LUDLUM MODEL 2350-1
DATA LOGGER

February 2017

Serial No. 126167 and Succeeding Serial Numbers

CPU Firmware 37122N32

I/O Firmware 37123N05

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LUDLUM MEASUREMENTS, INC
501 OAK STREET, P.O. BOX 810
SWEETWATER, TEXAS 79556
325-235-5494, FAX: 325-235-4672

STATEMENT OF WARRANTY

Ludlum Measurements, Inc. warrants the products covered in this manual to be free of defects due to workmanship, material, and design for a period of twelve months from the date of delivery. The calibration of a product is warranted to be within its specified accuracy limits at the time of shipment. In the event of instrument failure, notify Ludlum Measurements to determine if repair, recalibration, or replacement is required.

This warranty excludes the replacement of photomultiplier tubes, G-M and proportional tubes, and scintillation crystals which are broken due to excessive physical abuse or used for purposes other than intended.

There are no warranties, express or implied, including without limitation any implied warranty of merchantability or fitness, which extend beyond the description of the face there of. If the product does not perform as warranted herein, purchaser's sole remedy shall be repair or replacement, at the option of Ludlum Measurements. In no event will Ludlum Measurements be liable for damages, lost revenue, lost wages, or any other incidental or consequential damages, arising from the purchase, use, or inability to use product.

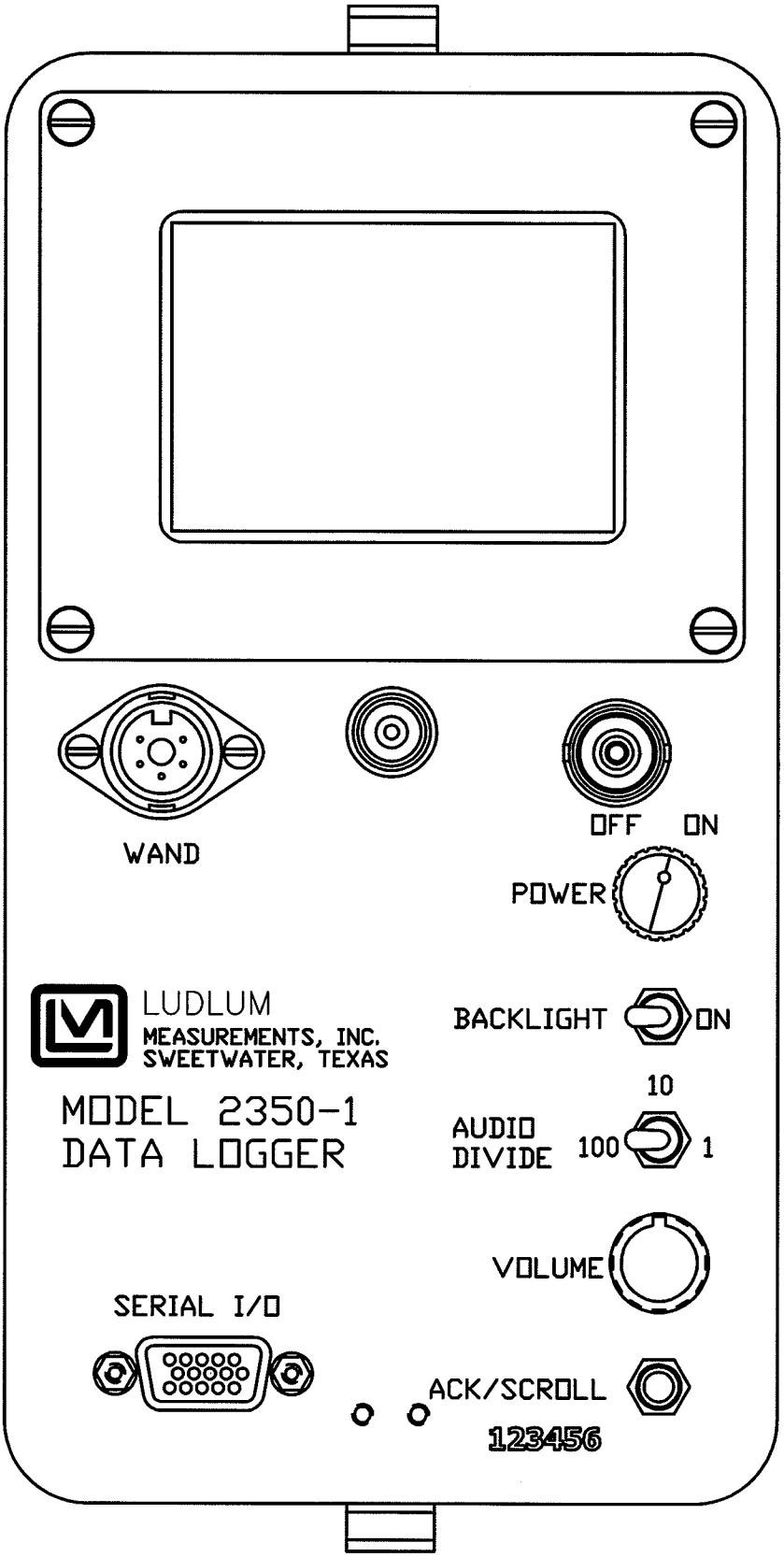
RETURN OF GOODS TO MANUFACTURER

If equipment needs to be returned to Ludlum Measurements, Inc. for repair or calibration, please send to the address below. All shipments should include documentation containing return shipping address, customer name, telephone number, description of service requested, and all other necessary information. Your cooperation will expedite the return of your equipment.

LUDLUM MEASUREMENTS, INC.
ATTN: REPAIR DEPARTMENT
501 OAK STREET
SWEETWATER, TX 79556

800-622-0828 325-235-5494
FAX 325-235-4672

REV #	ALTERATIONS	DATE	BY
1	VALID	06/29/06	PW

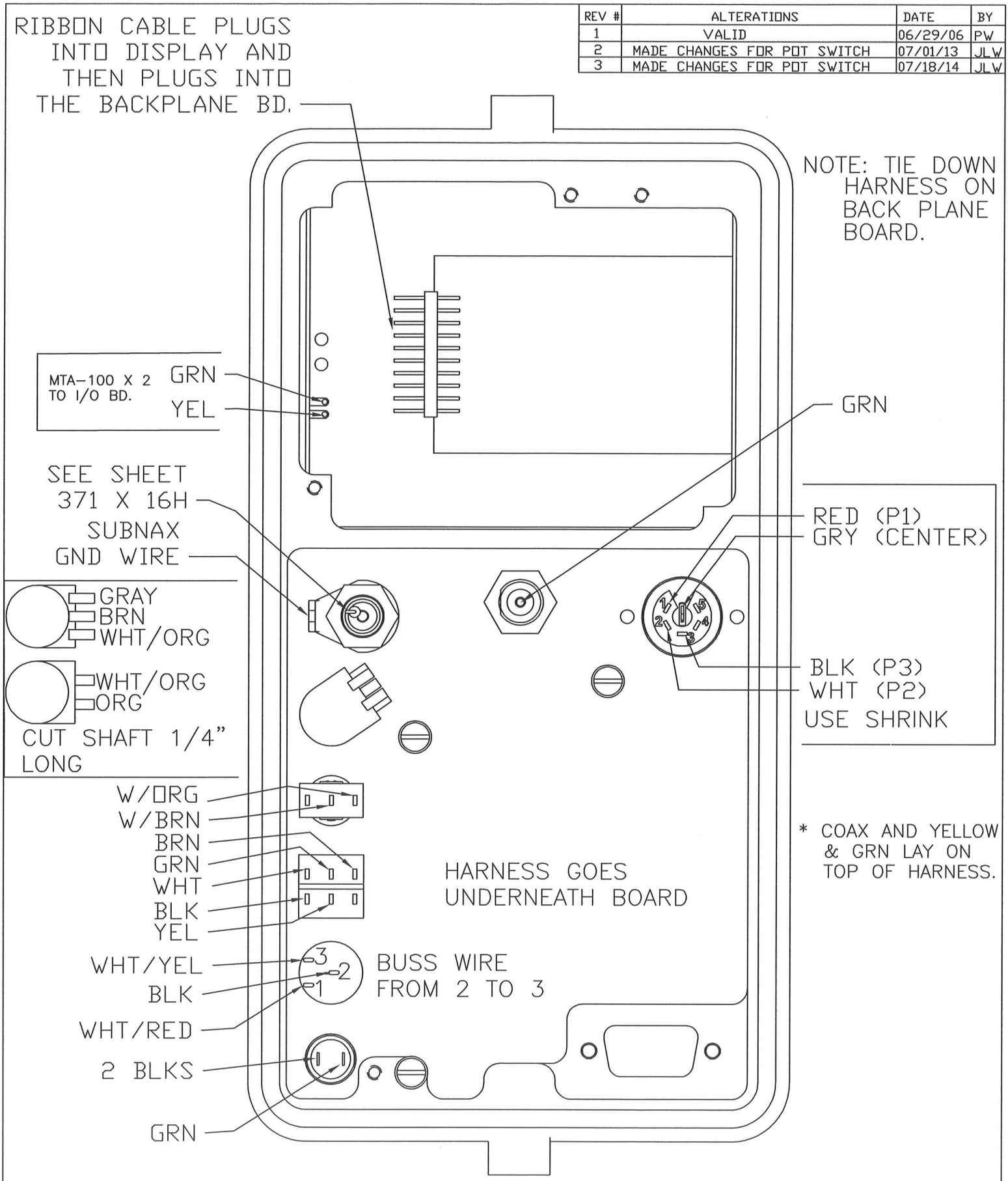


DWN	DATE	CHK	DATE	APP	DATE
PW	06/29/06			JGS	7-18-06

DWG NUM: 4371-018	SCALE: FULL ☒ OTHER
TITLE M 2350-1 FRONT PANEL	

LUDLUM MEASUREMENTS, INC. 501 OAK STREET SWEETWATER, TEXAS 79556	SERIES 371	SHEET 16A

REV #	ALTERATIONS	DATE	BY
1	VALID	06/29/06	PW
2	MADE CHANGES FOR POT SWITCH	07/01/13	JLW
3	MADE CHANGES FOR POT SWITCH	07/18/14	JLW



NOTE: FOR MHV OR SHV USE ADAPTOR #7334-055.

DWN	DATE	CHK	DATE	APP	DATE
JLW	7/18/14			JW	8-18-14

DWG NUM: 4371-018 SCALE: FULL ☒ OTHER

TITLE M 2350-1 WIREUP

LUDLUM MEASUREMENTS, INC.
501 OAK STREET
SWEETWATER, TEXAS 79556

SERIES 371

SHEET 16B

Table of Contents

Section

1

Introduction

The Model 2350-1 Data Logger is a portable microprocessor-based counting instrument designed for use with Geiger-Mueller (GM), proportional, and/or scintillation detectors for measurement of alpha, beta, gamma, and/or neutron radiation. Radiation data is presented in four ways:

1. Auto-ranging digital ratemeter
2. Timed counter (scaler)
3. Integrated dose counter
4. Five-decade logarithmic bar graph

All readouts operate from a single input, and each display can be enabled or disabled if desired.

Up to 16 different sets of detector parameters can be stored, allowing for quick changing of detectors or operating parameters. Detector readings can be stored in the 1000 data point memory with identifiers for the date, time, sample number, detector number, and the type of count that was logged. There are also eight different location code identifiers, which include seven five-character alphanumeric codes and a five-digit location coordinate. Other features include individual alarms for each readout, click-per-event audio with audio divide and volume control, voltage sensitive amplifier, single channel analyzer, adjustable detector high voltage, adjustable window and threshold, detector overload sensing circuitry, adjustable dead time compensation, calibration constant, and response time.

Controlling the Model 2350-1 can be done by connection to a PC, optional keypad, and/or optional bar code reader. The Model 2350-1 also has built-in calibration sub-routines for calculating the calibration constant and dead time of detectors.

The instrument readout is an 8-line by 15-character alphanumeric liquid crystal display (LCD). A display backlight can be turned on or off by a toggle switch on the front panel of the instrument. Batteries are externally accessible from the back of the instrument housing for quick and easy replacement when necessary.

Section 2

Unpacking and Repacking

Remove the calibration certificate and place it in a secure location. Remove the instrument and accessories (batteries, cable, etc.) and ensure that all of the items listed on the packing list are in the carton. If more than one instrument (Model 2350-1 and detector(s)) is in a carton, refer to the calibration certificate(s) for the serial number (S/N) match. The Model 2350-1 S/N is located on the front-panel below the acknowledgeable button. Most LMI detectors have a label on the base or body of the detector for the Model and S/N identification.

To return the instrument for repair or calibration, provide sufficient packing material to prevent damage during shipment and appropriate warning labels to ensure careful handling.

Every returned instrument must be accompanied by an **Instrument Return Form**, which can be downloaded from the Ludlum website at www.ludlums.com. Find the form by clicking the "Support" tab and selecting "Repair and Calibration" from the drop-down menu. Then choose the appropriate Repair and Calibration division where you will find a link to the form.

Section 3

Specifications

Compatible Detectors: GM, proportional, scintillation

Connector: Series C (others available on request)

Display: 8-line LCD display with 15 characters per line

Backlight: a two-position toggle switch to activate backlight

Scaler: six-digit display

Timer: used in conjunction with scaler. Count time can be set from 1 to 65,535 seconds in one-second intervals.

Ratemeter: digital ratemeter, corrected for dead time and calibration constant

Trend Indicator: five-decade logarithmic bar graph

Linearity: reading within 10% of true value with detector connected

Scale: can display rem/hr, Sv/h, R/hr, cpm, cps, dpm, dps, rad(r), Gray (G), C/kg, Ci/cm^2, or Bq/cm^2

Integrated Dose: counter provided to give total accumulated dose for up to 45 days (will display in the same units as the ratemeter)

Audio: built-in unimorph speaker with volume control (greater than 60 dB at 0.61 m {2 ft}, full volume)

Audio Divide: operator selected divisions of 1, 10, or 100 events per click

Alarm: separate alarms for digital ratemeter, scaler, and integrated dose can be set at any point (audible and visual indicators)

ACK/Scroll: pushbutton to silence audio after alarm has been indicated and/or scrolled through the various displays

Data Logger: capable of logging up to 1000 individual data points with following identifiers for each point: eight location codes, time of day, month, day, and year, detector number, count rate/scaler count/integrated dose, count time, logging mode, sample number

Detector Parameters: capable of storing the following parameters for 16 different detectors: model number, serial number, calibration constant, dead time correction, high voltage, threshold, window, display range multiplier, display time base, display units, overload current, ratemeter alarm setting, scaler alarm setting, scaler count time, integrated dose alarm setting

RS-232 Port: a full duplex communication port that allows for instrument setup by optional keypad or PC, also allows for data to be transferred to a PC file

Bar Code Reader (optional): allows for setup of instrument by computer generated bar codes

High Voltage: adjustable from 400 to 2500 volts

Threshold: adjustable from -100 to -1000 mV

Window: adjustable from 0 to 1000 above threshold

Gain: adjustable from 2 to 350 mV at threshold setting of 100

Dead Time: adjustable to compensate for dead time of detector and electronics

Response: Fixed response is adjustable from 1 to 127 seconds in one-second intervals. Variable response will vary according to the number of counts present. FAST is typically 4 to 25 seconds, and SLOW is typically 4 to 60 seconds from 10% to 90% of final reading.

Power: four each D cell batteries (housed in sealed compartment that is accessible from back of instrument)

Battery Life: greater than 75 hours (low-battery condition is automatically indicated)

Battery Dependence: less than 3% change in readings to battery end point

Construction: cast-and-drawn aluminum with beige polyurethane enamel paint

Temperature Range: 0 to 50 °C (32 to 122 °F)

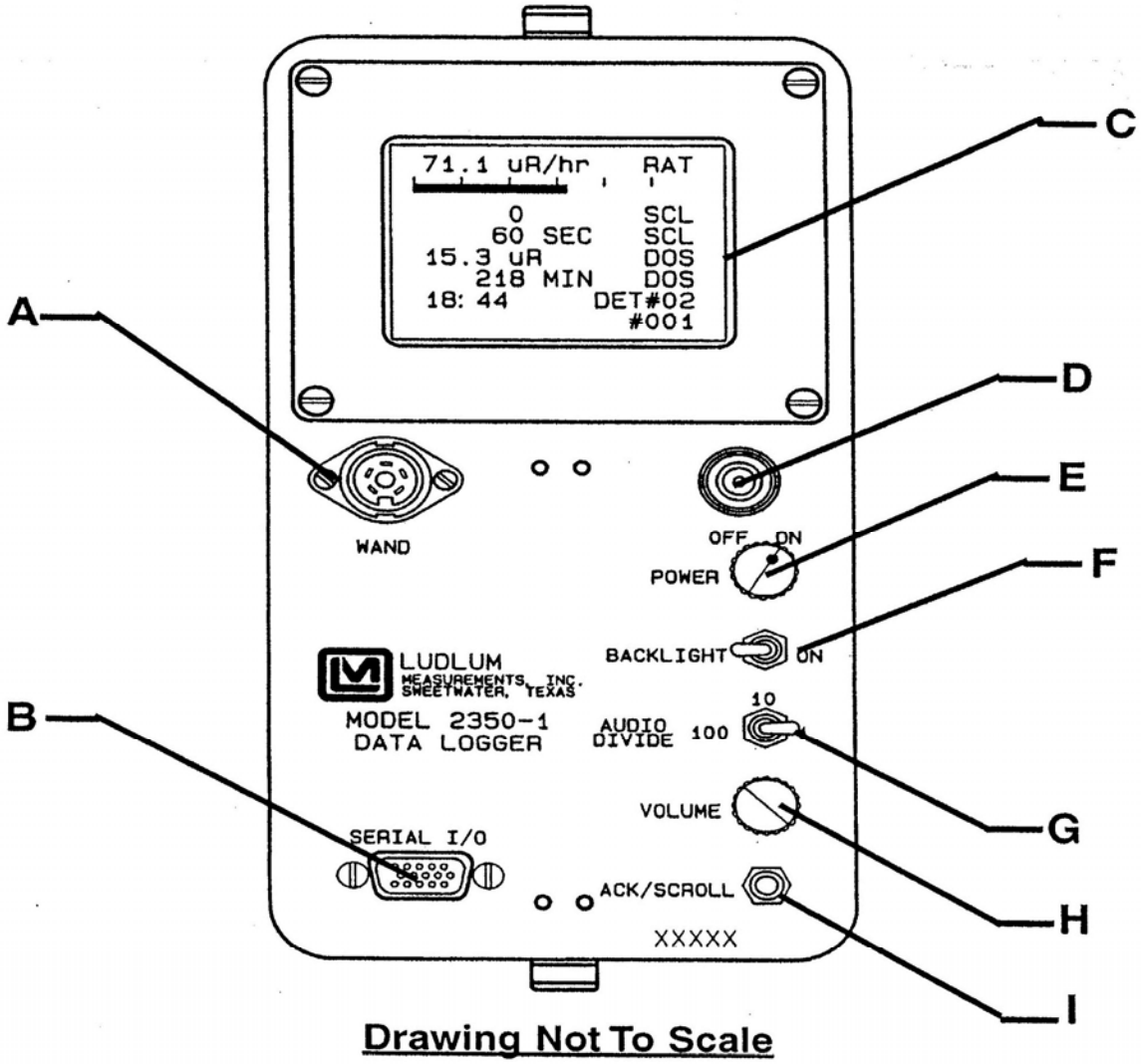
Size: 14.2 x 11 x 22 cm (5.6 x 4.3 x 8.8 in.) (H x W x L) without handle, 20.9 cm (8.2 in.) (H) with handle

Weight: 2.4 kg (5.2 lb), including batteries

Section

4

Description of Controls and Functions



Drawing Not To Scale

A. WAND: a plug that is used to connect an optional bar code reader want to the instrument

B. SERIAL I/O: a 15-pin RS-232 connector that is used to connect the instrument to the optional keypad to a computer

C. DISPLAY: an 8-line, 15-character alphanumeric liquid crystal display (LCD)

D. CONNECTOR: used to connect the detector to the instrument, typically Series C, but can be BNC, MHV, UHF, or others

E. POWER SWITCH: a two-position switch used to turn the instrument on and off

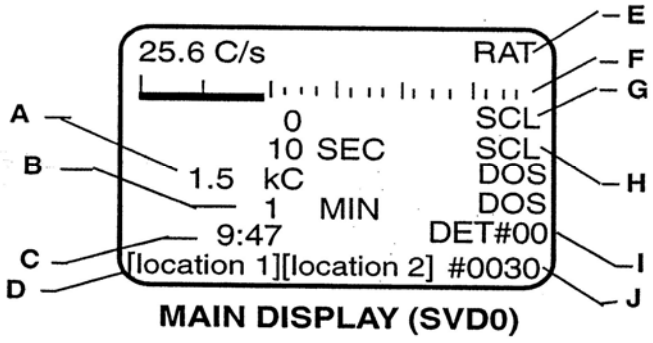
F. BACKILGHT: a two-position toggle switch that is used to turn the display backlight on and off

G. AUDIO DIVIDE: a three-position toggle switch that is used to adjust the audio divide between 1, 10, or 100 events per click

H. VOLUME: a one-turn potentiometer used to adjust the volume of the audio

I. ACK/SCROLL: a pushbutton that is used to silence the audible alarm indicator and scroll through the various displays

Main Display (SVD0)



MAIN DISPLAY (SVD0)

A. INTEGRATED DOSE INDICATOR: provides total integrated dose readout. In an alarm condition, the alarm indicator (ALM) displays in place of the DOS indicator and alternates at one-second intervals.

B. INTEGRATED DOSE TIMER: provides a readout in minutes of an integrated dose

C. CLOCK: displays the current time of day in 24-hours format

D. LOCATION CODES 1 & 2: identifies the five-character alphanumeric location code settings 1 & 2

E. DIGITAL RATEMETER: an auto-ranging display. Low and high-level alarm indicators LOW and ALM appear in place of the RAT indicator, and the display will alternate at one-second intervals until the alarm is reset. When overload or over-range conditions occur, the words OVER LOAD or OVER RANGE appear in place of the ratemeter, and the display will alternate at one-second intervals until the condition is corrected. In the event an overload or over-range condition occurs simultaneously, the overload message takes priority.

F. LOG BAR GRAPH DISPLAY: a bar-graph ratemeter display that is presented in cps only and does not have dead time correction applied to it. The display ranges from 1 cps to 100 kcps. (**Note:** The counting limit of the instrument is 50 kcps.

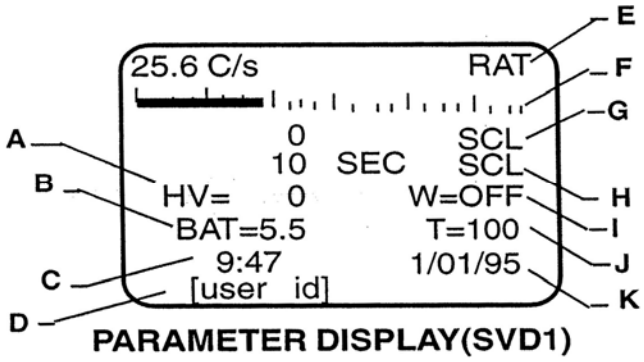
G. SCALER: a six-digit gross counter. When a count is being taken, the count message (CNT) is shown in place of the scaler indicator (SCL). When the instrument is in the data logging mode, the logging indicator (LOG) is displayed in place of SCL. When in an alarm condition, the alarm indicator (ALM) displays, and the display will alternate between the ALM and SCL indicators at one-second intervals.

H. SCALER TIMER: The scaler timer is displayed on this line. The count time is always displayed in seconds and will do a count-down to indicate the amount of time left in the count.

I. DETECTOR IDENTIFIER: This identifies which set of detector parameters is currently being used.

J. LOGGED READING INDICATOR: This indicator identifies the number of the last reading logged.

Parameter Display (SVD1)



PARAMETER DISPLAY(SVD1)

A. HIGH VOLTAGE: provides a reading of the current HV setting

B. BATTERY: displays the current battery voltage. When the battery voltage reads 4.4 volts or less, the message LOW replaces the voltage reading.

C. CLOCK: displays the current time of day in 24-hour format. If the battery voltage reads 4.4 volts or less, the message LO BAT alternates with the time at one-second intervals.

D. USER ID: a 15-character alphanumeric display to allow for individual operator ID codes

E. DIGITAL RATEMETER: an auto-ranging display. Low and high-level alarm indicators LOW and ALM appear in place of the RAT indicator, and the display will alternate at one-second intervals until the alarm is reset. When overload or over-range conditions occur, the words OVER LOAD or OVER RANGE appear in place of the ratemeter, and the display will alternate at one-second intervals until the condition is corrected. In the event an overload and over-range condition occurs simultaneously, the overload messages takes priority.

F. LOG BAR GRAPH DISPLAY: a bar graph ratemeter display that is presented in cps only and does not have dead time correction applied to it. The display ranges from 1 cps to 100 kcps. **Note:** The counting limit of the instrument is 50 kcps.

G. SCALER: a six-digit gross counter. When a count is being taken, the count message (CNT) is shown in place of the scaler indicator (SCL). When the instrument is in the data logging mode, the logging indicator (LOG) is displayed in place of the SCL. When in an alarm condition, the alarm indicator (ALM) displays, and the display will alternate between the ALM and SCL indicators at one-second intervals.

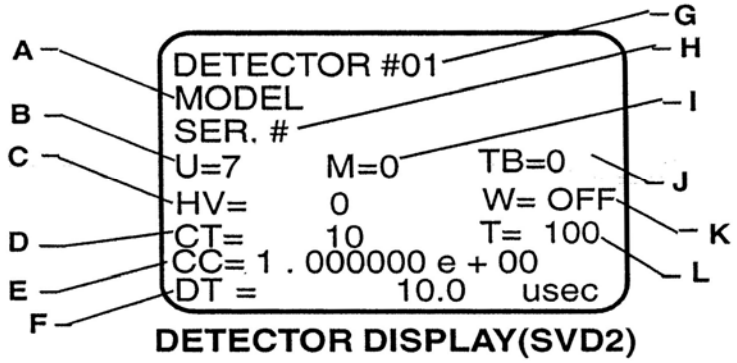
H. SCALER TIMER: The scaler timer is displayed on this line. The count time is always displayed in seconds and will do a count-down to indicate the amount of time left in the count.

I. WINDOW: This identifies the window setting of the chosen detector. The display reads OFF when the window is not activated.

J. THRESHOLD: This display indicates the threshold setting of the chosen detector.

K. DATE: displays the current date

Detector Display (SVD2)



DETECTOR DISPLAY(SVD2)

A. MODEL: used to identify the model number of the detector being used (44-2, 44-3, etc.)

B. DISPLAY UNITS: identifies the current display units used by the detector (R, Sv, counts, etc.)

C. HIGH VOLTAGE: provides a reading of the current HV setting

D. SCALER COUNT TIME: displays the scaler count time in seconds for the detector

E. CALIBRATION CONSTANT: indicates the current dead time compensation factor that is being used for the detector

F. DEAD TIME: indicates the current dead time compensation factor that is being used for the detector

G. DETECTOR: identifies which detector parameters are being displayed

H. SERIAL NUMBER: used to identify the serial number of the detector being used

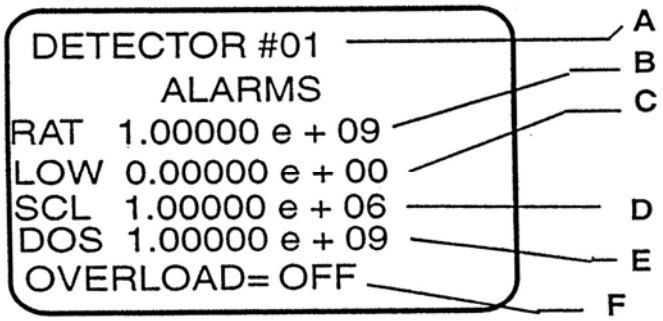
I. MULTIPLIER CODE: identifies the current range multiplier being used. (The display multiplier can be auto-ranging, read in micro, milli, kilo, etc.)

J. TIME BASE: indicates the current time base being used (seconds, minutes, or hours)

K. WINDOW: This identifies the window setting of the detector. The display reads OFF when the window is not activated.

L. THRESHOLD: This display indicates the threshold setting of the detector.

Alarm Display (SVD3)



ALARM DISPLAY(SVD3)

A. DETECTOR: identifies which detector alarm settings are being displayed

B. RATEMETER LOW ALARM: indicates the ratemeter alarm setting

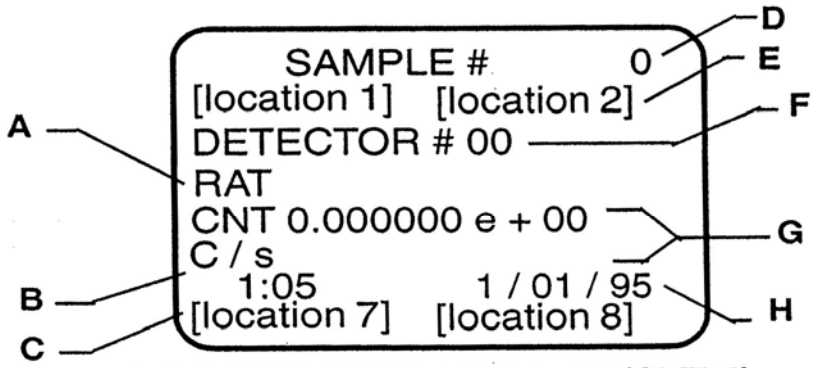
C. RATEMETER LOW ALARM: indicates the low alarm setting for the ratemeter. This alarm is used to identify a possible detector failure. When the counts from the detector drop below the alarm set point, the alarm is activated.

D. SCALER ALARM: indicates the scaler alarm setting

E. INTEGRATED DOSE ALARM: indicates the alarm setting for the integrated dose counter

F. OVERLOAD: indicates the current overload current setting. When disabled, the word OFF appears.

Logged Data Display (SVD4)



LOGGED DATA DISPLAY(SVD4)

A. DATA SOURCE: identifies the source of the logged data (i.e. ratemeter, scaler, or integrated dose)

B. CLOCK: displays the current time of day in 24-hour format. If the battery voltage reads 4.4 volts or less, the message LO BAT alternates with the time at one-second intervals.

C. LOCATION CODES 7 & 8: identifies the preset Location Code 7 and Location Coordinate 8

D. SAMPLE NUMBER: identifies the sample number you are viewing

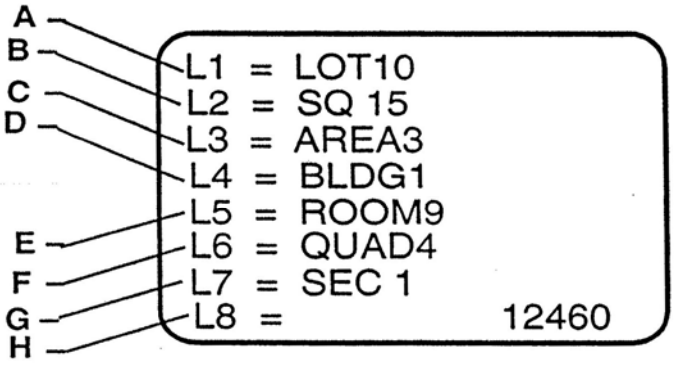
E. LOCATION CODE 1 & 2: identifies the five-character alphanumeric Location Codes 1 & 2 (These are the same codes that appear on the normal display.)

F. DETECTOR NUMBER: identifies the detector used in the logged sample

G. LOGGED COUNT: displays the actual count taken in exponential format. When ratemeter count or integrated dose count is taken, the exposure rate will display. If a scaler count is taken, the count time will display.

H. DATE: This identifier indicates the current date.

Logged Data Location Display (SVD8)



LOGGED DATA LOCATION DISPLAY (SVD8)

This display provides the user with the eight different identifiers for each location. L1-L7 are strings of five alphanumeric characters, and L8 is a five-digit location coordinate.

A. L1: a five-character alphanumeric location identifier

B. L2: a five-character alphanumeric location identifier

C. L3: a five-character alphanumeric location identifier

D. L4: a five-character alphanumeric location identifier

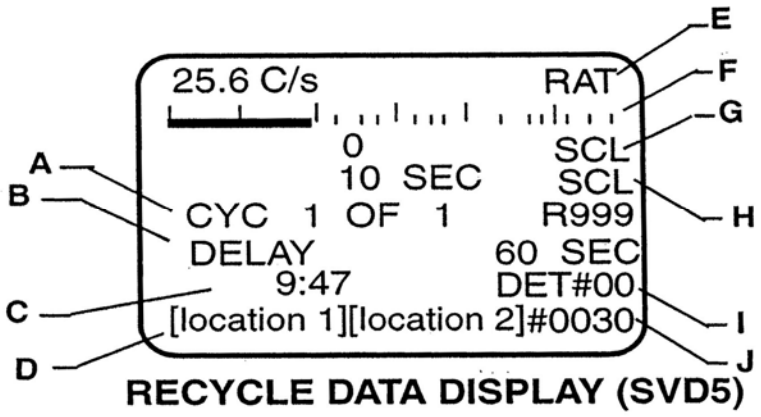
E. L5: a five-character alphanumeric location identifier

F. L6: a five-character alphanumeric location identifier

G. L7: a five-character alphanumeric location identifier

H. L8: a five-digit location coordinate that can have a value from 0 to 65535 (The location coordinate can be set to automatically change by a set increment when data is logged.)

Recycle Data Display (SVD5)



RECYCLE DATA DISPLAY (SVD5)

A. CYCLE COUNTER: indicates the number of cycles that will be run, the number of cycles in process, and the number of recycles remaining

B. CYCLE DELAY: indicates the time delay between each cycle

C. CLOCK: displays the current time of day in 24-hour format

D. LOCATION CODES 1 & 2: identifies the five-character alphanumeric Location Code Settings 1 & 2

E. DIGITAL RATEMETER: an auto-ranging display. Low and high-level alarm indicators LOW and ALM appear in place of the RAT indicator, and the display will alternate at one-second intervals until the alarm is reset. When overload or over-range conditions occur, the words OVER LOAD or OVER RANGE appear in place of the ratemeter, and the display will alternate at one-second intervals until

the condition is corrected. In the event an overload and over-range condition occurs simultaneously, the overload message takes priority.

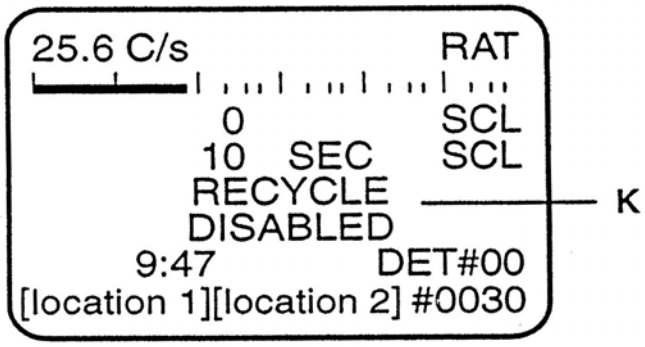
F. LOG BAR GRAPH DISPLAY: a bar graph ratemeter display that is presented in cps only and does not have dead time correction applied to it. The display ranges from 1 cps to 100 kcps. (**Note:** The counting limit of the instrument is 50 kcps.)

G. SCALER: a six-digit gross counter. When a count is being taken, the count message (CNT) is shown in place of the scaler indicator (SCL). When the instrument is in the data logging mode, the logging indicator (ALM) displays and the display will alternate between the ALM and SCL indicators at one-second intervals.

H. SCALER TIMER: The scaler timer is displayed on this line. The count time is always displayed in seconds and will do a count-down to indicate the amount of time left in the count.

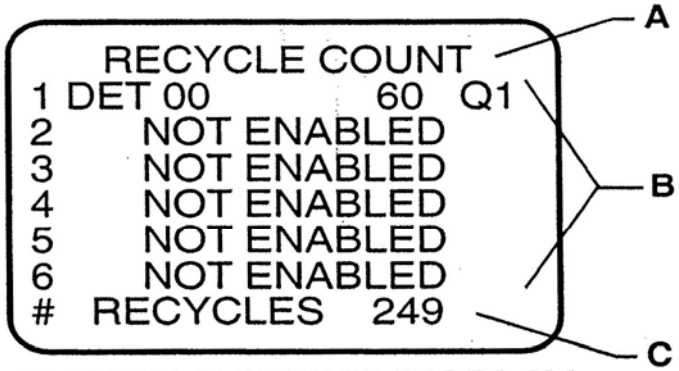
I. DETECTOR IDENTIFIER: This identifies which set of detector parameters is currently being used.

J. LOGGED READING INDICATOR: This indicator identifies the number of the last reading logged.



K. RECYCLE DISABLE: indicates that Recycle Mode has been disabled. (Message replaces the Recycle Mode parameters.)

Recycle Setup Display (SVD6)



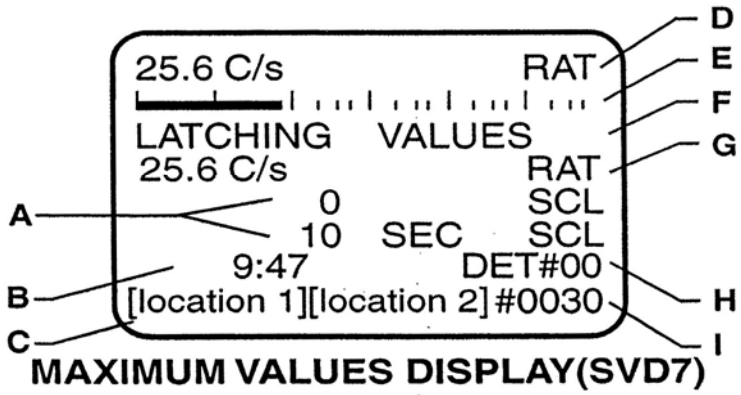
RECYCLE SETUP DISPLAY (SVD6)

A. IDENTIFIER: indicates that this is the Recycle Setup display

B. RECYCLE SETUP: displays the parameters for Cycles 1-6. When enabled, the cycle number, detector number, delay time between recycles, and logging mode (i.e. ratemeter, scaler, or integrated dose) are displayed.

C. RECYCLE COUNT: indicates the number of recycles that will run once initiated

Maximum Values Display (SVD7)



MAXIMUM VALUES DISPLAY(SVD7)

A. SCALER: displays the maximum scaler count logged and the count time used

B. CLOCK: displays the current time of day in 24-hour format

C. LOCATION CODES 1 & 2: identifies the five-character alphanumeric Location Code Settings 1 & 2

D. DIGITAL RATEMETER: an auto-ranging display. Low and high-level alarm indicators LOW and ALM appear in place of the RAT indicator, and the display will alternate at one-second intervals until the alarm is reset. When overload or over-range conditions occur, the words OVER LOAD or OVER RANGE appear in place of the ratemeter, and the display will alternate at one-second intervals until the condition is corrected. In the event an overload and over-range condition occurs simultaneously, the overload message takes priority.

E. LOG BAR GRAPH DISPLAY: a bar graph ratemeter display that is presented in cps only and does not have dead time correction applied to it. The display ranges from 1 cps to 100 kcps. (**Note:** The counting limit of the instrument is 50 kcps.)

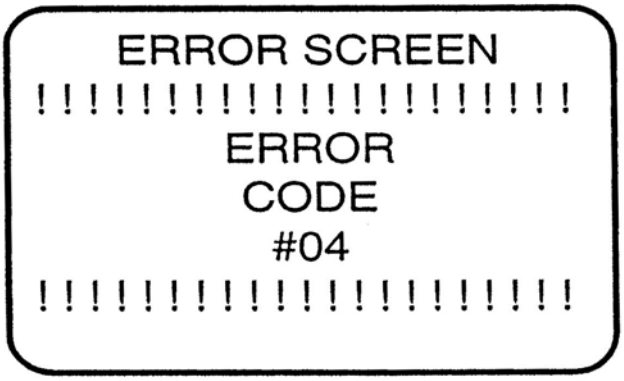
F. DISPLAY IDENTIFIER: displays the words MAXIMUM VALUES when the maximum values latching mode is off. When activated, the words LATCHING VALUES display.

G. RATEMETER: displays the maximum ratemeter reading logged

H. DETECTOR IDENTIFIER: this identifies which set of detector parameters is currently being used

I. LOGGED READING INDICATOR: This indicator identifies the number of the last reading logged.

Error Message Display



ERROR MESSAGE DISPLAY

The error message display is activated when one of the following errors occur:

1. Mathematical bit shift overflow
2. Multiply overflow

3. Divide by zero
4. Dead time multiplied by recorded rate > 1
5. Dead time corrected count has exceeded 3 bytes
6. Accumulator overflow when adding new count
7. Accumulator overflow when correcting for new time constant
8. Counts per second larger than 4 bytes

Note: This screen cannot be called up. It appears alternately with whichever screen is currently active until the error is corrected.

Command Verification Display

COMMAND VERIFICATION DISPLAY

These commands require the instrument to save parameters to memory or change or delete data required verification. The following commands require command verification when executed:

SAA

SAC

SCA

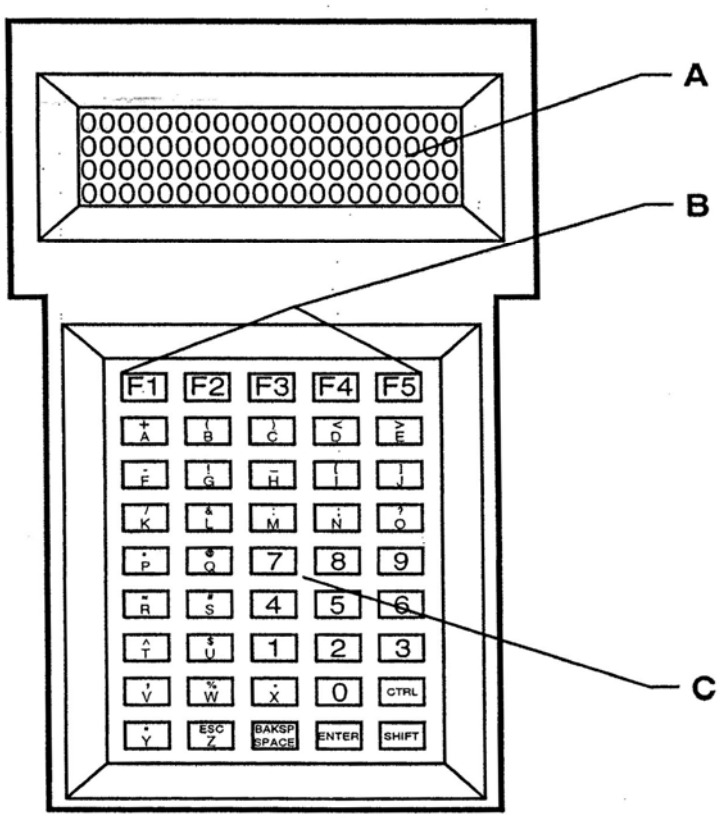
SKD

SP

SSC

SSR

Optional Keypad Control



A. DISPLAY: 4-line by 20-character LCD display

B. FUNCTION KEYS: programmable multi-task function keys

C. KEYPAD: 40-key complete alphanumeric, soft-touch keypad

Section 5

Safety Considerations and Warning Markings

Environmental Conditions for Normal Use

Indoor and outdoor use

No maximum altitude

Temperature range of 0 to 50 °C (32 to 122 °F)

Maximum relative humidity of less than 95% (non-condensing)

Mains supply voltage range 95-250 Vac

Maximum transient voltage of 1500 Vac

Installation Category (Overvoltage Category) II (as defined by IEC 1010-1)

Pollution Degree 3 (as defined by IEC 644) (Conductive pollution or dry nonconductive pollution that becomes conductive due to condensation to be found in industrial environments or construction sites – harsh environments.)

Cleaning Instructions and Precautions

The Model 2350-1 may be cleaned externally with a damp cloth, using only water as the wetting agent. Do not immerse the instrument in any liquid. Observe the following precautions when cleaning:

1. Turn the instrument OFF.

2. Allow the instrument to sit for one minute before cleaning.

Warning Markings and Symbols

Caution!

The operator or responsible body is cautioned that the protection provided by the equipment may be impaired if the equipment is used in a manner not specified by Ludlum Measurements, Inc.

Warning!

The operator is strongly cautioned to take the following precautions to avoid contact with internal hazardous live parts that are accessible using a tool:
1. Turn the instrument power OFF and disconnect the power cord.
2. Allow the instrument to sit for one minute before accessing internal components.

The "**crossed-out wheelie bin**" symbol notifies the consumer that the product is not to be mixed with unsorted municipal waste when discarding; each material must be separated. See section 9, "Recycling," for further information. Also

Section

6

Operating Procedures

Initial Instrument Setup

Battery Installation

Ensure that the power switch is in the OFF position. Open the battery lid by turning the thumb screw counter-clockwise one quarter of a turn.

Note: The battery compartment is accessible from the back side of the instrument housing.

Install four D cell batteries in the compartment, making sure to align (+) and (-) marks on the battery door with the markings on the batteries.

Note: Center post of the battery is positive (+).

Close the battery door and latch it by turning the thumbscrew one quarter of a turn clockwise until it latches firmly. Turn the power switch on. The instrument will perform an LCD check, causing the display to go black, then it will initiate a memory check. Once this has been completed, the instrument will momentarily display the current battery voltage and then the last screen that was active when the instrument was turned off. Once this process is complete, turn the instrument off and connect it to the optional keypad and/or bar code reader, or connect it directly to a computer. When batteries need to be replaced, ensure that the instrument is turned off and batteries are replaced as quickly as possible. The parameter memory is protected by a back-up power supply for approximately 15 minutes before data is lost.

Note:

The following three sections go through the process of setting up the instrument with the keypad, computer, and/or bar code reader.

Computer Control Setup

The Model 2350-1 is provided with a basic software package that allows the user to control eh instrument by a computer. The software has a demonstration program, a terminal emulator to allow for command entry, and a program to format logged data so that it may be downloaded into a spreadsheet program.

Once the software is loaded onto the computer, the following procedures will prepare you to control the Model 2350-1 by your computer.

Connect the computer interface cable to an available serial port on your computer.

Connect the other end to the Model 2350-1 Data Logger.

Refer to the software user's manual for instruction on starting the software and follow the instructions in the program.

Note:

The terminal emulator software utilizes the same commands as the optional terminal, which are entered the same way.

Optional Keypad Setup

Note: When keypads are purchased with instruments, the following procedures are done at initial setup and calibration. If the keypad is connected to the instrument and the batteries go dead, it is possible that the keypad will have to be re-initialized. New keypads that are purchased after the instrument will also need to be initialized.

To initialize the keypad:

1. Connect the keypad to the Model 2350-1.
2. Turn the Model 2350-1 ON.
3. Press the CNTRL, SHIFT, and F1 keys simultaneously to activate the keypad parameter display. The following screen will appear on the keypad display.

   BAUD = 9600
   F1-CHANGE PARAMETER
   F2-NEXT
   F3-PREVIOUS
   F4-QUIT
   F5-SAVE

4. Press the F2 button to scroll through the parameters until you find one that needs to be changed.

5. Press the F1 button to scroll through the parameter settings until the correct setting appears.
6. Repeat the process until all parameters are correctly set as listed below.
7. When all parameters have been set, press the F5 button to store the new parameters in the terminal memory.

   Note: Terminal memory is non-volatile and will hold the parameters even when the keypad is disconnected from the instrument and has no power supply

8. The keypad will beep three times and prompt you with the question, "ARE YOU SURE?" If you want to save the parameters as you have selected, press F1, and the parameters will be saved and the keypad will return to normal operating mode. If not, press F5 and the terminal will return to normal operating mode without saving the changes.

   The keypad parameters should be set as follows for proper operation with the Model 2350-1 Data Logger:

BAUD = 9600	DATA BITS = 8
PARITY = IGNORE	REPEAT = FAST
ENABLE KEY CLICK	DISABLE KNP FUNCTION
ENABLE CURSOR	ENABLE CURSOR BLINK
DISABLE XON/XOFF	ENABLE HANDSHAKE
ENABLE ECHO	ESCAPE MODE = ANSI
CR/LF MODE = NEWLINE	DISABLE TEST
SHIFT LOCK DISABLE	SCROLL ON 80
VIEWING ANGLE MAX	ENABLE BREAK CMND
BACKLIGHT TIMED	

   Once the parameters are set as listed above, the instrument is ready for operation, and the user can proceed to Section 7 for setting up the instrument for specific applications.

Determining Instrument Plateau

The bar code reader utilizes the 3 of 9 code format. This code consists of a start character, command characters, termination character, check sum character, and a stop character. As an example, the symbols and code to activate the normal display would be as follows:

In this example, the "*" is the start and stop character. "SVD0" is the command being executed. "$" is the command to execute the carriage return and lien feed, and the "P" is the check sum character that is used to ensure that the data being sent is correct.

The following instructions will explain how to install the bar code reader wand and begin operation:

1. Connect the wand to the instrument by aligning the pins of the connector, pressing down firmly, and twisting approximately a quarter of a turn clockwise until the connector latches.

2. Turn the instrument on.

3. Hold the wand at about a 10 to 20-degree angle from vertical with the tip touching the surface approximately one-fourth of an inch from the left side of the bar code to be read.

4. Scan the bar cod rapidly with a uniform speed.

When the instrument recognizes the code, it will give a short beep. For first-time users, it can sometimes be difficult to get good scans. For the most part when a user has trouble getting the reader to work, the scanning speed is too slow.

Bar code reading can make routine procedures simple to do. In some cases, though, the bar codes will need to be protected from surrounding elements by a laminated covering. Below are a few things to keep in mind when laminating or covering bar codes to protect them.

1. Make sure the laminate extends at least one-fourth of an inch from the ends of the bar code.

2. When scanning a laminated code, make sure not to scan past the edge of the laminate, as the reader may try to identify the edge as part of the code.

3. Extended outside applications may require an ultraviolet (UV) resistant laminate to protect the label from fading.

Setting Operating Parameters

The following section provides examples for setting the various parameters of the instrument. For clarification purposes, these examples all start by activating a display where the various parameters can be viewed. System programming allows for the operator to set individual parameters at any time and any display. The displays are simply used as a method of confirmation that the parameters are set correctly. In addition to the various displays, all parameter settings can be individually displayed on a computer screen or keypad by initiating the read commands. To initiate a read

command, enter an R and then the command that you want to read, and the current setting will be displayed.

Example: To read the current high-voltage setting:

KEYSTROKES	RESPONSE
RH – ENTER	The current setting will be displaying on either the computer screen or keypad display.

Setting the Time of Day

KEYSTROKES	RESPONSE
SVD0 – ENTER	The instrument will display the main display.
ST9:25 – ENTER	Sets the instrument clock to 9:25 AM.

Setting the Date

KEYSTROKES	RESPONSE
SVD1 – ENTER	The instrument will display the parameter display.
SD01/01/95 – ENTER	Sets the date to January 1, 1995.

Setting the Location Code

KEYSTROKES	RESPONSE
SVD8 – ENTER	The instrument will display the logged data location display.
L1BLDG1 – ENTER	Sets Location Code 1 to Building 1.
L2ROOM2 – ENTER	Sets Location Code 2 to Room 2.
L8123 – ENTER	Sets the location coordinate to Position 123.

The data location code is an eight-part identifier that allows the user to set up seven different five-character alphanumeric codes and one five-digit coordinate for each piece of logged data. The above example could be expanded to have five other location identifiers of up to five characters, if desired to pinpoint the location of a reading.

Setting the User ID

KEYSTROKES	RESPONSE
SVD1 – ENTER	The instrument will display the parameter display.
IJOHN DOE – ENTER	Sets John Doe as the user ID.

Detector Setup

The following example will set up a Model 44-2 gamma scintillator with a serial number PR 123456 as detector #00. The detector will display in cpm, high voltage will be 800 volts, the threshold setting will be 100, and the window will be off. The scaler count time will be 6 seconds, the calibration constant will be 1, and the dead time will be set at 18 microseconds.

KEYSTROKES	RESPONSE
SVD2 – ENTER	The Model 2350-1 displays the detector parameter screen. **Note:** The Model 2350-1 will display the detector parameters that are currently being used by the instrument (i.e. DET 00-15). If there are no parameters stored in memory, the display will show the default values of DET 00.
DO – ENTER	The instrument will display the parameters for detector 00.
M44-2 – ENTER	The numbers 44-2 will display after MODEL on line 2 of the display.

NPR123456 – ENTER	The numbers PR123456 will display after serial number on line 3 of the display.
SU7 – ENTER	Sets the display units to counts. The display will read U=7.
SM0 – ENTER	Sets the multimeter to auto-ranging. The display will read M=0.
SB1 – ENTER	Sets the display time base to minutes. The display will read TB=1.
H800 – ENTER	Sets the detector high voltage to 800 volts. The display will read HV=800.
WOFF – ENTER	Turns the window off. The display will read W=OFF.
F6 – ENTER	Sets the scaler count time to 6 seconds. The display will read CT=6.
T100 – ENTER	Sets the threshold to 100. The display will read T=100.
SC1 – ENTER	Sets the calibration constant to 1. The display will read CC=1.000000e+00.
SL1.8E-5 – ENTER	Sets the dead time to 18 µs. The display will read DT=1.799999e.05.
SP0 – ENTER	Saves the above parameters as detector 00.

Note: A verification screen will appear when this command is done. To execute the command, answer "Y ENTER." If you do not want to save the parameters as DET 00, press "N ENTER" to cancel the command.

Note: When setting the dead time, the actual setting may be slightly different than the one entered, due to rounding parameters used by the instrument.

Alarm Setup

There can be a total of 16 different sets of alarm parameters. One for each set of detector parameters:

KEYSTROKES	RESPONSE
SVD3 – ENTER	The instrument will display the alarm parameters for the detector that is currently being used.
D0 – ENTER	The instrument will display the alarm parameters for detector 00.
J1.0E+4 – ENTER	Sets the ratemeter alarm at 10,000 cpm. The display will read RAT 1.00000e+04.
SVC1.0E+4 – ENTER	Sets the low ratemeter alarm at 10,000 counts. The display will read 1.00000e+06.
K1.0E+6 – ENTER	Sets the integrated dose alarm at 1,000,000 counts. The display will read 1.0000e+6.
P1.0E+6 – ENTER	Sets the integrated dose alarm at 1,000,000 counts. The display will read 1.0000e+6.
O200 – ENTER	Sets the detector overload alarm at 20 microamperes. The display will read OVERLOAD=200.
OON – ENTER	Turns the overload alarm on.
SP0 – ENTER	Saves the above alarm parameters to detector 00. (Please see the note on the previous page about the verification requirement of this command.)

Recycle Data Setup

The recycle mode can be set up with one count per cycle and be able to log a maximum of 1000 samples, or up to six different counts per cycle with approximately 166 cycles per count.

KEYSTROKES	RESPONSE
SVD6 – ENTER	The instrument will display the Recycle Setup Display.
SR2 – ENTER	Enables the first two sets of count parameters on the recycle display. **Note:** Cycle #1 cannot be disabled and will always show. When using the SR command, any number between 1 and 6 can be used to activate that number of counts.
SY25 – ENTER	Sets the number of recycles. The bottom line of the display should read # RECYCLES 25
SQ1 1 10 1 – ENTER	Sets count one of the cycle to use DET 01, with a 10-second delay between counts, and logs a scaler count. Line one of the display will read 1 DET 01 10 Q1
SQ2 2 25 1 – ENTER	Sets count two of the cycle to use DET 02, with a 25-second delay between counts, and logs a scaler count. Line two of the display will read 2 DET 02 25 Q1

Note: The delay time between the counts comes before the count is taken. In the above example when the count is started the 10-second delay in count 1 will occur before the count is taken. After count 1 is complete, then there will be a 25-second delay before count 2 is taken.

Setting Response Time

KEYSTROKES	RESPONSE
G1 – ENTER	Sets the response time to the fast mode. **Note:** The "1" after the "G" is the code for fast response time. It can also be set for slow response – 0, or fixed respond time – 2.

When setting the fixed response time, the following procedures may be followed:

KEYSTROKES	RESPONSE
G1 – ENTER	Sets the response time to the fast mode.
SXG30 – ENTER	Sets the time constant to 30 seconds. **Note:** The time constant can be set at any point from 1 and 127 seconds.

Setting the Security Code

The security code is used only when changing the access levels, or restarting the access level and security code to their default values. To change the security code, you must be in Access Level 1.

KEYSTROKES	RESPONSE
SAC1234 – ENTER	Sets the security code to 1234.
SAA1234 – ENTER	Sets the security code and access level to their default settings. (SC = 0; AL = 1) **Note:** The 1234 is an example of the current security code.

Setting Access Levels

The Model 2350-1 has eight different access levels for control of the instrument. Level 1 allows for total control of the instrument, while Level 8 allows the user to control data logging functions only. The following example will set the access level to 3, which provides the user with some control of the instrument and access to all of the read commands.

KEYSTROKES	RESPONSE
SAL3 0 – ENTER	The command access level is changed to Level 3. **Note:** The "0" is the default security code. This can be changed by the user at any time. A space must be between the access level number and the security code for the command to be properly read.

To ensure that the access level has been properly changed, the following procedure may be followed to read the current access level.

KEYSTROKES	RESPONSE
RCA – ENTER	Displays the current access level of the instrument on the computer or keypad display.

Operation Commands

There are 113 different commands that can be used to control the various applications of the Model 2350-1 Data Logger.

A more detailed description of the commands is available in the command reference manual. What follows is an alphabetized list of all of the commands with a brief description of each and their adjustable parameters.

Command	Description	Parameters
C	Starts a scaler count	
D(0-15)	Recalls a stored detector setup	Any number between 0 and 15
E	Stops a scaler count	
F(1-65535)	Sets the scaler count time	Any number between 1 and 65535 seconds
G(0-2)	Sets the ratemeter response time	0 = slow 1 = fast 2 = fixed
H(0-2500)	Sets the detector high voltage	Any number between 0 and 2500 volts
$I_{(a)}$	Sets the user ID code	Up to 15 alphnumeric characters
J(10^{-30} to 10^{30})	Sets the ratemeter alarm	Can be set at any point from 10^{-30} to 10^{30}
K(1-4294967295)	Sets the scaler alarm	Can be set at any point from 1 and 4294967296
L(a)	Sets the location code	Up to 10 alphanumeric characters
M(a)	Sets the detector model number	Up to 9 alphanumeric characters
N(a)	Sets the detector serial number	Up to 9 alphanumeric characters
O(0-400)	Sets the overload alarm	Can be set at any point from 0 to 400
P(10^{-30} to 10^{30})	Sets the integrated dose alarm	Can be set at any point from 10^{-30} and 10^{30}
Q(0-2)	Logs a count	0 = ratemeter 1 = scaler 2 = integrated dose
RBV	Reads the battery voltage	Will read from 0 and 6.2

RCA	Reads the current access level	Displays a value from 1 to 8
RCB	Reads the bar graph count	Displays a value from 0 to $1e^{30}$
RCD	Reads the ID elapsed time	Displays a value from 0 to 64768
RCI	Reads the ID count	Displays a value from 10^{-30} to 10^{30}
RCR	Reads the ratemeter	Displays a value from 10^{-30} to 10^{30}
RCS	Reads the ratemeter	Displays a value from 10^{-30} to 10^{30}
RCT	Reads the time remaining in scaler count	Displays a value from 0 to 65535
RD	Reads the detector setup in use	Will display a number from 0 to 15
REC	Reads all detector setups (binary format)	
RED	Reads the current detector setup	
REF	Reads all detector setups	
REL	Reads the logged memory with L1 & L2 codes	
REM	Reads the logged memory (formatted)	
REN	Reads the Model 2350-1 serial number	Displays a value from 0 to 999999
REO	Reads the logged data with all location codes and two-second time stamp	
REP	Reads the logged data with all location codes	

REQ	Reads the logged memory in binary format	
RES	Reads the logged memory with L1 & L2 codes	
RET	Reads the logged memory (formatted)	
RF	Reads the scaler count time	Displays a value from 0 to 65535
RG	Reads the ratemeter response time	0 = slow 1 = fast 2 = fixed
RH	Reads the detector high voltage	Displays a value from 0 to 2500 volts
RI	Reads the user ID code	
RID	Reads the user ID counter status	0 = off 1 = on
RIO	Reads the I/O firmware number	
RJ	Reads the ratemeter alarm setting	Displays a value from $10e^{-30}$ to 10^{30}
RK	Reads the scaler alarm setting	Displays a value from 0 to 4294967295 counts
RL	Reads the current location code number	
RM	Reads the detector model number	
RN	Reads the detector serial number	
RNI	Reads the location increment	Displays a number from 0 to 2500
RO	Reads the overload alarm setting	Displays values x, y x = setting (0-400) y = on/off status (0/1)

RP	Reads the ID counter alarm setting	Displays a value from $10e^{-30}$ to $10e^{30}$
RR	Reads the raw counts from the detector	Displays a value from 0 to 50000 cps
RSB	Reads the time base of the ratemeter	0 = seconds 1 = minutes 2 = hours
RSC	Reads the calibration constant	Displays a value from 10^{-30} to 10^{30}
RSD	Reads the date	
RSE	Reads which counters are currently displayed	0 = All counters off 1 = Ratemeter 2 = Scaler 3 = Ratemeter and scaler 4 = Integrated dose (ID) 5 = Ratemeter and ID 6 = Scaler and ID 7 = All counters on
RSL	Reads the dead time setting	Displays a value from 10^{-12} to 1
RSM	Reads the ratemeter multiplier	0 = Auto range 1 = micro 2 = milli 3 = None 4 = Kilo 5 = Mega 6 = Giga 7 = Tera
RSN	Reads the CP firmware number	
RSP	Reads the pushbutton logging operation	0 = Log ratemeter 1 = Log scaler 2 = Log integrated dose
RSQ(1-6)	Reads the current cycle count	Displays values x, y, z x = detector number y = delay in seconds z = logging mode (0-2) 0 = ratemeter 1 = scaler 2 = ID counter

RSR	Reads the number of sub-cycles per recycle	Displays a number from 1 to 6
RSS	Reads the instrument alarm status	
RST	Reads the 24-hour format	
RSU	Reads the ratemeter display units	0 = (r)ad 1 = (G)ray 2 = rem 3 = Sv 4 = R 5 = C/kg 6 = D 7 = C 8 = Ci/cm^2 9 = Bq/cm^2
RSY	Reads the number of recycles	Displays a number from 0 to 1000
RT	Reads the detector threshold setting	Displays a number from 0 to 1000
RVC	Reads the low ratemeter alarm setting	Displays a value from 10^{-30} to 10^{30}
RVM	Reads the maximum values latching mode	0 = Off 1 = On
RVR	Reads the maximum ratemeter value	Displays a value from 10^{-30} to 10^{30}
RVS	Reads the maximum scaler value	Displays a value from 10^{-30} to 10^{30}
RW	Reads the detector window setting	Displays a value from 0 to 1000
RXG	Reads the ratemeter response time	If the response time is set on fast or slow, the display reads "VARIABLE." If the response time is fixed, the display will show a number from 1 to 127 seconds.

SAA	Sets the access level and security codes to default values	This command requires entry of the current security code
SAC	Sets the security code	Any number from 0 to 65535
SAD(x y f)	Sets up and starts the auto dump	X = ON/OFF (1, 0) Y = 1-10 1 = Ratemeter 2 = Scaler 3 = Ratemeter and scaler 4 = Integrated dose (ID) 5 = Ratemeter and ID 6 = Scaler and ID 7 = Ratemeter, Scaler and ID 8 = Raw cps 9 = Ratemeter and raw cps 10 = Timed scaler F = 1 to 65535 seconds
SAL(x y)	Sets the access level	x = 0-3 y = security code
SB(0-2)	Sets the ratemeter time base	0 = Seconds 1 = Minutes 2 = Hours
SC(a)	Sets the calibration constant	a = 10^{-30} to 10^{30}
SD	Sets the date	mm/dd/yy format
SE(1-7)	Sets the counter display	0 = All counters off 1 = Ratemeter 2 = Scaler 3 = Ratemeter and scaler 4 = Integrated dose (ID) 5 = Ratemeter and ID 6 = Scaler and ID 7 = All counters on
SHR(0-1)	Starts the HV ramp routine	0 = Data dump off 1 = Data dump on
SID(0-1)	Turns integrated dose counter on/off	0 = off 1 = on
SIZ	Resets ID counter	

SKB	Starts CC and DT routines with background subtract	
SKD	Resets current detector parameters to defaults	
SL	Sets detector dead time	Any number from 10^{-12} to 10 = off
SM(0-7)	Sets the ratemeter multiplier	0 = Auto range 1 = micro 2 = milli 3 = none 4 = Kilo 5 = Mega 6 = Giga 7 = Tera
SNE(x)	Sets the instrument serial number	Any number from 0 to 999999
SNI(0-2500)	Sets the L8 location code auto incremental value	Any number from 0 to 2500
SP(0-15)	Saves a detector setup	Detector setup 0-15
SQ(w x y z)	Sets up a set of cycle parameters	w = cycle number (1-6) x = detector no. (0-15) y = delay in seconds z = logging mode (0-2) 0 = ratemeter 1 = scaler 2 = integrated dose
SR(1-6)	Sets the number of recycles per cycle	Any number from 1 to 6
SSB	Starts single point calibration routine with background subtract	
SSC	Clears the logged memory	
SSD	Starts the dead time routine with background subtract	
SSE	Stops the recycle mode	

SSF	Starts the recycle mode	
SSG	Restarts a stopped recycle mode	
SSK	Starts calibration constant and dead time routines	
SSP(0-2)	Sets logging pushbutton operation	0 = logs ratemeter 1 = logs scaler 2 = logs integrated dose
SSQ	Logs a count based on SSP setup	
SSR	Resets all memory to default values	
SSS	Starts a single point calibration routine	
ST	Sets the time in 24-hour format	
SU(0-9)	Sets the ratemeter and integrated dose display units	0 = (r)ad 1 = (G)ray 2 = rem 3 = Sv 4 = R 5 = C/kg 6 = (d)isintegrations
SVC(f)	Sets the low ratemeter alarm	Any number from 10^{-30} to 10^{30}
SVD(0-7)	Sets the instrument display screen	0 = Main 1 = Parameters 2 = Detectors 3 = Alarms 4 = Logged data 5 = Recycle data 6 = Recycle setup 7 = Maximum values
SVL(0-999)	Selects the logged data sample to view	Any number from 0 to 999
SVM(0-6)	Sets and/or clears maximum values latching mode and	0 = Latching mode off 1 = Latching mode on 2 = zeros $rate_{max}$ & $scal_{max}$

	displays	3 = zeros $rate_{max}$ 4 = zeros $scaler_{max}$ 5 = zeros $scal_{max}$ & $scal_{max}$ 6 = zeros $rate_{max}$ & $scal_{max}$ & scal
SXG(0-127)	Sets the fixed response	Any number from 0 to 127 seconds
SY(0-999)	Sets number of recycles	Any number from 0 to 999
T(0-1000)	Sets the threshold	Any number from 0 to 1000
W(0-1000)	Sets the window	Any number from 0 to 1000
X	Resets the alarm	
Y	Silences audible alarm	
Z	Zeros the ratemeter	

Section 7

Sample Applications

Recycle Mode Applications

The recycle mode in the Model 2350-1 is ideal for applications that require repetitive counting processes over a grid layout, as in site decommissioning or other related activities. The following example will demonstrate how to set up and use the recycle mode to take an alpha survey of a site using a Ludlum Model 43-90 100 cm^2 alpha scintillator. The grid is the floor of a 3 x 3 m (10 x 10 ft) room.

KEYSTROKES	**RESPONSE**
SVD2 – ENTER	Sets the display to the detector display.

You can scroll through the detector setups using the D(x) command with (x) = a number from 0 to 15. If you do not have a detector configuration already set up for the Model 43-90, then find a blank setup (i.e. all parameters set to default settings), and set the detector up according to the instructions on page 27 of this manual. Once the detector is set up, save it to the active memory and proceed with the following procedures.

KEYSTROKES	**RESPONSE**
SSC – ENTER	Clears all logged memory registers.
SVD6 – ENTER	Displays the Recycle Setup Display.
SR1 – ENTER	Activates the first count sub-routine. **Note:** The first routine is always active. The SR1 command does, however, ensure that only one count sub-routine is active.
SQ1 0 15 1 – ENTER	Sets the count sub-routine parameters so that it uses "0" for the count with a 15-second delay between counts, and it will log a scaler reading.

KEYSTROKES	RESPONSE
SY10 – ENTER	Sets the number of recycles to 10.
SVD5 – ENTER	Displays the Recycle Data Display.
SSF – ENTER	Activates the recycle routine. The routine will start with a 15-second time-out to allow the user to position the detector. It will then take a 10-second scaler count and log it to the data logging memory. It will then do another 15-second time-out to allow the user to re-position the detector and prepare for the next count.

The command SSE will stop a recycle routine in progress, and the command SSG will restart a routine from the point it was stopped at.

A recycle routine can have up to six different count sub-routines performed in a cycle. When more than one count sub-routine is performed, the logging memory is divided by the number of sub-routines done.

Example: A recycle mode is set up with four different count sub-routines. The maximum number of cycles that can be logged is (1000 / 4 = 2500).

Maximum Value with Logging Pushbutton

The maximum value latching feature is useful when surveying an object, and the user is only interested in the highest reading from the object. The instrument can be set up with the optional pushbutton logging control in the handle and the optional bar code reader for clearing the maximum value readings between each count. The following description sets up the optional pushbutton and assumes that the user is going to use a Model 44-10 5.1 x 5.1 cm (2 x 2 in.) NaI detector, which is set up as Detector #4.

KEYSTROKES	RESPONSE
SVD2 – ENTER	Displays the Detector Display.
D4 – ENTER	Places Detector #4 parameters into active memory.
SSP0 – ENTER	Sets up the optional pushbutton so that it will log a ratemeter reading when pressed.
SVD7 – ENTER	Displays the Maximum Value Display.
SVM3 – ENTER	Clears the maximum ratemeter reading.

SVM1 – ENTER	Activates the latching maximum values option.

After the above commands are completed, turn the instrument off, disconnect the keypad or computer from the instrument, and connect the optional pushbutton to the serial port and the bar code reader to its connector. Turn the instrument on and connect the detector. You are now ready to survey. After each survey, the bar code reader can be used to issue a command to clear the maximum ratemeter reading.

Section 8

Recycling

Ludlum Measurements, Inc. supports the recycling of the electronics products it produces for the purpose of protecting the environment and to comply with all regional, national, and international agencies that promote economically and environmentally sustainable recycling systems. To this end, Ludlum Measurements, Inc. strives to supply the consumer of its goods with information regarding reuse and recycling of the many different types of materials used in its products. With many different agencies – public and private – involved in this pursuit, it becomes evident that a myriad of methods can be used in the process of recycling. Therefore, Ludlum Measurements, Inc. does not suggest one particular method over another, but simply desires to inform its consumers of the range of recyclable materials present in its products, so that the user will have flexibility in following all local and federal laws.

The following types of recyclable materials are present in Ludlum Measurements, Inc. electronics products, and should be recycled separately. The list is not all-inclusive. Nor does it suggest that all materials are present in each piece of equipment:

- Batteries
- Glass
- Aluminum and Stainless Steel
- Circuit Boards
- Plastics
- Liquid Crystal Display (LCD)

Ludlum Measurements, Inc. products, which have been placed on the market after August 13, 2005, have been labeled with a symbol recognized internationally as the "crossed-out wheelie bin." This notifies the consumer that the product is not to be mixed with unsorted municipal waste when discarding; each material must be separated. The symbol will be placed near the AC receptacle, except for portable equipment where it will be placed on the battery lid.