⊞ MERLIN GERIN

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March 21, 1994

Mr. LeMoine J. Cunningham, Chief
Radiation Protection Branch
Division of Radiation Safety
    and Safeguards
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Dear Mr. Cunningham:

This communication is in response to your letter of March 10, 1994, with regards to the accuracy and security of Merlin Gerin dosimeters' dose data.

We would like to inform you that both models of dosimeters made by Merlin Gerin, the DMC-90 and the DMC-100, can be programmed in two different modes of operation. Mode 1, autonomous, to be used by the wearer without benefit of a reader; mode 2, satellite, to be used by the wearer for the benefit of a reader.

All nuclear plants use the dosimeters in the satellite mode since this is the mode that lends itself to access control automatic operation and data communications and analysis. When a dosimeter is used in the autonomous mode, the DMC-90 allows on/off operation by using a small magnet passed in front of the internal reed switch in the dosimeter. The DMC-100, in autonomous mode, can be switched on and off by the wearer by proper sequencing pushbutton.

Procedures on how to operate the dosimeter in autonomous mode are attached to this letter with a sample of each unit set in autonomous. In the case of use in satellite mode, the passage of the magnetic field will cause only temporary disturbance of the display but the status of the dosimeter on "in zone" or "off zone" and the data currently in the memory of the device (during the user period of use) stays unchanged. It cannot be modified by this event.

We assume from the beginning that our devices are used following proper procedures that assure no user can tamper with the data, either inadvertently or on purpose unless he maliciously damages a dosimeter.
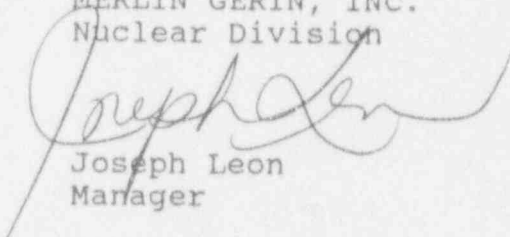
We have approximately 40,000 devices in operation in the United
States in 40 plus facilities and we have had no complaints ever of
a dosimeter used in satellite mode and used properly by the wearer
being disturbed or having its data lost by a magnetic field.

I hope that this explanation will be satisfactory in response to
your letter. If you find there is additional information I can
provide you to clarify your findings, please let me know and I will
be glad to reply.

Thank you for your attention.

                              Yours very truly,

                              MERLIN GERIN, INC.
                              Nuclear Division

                              Joseph Leon
                              Manager

JL:sg

USE OF THE MERLIN GERIN MODEL DMC-90 DOSIMETER IN THE ABSENCE OF THE MODEL LDM-91 READER (AUTONOMOUS MODE)

Model DMC-90 Electronic Dosimeter may be turned on and turned off, and the available pre-alarms and time alarms, if previously initiated with the LDM-91 reader, may also have their values modified. The primary Dose Alarm and the primary Dose Rate Alarm are always available in the Autonomous Mode.

2.0
Selecting Autonomous Mode.

2.1
Using an appropriate screw driver, remove the single screw located at the centerline of the dosimeter immediately below the Infrared window and the bottom of the clip at the back of the dosimeter to expose the dip switch array, the RS232 connector (blue) and the primary 3.5 volt Lithium Chloride Battery.

2.2
Locate the four (4) dip switch array. It appears as four white dip switches on red backed switch block.

2.3
To select autonomous operation, locate switch number 1. This is the switch at the bottom, right hand side of the switch block when looking down at the opened dosimeter. Place this switch in the right hand position, i.e. away from the blue RS232 connector. Turn the dosimeter over to view the LCD Display on the front of the unit. The Display should be reading **PAUSE**. Confirm that the dosimeter is now in Autonomous Position by pushing the black button located on the left side of the dosimeter once. The LCD display should now read **AUT**. After about 10 seconds, the display will return to **PAUSE**.

3.0
Modifying Alarm Parameters

3.1
With the dosimeter in **PAUSE** locate switch number 2. This is the switch at the top right hand side of the switch block when looking down at the opened dosimeter. To allow the modification of Alarm parameters, place this switch in the Left Hand position, i.e. towards the blue RS232 connector. This "unlocks" the unit and permits further modification.

3.2
Press and hold the black button located at the left side of the unit (as described in 2.3 above) until the LCD display begins to "Flash". Note which value is flashing. The actual DOSE value and DOSE RATE value may not be modified as these values change only when radiation is detected.

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3.3

Locate switch number 3 on the switch block. This is the switch at the bottom left hand position. To advance the LCD display to the first modifiable parameter, move switch number 3 to its opposite position and then back again to its former position. Note that the LCD display advances one value, i.e. from dose display to dose rate display, or from dose rate display to dose alarm display.

3.4

Continue to operate switch number 3 as described in 3.3 (above), i.e. from its present position to the opposite position and back again to reach the first modifiable parameter which is DOSE ALARM. Note that the first digit of the display is flashing.

3.5

Press the black button located on the left side of the dosimeter (face up) one time to advance the flashing digit, i.e. from 1 to 2, 2 to 3, etc.

3.6

Locate switch number 4 on the switch block. It is the switch on the upper left side of the switch block when looking down at the opened dosimeter. Move this switch to its opposite position and back to the former position, i.e. over and back to advance the flashing digit to the next digit on the display.

3.7

Use the black button as described in 3.5 (above) to advance the flashing digit.

3.8.

Continue to use switch number 3 to advance to the next modifiable parameter, i.e. DOSE RATE ALARM followed by the prealarms (notated with a small round symbol on the display), followed by the time alarm. Note that prealarms and the time alarm must be "initialized" in the LDM-91 reader to be available.

3.9.

Continue to use the black button as described in 3.5 (above) to advance to the next highest digit.

3.10.

Continue to use switch number 4 to advance the flashing digit.

4.0

TOTAL and RESET Modes

4.1

Use switch number 3 to advance the flashing display until the word TOTAL or the word RESET appears. The word will be flashing. Use the black button as described in 3.5 to "toggle" between RESET and TOTAL.

4.2

If left in RESET mode, the dosimeter will return to zero each time it is turned on.

4.3

If left in **TOTAL** mode, the dosimeter will not return to zero and will continue to add to the existing integrated dose each time it is turned on.

5.0

Return Switch number 2 to the right hand position (away from the blue RS232 connector) to prevent further modifications. The dosimeter display stops flashing. The dosimeter display will return to PAUSE after approximately 10 seconds.

6.0

Turning the dosimeter ON and OFF.

6.1

With the battery cover removed, note the position of the Magnetic Reed Switch. It is located to the left of the blue RS232 connector.

6.2

With the cover replaced, a magnet of sufficient strength may be passed down the right side of the dosimeter in close proximity to the reed switch.. Each application of the magnet will turn the dosimeter from **PAUSE** to **ON** or from **ON** to **PAUSE**.

7.0

With the dosimeter in **PAUSE**, press and hold the black button on the left side of the dosimeter. The display will "scroll" through the stored parameters after displaying the last integrated dose and dose rate detected. You may use this feature to check the programmed alarm values. When the button is released, the dosimeter will return to pause after approximately 10 seconds.

DMC-100 OPERATOR'S MANUAL

Unit Description:

The Merlin Gerin Model DMC-100 is a fifth generation electronic, alarming dosimeter and represents the latest technology available incorporating features not found on any previous or competitive model.

The Model DMC-100 incorporates the following major improvements along with the proven accuracy and linearity of previous Merlin Gerin electronic dosimeters.

    a) Largest, easiest to read display of any model ever produced by any manufacturer, (top mounted) Measures 38 mm X 12 mm
    b) Backlit display enabled by inertial switch (programmable permissive).
    c) Programmable Display characteristics via DMC-Manager Software
    d) Clear Warning and Alarm Displays
    e) Heart beat "live" indication
    f) Alarm acknowledgments (when permitted) via inertial switch (programmable permissive)
    g) EEPROM operation - no possible loss of data
    h) extended histogram operation and histogram management
    i) Specific attachments (no wires) for transmitters, ear phone (high noise environments) area monitor attachment, and "teletector" attachment.
    j) "On-Line" diagnostics with operation in PAUSE Mode.

The DMC-100 provides personal dose and dose rate monitoring in an extremely rugged package. The DMC-100 is protected from RF and EMI (Electro-magnetic) interference. As well as two integrated dose alarms and two dose rate alarms, the DMC-100 also provides a "stay time" alarm and a "time in area" alarm. A programmable "chirp" may be utilized to warn personnel of dose acquisition at specific increments.

When properly calibrated, the DMC-100 has been shown to correlate within +/- 2% to TLD readings.

OPERATION:

The DMC-100 allows three (3) modes of operation:
    a) Satellite - must be used in conjunction with a Merlin Gerin Dosimeter Reader
    b) Autonomous - may be used independent of a Merlin Gerin Dosimeter Reader
    c) "Emergency Fast Start" - for use in an Emergency Kit

The DMC-100 is shipped in Satellite Mode (requires reader), calibrated to Cesium 137 and then configured to over-respond by 10%. After calibration and quality assurance testing, the DMC-100 is returned to PAUSE Mode for shipping. A new battery is installed and remains in place during shipment. As the DMC-100 utilizes EEPROM technology, no data loss can occur if the battery is removed or allowed to fully deplete.

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Upon removal from its shipping container, the DMC-100 display should indicate PAUSE. The "heart beat ALIVE" indication (flashing colon) should be visible to the left of the letter "P" in PAUSE.

The clip is attached to the dosimeter and is designed to support three times the unit's weight when attached to typical worker's clothing. The clip also provides "eyes" for suspending the unit on a neck chain and for the attachment of the TLD mounting bracket which allows the TLD to be worn in the proper geometry. The clip may be removed and replaced without the use of tools.

The DMC-100's serial number is stamped on the case back panel, between the two eyes of the clip. This serial number (6 digits) is also carried in the dosimeter's memory and may be utilized to insure that a worker enters and exits the controlled area with the same dosimeter. This unique serial number may be changed to any number group, up to 9 digits with the use of any Merlin Gerin dosimeter reader and the proper software such as DMC-MANAGER for Windows.

The lower portion of the DMC-100's case (front panel) may be removed after loosening the single screw located on the panel's lower edge to expose the battery, the RS232/485 connector, and the two (2) dip switches used for MODE CONTROL.

Care should be taken to observe the indicated battery polarity when removing or changing the battery. As the DMC-100 utilizes EEPROM technology, no back-up battery is required.

The functionality of the two MODE CONTROL dip switches are as follows:

DIP SWITCH #1 (located closest to the battery:
    ON POSITION (switch pointing to RS232 connector) Autonomous Programming
        NOT permitted.
    OFF POSITION (switch pointing away from RS232 connector) Autonomous
        Programming permitted (see section labeled Autonomous Programming).

NOTE: Factory Default setting for Dip Switch #1 - Autonomous Programming NOT permitted.

DIP SWITCH #3 (located farthest from battery)
    ON POSITION: (switch pointing to RS232 connector) Unit configured for Satellite
        Operation
    OFF POSITION (switch pointing away from RS232 connector) Unit configured for
        Autonomous

NOTE: Factory Default setting for Dip Switch #2 - Satellite Operation

NOTE: Autonomous Operation may be blocked regardless of Dip Switch setting using any Merlin Gerin Dosimeter Reader and appropriate software such as DMC-MANAGER for Windows.

Reviewing Stored Parameters:

Values previously stored in the dosimeter (last recorded integrated dose, highest dose rate measured, alarm values, etc.) may be viewed on the LCD display via the black push-button

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located on the dosimeter's left side when the dosimeter is in the PAUSE MODE..
Pressing the black button will advance the screen, parameter by parameter, ultimately returning (round robin) to the first stored parameter. NOTE: Holding the button in will "freeze" further advancement of the display.

With the dip switches set for Satellite operation (factory default setting), i.e.

> Switch #1: ON POSITION (towards RS 232 connector - printing on circuit board
> indicates: RUN)
> Switch #2: ON POSITION (towards RS 232 connector - printing on circuit board
> indicates: SAT)

the following parameters may be viewed on the LCD display by pressing and/or holding the black push-button. These parameters, when enabled via a Merlin Gerin Reader and the appropriate software, will appear in the following order:

PAUSE: Indicates that the unit is not measuring exposure and exposure rate. Unit still perform self-diagnostics including detector and battery checks. Note the flashing "heart beat".

SAT: Indicates that the unit has been configured for Satellite Operation.

DOSE: Total integrated dose recorded during the last operational period. Note the letter "D" indicating DOSE, the word "DOSE," the indication of mREM, and the flashing "heart beat" alive indication.

RATE: Highest Dose Rate recorded during the last operational period. Note the letter "R" indicating RATE, the word "RATE," the indication of MREM/h and the flashing "heart beat" alive indication.

h: Indicates total elapsed time of last entry, i.e. amount of time between unit turn on and unit turn off. Note the "time" symbol at the top of the display and the flashing "heart beat" alive indication.

DOSE ALARM: Integrated Dose Alarm Set Point as previously programmed. Note the letter "d" for Dose, the words DOSE ALARM, the indication of mRem, and the flashing "heart beat" alive indication.

RATE ALARM: Dose Rate Alarm Set Point as previously programmed. Note the letter "r" for rate, the words RATE ALARM, the indication of mRem/h, and the flashing "heart beat" alive indication.

DOSE PRE-ALARM: Integrated Dose Pre-Alarm Set Point (Dose Warning Alarm) as previously programmed. Note the letter "d" for dose, the triangular "warning" symbol, the indication of mRem, and the flashing "heart beat" alive indication.

RATE PRE-ALARM: Dose Rate Pre-Alarm Set Point (Rate Warning Alarm) as previously programmed. Note the letter "r" for rate, the triangular "warning" symbol, the indication of mRem/h, and the flashing "heart beat" alive indication.

BEEP.0 - Indicates the "chirp" programmed value as previously programmed, i.e. 1 chirp per mRem, 1 chirp per 10 mRem, etc.

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100125: Six digit programmed serial number of dosimeter.

Ver. 1.1: Indicates software version identification number.

Autonomous Operation:

To operate the DMC-100 without the use of a Merlin Gerin Dosimeter Reader, follow the following procedure:

Set the dip switches to allow for Autonomous Operation (see page 2).
   Dip Switch #1: OFF POSITION (Note printing on Circuit board: RUN)
   Dip Switch #2: ON POSITION (Note printing on Circuit board: AUT)

Note: The above settings will allow the DMC-100 to be turned on/off without the use of a reader. The above settings will not allow for the modifications of alarm parameters. Only those parameters initialized for operation with a Merlin Gerin Reader will be available. The Dose Alarm and Dose Rate Alarm will always be available in Autonomous Operation. Pre Alarms, Time Alarms, Chirp Rate, Teletransmit Mode, Histogram and Histogram Management functions must first be initialized with a Merlin Gerin Reader and appropriate software such as DMC-Manager for Windows.

With the dip switches set for Autonomous Operation, and the dosimeter in PAUSE, the black push button may be used to "view" stored parameters as described on page 3. However, in Autonomous Operation, the screens presented are as follows. Note that the dosimeter must be in PAUSE MODE :

PAUSE: Indicates that the unit is not measuring exposure and exposure rate. Unit still performs self-diagnostics including detector and battery checks. Note the flashing "heart beat" alive indication.

CHANGE: Allows the dosimeter to be turned on without the use of a Merlin Gerin Reader. To turn the unit on, advance the display to "CHANGE" using the black push button. Do not push the button after the word "CHANGE" appears. After the word "CHANGE" appears for approx. eight (8) seconds, the word "ENTER" will appear. Acknowledge the "ENTER" by quickly pressing the black push button. NOTE: The word "ENTER" will only display for approx. 2 seconds. If not acknowledged within this time, the unit will return to PAUSE. While operating, the dosimeter, when set for Autonomous Operation, may be returned to PAUSE MODE as follow:
   1. Press and Hold the black push button while either dose or dose rate is displayed.
   2. When the word CHANGE appears after holding the push button for approximately eight (8) seconds continue holding the push button. DO NOT RELEASE or the dosimeter will return to its prior operating status and display.
   3. Continue holding the push button after the word CHANGE appears for an additional two (2) seconds until the word "OUT" appears.

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4. Acknowledge the word "OUT" by quickly releasing and pressing again the black button.

5. The dosimeter returns to PAUSE Mode.

AUT: Indicates that the unit has been configured for Autonomous Operation.
NOTE: Dosimeters that have been configured for Autonomous Operation will not operate in a Merlin Gerin Dosimeter Reader.

TOTAL: If selected, indicates that the DMC-100 will not return the integrated dose value to zero when it is turned on. This feature exists for those persons who use the same dosimeter for each entry/exposure period and wish to accumulate and display their integrated dose without re-zeroing the dosimeter each time the unit is turned off.

RESET: When selected, indicates that the DMC-100 will return to zero the integrated dose each time the unit is turned from PAUSE to ON. This mode operates the dosimeter in the same way as if the dosimeter was operated via a Merlin Gerin Dosimeter Reader.

DOSE: Total integrated dose recorded during the last operational period. Note the letter "D" indicating DOSE, the word "DOSE," the indication of mREM, and the flashing "heart beat" alive indication.

RATE: Highest Dose Rate recorded during the last operational period. Note the letter "R" indicating RATE, the word "RATE," the indication of MREM/h and the flashing "heart beat" alive indication.

h: Indicates total elapsed time of last entry, i.e. amount of time between unit turn on and unit turn off. Note the "time" symbol at the top of the display and the flashing "heart beat" alive indication.

DOSE ALARM: Integrated Dose Alarm Set Point as previously programmed. Note the letter "d" for Dose, the words DOSE ALARM, the indication of mRem, and the flashing "heart beat" alive indication.

RATE ALARM: Dose Rate Alarm Set Point as previously programmed. Note the letter "r" for rate, the words RATE ALARM, the indication of mRem/h, and the flashing "heart beat" alive indication.

DOSE PRE-ALARM: Integrated Dose Pre-Alarm Set Point (Dose Warning Alarm) as previously programmed. Note the letter "d" for dose, the triangular "warning" symbol, the indication of mRem, and the flashing "heart beat" alive indication.

RATE PRE-ALARM: Dose Rate Pre-Alarm Set Point (Rate Warning Alarm) as previously programmed. Note the letter "r" for rate, the triangular "warning" symbol, the indication of mRem/h, and the flashing "heart beat" alive indication.

BEEP.0 - Indicates the "chirp" programmed value as previously programmed, i.e. 1 chirp per mRem, 1 chirp per 10 mRem, etc.

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FAST IN: When allowed via a dosimeter reader and appropriate software such as DMC-MANAGER, the DMC-100 may be "fast started" i.e. changed from PAUSE to RUN via pushing the black push button on the side of the dosimeter one time. The function exists to allow the dosimeter's rapid start without a reader when the dosimeter is stored inside an emergency kit and fast start-up is required. Once "fast started" the dosimeter may not be returned to PAUSE except via a Merlin Gerin Dosimeter Reader.

STD IN - indicates that the dosimeter will require usual AUTONOMOUS MODE operation as described above to change from PAUSE to RUN.

100125: Six digit programmed serial number of dosimeter.

Ver. 1.1: Indicates software version identification number.

Programming Parameters in Autonomous Mode:

The following parameters may be programmed with the DMC-100 Dosimeter in Autonomous Mode. However, it should be noted that optional parameters such as Pre alarms and Time Alarms must first be initialized via a Merlin Gerin Dosimeter Reader before they may be so modified in Autonomous Mode. If these optional parameters have not been initialized via a reader, they will not appear in the "roster" of programmable parameters when displayed in Autonomous Mode. As the Dose Alarm (primary) and Dose Rate Alarm (primary) are always available regardless of mode, these parameters are always programmable via Autonomous Mode Programming.

To program allowed parameters in Autonomous Mode, proceed as follows:

1. With the dosimeter in PAUSE remove the battery cover leaving the battery in place and select the proper dip switch setting for programming parameters in Autonomous Mode:
        Dip Switch #1 - Right Hand Position (Note printing on circuit board: MOD)
        Dip Switch #2 - Right Hand Position (Note Printing on circuit board: AUT)

2. Press the black on the side of the dosimeter one time. The first programmable parameter, RESET or TOTAL appears with a flashing letter "p" to the left of the word. The flashing letter "P" indicates that the black push button on the side of the dosimeter, when pressed one time will advance the display from Parameter to Parameter. To advance the display to the next programmable parameter, press the black push button one time and continue to press one time until reaching the desired programmable parameter.

3. After reaching the desired programmable parameter, press and HOLD the black push button for approximately two (2) seconds until the flashing letter "p" changes to a flashing letter "I". When the letter "I" is flashing, the black push button, when pressed one time, may be used to advance the flashing INTEGER to the next INTEGER of the given, displayed parameter. I.E. with "I" flashing and the word TOTAL or RESET flashing, the black button may be used to "toggle" between either of these two settings. With an alarm value such as DOSE ALARM displayed and flashing, along with the flashing "I", the black button, when pressed one time, will advance the flashing or changeable integer one position to the right.

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4. To change the value of a particular flashing digit, press and hold the black button approximately two (2) seconds until the flashing "I" changes to a flashing "D". With the "D" flashing, pushing the black push button one time will advance the flashing digit to the next higher number.

4. Continue using the black push button as described above to advance (With flashing "P" indication) from parameter to parameter, and then use the flashing "I" function to change the position of the cursor from integer to integer. Use the flashing "D" function to change the value of each number until all programmable/allowable alarms, beep rate, etc. have been programmed.

5. Return the dip switches to the proper Autonomous Run Position as described above.

6. Reassemble the battery cover or reattach appropriate accessories.

Using DMC-100 Accessories:

The following DMC-100 Accessory attachments are available and are used as follows: The use of any Merlin Gerin Accessory with the DMC-100 will not prohibit the dosimeter's use in a reader or require any special reader modifications.

1. Connection Pack:

The optional DMC-100 Connection Pack allows the DMC-100 to be used in conjunction with the following plug-in accessories:

a) external WRM-91 transmitter
b) ear piece for hearing alarms in high noise environments.
c) extremity detector
d) Area Monitor (AM5 or AM10)
e) PERM Teletector.

NOTE: when connecting any of the above accessories, the dosimeter must be programmed to allow specific accessory use via appropriate software such as DMC-MANAGER. To use the transmitter, the dosimeter must be programmed either before or after the attachment of the Connection Pack to allow TELETRANSMIT MODE #1. To allow use of the ear piece or the extremity detector, the dosimeter must also be appropriately programmed.

To connect the Connection Pack, simply remove the existing dosimeter battery cover by removing the single screw located below at the bottom of the dosimeter's face below the speaker. The existing battery cover may then be lifted off. Leave the dosimeter's battery in place. Install the Connection Pack by aligning the pack's pins with the dosimeter's RS232 connector and carefully pressing the connection pack into place. Replace the single screw.

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2. Internal Mini-   smitter:

The Internal Transmitter is installed in the same way as the Connection Pack (see above) except that the dosimeter's 3.6 volt battery is first removed. Power from the two devices (dosimeter and transmitter) will be furnished from the transmitter's 9 volt battery. Use care to insure that the transmitter's connector pins are not bent or damaged during their insertion into the dosimeter's RS232 connector. Replace the battery cover screw. NOTE: The transmitter will begin transmitting when the dosimeter is turned on, either in Autonomous Mode or Satellite Mode, and will turn off (stop transmitting) when the dosimeter is turned off. Be sure that the dosimeter is in TELETRANSMIT MODE #1 before attempting to use the transmitter with a WRM-91 receiver.

Calibration of the DMC-100:

The DMC-100 may be calibrated using manual methods and a known source of radiation such as a Shepherd Calibrator or a Panoramic-type calibrator. A Merlin Gerin Dosimeter Reader and appropriate software such as DMC-MANAGER is required. "SMART" Merlin Gerin Readers, i.e. Model LDM-91 or Model LDM 110 do not require any additional software.

The DMC-100 may also be calibrated using the Merlin Gerin Model CDM automatic calibrator with or without the optional robotic loader. Using the Model CDM calibrator allows for completely hands-free calibration of up to 200 dosimeters per shift with a printed report for each dosimeter. Please call Merlin Gerin for further details on automatic calibration.

To calibrate the DMC-100 manually, it is necessary to expose the dosimeter to radiation of known values. Most U.S. Power plants use Cs-137 as the preferred isotope and expose the dosimeter to three dose rate values, one low range (approx. 20 mRem/h) one mid-range (approx. 200 mRem/h) and one high range (approx. 2 R/h).

Actual values as recorded by the dosimeter are noted on a work sheet and compared to the known values. The variance +/- to the known values is recorded and averaged to determine the exact percentage of under-response or over response to the known. A "safety factor" to allow the dosimeter to over-respond by a certain percentage may also be determined.

Using the dosimeter reader, the dosimeter's internal Calibration Efficiency Factor is displayed. This value equates to the number of counts the dosimeter must see per second to equal 1 R/hr. The Calibration Efficiency Factor is then adjusted (raised the calculated percentage if the dosimeter is over-responding or lowered the calculated percentage if the dosimeter is under-responding) using the dosimeter reader.

The new Calibration Efficiency Factor should then be recalled via the dosimeter reader to insure that the new number has indeed been "down-loaded" to the dosimeter.

Re-shoot the dosimeter to a known value(s) to determine that it is correctly responding within plant specifications.

A calibration verification sticker with appropriate information as required by be affixed to the dosimeter's smooth surface located on the unit's back cover between the clip's attachment points.

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If sample Calibration work sheets for manual calibration are required, please contact Merlin Gerin, Inc. Sample Calibration reports as furnished by the Merlin Gerin Automatic Calibrator are also available upon request.

Normal Operations:

Normal U.S. Power Plant operations typically place dosimeters into service after a bi-annual (every six months) calibration. Once calibrated, a calibration sticker indicating date, time, technician performing the work, and other pertinent details is placed on the smooth area located between the clip supports on the dosimeter's back cover. An additional sticker indicating when the dosimeter is next due for calibration may be placed on the smooth surface on the dosimeter's front cover located just above the battery cover retaining screw.

Calibrated and properly marked dosimeters are placed in storage racks at a location where personnel will enter the protected area.

During normal plant operations, the dosimeter will be turned on (from PAUSE to RUN) and turned off (from RUN to PAUSE) via an automatic dosimeter reader. Two distinct models of dosimeter readers are available from Merlin Gerin, Inc.

Model LDM-101 Dosimeter Reader:

The Model LDM-101 Dosimeter Reader has no internal processor capability and is designed to be serially interfaced with an external computer, either PC (Personal Computer) or Mainframe. Appropriate software to communicate with the reader must be resident in the computer. DMC-MANAGER is an example of appropriate software designed to interface the Model LDM-101 with a Personal Computer operating in a DOS/WINDOWS environment. The computer operating the Model LDM-101 Reader may also be used to communicate with another computer either via a serial link or Local Area Network (LAN) so as to interface a group of machines together. When all interfaced machines share a common data base where personnel health physics records are stored, automatic access control and automatic dosimetry information capture becomes feasible.

Entrance Transaction (PAUSE to RUN)

In the absence of a central computer data base, each LDM-101, via its associated local computer (PC) may be used to set default values (alarm values, Display Characteristics, Histogram Management, Chirp Rate, etc.) for each dosimeter being initialized (turned from PAUSE to RUN) by the reader. In this configuration, each dosimeter being initialized via the reader (PAUSE to RUN) will be set to the same default parameters.

With appropriate software, the worker may be prompted to enter his Worker I.D. number and Radiological Work Permit Number (RWP). With appropriate data base information, alarm values etc. may be set as a function of the RWP and/or other parameters. In the absence of such software, individual readers/computers may be designated for particular RWPs.

When the LDM-101 Reader's associated computer (PC) is communicating on line with an interactive data base, all of the dosimeter functions listed above (alarm values Display

characteristics, Histogram Management, Chirp Rate, etc.) may be independently controlled and set distinctly as a function of Radiological Work Permit (RWP) and/or Worker I.D. number after the system queries the data base as to worker's remaining dose and individual RWP requirements.

Exit Transaction (RUN to PAUSE)

The Model LDM-101 Reader, with its associated computer (PC) and appropriate software will allow the dosimeter to be switched from RUN to PAUSE. Exit transaction information, i.e. total integrated dose recorded, highest dose rate recorded, and stay time may be read from the dosimeter's LCD display. More detailed information, i.e. all of the above plus histogram values and information on alarm bits activated is available and may be displayed and/or printed via appropriate software such as DMC-MANAGER.

When the LDM-101 Reader is connected to a computer with an interactive data base, this recorded information may be used to automatically update personnel records.

Internal recorded data is available in the DMC-100 until the subsequent (next) entrance transaction is processed at which time previous exit information will be erased with the exception of recorded histogram data. As histogram data is written to the dosimeter as a function of time, data recorded from previous exit transactions remains available via appropriate software such as DMC-MANAGER until over-written by newly recorded information. DMC-MANAGER software may be used to view/print the previous exit transaction records. **NOTE:** Histogram functionality must be initialized via the reader during the Entrance transaction.

Model LDM-110 & Model LDM-91 Dosimeter Reader with Software Rev. 532A (or higher)

Either of the above dosimeter readers contains an internal processor, LCD display, and keyboard for data entry. As such, these readers may be used autonomously without connection to computer and either reader may be used to manipulate dosimeter default parameters.

Either reader, through its internal software, may be switched to "REMOTE" mode and may be connected to a computer through its serial port.

Entrance Transaction: (PAUSE to RUN)

With the Model LDM 110 or Model LDM 91, inserting a DMC-100 dosimeter in the Pause Mode will cause the dosimeter to switch from PAUSE to RUN. Operating parameters of the dosimeter, including alarm set points, time alarm values, histogram management, etc. will be set to the default values previously programmed in the reader.

Exit Transaction: (RUN to PAUSE)

Inserting a DMC-100 dosimeter into the reader while in RUN mode will cause it to switch to PAUSE. Recorded parameters such as histogram information may be extracted from the reader via the reader's parallel port directly to a printer or via the reader's serial port to a computer. Appropriate software is required for the computer.

For additional information pertaining to dosimeter readers, please see the appropriate reader's operations manual.

Typical Response to Energy

The following drawings/graphs are provided to indicate the DMC-100's typical response to energy at 65 Kev and 662 Kev as the dosimeter is rotated through a horizontal axis generated by the beam of a source in line with the detector:

Drawing #1: Indicates the DMC-100 typical response at 65 Kev as the dosimeter is rotated as indicated by the schematic on the drawing's lower left side.

Drawing #2: Indicates the DMC-100 typical response at 65 Kev as the dosimeter is rotated as indicated by the schematic on the drawing's lower left side.

Drawing #3: Indicates the DMC-100 typical response at 662 Kev (Cs 137) as the dosimeter is rotated as indicated by the schematic on the drawing's lower left side.

Drawing #4: Indicates the DMC-100 typical response at 662 Kev (Cs 137) as the dosimeter is rotated as indicated by the schematic on the drawing's lower left side.

Drawing #5: Indicates the DMC-100 typical response to energy, beginning at 48 Kev through 1.2 Mev when calibrated with Cs 137.

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