the appropriate amount of pre-fade time, irradiate the TLD card, wait the appropriate amount of post fade time, then read the TLD card applying all calibration factors.
  4. Repeat steps 2 and 3 ten times. Complete all reads as soon as possible after calibrating the reader.
  5. After the reader is upgraded, perform steps 1 - 4 of the procedure using the same TLD cards and parameters established in the prerequisites.
Data Analysis

- Established test parameters:
  
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-fade time</td>
<td>5 minutes</td>
</tr>
<tr>
<td>Post-fade time</td>
<td>10 minutes</td>
</tr>
<tr>
<td>Irradiation Value</td>
<td>500 mR</td>
</tr>
<tr>
<td>Irradiation Method</td>
<td>Harshaw/Bicron 6610C $^{137}$Cs Irradiator</td>
</tr>
</tbody>
</table>

Figure 1: Reader 2 Comparison Test Data

<table>
<thead>
<tr>
<th></th>
<th>Channel i (gU)</th>
<th>Channel ii (gU)</th>
<th>Channel iii (gU)</th>
<th>Channel iv (gU)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reader 2</td>
<td>556.40</td>
<td>575.79</td>
<td>559.42</td>
<td>584.84</td>
</tr>
<tr>
<td>Reader 1</td>
<td>554.57</td>
<td>546.46</td>
<td>549.80</td>
<td>572.12</td>
</tr>
<tr>
<td>% Difference</td>
<td>0.33</td>
<td>5.37</td>
<td>1.75</td>
<td>2.22</td>
</tr>
</tbody>
</table>

Figure 2: Reader 1 Comparison Test Data

<table>
<thead>
<tr>
<th></th>
<th>Channel i (gU)</th>
<th>Channel ii (gU)</th>
<th>Channel iii (gU)</th>
<th>Channel iv (gU)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upgraded Reader 1</td>
<td>568.38</td>
<td>578.03</td>
<td>574.75</td>
<td>587.92</td>
</tr>
<tr>
<td>Reader 1</td>
<td>567.35</td>
<td>560.59</td>
<td>562.92</td>
<td>580.52</td>
</tr>
<tr>
<td>% Difference</td>
<td>0.18</td>
<td>3.11</td>
<td>2.1</td>
<td>1.27</td>
</tr>
</tbody>
</table>
Trend Analysis

Figure 3: Reader 1 Trending Data (1 of 2)
Trend Analysis

Figure 3: Reader 1 Trending Data (2 of 2)
Trend Analysis

Figure 4: Reader 2 Trending Data (1 of 2)
Trend Analysis

Figure 4: Reader 2 Trending Data (2 of 2)
Software Review

Host version 26469.000.001
TLDREMS 23688.020.003

1. Inability to perform an Electronic QC.*

2. Controlled Shutdown did not work when the UPS is activated.*

3. No audible alarms for error conditions (e.g., Halt Machine Sound Alarm).*

4. TLDREMS did not properly store the channel location if less than 4 elements are used in the TTP.*

5. Program stop location for the rack was inoperable.

6. Glow Curve printing defaulted to filling in the glow curve.

7. Printer did not page advance when a new group number was started.

8. TLDREMS referred to a start button on the reader monitor to start the read. However, there was no start button on the reader monitor.

9. When the barcode reader was unable to read the barcode, a separate window would prompt the user for a card id. This window would not time out and allow the read to continue. It would remain on the screen stopping the reader until the user performed some action (i.e. enter a card id, reject the card, or accept a blank id). This function did not require that a card id be entered. Therefore, cards could be read without recording its barcode number.

10. Occasionally would get “Photronics Bin # Out of Range” error.

* - Required by local procedure to be operational prior to using the reader
1. All of the numbered items, above, were corrected, except #3 and #9.

2. Beep tones were added for missing card ids, end of read, and when errors occur. However, the Halt Machine Sound Alarm error did not have an audio alarm.

3. The Electronic QC was functional, but when the Electronic QC was completed the start button on the reader screen (item #8 above) was missing. It remained missing until the screen was refreshed.

4. The missing card id dialogue box (item #9 above) was enhanced with a time out function. However, the enhancement still allowed user input of blank card ids. Another noted problem in this enhancement occurred when the reader was unable to read the card id on the last card in a cartridge. After unloading this card the rack would return to the empty load cartridge. Though the rack would not retrieve a card, the reader would not recognize that the rack was empty. The reader did then try to read a card id. When it was unsuccessful, the routine for a missing card id would be initiated. If the user entered a card id or a blank id the reader performed a read cycle on an empty rack.

5. During testing of cards that included .035" thick CaF$_2$ Phosphor (TLD-200) with a signal of approximately 2uc, a loop error would occur and shut down the reader.

6. When the reader shut down due to error conditions it would not unload the card being read. The card would remain under the PMT Tube until rejected at the start of the next read.

Reader 2
Hard Drive

CRASHED
1. All problems noted in items 1 - 7 were corrected.

2. The approximate time to read 180 standard Beta/Gamma field cards (i.e. 7776 card) using the recommended TTP is approximately 2 hours.

3. If a card requires a reread and there is a loss of nitrogen just prior to the reread, the reader will unload the card and the rack will cycle between the read position and the unload position until the user intervenes.

4. Occasionally during an anneal cycle a window will be displayed showing the message “Value not within Allowable Range”. However, this did not stop the anneal cycle and no data was corrupted.
Current Software Evaluation

Host version 26469.000.011
TLDREMS 23688.020.005

- Cannot start a read with the *Carrousel Control* window opened.

- Cannot start an Electronic QC with the *Carrousel Control* window opened. If this occurs you must use ctrl/X to exit the Electronic QC program on the TLDREMS data PC. Remove the *Carrousel Control* window on the reader and then start over.

- The volume of the alarms on the reader is low.

- When testing the barcode reader using the *Transport Maintenance* window, the first card id that is detected by the barcode reader will be displayed in the card id text box. All other subsequent cards will beep as though they have been read, but the card id text box will not be updated.

- If the reader is powered off without first performing a shutdown of the *NT operating system*, then when power is returned, the date on the reader may be wrong. This may affect communication between the reader and the TLDREMS data PC.

- If the screen saver is used it will:
  1. Pop on during the read if no mouse or keyboard buttons have been used.
  2. When clearing the screen saver at the completion of reading a card using less than 4 channels, the unused channels will be grayed out.

  *Suggestion: Turn off the Screen Saver!*
• A change from the old 8800 reader is at the completion of a read the data PC will not exit to the comment line.

• There is no longer a warning if the reader has been started and no cards found.

• When you turn the reader on, the PMT tube will need to be booted prior to performing an Electronic QC. The PMT boot can be performed using the rack position commands in the Transport Maintenance window. However, the rack must be normalized prior to using any of these commands.

• Cannot use the “START” button on the reader to start an Electronic QC.

• Cannot start a read using the “START” button when the TLDREMS data PC is still on the comment line.

• The approximate time to read 180 standard Beta/Gamma field cards using the recommended TTP is approximately 1 hour 16 minutes (≈142 cards/hour).

• The Reference Light and PMT noise are now displayed graphically. Some factors affecting the read cycle (e.g., rack speed, reader doors opened or closed, etc.) will have an impact on the displayed graph. Since these graphs were not available on the old 8800, these effects may have gone unnoticed.

PMT cooling during noise reading.

Room light can affect the Reference Light readings when the reader doors are open.

* Suggestion: keep the reader doors closed during any data processing/taking. *
# PMT Noise

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>i</td>
<td>0.0486 nC</td>
<td>ii</td>
<td>0.1024 nC</td>
</tr>
<tr>
<td>iv</td>
<td>0.0225 nA</td>
<td>iii</td>
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<td></td>
<td>0.0238 nA</td>
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Attachment 1
Figure 5:
Reference Light Open vs. Close Door Comparison

<table>
<thead>
<tr>
<th>Channel</th>
<th>Reader 1</th>
<th>Reader 2</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Channel i</td>
<td>Channel ii</td>
</tr>
<tr>
<td>Door Opened</td>
<td>256.3</td>
<td>340.6</td>
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<tr>
<td>Door Closed</td>
<td>258.6</td>
<td>307.4</td>
</tr>
<tr>
<td>% Difference</td>
<td>-0.9</td>
<td>10.1</td>
</tr>
</tbody>
</table>
Conclusion

- The upgraded 8800PC TLD reader is a welcome change from the older 8800 model.
- The NT operating system provides a much more user friendly interface.
- Performance testing of the 8800PC proved satisfactory with both readers meeting the +/- 6% criteria.
- Trend analysis demonstrated virtually no change in the operating parameters after the upgrade.
- Many software upgrades were needed to bring the first 8800PC into compliance with the operating procedures.
- The comments in the Current Software Evaluation section are a guide to what upgraded 8800 users can expect.
- Upgrading to the 8800PC is recommended.
- History log and real time PMT data are just a few of the new outstanding features.
- Improved Transport Maintenance system reduces cryptic DEC codes to a double click.
- Easy to read and understand windows for operation and error codes.
- The 8800PC upgrade is backward compatible and trend analysis will be virtually seamless from the 8800 data.