LUDLUM MODEL 2363
GAMMA-NEUTRON SURVEY METER

October 2015

Serial Number 220855 and Succeeding

Serial Numbers

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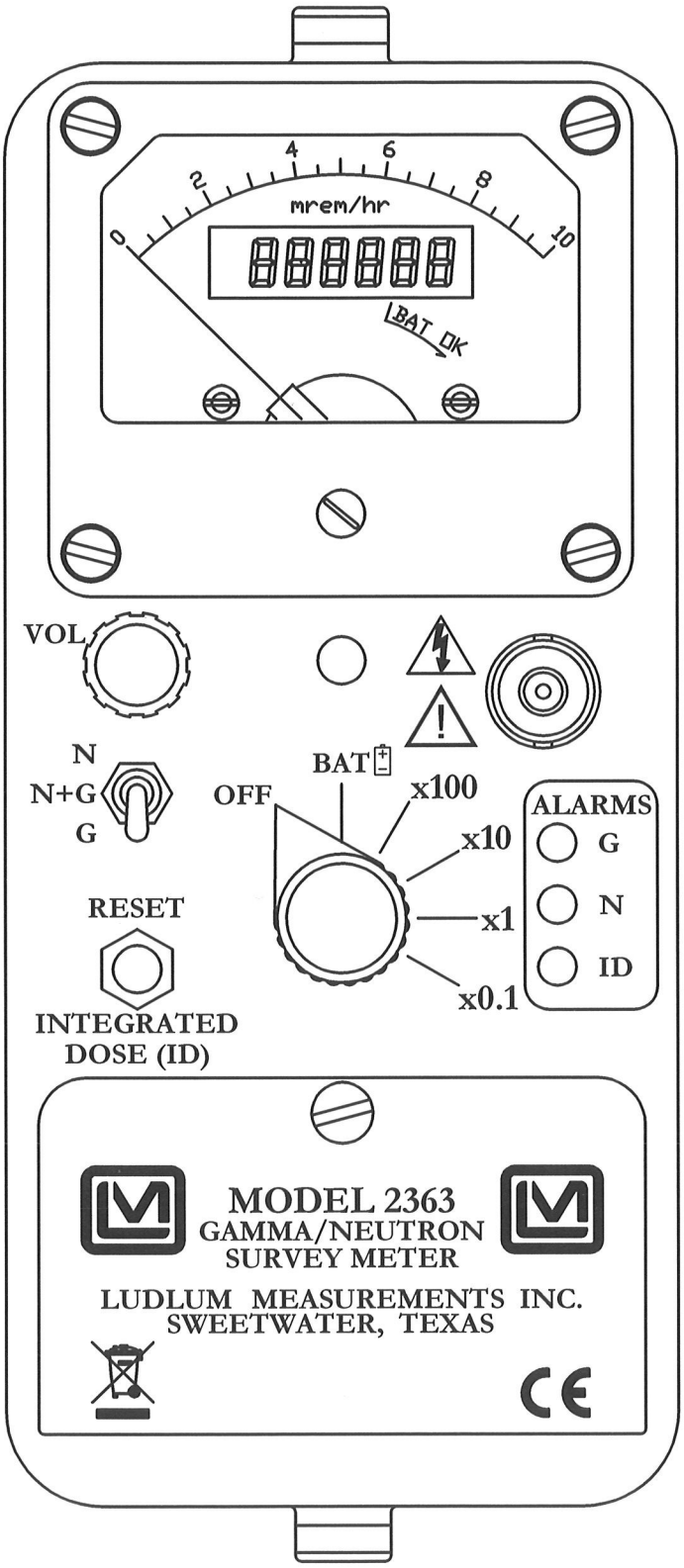

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LUDLUM MEASUREMENTS, INC. 501 OAK STREET SWEETWATER, TEXAS 79556	SERIES 390	SHEET 291

Table of Contents

Introduction ***1***

Getting Started ***2***

Unpacking and Repacking **2-1**

Battery Installation **2-1**

Connecting a Detector to the Instrument **2-2**

Battery Test **2-2**

Operating the Instrument **2-3**

Principle of Operation **2-3**

Specifications ***3***

Description of Controls and Functions ***4***

Operator Controls **4-1**

Internal Controls **4-2**

Safety Considerations ***5***

Environmental Conditions for Normal Use **5-1**

Cleaning Instructions and Precautions **5-1**

Warning Markings and Symbols **5-2**

Calibration and Maintenance ***6***

Calibration **6-1**

Meter Calibration **6-1**

Establishing an Operating Point **6-2**

Maintenance **6-3**

Recalibration **6-3**

Batteries **6-4**

RS-232 Interface ***7***

Communicating With the Model 2363 **7-1**

Commands **7-1**

Read Commands **7-1**

Set Commands **7-2**

Command Descriptions **7-2**

Model 2363 Interface Software 7-8
Functions 7-8
Main Screen 7-8
Auto Dump Data 7-10
Installation of the 2363 Interface Software 7-14
Removal of the Model 2363 Interface V2 7-14
Connecting to a Computer 7-14

Technical Theory of Operation ***8***

Troubleshooting ***9***

Recycling ***10***

Parts List ***11***
Model 2363 Gamma-Neutron Survey Meter 11-1
Main Board, Drawing 390 × 295 11-1
LED Board, Drawing 390 × 299 11-4
LCD Display Board, Drawing 390 × 170 11-4
Wiring Diagram, Drawing 390 × 290 11-4

Drawings and Diagrams ***12***

Section 1

Introduction

The Ludlum Model 2363 Gamma/Neutron Survey Meter is an easy-to-use survey instrument capable of measuring both neutron and gamma radiation levels simultaneously, incorporating both analog and digital displays for maximum versatility. This instrument logs up to 1000 data points in non-volatile memory and consists of sample number, date/time stamp, ratemeter measurements (both neutron and gamma), integrated dose, and location identifier (10 characters).

The Model 2363 contains an internal energy-compensated GM (Geiger-Mueller) detector for gamma measurements and is normally sold with an external Model 42-41 PRESCILA detector for use in neutron measurements.

This instrument incorporates a long arc-length analog meter face, which normally displays exposure rates from 0 to 10 mrem/hr. The instrument's digital display is a full six-digit liquid crystal display (LCD) with an arrow symbol for counting overflow. The display is direct-driven for optimal viewing and wide temperature response.

The Model 2363 range selector switch allows for multiplication ranges of ×0.1, ×1, ×10, and ×100, and a front-panel three-position toggle switch is used for selecting display of neutron, gamma, or neutron + gamma levels.

Neutron and gamma pulses are allotted different audible tones for ease of user discrimination. A two-position, momentary-action switch allows either an analog meter reset or display of the current integrated dose rate on the LCD.

The following alarms may be set via the RS-232 port:

Neutron Rate meter (0-9999.99 mrem/hr)

Gamma Rate meter (0-9999.99 mrem/hr)

Neutron + Gamma Rate (0-9999.99 mrem/hr)

Neutron + Gamma Integrated Dose (0-99999.9 mrem)

These alarm points, when exceeded, will light the appropriate LED on the front panel and activate the audio alarm. The alarms will continue until the RESET toggle switch is depressed, or until the INTEGRATED DOSE is zeroed.

The Model 2363 communicates through an RS-232 port located on the instrument can. The computer interface software is supplied on CD and includes the following functions:

- Downloading of header and logged data into an ASCII file
- Setting and reading of instrument parameters
- Setting of the CALIBRATION DUE DATE
- Setting of the internal real-time clock/calendar

Section

2

Getting Started

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. Check individual item serial numbers and ensure calibration certificates match. The Model 2363 serial number is located on the front panel below the battery compartment. Most Ludlum Measurements, Inc. detectors have a label on the base or body of the detector for model and serial number identification.

Important!

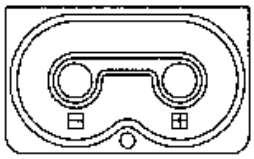
If multiple shipments are received, ensure that the detectors and instruments are not interchanged. Each instrument is calibrated to specific detectors, and therefore not interchangeable.

To return an instrument for repair or calibration, provide sufficient packing material to prevent damage during shipment. Also provide appropriate warning labels to ensure careful handling. Include detector(s) and related cable(s) for calibration. Include brief information as to the reason for return, as well as return shipping instructions:

- **Return shipping address**
- **Customer name or contact**
- **Telephone number**
- **Description of service requested and all other necessary information**

Battery Installation

Ensure the Model 2363 range selector switch is in the "OFF" position. Open the battery lid by pushing down and turning the quarter-turn thumbscrew



counterclockwise a quarter of a turn. Install two ″D″ size batteries in the compartment.

Note the (+) and (-) marks inside the battery door. Match the battery polarity to these marks. Close the battery box lid and push down and turn the quarter-turn thumb screw clockwise a quarter of a turn.

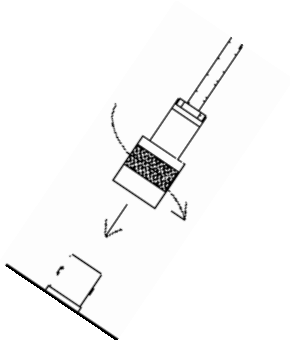
Note:

The center post of a flashlight battery is positive. The batteries are placed in the battery compartment in opposite directions.

Connecting a Detector to the Instrument

Caution!

The detector operating voltage (HV) is supplied to the detector via the detector input connector. A mild electric shock may occur if you make contact with the center pin of the input connector. Switch the Model 2363 to the OFF position before connecting or disconnecting the cable or detector.



Connect one end of a detector cable to the detector by firmly pushing the connectors together while twisting clockwise a quarter of a turn. Repeat the process in the same manner with the other end of the cable and in the instrument.

Battery Test

The batteries should be checked each time the instrument is turned on. Move the range selector switch to the BAT position. Verify that all three alarm LEDs on the front panel turn on briefly. The LCD should go through an initialization sequence displaying ″88:8.8:8.8″, then the current sample number, and finally ″0″. Ensure that the meter needle deflects to the battery check portion on the meter scale. If the meter does not respond, check to see if the batteries have been correctly installed. Replace the batteries if necessary.

Operating the Instrument

Connect a detector to the instrument if you have not already done so. Obtain a meter reading from a check source or calibrated source, if available. Verify that the reading falls within the expected range. Remove the source. If a radiation source is available, increase the meter count to exceed the alarm threshold. Both the appropriate alarm lamp and audio alarm signal should activate.

Depress the RESET toggle switch. The meter needle should drive to zero, and the alarm circuit should de-energize, shutting off both visual and audible alarms.

Proceed with use.

Principle of Operation

The detected neutron count rate is displayed by selecting the ″N″ position on the three-position ″N/N+G/G″ toggle switch. Similarly, the sum of the neutron and gamma count rate or the gamma count rate only is displayed by selecting the appropriate ″N+G″ or ″G″ position. The digital display will show a direct reading in dose rate. Multiply the reading on the analog rate meter by the range multiplier position.

The ″RESET″ toggle switch position resets the meter pointer to zero and deactivates any current alarm. The current integrated dose is displayed on the digital meter dial by selecting the ″INTEGRATED DOSE (ID)″ position.

Note:

The accumulated integrated dose may be reset by pressing the ID toggle switch while turning the instrument ON.

Section 3

Specifications

Ranges: four linear range multiples of ×0.1, ×1, ×10, and ×100; used in combination with the 0-10 mrem/hr meter dial, providing an overall range of 0-1000 mrem/hr

Gamma Energy Range: 60 keV to 3 MeV

Gamma Energy Response: ≤ 15%

Sensitivity: Gamma is approximately 1000 cpm/mR/hr (internal detector. Neutron is approximately 350 cpm/mrem/hr (with Model 42-41L).

Thresholds: Gamma threshold is fixed at 50 millivolts (mV). Neutron threshold is adjustable from 5 to 100 mV.

Neutron High Voltage: internally adjustable from 500 to 1500 Vdc

Gamma High Voltage: fixed at 550 Vdc

Linearity: within 10% of true value for the analog rate meter; 2% for the LCD

Response Time: ×0.1 range multiplier = 7 seconds, ×1 = 7 seconds, ×10 = 2 seconds, ×100 = 2 seconds; all response times measured from 10-90% of full scale

Audio: dual- or single-tone click-per-event through a built-in speaker with an adjustable volume control located on the front panel; headset jack located on the instrument can

Alarm points: four separate alarms set through the RS-232 port, activating the alarm audio tone and lighting the appropriate LEDs; marked GALARM, NALARM, or IDALARM. The four alarm points can be set from 0 to 99999 for the following:

Neutron Rate meter

Gamma Rate meter

Neutron+Gamma Rate meter

Neutron+Gamma Integrated Dose

Meter: rugged 1 milliamp (mA), with pivot-and-jewel suspension and 6.4 cm (2.5 in.) arc

LCD: six-digit direct-driven with 6.4 mm characters and a counter overflow arrow

Connector: series ″C″ standard; others available

Power: two standard ″D″ size batteries

Battery Life: 200 hours of operation with a fresh set of alkaline ″D″ cell batteries

Temperature Range:

Neutron: ±30% from 0 to 40°C (32 to 104 °F) (PRESCILA)

Gamma: ±10% from -20 to 50 °C (-4 to 122 °F) (internal GM)

Size (including connector protrusion):

	Without PRESCILA	With PRESCILA
Height:	19.6 cm (7.7 in.)	32.3 cm (12.7 in.)
Width:	8.9 cm (3.5 in.)	13.7 cm (5.4 in.)
Length:	21.1 cm (8.3 in.)	34.3 cm (13.5 in.)

Weight (including internal detector and batteries):

Without PRESCILA	With PRESCILA
2.0 kg (4.5 lb)	4.2 kg (9.2 lb)

Finish: drawn-and-cast aluminum, with beige powder coating

Section 4

Description of Controls and Functions

Operator Controls

OFF/BAT/X100/X10/X1/X0.1 Switch (or Range Selector Switch): a six-position rotary switch to select the analog meter range multipliers and check the battery status. When switched to the ″BAT″ position, the meter pointer should deflect above the left vertical mark on the ″BAT OK″ line. Moving the range selector switch to one of the range multiplier positions (×0.1, ×1, ×10, ×100) provides the operator with an overall range of 0-1000 mrem/hr. Multiply the scale reading by the multiplier to determining the actual reading.

During initial instrument turn-on, the meter will be driven full scale for about two seconds and then return to 0. The LCD will show "88:8.8:8.8," display the current sample number, and then ″0″. If the count button is pressed while the display is showing all 8s, then the following numbers are shown: firmware number, date, time, neutron rate meter alarm, gamma rate meter alarm, neutron + gamma rate meter alarm, integrated dose alarm, current sample number, and then ″0″.

Liquid Crystal Display (LCD): six-digit display that displays the count rate for the selected channel

VOL: Turning this control clockwise will increase the speaker volume and counterclockwise will decrease the volume.

Note:

The volume should be turned down when not required, in order to reduce battery drain.

N/N+G/G Switch: a three-position toggle switch used to select the sum of neutron and gamma count channels (N+G), neutron count only (N), or gamma count only (G), for display. This switch affects both the analog

meter and digital display. The rate meter channels are active regardless of the switch position and will continue to function when the channel is not selected for display. This ability allows the operator to view each channel separately or together by simply selecting the appropriate switch position.

Headphone Jack: 0.03 cm (one-eighth inch) phone jack for connection of external headphones. Inserting a phone plug into the jack disconnects the external unimorph speaker from the audio circuitry. Use 0.03 cm (one-eighth inch) mating plug – LMI part # 21-9653.

RESET/INTEGRATED DOSE (ID): a dual-position momentary toggle switch that provides readout of the integrated dose when the "INTEGRATED DOSE (ID)" position is selected. When the RESET position is selected, this switch provides a rapid means of driving the analog rate meter to zero and resetting the meter after an alarm condition. The integrated dose may be reset by holding this switch in the ID position while turning the instrument on.

Log Pushbutton (located in the carrying handle): When pressed, the instrument stores the current readings into non-volatile memory.

Internal Controls

Remove the instrument cover (can) to access the following dipswitches on SW1.

Dipswitch1: This switch, when placed in the ON position, enables calibration due date. The date is entered in Month/Day/Year format. During power-up the Model 2363 checks to see if the current date is past the calibration due date. If it is, then the Model 2363 displays ″OUTCAL″ and is disabled until this command is issued to set the calibration date ahead of the current date. (See page 7-4, command SC, for more information on calibration due date.)

Dipswitch 2: This switch is used to select tone discrimination between neutron and gamma count channels. When in the DUAL mode, neutron and gamma pulse tones will be audible in all selector switch positions (i.e. if in the N-only position and gamma radiation is detected, the gamma tones will be heard in addition to the neutron tones).

When the ″SNGL″ tone position is selected, both neutron and gamma pulse tones can be heard in the ″N + G″ selection, but neutron pulses are

the only audible tones in the ″N″ channel selection, and gamma pulse tones are the only audible tones in the ″G″ channel selection.

SWITCH 2	TONE MODE
ON	DUAL
OFF	SINGLE

Dipswitch 3: This switch, when placed in the ON position, disables auto-dump to the RS-232 port. (See page 7-6, command SM, for more information on auto-dump.)

Remove the instrument cover to access the following calibration potentiometers.

MTR: a multi-turn potentiometer used to calibrate the meter to the cpm reading

NHV: a multi-turn potentiometer used to adjust the neutron high voltage from 500 to 1000 Vdc

NTHR: a multi-turn potentiometer used to adjust the neutron pulse threshold from 5 to 100 mV

Section 5

Safety Considerations

Environmental Conditions for Normal Use

Indoor or outdoor use

No maximum altitude

Temperature range of ±30% from 0 to 40°C (32 to 104 °F) for Neutron (PRESCILA probe) and ±10% from -20 to 50 °C (-4 to 122 °F) for Gamma (internal GM)

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

Maximum transient voltage of 1500 Vdc

Pollution Degree 3 (as defined by IEC 664) Occurs when conductive pollution or dry nonconductive pollution becomes conductive due to condensation. This is typical of industrial or construction sites.)

Cleaning Instructions and Precautions

The Model 2363 Gamma-Neutron Survey Meter 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 range selector switch to the OFF position.
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.

The Model 2363 Gamma-Neutron Survey Meter is marked with the following symbols:

CAUTION (per ISO 3864, No. B.3.1): designates hazardous live voltage and risk of electric shock. During normal use, internal components are hazardous live. This instrument must be isolated or disconnected from the hazardous live voltage before accessing the internal components. This symbol appears on the front panel. **Note the following precautions:**

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.

CAUTION, RISK OF ELECTRIC SHOCK (per ISO 3864, No. B.3.6): designates a terminal (connector) that allows connection to a voltage exceeding 1 kV. Contact with the subject connector while the instrument is on or shortly after turning off may result in electric shock. This symbol appears on the front panel.

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. The symbol is placed near the AC receptacle. See Section 10, "Recycling," for further information.

Section 6

Calibration and Maintenance

Calibration

Note:

Local procedures may supersede the following.

Meter Calibration

A Ludlum Model 500 Pulser or equivalent is required. If the pulser does not have high-voltage readout, use a-high impedance voltmeter with at least 1000 megohm input resistance to measure the detector voltage.

Ensure that the meter movement has proper mechanical zero. The adjustment is on the front of the meter bezel. It must be adjusted to ″0″ with the ON/OFF selector switch in the OFF position.

Connect the Model 500 Pulser to the Model 2363 with the appropriate cable. Rotate the Model 2363 range selector switch to the ×100 position. Select the ″N″ channel position.

Adjust the pulser for 400 cpm and the pulse amplitude to -20 mV. Connect the instrument to a computer using a straight-thru 9-pin cable. Using the Ludlum Model 2363 interface software, adjust ″SE10001″ for 1 cpm per mrem/hr.

Remove the instrument cover and adjust the MTR potentiometer until the meter reads 400 cpm. Adjust the pulser to 100 cpm and ensure the rate meter reads 100 ±10%. Decade the pulser and the Model 2363 range selector switch to check meter linearity on the ×10, ×1, and ×0.1 positions. Linearity should be within ±10% of each reading.

Adjust the NHV and NTHR controls for the appropriate set points as described in the following subsection, "Establishing an Operating Point."

Replace 2363 cover and proceed with use.

Establishing an Operating Point

The Model 2363 contains an internal energy-compensated GM (Geiger-Mueller) detector for gamma measurements. The operating point for this detector is fixed, with a high-voltage requirement of 550 Vdc, and a threshold of -50mV.

The Model 2363 is normally sold with an external PRESCILA neutron detector (Model 42-41). The PRESCILA detector operating parameters are established by adjusting the detector operating voltage (HV) and neutron threshold to find an optimum efficiency for the neutron scintillator with a known level of gamma cross-talk. The following is an outline of this procedure.

1. Using the Ludlum Model 500 pulser or equivalent, adjust the neutron threshold (NTHR) of the Model 2363 to -10 mV and set the HV (NHV) to 635 Vdc.

2. Connect the Model 42-41 PRESCILA to the Model 2363 with a 0.99 m (39 in.) cable. Using the front face of the detector as the detector reference point (not the center of the detector), point the detector at the source. Ensure that all internal dipswitches are set to the ON position.

3. Connect the Model 2363 to a computer using a straight-thru 9 pin cable. Use the Ludlum Model 2363 Software interface to ensure that the following parameters are set:

SE10350	Neutron calibration constant of 350 cpm/mrem/hr
SE21050	Gamma calibration constant of 1000 cpm/mR/hr
RP100	Gamma dead time correction of 100 μsec
SI00	Automatic time constant
ST	Set the current time
SD	Set the current date
SC	Set the calibration due date (one year, unless specified)

4. Move the PRESCILA to a 100 mR/hr ^{137}Cs field, set the selector switch to "N" (neutron only), and adjust the neutron threshold until a meter reading of 1.2 mrem/hr ±5% (corresponding to 450 cpm) is achieved. Do not adjust the threshold below -5 mV. If necessary, switch to increasing the HV in 5-volt steps. Record this reading.

5. Take the PRESCILA to an AmBe neutron field of 20 mrem/hr. Adjust the calibration constant to calibrate the reading of the meter to 20 mrem/hr. A typical conversion rate (as determined by LANL) is 350 cpm per mrem/hr ±25%. Record and verify that the following readings are within 10%: 2 and 5 mrem/hr, 20 and 50 mrem/hr, and 200 and 500 mrem/hr.

6. Take the Model 2363 to a ^{137}Cs range and change the selector switch to "G" (gamma only). Adjust the gamma calibration constant and dead time correction to calibrate the meter within 10% at the following fields: 2 and 5 mR/hr, 20 and 50 mR/hr, and 200 and 500 mR/hr.

Maintenance

Instrument maintenance consists of keeping the instrument clean and periodically checking the batteries and the calibration. The Model 2363 instrument may be cleaned with a damp cloth (using only water as the wetting agent). Do not immerse instrument in any liquid. Observe the following precautions when cleaning:

1. Turn the instrument OFF and remove the batteries.
2. Allow the instrument to sit for one minute before accessing internal components.

Recalibration

Recalibration should be accomplished after maintenance or adjustments have been performed on the instrument. Recalibration is not normally required following instrument cleaning, battery replacement, or cable replacement.

Note:

Ludlum Measurements, Inc. recommends recalibration at intervals no greater than one year. Check the appropriate regulations to determine required recalibration intervals.

Ludlum Measurements offers a full-service repair and calibration department. We not only repair and calibrate our own instruments but most other manufacturers' instruments. Calibration procedures are available upon request for customers who choose to calibrate their own instruments.

Batteries

The batteries should be removed any time the instrument is placed into storage. Battery leakage may cause corrosion on the battery contacts, which must be scraped off and/or washed using a paste solution made from baking soda and water. Use a spanner wrench to unscrew the battery contact insulators, exposing the internal contacts and battery springs. Removal of the handle will facilitate access to these contacts.

Note:

Never store the instrument over 30 days without removing the batteries. Although this instrument will operate at very high ambient temperatures, battery seal failure may occur at temperatures as low as 37.7 °C (100 °F).

Section 7

RS-232 Interface

Communicating with the Model 2363

The Model 2363 has an RS-232 serial port that can be connected to a PC or other RS-232 device. The proper communication settings are (**38400,8,N,1**):

38400 Baud

8 data bits

No parity

1 stop bit

Commands

The following table shows all the commands used to communicate with the Model 2363. All commands must be in uppercase letters. The data can be in either upper or lower case. All set commands should return ″OK″ + a carriage return and line feed.

Read Commands

RA	Read sample number
RC	Read calibration date
RD	Read date
REx	Read cal constant
RHx	Read header
RI	Read time constant
RL	Read current location
RP	Read paralyzed time
RR	Read rate meter

RS	Read samples
RT	Read current time constant
R1	Read neutron alarm
R2	Read gamma alarm
R3	Read neutron + gamma alarm
R4	Read neutron + gamma Integrated dose alarm

Set Commands

SCmmddyyyy	Set calibration date
SDmmddyyyy	Set current date
SExyyyy	Set cal constant
Shxyyyyyyyyyyyyyyy	Set Header
SIxx	Set time constant
SLxxxxxxxxxx	Set current location
SMx	Sets rate meter dumping
SPxxx	Set paralyzed time
SR	Send reset samples
SThhmm	Set current time
S1xxxxxx	Set neutron Rate meter alarm
S2xxxxxx	Set gamma rate meter alarm
S3xxxxxx	Set neutron + gamma rate meter alarm
S4xxxxxx	Set neutron + gamma integrated dose alarm

Command Descriptions

RA
This command reads the current sample number. The output is six characters including a [CR] and [LF]. The format is:

```
0001[CR][LF]
```

RC
This command reads the calibration date. During power up the Model 2363 checks the current date against this date. If the current date is past the calibration date, the message "OUTCAL" is displayed and the Model 2363 is disabled until the calibration date is changed ahead of the current date. The output is 10 characters including a [CR] and [LF]. The format is:

```
MMDDYYYY
12251996[CR][LF]
```

RD
This command reads the current date and time. The output is 21 characters including a [CR] and [LF]. The format is :

```
HH:MM:SS MM/DD/YYYY
16:16:29 11/20/1996[CR][LF]
```

REx
This command reads the specified calibration constant where if x = 1, the neutron cal constant is returned. If x = 2, the gamma cal constant is returned. The output is six characters, including a [CR] and [LF]. The format is :

```
1000[CR][LF]
```

RHx
This command reads the specified header where "x" equals a number between 1 and 6. The output is 17 characters, including a carriage return [CR] and line feed [LF].

```
[ 15 characters]
John Smith [CR][LF]
```

RI
This command reads the time constant The output is four characters, including a carriage return [CR] and line feed [LF].

```
02[CR][LF]
```

RL
This command reads the current location. The output is 12 characters, including a [CR] and [LF]. The format is:

```
TABLE0001[SPACE][CR][LF]
```

RP
This command reads the paralyzed time. The output is five characters, including a [CR] and [LF]. The format is:

```
100[CR][LF]
```

RR

This command reads the current neutron, gamma Rate meter, and integrated dose reading. The gamma and neutron values have an implied two decimal places. The integrated dose reading has an implied one decimal place. The output is 22 characters, including a [CR] and [LF]. The format is:

```
neutron  gamma int dose
000003 002305 012456[CR][LF]
```

RS

This command will return all logged samples from memory. A "$" signifies the end of samples. See Figure 1 for sample output.

Figure 1 - Sample Output from Command "RS"

```
0001 12/18/05 14:31:04 008939 000000 R D 032090 Table 007
0002 12/18/05 14:31:08 010350 000000 R D 032090 Table 007
0003 12/18/05 14:31:12 011265 000000 R D 032090 Table 007
0004 12/18/05 14:31:16 010410 000000 R D 032090 Table 007
0005 12/18/05 14:31:20 011175 000000 R D 032102 Table 007
$
```

RT

This command reads the current time constant for the neutron and gamma channels. The output is seven characters, including a [CR] and [LF]. The format is:

```
02 02[CR][LF]
```

R1, R2, R3, R4

These commands read the alarm setpoints. The gamma and neutron values have an implied two decimal places. The integrated dose reading has an implied one decimal place. The output is eight characters, including a [CR] and [LF]. The format is:

```
000500[CR][LF]
```

SCmmddyyyy

This command sets the calibration due date. The date is entered in "Month Day Year format." During power-up the Model 2363 checks to see if the current date is past the calibration due date. If it is, then the Model 2363 displays "OUTCAL" and is disabled until this command is issued to set the

calibration date ahead of the current date. The length of the command is 12 characters, including a [CR] and [LF]. The format is:

SC11201997[CR][LF]

Sdmmddyyyyz
This command sets the current date. The date is entered in "Month Day Year" format. The PCF8593 clock/calendar chip uses a counter from 0 to 3 to represent the year. The variable "z" must correspond to the following table. The length of the command is 13 characters including a [CR] and [LF].

Year ending in	Year Code
96	0
97	1
98	2
99	3
00	0
01	1
02	2
03	3
04	0
05	1
06	2
07	3
08	0
09	1
10	2

For example, the command to set the date to November 20, 1996 is:

SD112019960[CR][LF]

SExyyyy
This command sets the neutron or gamma cal constant. If x = 1, the neutron cal constant is set. If x = 2, then the gamma cal constant is set. The length of the command is nine characters, including a [CR] and [LF].

Shxyyyyyyyyyyyyyyy
This command sets the specified header. The variable "x" can be any number between 1 and 6. The variable "y" can be up to 15 characters. The length of the command is 20 characters, including a [CR] and [LF].

The format is:

```
SH1JOHN SMITH[CR][LF]
```

SIxx
This command sets the time constant for both the neutron and gamma channels. The length of the command is six characters, including a [CR] and [LF]. The format is:

SI02[CR][LF]

SLxxxxxxxxxx
This command sets the current location that will be saved with any following logged samples. The location can be up to 10 characters in length. The length of the command is 14 characters, including a [CR] and [LF]. The format is:

SLTABLE007[CR][LF]

SMx
This command disables or enables the automatic dumping of the rate meter when the Model 2363 is set not to log samples. Specifying SM0 will disable the rate meter, dumping until the unit is turned off or the command SM1 is issued.

SPxxx
This command sets the paralyzed time in microseconds. The length of the command is seven characters, including a [CR] and [LF]. The format is:

SP100[CR][LF]

SR

Warning!

This command will erase all logged samples from memory. The length of the command is four characters, including a [CR] and [LF].

This command resets the sample number to one, which will effectively erase all samples stored in memory. Use this command with caution. The format is:

```
SR[CR][LF]
```

SThhmm

This command sets the current time in military format. Military time is as follows:

```
12:00am    0000  12:00 pm   1200
1:00 am    0100  1:00 pm    1300
2:00 am    0200  2:00 pm    1400
3:00 am    0300  3:00 pm    1500
4:00 am    0400  4:00 pm    1600
5:00 am    0500  5:00 pm    1700
6:00 am    0600  6:00 pm    1800
7:00 am    0700  7:00 pm    1900
8:00 am    0800  8:00 pm    2000
9:00 am    0900  9:00 pm    2100
10:00 am   1000  10:00 pm   2200
11:00 am   1100  11:00 pm   2300
```

The length of the command is eight characters, including a [CR] and [LF].

For example, the command to set the time to 1:00 pm is:

ST1300[CR][LF]

S1, S2, S3, S4

These commands set the alarms for the neutron, gamma, and neutron + gamma rate meter and also the neutron + gamma, integrated dose. If the alarm is set to 0, then the alarm is disabled. The gamma and neutron values have an implied two decimal places. The integrated dose reading has an implied one decimal place. The length of the command is 10 characters, including a [CR] and [LF]. For example, to set the neutron rate meter alarm to 5.00 mrem the command is:

```
S1000500[CR][LF]
```

Model 2363 Interface Software

The Model 2363 Interface Software has a user-friendly interface that allows the user to communicate with the Model 2363. The Model 2363 Interface features include Load Defaults and Auto Dump Mode Display. When the program is started, it searches for a Model 2363 attached to any valid serial com port. Once found, it will download all data from the Model 2363, which includes Headers and Logged Data. The user is able to change any parameter and update the Model 2363, make hard copies, or save data to an ASCII file for later import in word processors, spreadsheets, or other applications.

Version 1.4.4 and higher support the 2363-4 (39063n14 firmware) which has a decimal place for the calibration constants.

Functions

The Model 2363 Interface program has three main functions:

1. Allows user to read or update the header information stored in the Model 2363
2. Allows user to read, save or delete the logged data stored in the Model 2363
3. Allows the user to collect and save real-time data at specified intervals of time.

Main Screen

Form 1: Model 2363 Scaler/Rate meter Data

[**Set**]—Each parameter has a "Set" button that when clicked will store the parameter into the Model 2363.

[**Auto Dump**]—allows for real-time data logging from the Model 2363.

[**Clear Log Data**]—The user will be prompted to clear the data in the Model 2363.

Caution:

The data will be lost if the logged data has not been previously saved.

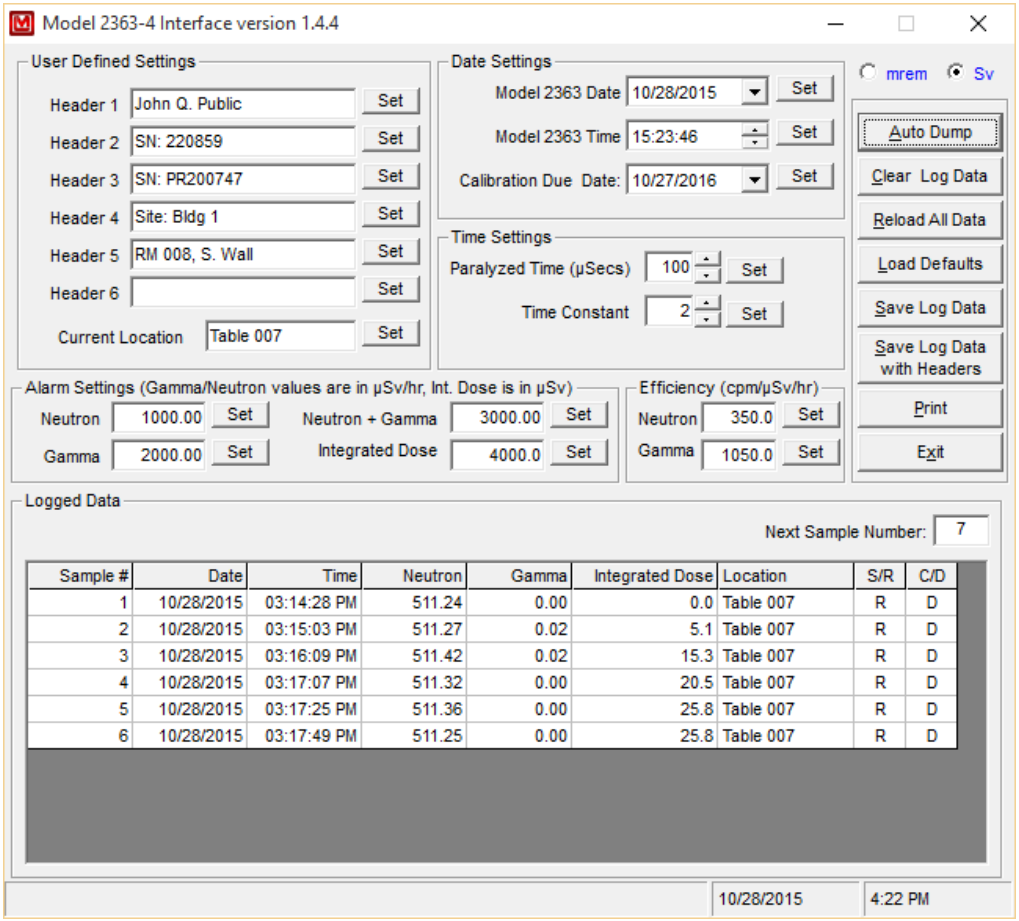
[**Reload All Data**]—downloads all information from the Model 2363. If there are logged samples, the user is prompted to download them after all the parameters have been retrieved.

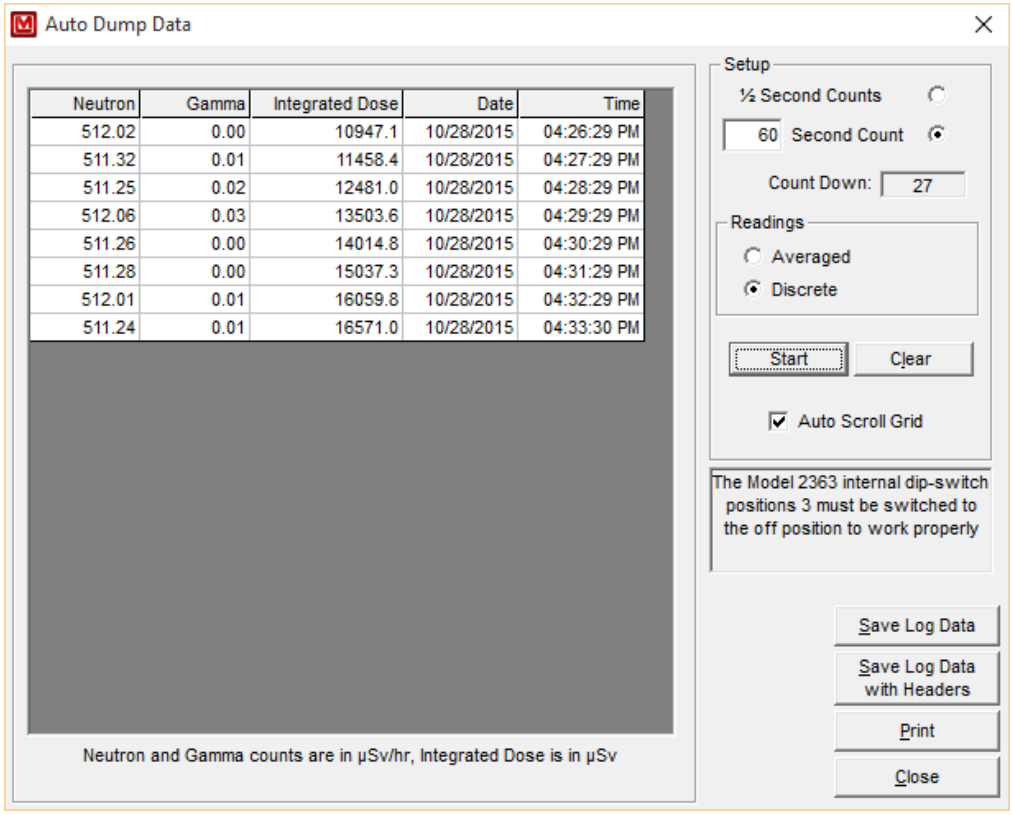
[**Load Defaults**]—reloads all header data to the original state as shipped from LMI.

[**Save Log Data**]—displays the "save file" prompt to allow the user to specify which drive and directory to save the log file.

[**Save Log Data With Headers**]—displays the "save file" prompt to allow the user to specify which drive and directory to save the log file. The six header fields will be added to the top of the save file.

[**Print**]—sends data, including the log data, to the default printer. If there is no data in the log data area, only the parameters will be printed.





Auto Dump Data

Note:

For auto dumping to work properly, the Model 2363 internal dip switches 3 and 4 must be set to the OFF position.

The auto dump data screen allows the user to capture real-time data coming from the Model 2363. The Model 2363 outputs the data every two seconds, which is captured and recorded to the grid. After capturing the data it, may be saved to a file or printed to the default printer.

Note:

Neutron and gamma counts are in mrem/hr. Integrated dose counts are in mrem.

Options

1/2-Second Counts—displays current readings every 1/2 second in the grid. In this mode, the readings are the actual counts from the Model 2363. No averaging is preformed.

60-Second Counts—Allows the user to determine the count time from 2 to 9999 seconds. The reading logged is the average of the two second counts received during the count time. For example, if the count time is 10 seconds, the readings displayed in the grid would be the average of the 20 1/2-second readings. If at any time you change the count time in the textbox, it will not take effect until the current count time is finished. It will then start the new count time.

Note:

A "0" or "1" will not be allowed in this text box.

[**Turn ON**] [**Turn OFF**]—Toggle from ON-OFF to start or stop the Auto Data Dump.

[**Clear**]—clears data from the grid

Note:

This does NOT clear memory in the Model 2363.

[**Save Log Data**]—displays the save file prompt to allow the user to specify which drive and directory to save the log file

[**Print]**—Sends data, including the displayed readings, to the default printer. If there is no data displayed, only the header information will be printed.

[**Close**]—Return to main menu area.

2363 Interface Software ASCII Files and Printout

Table 1: logged data downloaded from the Model 2363 and saved to an ASCII file

Table 2: real-time logged data saved to an ASCII file

Table 3: printout of header and log data information

Table 1:
Sample File: LogData.log

```
Neutron and Gamma counts are in mrem/hr.
Integrated Dose counts are in mrem.

S=Scaler, R=Rate meter, C=CPM, D=Dose
```

Sample #	Date	Time	Neutron	Gamma	Integrated Dose	Location	S/R	C/D
1	12/18/2005	02:31:04 PM	89.39	0.00	3209.0	Table 007	R	D
2	12/18/2005	02:31:08 PM	103.50	0.00	3209.0	Table 007	R	D
3	12/18/2005	02:31:12 PM	112.65	0.00	3209.0	Table 007	R	D
4	12/18/2005	02:31:16 PM	104.10	0.00	3209.0	Table 007	R	D
5	12/18/2005	02:31:20 PM	111.75	0.00	3210.2	Table 007	R	D

Table 2:
Sample File: AutoDumpLog.Log

```
Header 1: header1
Header 2: header2
Header 3: header3
Header 4: header4
Header 5: header5
Header 6: header6
```

Neutron	Gamma	Integrated Dose	Date	Time
132.88	0.02	3121.7	12/12/2005	01:34:34 PM
132.60	0.00	3121.7	12/12/2005	01:34:36 PM
132.48	0.00	3121.7	12/12/2005	01:34:38 PM
132.48	0.00	3121.7	12/12/2005	01:34:40 PM
132.48	0.00	3121.7	12/12/2005	01:34:42 PM
139.56	0.00	3123.0	12/12/2005	01:34:44 PM
134.72	0.01	3123.0	12/12/2005	01:34:46 PM
133.18	0.03	3123.0	12/12/2005	01:34:48 PM
132.68	0.02	3123.0	12/12/2005	01:34:50 PM
132.54	0.02	3123.0	12/12/2005	01:34:52 PM
132.50	0.00	3123.0	12/12/2005	01:34:54 PM
132.48	0.00	3123.0	12/12/2005	01:34:56 PM
132.48	0.00	3123.0	12/12/2005	01:34:58 PM
132.48	0.00	3123.0	12/12/2005	01:35:00 PM
132.48	0.01	3123.0	12/12/2005	01:35:02 PM
132.48	0.02	3123.0	12/12/2005	01:35:04 PM
132.48	0.00	3123.0	12/12/2005	01:35:06 PM
132.48	0.01	3123.0	12/12/2005	01:35:08 PM
132.46	0.00	3123.0	12/12/2005	01:35:10 PM
132.47	0.08	3123.0	12/12/2005	01:35:12 PM
132.47	0.02	3123.0	12/12/2005	01:35:14 PM
132.47	0.00	3123.0	12/12/2005	01:35:16 PM
132.48	0.00	3123.0	12/12/2005	01:35:18 PM
139.52	0.00	3124.3	12/12/2005	01:35:20 PM
134.70	0.00	3124.3	12/12/2005	01:35:22 PM

Table 3:
Model 2363 Data Printout:

```
Model 2363 Log Data     Date: 12/13/2005     Time: 01:49:18 PM     Page: 1
------------------------------------------------------------------------

    Header 1: John Q. Public
    Header 2: SN: 220859
    Header 3: SN: PR200747
    Header 4: Site: Bldg 1
    Header 5: RM 008, S. Wall
    Header 6:
    Location: Table 007
    Calibration Due Date: 12/12/2006
         Model 2363 Date: 12/19/2005
         Model 2363 Time: 01:46:13 PM
    Logged Samples:  5
    Paralyzed Time: 100 µSeconds
           Time Constant Setpoint:    2
    Current Neutron Time Constant:    2
      Current Gamma Time Constant:    2
             Neutron Alarm Setpoint: 1000.00 mrem/hr
               Gamma Alarm Setpoint: 2000.00 mrem/hr
    Neutron + Gamma Alarm Setpoint: 3000.00 mrem/hr
    Integrated Dose Alarm Setpoint:    4000.0 mrem
    Neutron Cal Constant: 1111 cpm/mrem/hr
      Gamma Cal Constant: 2222 cpm/mrem/hr

    Neutron and Gamma counts are in mrem/hr.
    Integrated Dose counts are in mrem.
    S=Scaler, R=Rate meter, C=CPM, D=Dose
                                                  Integrated
Sample#   Date     Time      Neutron    Gamma     Dose      Location
-----  ---------  ---------- -------   ------- ----------  ----------
  1    12/18/2005 02:31:04 PM   89.39    0.00     3209.0    Table 007
  2    12/18/2005 02:31:08 PM  103.50    0.00     3209.0    Table 007
  3    12/18/2005 02:31:12 PM  112.65    0.00     3209.0    Table 007
  4    12/18/2005 02:31:16 PM  104.10    0.00     3209.0    Table 007
  5    12/18/2005 02:31:20 PM  111.75    0.00     3210.2    Table 007
```

Installation of the 2363 Interface Software

Insert the CD, and the software installation routine will automatically start. If it does not, navigate to the CD drive and double-click on ″setup.exe″. The default installation location for the software is ″C:\Program Files\Model 2363.″

Removal of Model 2363 Interface V2

To remove the program, start from the Windows Desktop. Click on Start Button, Settings, Control Panel, and then Add/Remove Programs. Find LMI 2363 Interface from the list and highlight, then press the add/remove button to start uninstall.

Setup will prompt to make sure removal of program LMI 2363 Interface is okay.

Setup installed shared files and will prompt if you wish to keep, remove, remove none, or remove all. Files can be removed since they are installed in C:\Program Files\Model 2363 and should not cause any problems.

The uninstall screen appears, and the program removal will be complete.

Connecting to a Computer

Using the supplied cable, connect the end with the female connector to the Model 2363 and the other end to a free COM port on your computer. The pinouts of the cables are as follows:

9-pin cable

Model 2363	Computer
2	2
3	3
5	5
7	7
8	8

25-pin cable

Model 2363	Computer
2	3
3	2
5	7
7	4
8	5

Section 8

Technical Theory of Operation

Gamma

Transistor pairs, U9 and U10, form the charge sensitive amplifier. U13, comparator with 0.23 Vdc threshold, produces negative-going 5-volt pulses for every valid gamma pulse. One-shot, U15A provides single pulses for each event

Gamma HV

Switching of U17 sends 5-volt pulses through step-up transformer T2. Diode and capacitor multiplying ladder produces 550 Vdc, regulated by feedback voltage through R47.

Neutron

Transistor pairs, U11, and U12 form the charge sensitive amplifier. U14 comparator with 0.23 Vdc threshold produces negative-going 5-volt pulses for every valid neutron pulse. One-shot, U15B produces single pulses for each event.

Neutron HV

Switching of U18 sends 5-volt pulses through step-up transformer T3. Diode and capacitor multiplying ladder produces high voltage, regulated by feedback voltage through R48 and controlled by NHV potentiometer R55.

Low Voltage Power Supply

U16 step-up regulator (LT1304) switches battery voltage through inductor L1 to produce regulated +5 Vdc. Resistor divider R32 and R49 provide input for low-battery signal, which is sent to the microprocessor.

Section

9

Troubleshooting

Occasionally, you may encounter problems with your LMI instrument or detector that may be repaired or resolved in the field, saving turnaround time and expense in returning the instrument to us for repair. Toward that end, LMI electronic technicians offer the following tips for troubleshooting the most common problems. Where several steps are given, perform them in order until the problem is corrected. Keep in mind that the most common problems encountered with this particular instrument are: (1) detector cables, (2) sticky meters, and (3) battery contacts.

Note that the first troubleshooting tip is for determining whether the problem is with the electronics or with the detector. A Ludlum Model 500 Pulser can be invaluable at this point, because of its ability to simultaneously check high voltage, input sensitivity or threshold, and the electronics for proper counting.

We hope these tips will prove to be helpful. As always, please call if you encounter difficulty in resolving a problem or if you have any questions.

Troubleshooting Electronics that utilize GM and Scintillator Type Detectors

SYMPTOM	POSSIBLE SOLUTION
No power (or meter does not reach BAT TEST or BAT OK mark)	1. Check batteries and replace if weak. 2. Check polarity (see marks inside battery lid). Are the batteries installed backwards?

SYMPTOM	POSSIBLE SOLUTION
No power (or meter does not reach BAT TEST or BAT OK mark) (continued)	3. Check battery contacts. Clean them with rough sandpaper or use an engraver to clean the tips. 4. Check for loose or broken wires, especially between the main board and the calibration board.
Nonlinear Readings	1. Check the high voltage (HV) by using a Ludlum Model 500 Pulser (or equivalent). If a multimeter is used to check the HV, ensure that one with high impedance is used, as a standard multimeter could be damaged in this process. 2. Check for noise in the detector cable by disconnecting the detector, placing the instrument on the lowest range setting, and wiggling the cable while observing the meter face for significant changes in readings. 3. Check for "sticky" meter movement. Does the reading change when you tap the meter? Does the meter needle "stick" at any spot? 4. Check the "meter zero." Turn the power OFF. The meter should come to rest on "0".
Meter goes full scale or "pegs out"	1. Replace the detector cable to determine whether or not the cable has failed, causing excessive noise. 2. Check the HV, and if possible, the input threshold for proper setting.

SYMPTOM	POSSIBLE SOLUTION
Meter goes full scale or "pegs out" (continued)	3. Open the instrument can, and check for loose wires. 4. Ensure that the instrument's can is properly attached. When attached properly, the speaker will be located on the left side of the instrument. If the can is on backwards, interference between the speaker and the input preamplifier may cause noise.

Section

10

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.

The symbol appears as such:

Section 11

Parts List

	Reference	Description	Part Number
Model 2363 Gamma-Neutron Survey Meter	UNIT	Completely Assembled Model 2363 Gamma-Neutron Survey Meter	48-3501
Processor Board, Drawing 390 × 295	BOARD	Completely Assembled Processor Board	5390-295
DETECTOR	V1	LND 71210, GM DET	01-5295
CRYSTALS	Y1	11.0592Mhz, 2=GND, 3=GND	01-5738
	Y2	32.768KHZ	01-5740
CAPACITORS	C1-C8	0.01µF, 50V	04-5741
	C9	100pF, 3KV	04-5735
	C10	0.01µF, 50V	04-5741
	C11-C12	4.7µF, 25V	04-5653
	C13-C16	10µF, 25V	04-5655
	C17	47µF, 10V	04-5666
	C18-C19	27pF, 100V	04-5658
	C20-C21	10pF, 100V	04-5673
	C22	4.7pF, 200V	04-5787
	C23	0.01µF, 50V	04-5741
	C24	1µF, 16V	04-5701
	C25	0.01µF, 50V	04-5741
	C26	1µF, 16V	04-5701
	C27	0.01µF, 50V	04-5741
	C28-C29	47pF, 100V	04-5660
	C30	100pF, 3KV	04-5735
	C31-C32	0.001µF, 2KV	04-5703
	C33-C48	0.01µF, 500V	04-5696
	C49-C51	68µF, 10V	04-5654

	Reference	Description	Part Number
	C52	10µF, 25V	04-5728
	C53-C54	220pF, 100V	04-5674
	C55	10µF, 25V	04-5728
	C56-C59	0.01µF, 50V	04-5741
TRANSISTORS	Q1-Q5	2N7002L	05-5840
	Q6-Q8	MMBT3904LT1	05-5841
INTEGRATED CIRCUITS	U1	24LC515ISM	06-6570
	U2	DS1621S	06-6565
	U3	MAX220CSE	06-6329
	U4	MAX810LEUR	06-6424
	U5	N87C51FC	06-6303
	U6	PCF8593TD	06-6403
	U7	PCF8574TD	06-6402
	U8	TLC27M7ID	06-6292
	U9	CMXT3904, X1A	05-5888
	U10	CMXT3906	05-5890
	U11	CMXT3904, X1A	05-5888
	U12	CMXT3906	05-5890
	U13-U14	MAX985EUK-T	06-6495
	U15	CD74HC4538M	06-6297
	U16	LT1304CS8-5	06-6434
	U17-U18	LT1304CS8	06-6394
DIODES	CR1-CR2	MMBD914LT1	07-6353
	CR3-CR12	CMPD2005S	07-6468
	CR13	CMSH1-40M	07-6411
	D1-D2	CMSH1-40M	07-6411
SWITCH	SW1	90HBW08, 8 POS	08-6711
POTENTIOMETERS	R36	5K, 3269W1-502, MTR	09-6918
	R53	50K, 3269W1-503, NTHR	09-6954
	R55	1M, 3269W1-105, NHV	09-6911
RESISTORS	R1-R2	22.1K, 1/4W, 1%	12-7843
	R3-R6	1K, 1/4W, 1%	12-7832
	R7-R11	200 Ohm, 1/8W, 1%	12-7846
	R12	221K, 1/4W, 1%	12-7845
	R13-R21	10K, 1/4W, 1%	12-7839

	Reference	Description	Part Number
	R22	7.5K, 1/8W, 1%	12-7847
	R23-R25	1M, 1/4W, 1%	12-7844
	R26	100K, 1/4W, 1%	12-7834
	R27	2.21K, 1/4W, 1%	12-7835
	R28	301 Ohm, 1/4W, 1%	12-7863
	R29	2.37K, 1/4W, 1%	12-7861
	R30-R34	100K, 1/4W, 1%	12-7834
	R35	1M, 1/4W, 1%	12-7844
	R37	200K, 1/4W, 1%	12-7992
	R38	392K, 1/4W, 1%	12-7841
	R39	4.75K, 1/4W, 1%	12-7858
	R40-R42	4.75K, 1/4W, 1%	12-7858
	R43	3.32M, 1/8W, 1%	12-7967
	R44-R45	4.75M, 1/4W, 1%	12-7995
	R46	4.75K, 1/4W, 1%	12-7858
	R47-R48	500M, 3KV, 2%	12-7031
	R49	68.1K, 1/8W, 1%	12-7881
	R50	NOT USED	
	R51	22.1K, 1/4W, 1%	12-7843
	R52	121K, 1/8W, 1%	12-7014
	R54	402K, 1/8W, 1%	12-7888
	R56-R57	1K, 1/4W, 1%	12-7832
	R58	3.3M, 1/4W, 5%	10-7044
RESISTOR NETWORKS	RN1-RN2	220K	12-7923
CONNECTORS	P1	1-640456-1, MTA100x11	13-8059
	P2	640456-6, MTA100x6	13-8095
	P3	1-640456-4, MTA100x14	13-8141
	P4	640456-4, MTA100x4	13-8088
INDUCTOR	L1	22µH, CD43-220	21-9808
TRANSFORMERS	T1	AUDIO	4275-083
	T2-T3	31032R, Midcom	21-9925
BATTERY	B1	DL2450, 3V LITHIUM	22-9786

	Reference	Description	Part Number
LED Board, Drawing 390 × 299	BOARD	Completely Assembled LED Board	5390-299
DIODES	DS1-DS3	E176 LED-0.2X0.1	07-6494
RESISTORS	R1-R3	470 Ohm, 1/4W, 5%	10-7008
CONNECTOR	J1	640456-4, MTA100x4	13-8088
LCD Display Board, Drawing 390 × 170	BOARD	Completely Assembled LCD BOARD	5390-170
CAPACITOR	C201	27pF, 100V	04-5658
INTEGRATED CIRCUITS	U001	AY0438-I/L	06-6358
	U101	AY0438-I/L	06-6358
DIODES	DS001	NOT USED	
	DS201	NOT USED	
Wiring Diagram, Drawing 390 × 290			
BATTERIES	B1-B2	MN1300, 1.5V	21-9313
POTENTIOMETER	R1	10K, NON-LOCKING, VOLUME	09-6753
CONNECTORS	J1	1-640456-1, MTA100×11, MAIN BOARD	13-8059
	J2	640456-5, MTA100×5, MAIN BOARD	13-8057
	J3	1-540456-4, MTA100×14	13-8141
	J4-J5	640456-4, MTA100×4	13-8088
	J6	640456-9, MTA100×9	13-8094
	J7	JACK-09-9011-1-419	*
	J9	DETECTOR, UG706/U	*
AUDIO	DS1	UNIMORPH	21-9251

	Reference	Description	Part Number
SWITCHES	S1	SWITCH-PA-600-210-4P-5P (RANGE SELECTOR)	*
	S3	COUNT (HNDL BUTTN)	*
	S4	HEADPHONE JACK ON CAN, TINI #42	21-9333
	S5	TYPE SELECT	*
	S6	READ INT. DOSE	*
MISCELLANEOUS	M1	Meter Assembly	4390-303
	*	MODEL 2363 Interface Software	1370-072
	*	Model 2363 Meter Face	7390-294
	*	Model 42-41 Probe Sleeve Assy.	4390-321
	*	Model 2241-2 RLLD Handle Assy.	4408-178

Section

12

Drawings

PROCESSOR BOARD, Drawing 390 × 295 (4 sheets)

PROCESSOR BOARD COMPONENT LAYOUT, Drawing 390 × 296 (2 sheets)

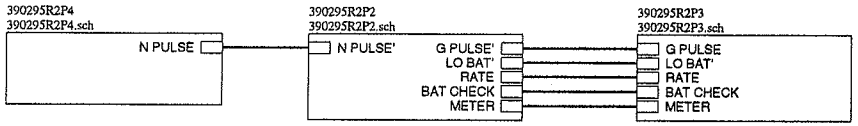
LCD DISPLAY BOARD, Drawing 390 × 170

LCD DISPLAY BOARD COMPONENT LAYOUT, Drawing 390 × 171 (2 sheets)

LED BOARD, Drawing 390 × 299

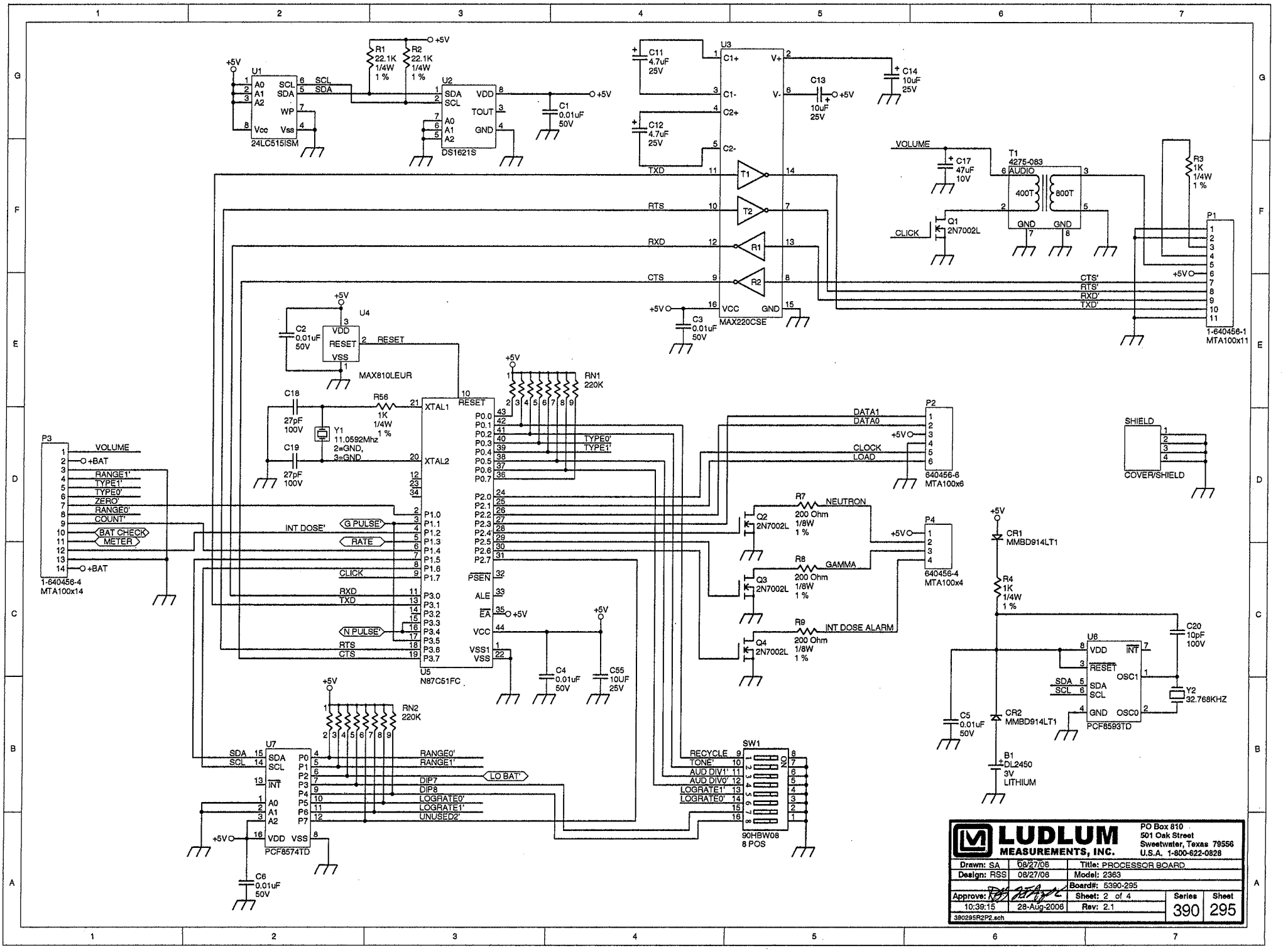
LED BOARD COMPONENT LAYOUT, Drawing 390 × 300 (2 sheets)

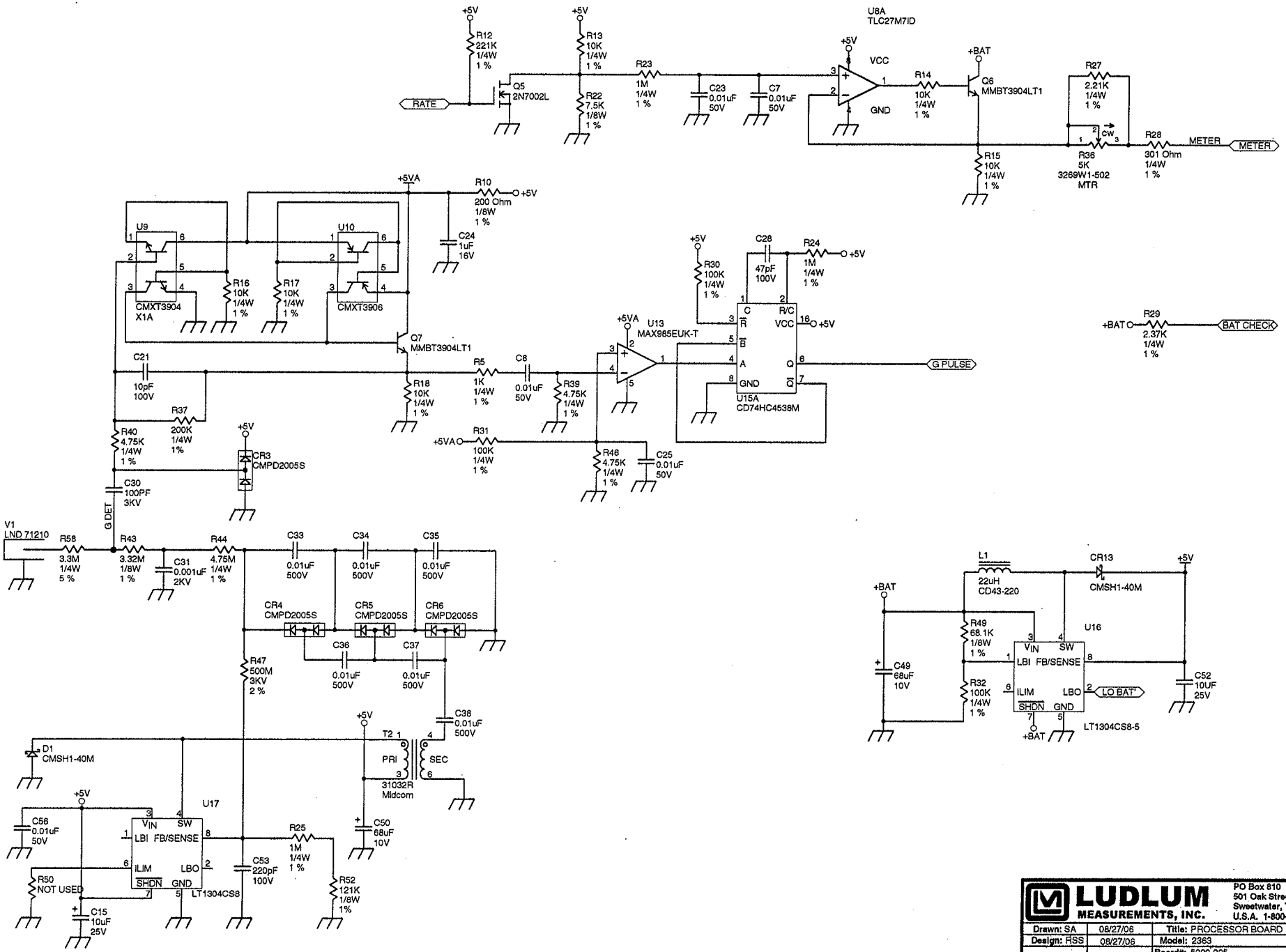
WIRING DIAGRAM, Drawing 390 × 290



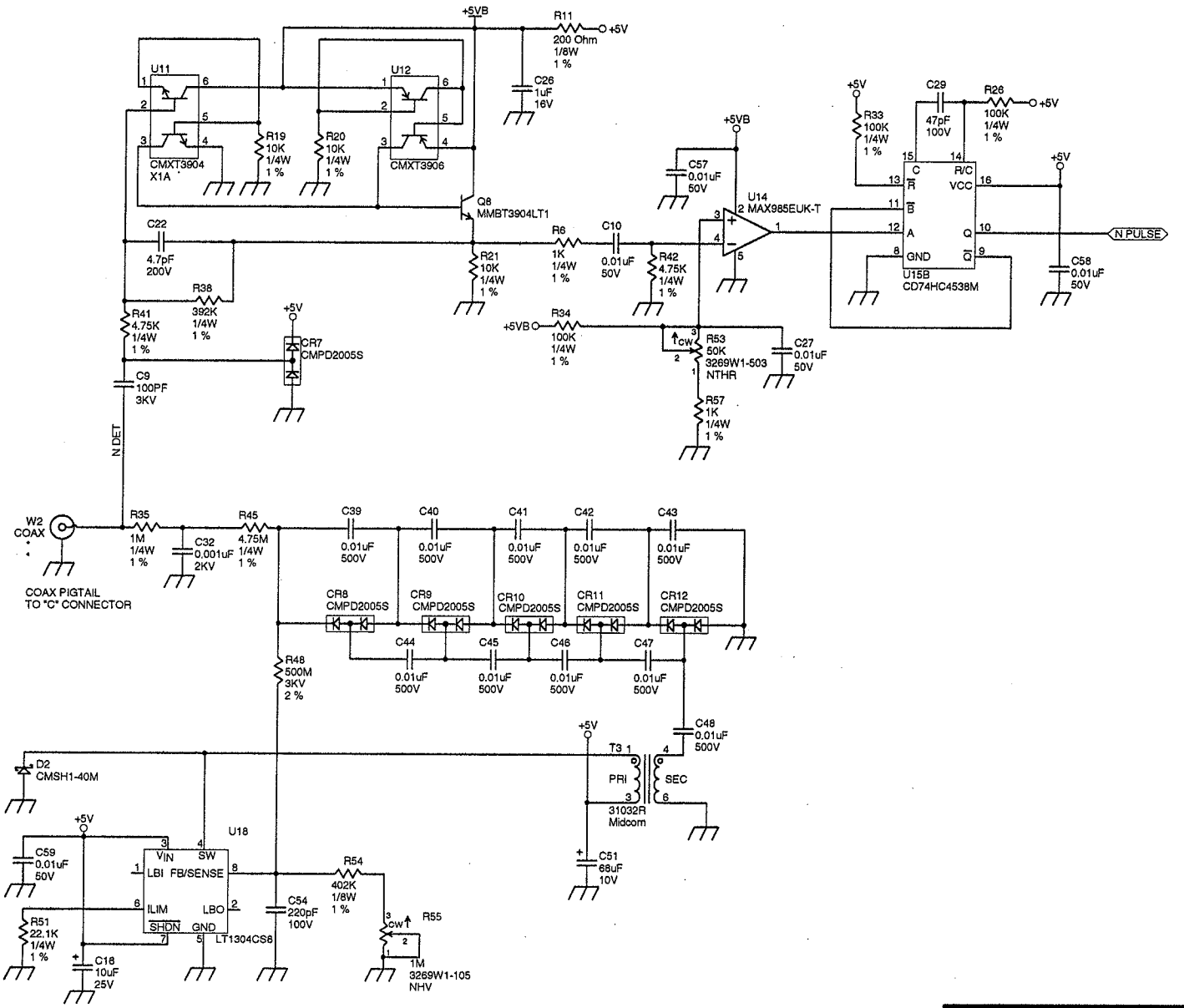
LUDLUM MEASUREMENTS, INC.
PO Box 810
501 Oak Street
Sweetwater, Texas 79556
U.S.A. 1-800-622-0828

Drawn: SA	08/27/06	Title: PROCESSOR BOARD		
Design: RSS	08/27/06	Model: 2363		
		Board#: 5390-295		
Approved:		Sheet: 1 of 4	Series	Sheet
10:39:15	28-Aug-2006	Rev: 2.1	390	295
390295R2P1.sch				

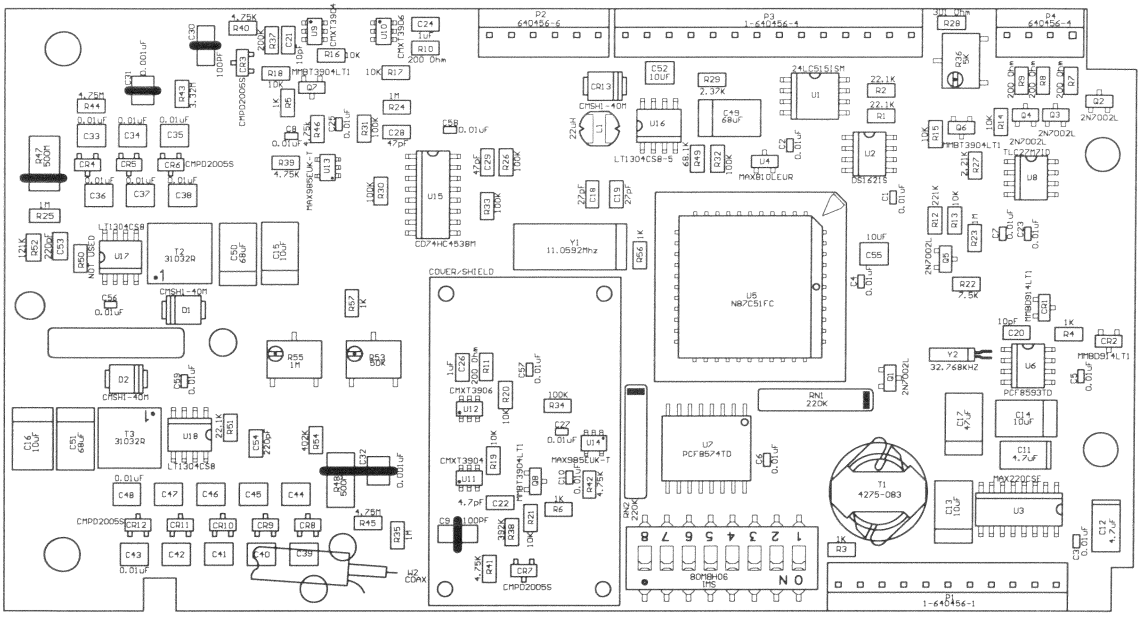

U1
24LC515ISM
U2
DS1621S
U3
MAX220CSE
U4
MAX810LEUR
U5
N87C51FC
U6
PCF8593TD
U7
PCF8574TD
T1
4275-083
Q1 2N7002L
Q2 2N7002L
Q3 2N7002L
Q4 2N7002L
CR1 MMBD914LT1
CR2 MMBD914LT1
B1 DL2450 3V LITHIUM
Y1 11.0592Mhz
Y2 32.768KHZ
SW1 90HBW08 8 POS
P1 1-640456-1 MTA100x11
P2 640456-6 MTA100x6
P3 1-640456-4 MTA100x14
P4 640456-4 MTA100x4
RN1 220K
RN2 220K
VOLUME
+BAT
RANGE1'
TYPE1'
TYPE0'
ZERO'
RANGE0'
COUNT'
BAT CHECK
METER
INT DOSE'
G PULSE'
RATE
CLICK
RXD
TXD
N PULSE'
RTS
CTS
NEUTRON
GAMMA
INT DOSE ALARM
DATA1
DATA0
CLOCK
LOAD
SHIELD
COVER/SHIELD
CTS'
RTS'
RXD'
TXD'
LO BAT'
RECYCLE
TONE'
AUD DIV1'
AUD DIV0'
LOGRATE1'
LOGRATE0'
DIP7
DIP8
UNUSED2'
LUDLUM MEASUREMENTS, INC.
PO Box 810
501 Oak Street
Sweetwater, Texas 79556
U.S.A. 1-800-622-0828
Drawn: SA 08/27/08
Design: RSS 08/27/08
Approve:
10:39:15 28-Aug-2006
Title: PROCESSOR BOARD
Model: 2363
Board#: 5390-295
Sheet: 2 of 4
Rev: 2.1
Series 390
Sheet 295
390295R2P2.sch



LUDLUM MEASUREMENTS, INC.		PO Box 810 501 Oak Street Sweetwater, Texas 79556 U.S.A. 1-800-622-0828	
Drawn: SA	08/27/06	Title: PROCESSOR BOARD	
Design: RSS	08/27/06	Model: 2363	
		Board#: 5390-295	
Approve:		Sheet: 3 of 4	Series 390 / Sheet 295
10:39:15	28-Aug-2006	Rev: 2.1	
390295R2P3.sch			

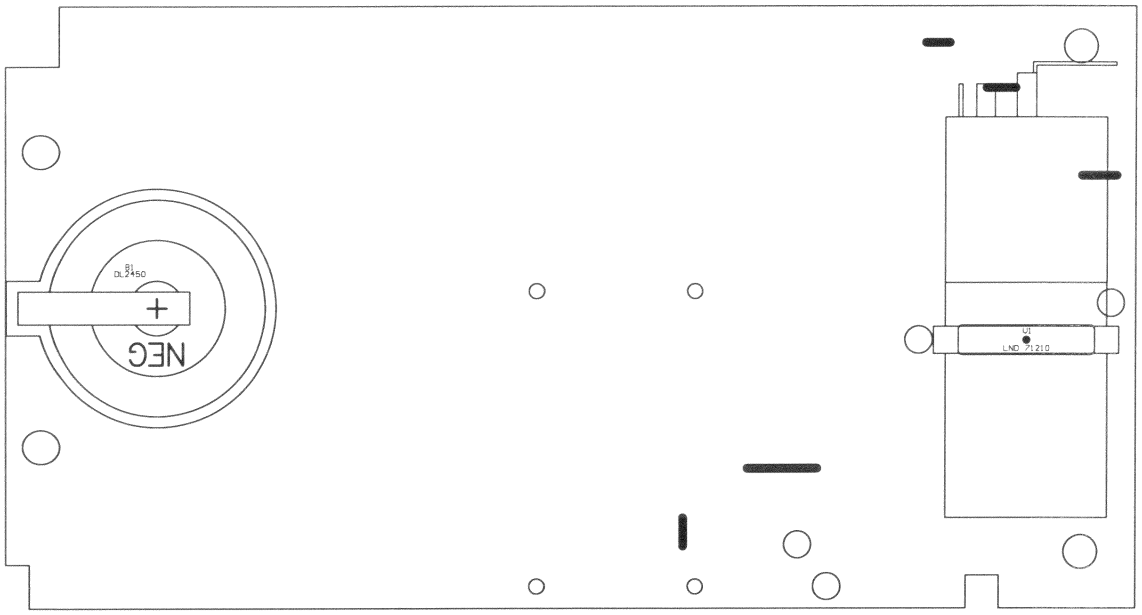


LUDLUM MEASUREMENTS, INC.		PO Box 810 501 Oak Street Sweetwater, Texas 79556 U.S.A. 1-800-622-0828	
Drawn: SA	08/27/06	Title: PROCESSOR BOARD	
Design: RSS	08/27/06	Model: 2363	
		Board#: 5390-295	
Approve:		Sheet: 4 of 4	Series 390 / Sheet 295
10:39:16	28-Aug-2006	Rev: 2.1	
390295R2P4.sch			



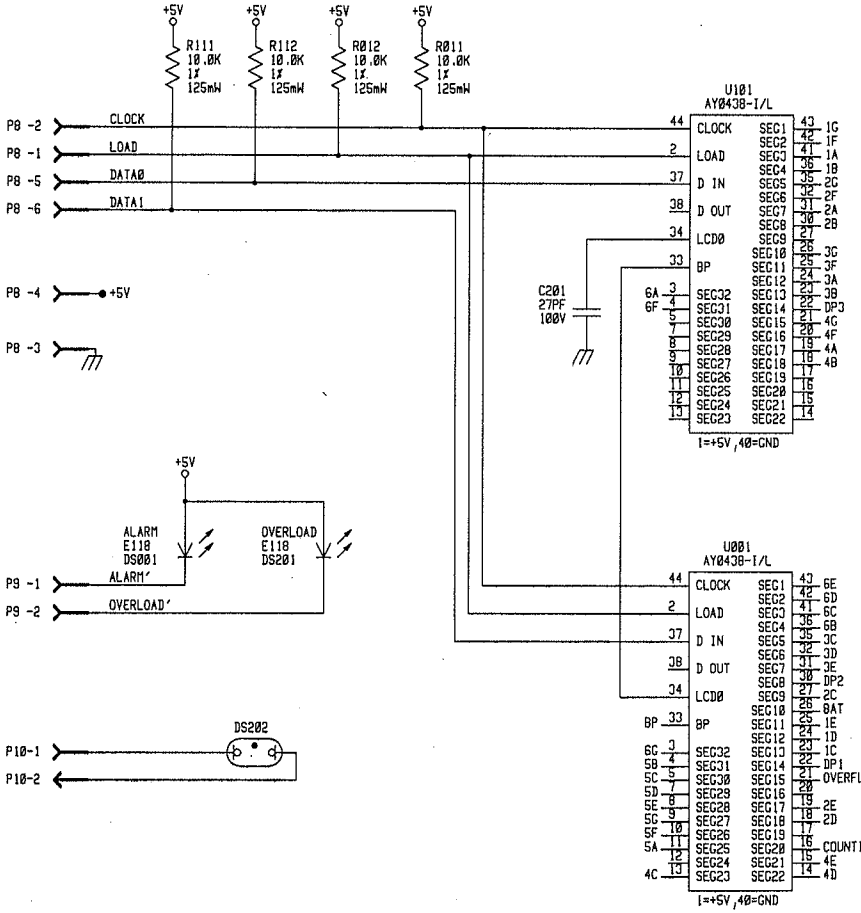
Drawn: JK	19–OCT–05	Title: PROCESSOR BOARD			
Design: DSS	19–OCT–05				
		Model: 2363			
Approve: RSS	30 Dec 05	Board#: 5390–295			
Layer:		Rev: 2.0	Series 390	Sheet 296	
	MID:	SCALE: 1.14			
	09:55:54 28–Dec–2005				
390295R2X1.pcb					

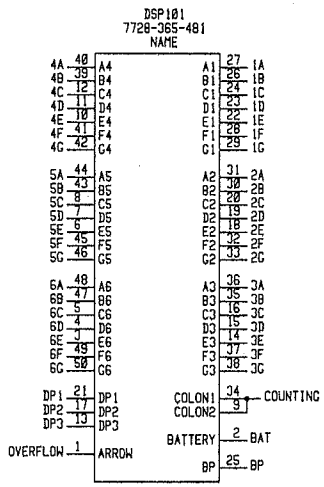
2



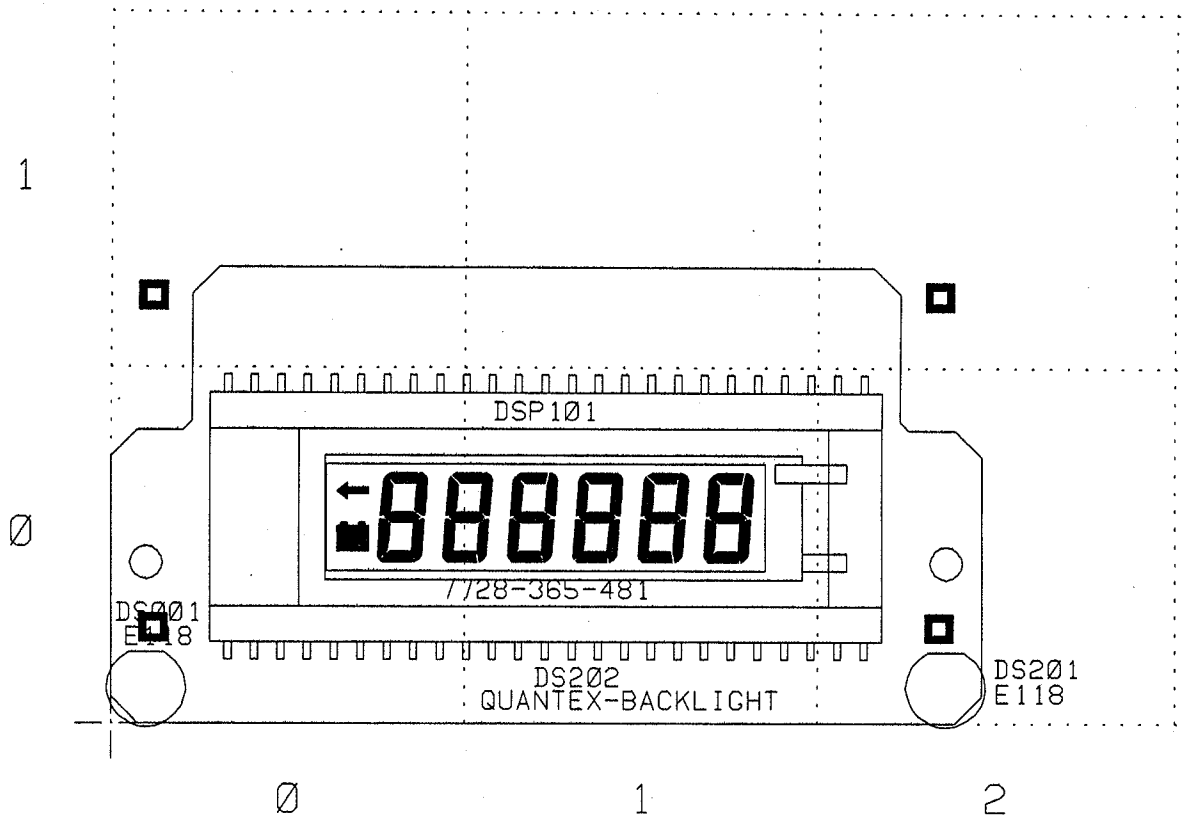
Drawn: JK	19-OCT-05	Title: PROCESSOR BOARD			
Design: DSS	19-OCT-05				
		Model: 2363			
Approve:		Board#: 5390-295			
Layer: Mech.1 Mech.2 Mech.3 Mech.4	MID: 09:55:55 28-Dec-2005	Rev: 2.0	Series 390	Sheet 296	
390295R2X1.pcb		SCALE: 1.14			

REVISIONS						
EFF	AUTHORITY	ZONE	LTR	DESCRIPTION	DATE	APPROVED

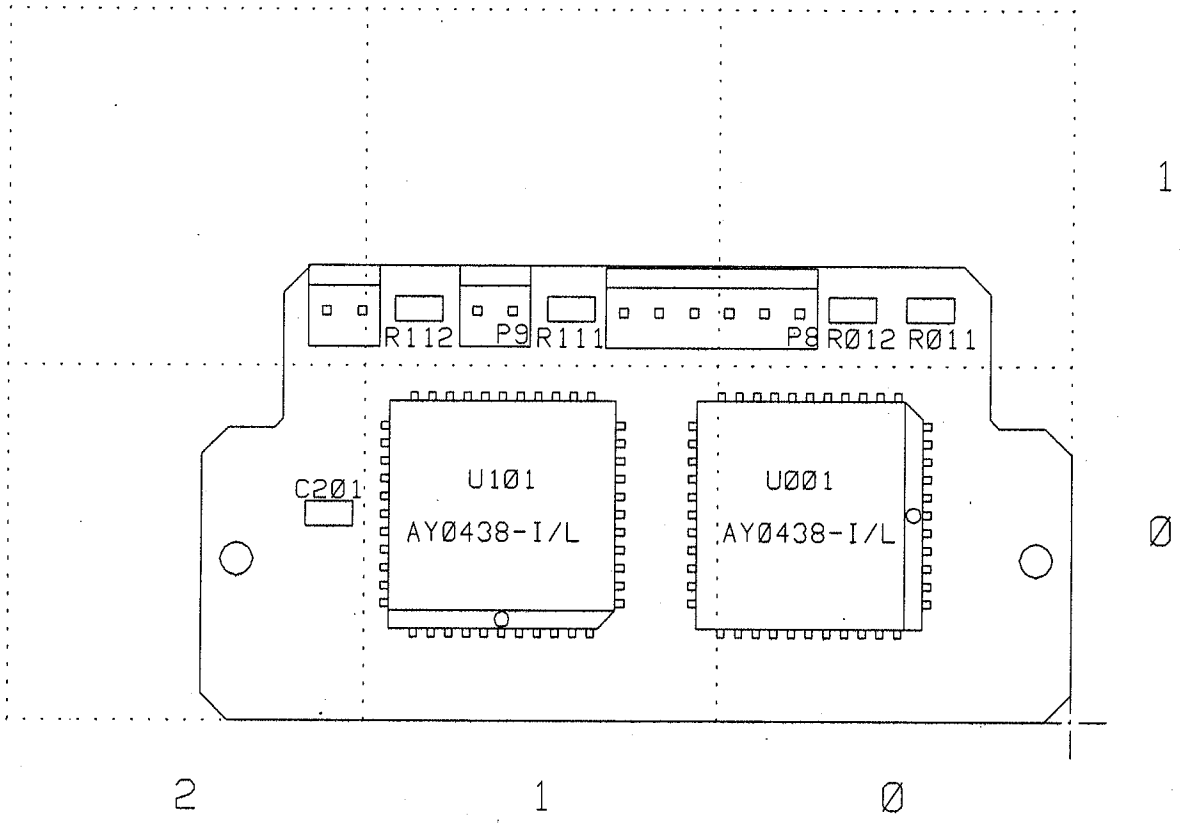




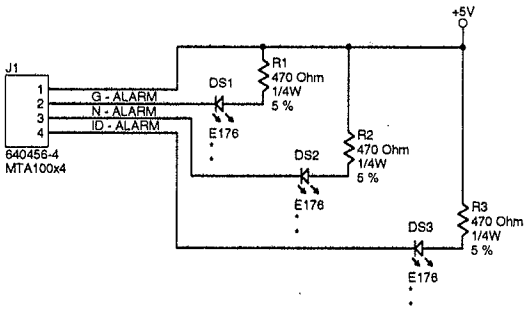
UPDATED	-	LUDLUM MEASUREMENTS INC.
DR CKB	11-APR-00	TITLE: LCD DISPLAY BOARD
CHK T.W.	4-27-00	
DSGN RSS	03-05-96	BOARD# S390-170
APPD RSS	4-28-00	SIZE C | MODEL 2360 | SERIES 390 | SHEET 170
NEXT HIGHER ASSY. -		
16:27:09	11-Apr-00	SB390170 | SHEET 1 OF 1



LUDLUM MEASUREMENTS INC. SWEETWATER, TX.			
DR CKB	12/12/96	TITLE: LCD DISPLAY BOARDS	
CHK [illegible]	4-28-00	BOARD: 5390-170	
DSGN RSS	05/31/96	MODEL: 2360	
APP [illegible]	4-28-00	FILENAME: BS390170	
		10:53:32	28-Apr-00
COMPONENT	SOLDER	REVISION	SERIES / SHEET
OUTLINE	OUTLINE	1.0	390 / 171

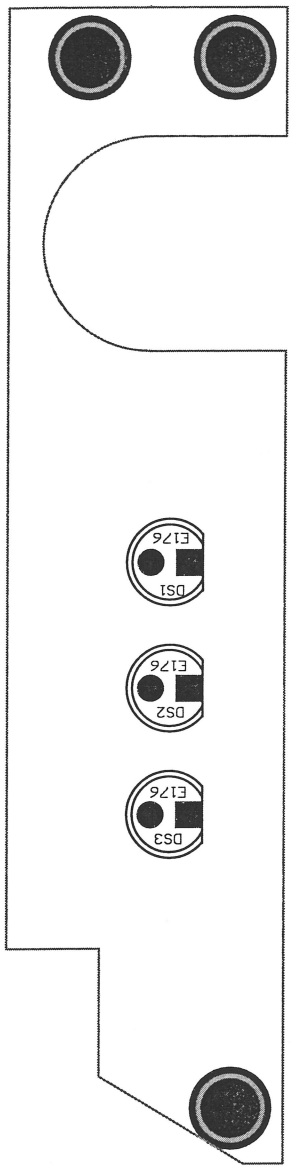


LUDLUM MEASUREMENTS INC. SWEETWATER, TX.				
DR CKB	12/12/96	TITLE: LCD DISPLAY BOARD		
CHK P.W.	4-27-00	BOARD# 5390-170		
DSGN RSS	05/31/96	MODEL 2360	SERIES 390	SHEET 171
APP BS	4-28-00	COMP ARTWORK ☐	SLDR ARTWORK ☐	
		COMP OUTLINE ☐	SLDR OUTLINE ☒	
COMP PASTE ☐	COMP MASK ☐	SLDR PASTE ☐	SLDR MASK ☐	

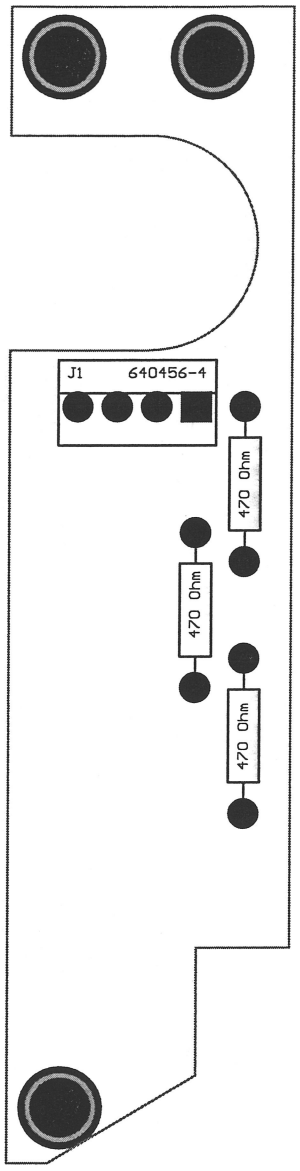


LUDLUM MEASUREMENTS, INC.
PO Box 810
501 Oak Street
Sweetwater, Texas 79556
U.S.A. 1-800-622-0828

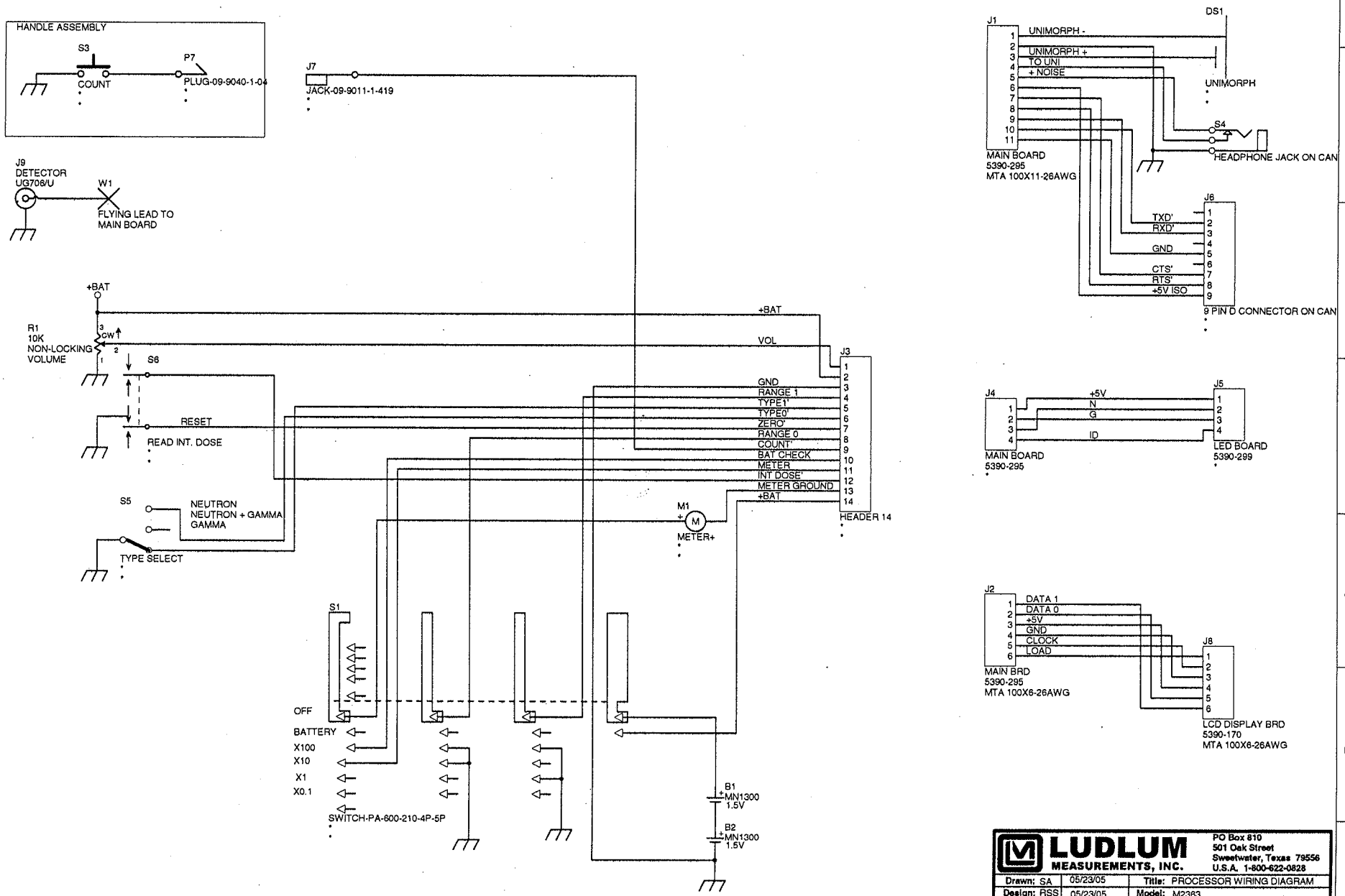
Drawn: SA	06/20/05	Title: LED BOARD		
Design: RSS	05/26/05	Model: 2363		
		Board#: 5390-299		
Approve:		Sheet: 1 of 1	Series	Sheet
13:46:16	16-Dec-2005	Rev: 2.0	390	299
390299R2P1.SCH				



Drawn: SA	06/20/05	Title: LED BOARD			
Design: RSS	05/27/05				
		Model: 2363			
Approve: JGW	9-11-12	Board#: 5390-299			
Layer: Mech.1 Mech.2		Rev: 2.0	Series 390	Sheet 300	
	MID: 11:50:07 22-Feb-2006	SCALE: 2.01			
390299R2X1.Pcb					



Drawn: SA	06/20/05	Title: LED BOARD			
Design: RSS	05/27/05				
		Model: 2363			
Approve: JGW	9-11-12	Board#: 5390-299			
Layer: Mech.1		Rev: 2.0	Series 390	Sheet 300	
	MID: 11:50:06 22-Feb-2006	SCALE: 2.01			
390299R2X1.Pcb					



LUDLUM MEASUREMENTS, INC.		PO Box 810 501 Oak Street Sweetwater, Texas 79556 U.S.A. 1-800-622-0828	
Drawn: SA	05/23/05	Title: PROCESSOR WIRING DIAGRAM	
Design: RSS	05/23/05	Model: M2383	
		Board#: 390-290	
Approve: BSS	30Dec05	Sheet: 1 of 1	Series 390 / Sheet 290
09:53:48	28-Dec-2005	Rev: 2.0	
390X290			