# Model 79 Series Stretch Scope

## Ludlum Measurements

## June 2022

**Serial Number: 25024424 and Succeeding**

**Firmware: F.3.1.4549 and Higher**

# Model 79 Series Stretch Scope

Ludlum Measurements

June 2022

Serial Number: 25024424 and Succeeding

Firmware: F.3.1.4549 and Higher

**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**

# CONTENTS

**Contents** 3

**List of Figures** 7

**List of Tables** 9

**1 Introduction** 11
1.1 Model 79/1, 79/2, and 79/4 . . . 12

**2 Features** 13

**3 Quick Reference** 15
3.1 Instrument Front Diagram . . . 15
3.2 Instrument Rear and Sides Diagram . . . 16
3.3 Instrument Internal Diagram . . . 17

**4 Getting Started** 19
4.1 Unpacking and Repacking . . . 19
4.2 Battery Installation . . . 19
4.3 Instrument Use and Controls . . . 20
4.4 Turning the Instrument On and Off . . . 20
4.5 Instrument Power ON Sequence . . . 20

**5 Normal Operation** 23
5.1 Buttons . . . 23
5.2 Status Icons . . . 23
5.3 Display Units . . . 24
5.4 Alerts and Alarms . . . 24
5.5 RATE Mode . . . 25
5.6 MAX Mode . . . 26
5.7 COUNT Mode . . . 27

**6 Fault Detection** 31
6.1 Instrument Faults . . . 31
6.1.1 Detector Loss of Counts . . . 31
6.1.2 Detector Over Range . . . 32
6.1.3 Detector Overload . . . 32
6.1.4 Calibration Expiration . . . 32
6.1.5 Date (Real Time clock) Reset . . . 33
6.1.6 Defaults Loaded . . . 33

**7 Configuration** 35
7.1 Setup Overview . . . 35
7.2 Setup Menu Introduction . . . 36

7.3 Entering Setup Menu . . . 36
7.4 Entering Setup Menu (Alternative) . . . 36
7.5 Exit Setup Mode . . . 37
7.6 Setup Mode Operation . . . 37
7.7 Setup Menus . . . 38
7.7.1 Menu Map . . . 38
7.7.2 Setup Group (dEt) - Detector . . . 40
7.7.3 Setup Group (Ch1) Channel 1 . . . 42
7.7.4 Setup Group (U-1) - Display Unit . . . 45
7.7.5 Setup Group (U-2) - Display Unit 2 . . . 49
7.7.6 Setup Group (InS) - Instrument . . . 50
7.7.7 Setup Group (rtc) - Real Time Clock . . . 53
7.8 DIP Switches . . . 53

**8 Advanced Features 55**
8.1 Dead Time Correction . . . 55
8.2 Units . . . 55
8.2.1 R to Sv Conversion . . . 56
8.3 Calibration Expiration Lockout . . . 56
8.4 Variable LED Brightness . . . 57
8.4.1 Backlight . . . 57
8.4.2 Ambient Light Value . . . 57
8.5 Audio . . . 57
8.6 Low-Battery Alarm Interval . . . 57
8.7 Software Calibration Tools . . . 58
8.8 Instrument Calibration . . . 58
8.9 DIP Switch Viewing . . . 58
8.10 Other Device Data . . . 58
8.11 Real-time Streaming . . . 59

**9 Specifications 61**
9.1 Instrument . . . 61
9.2 Scope Assembly . . . 64

**10 Safety Considerations 67**
10.1 Environmental Conditions for Normal Use . . . 67
10.2 Warning Markings and Symbols . . . 67
10.3 Cleaning and Maintenance Precautions . . . 68

**11 Revision History 69**

**12 Recycling 71**

**A Typical Values 73**

**B All Paramters 75**

**C Errata 83**

C.1 Firmware Known Issues . . . . . 83

**D Assembly Parts Lists and Drawings** **85**
D.1 Overall View and Dimensions . . . . . 86
D.2 Overall Assembly . . . . . 87
D.3 Model 79 Detector and Scope Assembly 4272-576 . . . . . 88
D.4 Detector and Scope Assembly . . . . . 89
D.5 Model 79 Clamp Assembly 4498-951 . . . . . 90
D.6 Clamp Assembly . . . . . 91
D.7 Model 79 High Range Detector Assembly 4272-557 . . . . . 92
D.8 Detector Assembly . . . . . 93
D.9 Electronics Assembly 4498-383 . . . . . 94
D.10 Electronics Assembly . . . . . 95
D.11 Electronics Assembly . . . . . 96

# LIST OF FIGURES


4.1 Startup display with all LCD segments shown. . . . . 20
4.2 Firmware version display. . . . . 21
4.3 Battery voltage display. . . . . 21

5.1 Alert example in rate mode. . . . . 25
5.2 Alarm example in rate mode. . . . . 25
5.3 RATE mode display. . . . . 26
5.4 MAX mode display. . . . . 27
5.5 Entering COUNT mode from another mode or changing units within COUNT mode. 28
5.6 COUNT mode ready to start. . . . . 28
5.7 COUNT mode results. . . . . 28

6.1 Fault - Loss of Counts. . . . . 31
6.2 Fault - Over Range. . . . . 32
6.3 Fault - Overload. . . . . 32
6.4 Fault - Calibration Expired. . . . . 33
6.5 Fault - Date Reset. . . . . 33
6.6 Fault - Defaults Loaded. . . . . 33

7.1 Button Press . . . . . 36
7.2 Menu Short Cut . . . . . 36
7.3 Setup - DIP switch protection enabled. . . . . 38
7.4 Setup Group - Detector. . . . . 40
7.5 Setup Group - Channel 1. . . . . 42
7.6 Setup Group - Display Unit 1. . . . . 45
7.7 Setup Group - Display Unit 2. . . . . 49
7.8 Setup Group - Instrument. . . . . 50
7.9 Setup Group - Real Time Clock. . . . . 53

# LIST OF TABLES

2.1 . . . . . 13

5.1 COUNT mode uits . . . . . 27

7.1 Display Unit RATE/MAX Minimum Values . . . . . 46
7.2 Display Unit RATE/MAX Maximum Values . . . . . 46
7.3 Display Unit Count Minimum Values . . . . . 48
7.4 Display Unit Count Maximum Values . . . . . 48

8.1 Features That Affect Units in All Modes . . . . . 56

9.1 Instrument Display Range . . . . . 61
9.2 Auto Response Times (in seconds) . . . . . 62

CHAPTER 1

# INTRODUCTION

The Model 79 Stretch Scope allows the user to operate at a safe distance from high-radiation areas while providing the ability to reach areas that are difficult to access with other probes. It also has a wide detection range, which is accomplished using an energy-compensated GM (Geiger-Mueller) detector.

Three modes of operation are available for the Model 79 Series - **RATE**, **MAX** rate, and **COUNT**.

- **RATE** mode operation will display the current count, exposure, or activity rate.
- **MAX** rate mode is used to capture the highest count, activity, or exposure rate detected. MAX mode is useful for finding a peak rate or frisking when the display is not visible.
- **COUNT** mode allows the user to perform a count for a predetermined time. Depending on the units chosen, the result can be a scaler count, a time-averaged rate, a time-averaged exposure or dose, or an integrated exposure or dose.

Two sets of display units can be configured for RATE/MAX mode and COUNT mode. The user can switch between these by simply pressing the Units button. Available units for each mode are:

- **RATE/MAX**: cps, cpm, Bq, dpm, rem/h, R/h, or Sv/h
- **COUNT**: cps, cpm, c (counts), Bq, dpm, d (disintegration), rem/h, rem, R/h, R, Sv/h, or Sv

The instrument features a large LCD (liquid crystal display), automatic backlight, audio warning, and intuitive operation. The instrument housing is made of lightweight but durable plastic. The instrument has an IP (Ingress Protection) rating of 52 and is splash resistant when the audio hole seal option is installed (P/N: 4498-913).

The foam grip provides a comfortable ergonomic grip, but may be removed for ease of decontamination. Also available to ease decontamination of the telescoping pole is a clear plastic sleeve (P/N: 2310599).

An internal switch is used to enable or disable the front-panel setup feature to protect desired settings from inadvertent modification. Setup is also available via Ludlum's Lumic Calibration Software.

## 1.1 Model 79/1, 79/2, and 79/4

There are three additional versions of the Model 79 - the Model 79/1 (part # 48-4241), the Model 79/2 (part # 48-4203), and the Model 79/4 (part # 48-4325). These versions use different detectors than the Model 79 to provide higher sensitivity for measuring in lower ranges. The Model 79/1 uses an 18 x 18 mm (0.7 x 0.7 in.) Csl (Tl) crystal scintillator to detect the lowest range of 0.01 µSv/h to 0.5 mSv/h (1 µR/hr to 50 mR/h). The Model 79/2 is designed for medium range measurement. It uses an internal energy-compensated GM detector to provide a detection range of 0.001 mSv/h to 0.04 Sv/h (0.1 mR/h to 4 R/h). The Model 79/4 also uses a internal energy-compensated GM detector. It provides a detection range of 0.010 mSv/h to 0.500 Sv/h (1 mR/h to 50 R/h).

CHAPTER 2

# FEATURES

**Detection Ranges:**
**Model 79:** 10 µSv/h to 10 Sv/h (1 mR/h to 1000 R/h
**Model 79/1:** 0.01 µSv/h to 0.5 mSv/h (1 µR/h to 50 mR/h)
**Model 79/2:** 0.001 mSv/h to 0.04 Sv/h (0.1 mR/h to 4 R/h)
**Model 79/4:** 0.010 mSv/h to 0.500 Sv/h (1 mR/h to 50 R/h)

**Extended Length:** 4.5 meters (14.75 ft)

**Weight:** 1.4 kg (3 lb), including batteries and shoulder strap

**Fault Detection:**

- Overload Protection
- Loss of Count Protection
- Over Range
- Calibration Expiration Lockout

**LCD Display:** 3-digit with 13.4 mm (0.53 in.) digits

**Available Display Range:** auto-ranging, maximum and minimum display can be set to limit display to calibrated range.

Table 2.1

| Unit | Range | Rate Mode | Count Mode |
|---|---|---|---|
| R/h | 0.00 µ - 999 | x | x |
| Sv/h | 0.00 µ - 999 | x | x |
| R | 0.00 µ - 999 | | x |
| Sv | 0.00 µ - 999 | | x |
| cpm | 0.00 - 999 k | x | x |
| cps | 0.00 - 999 k | x | x |
| c (counts) | 0.00 - 999 k | | x |

(x indicates if the unit is available in a certain Mode)

**Alerts and Alarms:** count rate, exposure/dose, and count alarm set points are adjustable over the display range

**On Device Setup:** check or configure primary operating parameters without the need of a computer

**Backlight:** low-power LED display illumination

**Ambient Light Sensor:** automatically turns on backlight and varies status LED intensity

**Response Time:** programmable to fixed fast (4 s), fixed slow (22 s), auto fast, auto slow, or user defined (0-60 s)

**Audio:** greater than 75 dB at 0.6 m (2 ft), approximately 4 kHz

**Battery Power:** two alkaline or rechargeable "AAA" (does not support in-device charging)

**Battery Life:** approximately 100 hours of operation, 24-hour low-battery warning

**Construction:** high-impact plastic with water-resistant rubber seals and separate battery compartment

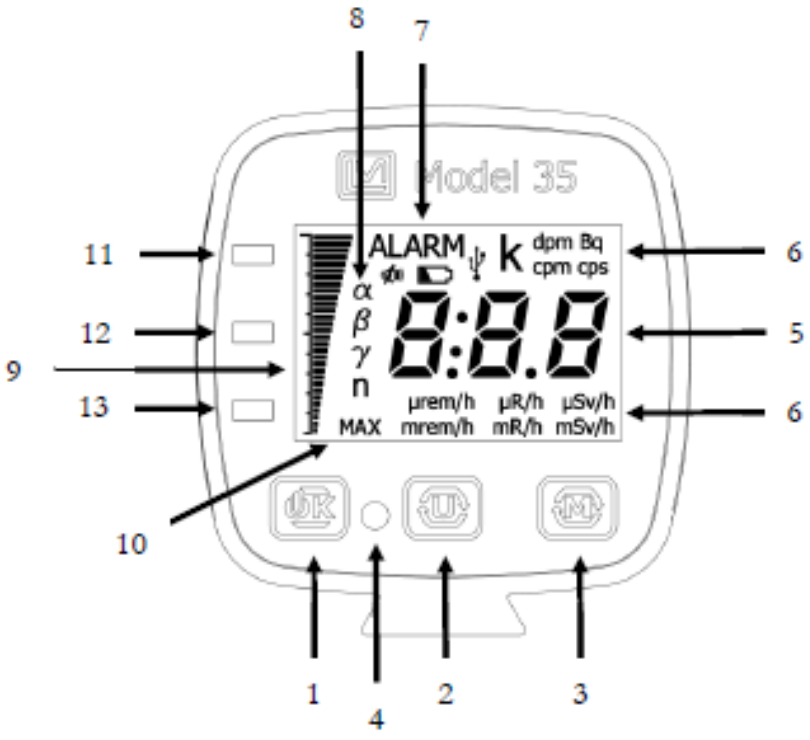
**Environmental Rating:** NEMA (National Electrical Manufacturers Association) rating of 3x or IP (Ingress Protection) rating of 52 with audio hole seal option

**Temperature Range:** -20 to 50 °C (-4 to 122 °F), may be certified for operation from -40 to 65 °C (-40 to 150 °F)

CHAPTER 3

# QUICK REFERENCE

## 3.1 Instrument Front Diagram




LED Legend:

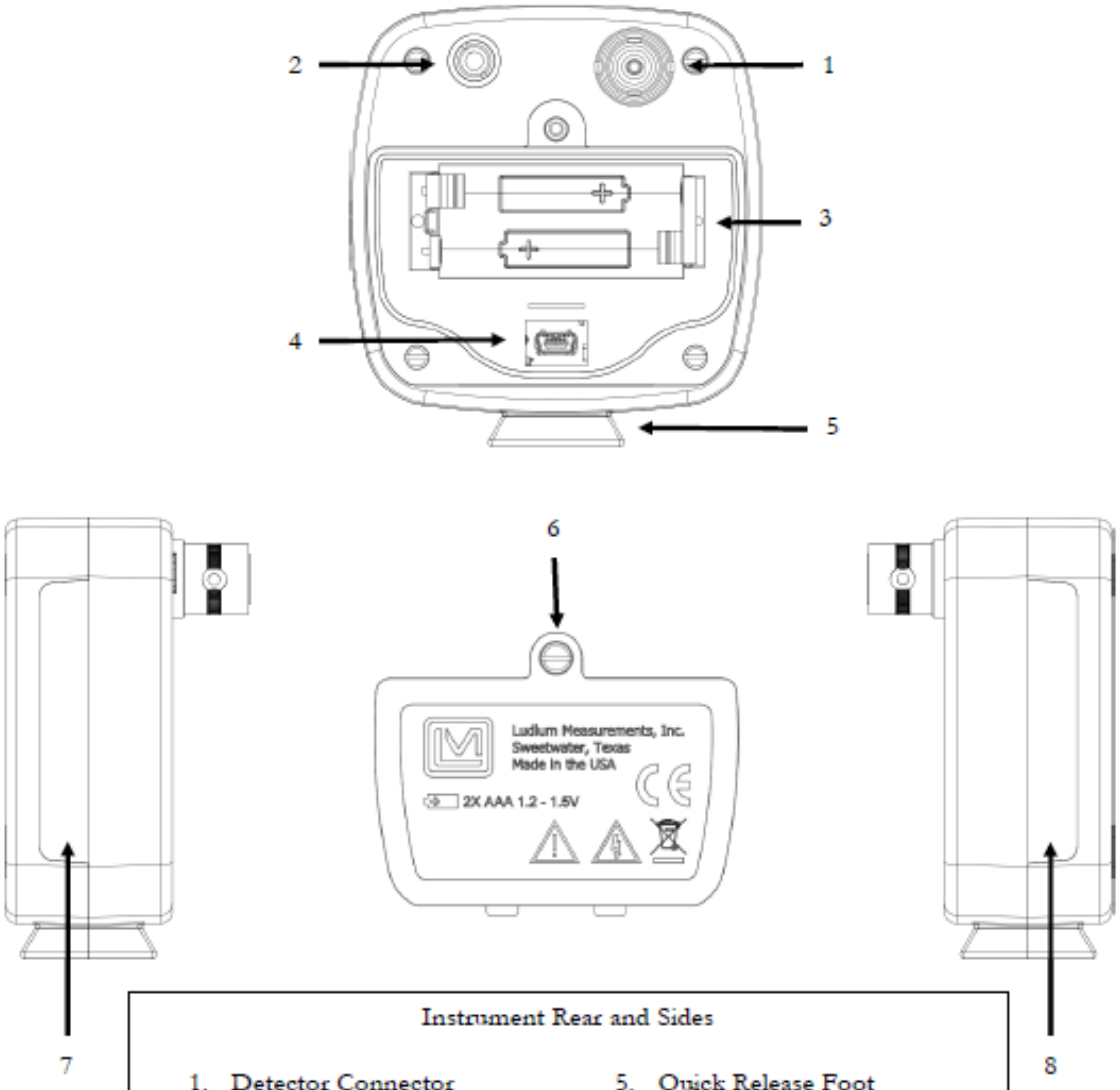
Solid On | Flashing | Off

Used throughout manual

Front Display Components

1. On/OK Button
2. Units Button
3. Mode Button
4. Audio Vent
5. 3-Digit Display
6. Units Icons
7. Status Icons
8. User Selectable Icons
9. Linear Scale
10. Max Mode Icon
11. Alarm LED (Red)
12. Alert LED (Orange)
13. Nominal LED (Green)

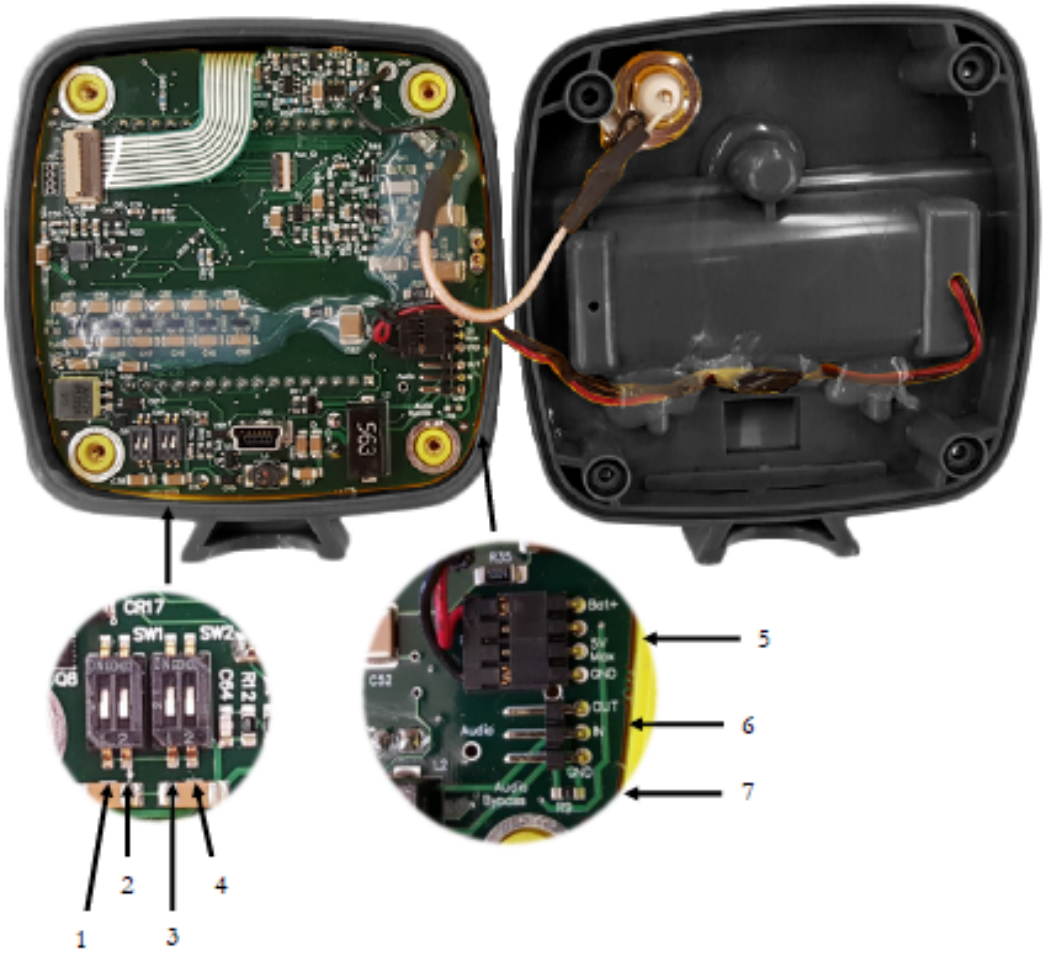
## 3.2 Instrument Rear and Sides Diagram




Instrument Rear and Sides

1. Detector Connector
2. Headphone Port (optional)
3. Battery Compartment
4. Mini B USB Connector
5. Quick Release Foot
6. Battery Door Screw
7. Serial # Sticker Location
8. Calibration Sticker Location

## 3.3 Instrument Internal Diagram




Instrument Internal

1. DIP Switch 1.1 (Calibration Protect)
2. DIP Switch 1.2 (Backlight On)
3. DIP Switch 2.1 (Calibration Expire)
4. DIP Switch 2.2 (N/A)
5. Power Connector
6. External Audio Connector
7. External Audio Bypass Resistor

CHAPTER 4

# GETTING STARTED

## 4.1 Unpacking and Repacking

Remove the calibration certificate and place it in a secure location. Remove the instrument 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 between instruments and detectors (if applicable). The serial number is located on the side of the unit.

To return an instrument for repair or calibration, provide sufficient packing material to prevent damage during shipment.

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 "Service Department" from the drop-down menu. Then choose the appropriate Service Department division where you will find a link to the form.

## 4.2 Battery Installation

A low-battery indicator appears on the top of the LCD when less than 24 hours of battery life remain. Follow these steps to replace the two standard AAA batteries:

1. Disconnect HV cable and remove from mount.
2. Turn the instrument over so that the back of the instrument is facing up.
3. Use a flat-bladed screwdriver to completely loosen the single captive screw on the battery cover.
4. Release and remove the battery cover.
5. Install two new AAA batteries following the symbols on the bottom of the battery compartment.
6. Replace the cover and tighten the screw.

## 4.3 Instrument Use and Controls

This instrument is simple and easy to use with minimal training required. The following describes the front-panel controls:

**OK button:** Used to power the instrument ON and OFF, toggle click audio, acknowledge audio alarms, reset MAX mode, and start/reset the COUNT timer.

**Unit button:** Cycles through configured display units.

**Mode button:** Cycles through operating modes in the following order: RATE, MAX, and COUNT. If a particular mode is disabled, it will be skipped. The device can be configured with only one enabled mode.

## 4.4 Turning the Instrument On and Off

To turn the instrument ON, momentarily press the OK button. Display should activate within moments.

To turn the instrument OFF, press and hold the OK button at any time. A countdown will start. Continue holding until the screen turns off.

## 4.5 Instrument Power ON Sequence

Turn the instrument ON by pressing the OK button momentarily, and then releasing.

The instrument will activate all of the LCD segments and the audio. Observe the device during this time. If any LCD segments are non-functioning, or audio fails to work, the device is in need of repair. (See the following figure.)

If alarm volume is set to zero, there will be no power on audio.

Figure 4.1: Startup display with all LCD segments shown.

The instrument displays the firmware version.

Figure 4.2: Firmware version display.

Next, the instrument will display the current battery voltage.

Figure 4.3: Battery voltage display.

The instrument will then move to normal operation.

CHAPTER 5

# NORMAL OPERATION

Normal operation begins immediately after power-on sequence. The device will display unit 1 of the first enabled mode (Mode order: Rate, Max Rate, Count). If a fault condition is present, it will immediately change to the fault state as long as the fault is active.

## 5.1 Buttons

**OK:** The functionality of this button varies depending on the active mode. It is described with each mode below.

**UNIT:** The button will advance to the next display unit in the same mode if it is enabled.

**MODE:** In normal operation, this button will advance to the next enabled mode. (If the next mode is enabled but the unit is disabled, it will be skipped.)

- In RATE or MAX modes, performing a long press (press and hold for approximately 0.5 seconds) will toggle the response time between fixed fast and fixed slow or auto fast and auto slow. If user defined time is selected, this feature will be ignored.
- In COUNT mode, performing a long press (press and hold for approximately 0.5 seconds) will advance the COUNT time to the next available count time.

## 5.2 Status Icons

The Low Battery indicator turns on continuously when battery voltage is below 2.2 volts. The instrument is in critical battery voltage when the voltage falls below 1.8 volts. If the instrument is currently powered by batteries while in a critical battery state, the instrument will turn off while leaving the indicator flashing.

The USB indicator activates when a computer connects to the device.

The MUTE icon turns on when the click audio (or other activity indicating audio) is silenced by the user, the volume set to 0, or the current device state silences audio.

The ALARM icon flashes while in an alarm condition and when sigma audio is engaged only, not during an alert.

## 5.3 Display Units

A display unit is a set of the following settings:

**Rate/Max** (shared)

- Unit
- Minimum Display Value
- Maximum Display Value
- Alert set point
- Alarm set point

**Count**

- Unit
- Minimum Display Value
- Alert set point
- Alarm set point

This device has two sets of display units.

## 5.4 Alerts and Alarms

The radiation levels that activate an Alert or an Alarm are user-defined. This instrument has an alert and an alarm set-point for RATE/MAX mode and another set of set-points for COUNT mode per display unit.

An alarm has a higher priority than an alert. Acknowledging an alert will not cause acknowledgement of the alarm. Acknowledgement of an alarm will acknowledge an alert as well.

Both the alert and the alarm are automatically re-armed when the readings fall below their respective thresholds.

OK button: When a new alert and/or alarm is tripped, a press of the OK button will acknowledge the alert and/or alarm to silence the audio instead of the normal mode specific function.

- An ALERT will flash the orange LED and sound a tone. An alert can be silenced.
- An ALARM will flash the red LED, sound a tone, and flash the ALARM icon. An alarm can be silenced.
- A FORCED ALARM will activate when the reading exceeds the user configured maximum display. A forced alarm is similar to an ALARM with the addition of the maximum value or 888 flashing on the display. A FORCED ALARM CANNOT be silenced.

Figure 5.1: Alert example in rate mode.

Figure 5.2: Alarm example in rate mode.

## 5.5 RATE Mode

In RATE mode, the current count rate is displayed. The rate is averaged based on the response rate setting.

**OK button:** Toggles click audio (or other activity indicating audio). If there are alerts/alarms, the alert/alarm acknowledgement takes precedent and will register the button press instead (see Alerts and Alarms on page 24).

**MODE button:** A long press (0.5 seconds or more) will allow the instrument to toggle the response rate. The instrument can toggle between Auto-Fast and Auto-Slow or Fixed-Fast and Fixed-Slow. Within 2 seconds, the new response rate will be displayed on the screen. If the response time is user defined, a long press of the MODE button is ignored.

Alerts and Alarms are non-latching in RATE mode. They will clear automatically if the reading falls below the user-defined threshold.

Figure 5.3: RATE mode display.

## 5.6 MAX Mode

While in MAX mode, the highest detected count rate (since the last reset) is displayed. The MAX icon is displayed to indicate when in MAX mode.

MAX mode is always running in the background on power-up. While in other modes or units, the maximum rate encountered will be stored.

**OK button:** The first press of the button mutes click audio (or other activity audio). The second press of the button resets max value to zero and re-enables click audio. If there are alerts/alarms, the alert/alarm acknowledgement takes precedent and will register the button press instead (see Alerts and Alarms on page 24).

**MODE button:** A long press (0.5 seconds or more) will allow the instrument to toggle the response rate. The instrument can toggle between Auto-Fast and Auto-Slow or Fixed-Fast and Fixed-Slow. Within 2 seconds, the new response rate will be displayed on the screen. If the response time is user defined, a long press of the MODE button is ignored.

Alerts and alarms in MAX mode latch with the display

Figure 5.4: MAX mode display.

## 5.7 COUNT Mode

The purpose of COUNT mode is to count for a predetermined amount of time, and to show the results on the display. Note that the predetermined count time can be from 1 second to 3600 seconds, or can be set to zero to enable continuous counting until stopped by the user. The instrument is equipped with seven unique count times (one user defined time, 0 [continuous count], 6 seconds, 30 seconds, 60 seconds, 2 minutes, 5 minutes, and 10 minutes) that are selectable in COUNT mode by performing a long press (press and hold for approximately 0.5 seconds) of the MODE button.

Count mode operation is very flexible, depending on the units chosen. A common choice is for the count mode to perform a scaler count for a specified time, with a resulting answer in counts (equaling detected radiation events). If the count units chosen are cpm or cps, then the resulting answer is an averaged count rate over the time interval.

Other choices are to have count mode units of R/h, Sv/h or rem/h, in which case the COUNT mode results in a averaged exposure or dose rate. But if count mode units of R, Sv, or rem are chosen, the result is shown in accumulated exposure or accumulated dose over the chosen count time.

Activity measurements that utilize the efficiency parameter for 2pi, 4pi, etc. can also be selected. The Bq and dpm units will result in an average activity over the count time. The count (c) disintegrations (d) will sum the total activity (efficiency corrected) over the count time. The following table lists the possibilities:

Table 5.1: COUNT mode uits

| UNITS | RESULT |
|---|---|
| c | counts per count time |
| d | disintegrations per count time |
| cpm, cps | count rate, averaged over the count time |
| dpm, Bq | disintegration rate, averaged over the count time |
| R, Sv, rem | integrated exposure or dose over the count time |
| R/h, Sv/h, rem/h | exposure or dose rate, averaged over the count time |

When entering COUNT mode or changing units within COUNT mode, the current display units will be displayed for approximately one second.

Figure 5.5: Entering COUNT mode from another mode or changing units within COUNT mode.

Count mode operates in the following states:

1. **Ready to count:** Count has been reset. Total count time is shown. Alerts/alarms are not armed.

Figure 5.6: COUNT mode ready to start.

A solid colon is in the m:ss format; a flashing colon is in the h:mm format.

2. **Counting:** Time remaining is shown and alerts/alarms are armed. If an alert/alarm level is reached while counting, the count value will alternate with the current reading. When count-down timer reaches 0, the device will automatically advance to the Results state.

3. **Results:** Results will be displayed when countdown is finished if count time is greater than 0. If count time is 0, this will show a live total/average (depending on the display units) until reset. Alerts/alarms are armed.

Figure 5.7: COUNT mode results.

**OK button:** The function of the OK button varies depending on the current state of count mode. If there are alerts/alarms, the alert/alarm acknowledgement takes precedent and will register the button press instead (see Alerts and Alarms on page 24).

**MODE button:** Prior to initiating a count, a long press (0.5 seconds or more) will allow the instrument to toggle through a list of available count times. The instrument is equipped with seven unique count times (one user defined time, 0 [continuous], 6 seconds, 30 seconds, 60 seconds, 2 minutes, 5 minutes, and 10 minutes). If the count is in progress or has concluded, a long press of the MODE button is ignored.

1. **Ready to count:** Starts counting. Automatically advances to Counting.
2. **Counting:** Resets count. Changes the state of count mode to ready to count.
3. **Results:** Clears results. Changes the state of count mode to ready to count.

Alerts and alarms are latching in COUNT mode.

Changing units will not affect state of COUNT mode. Click audio (or other activity audio) are muted in COUNT mode.

CHAPTER 6

# FAULT DETECTION

## 6.1 Instrument Faults

This instrument has several faults it can report to the user. A fault is signified by flashing in order of the red, orange, and green LEDs in addition to a unique fault tone. The display will also cycle through the active faults.

If a fault cannot be acknowledged, the display will flash the fault code. If a fault can be acknowledged, the fault code will be solid.

**OK button:** Momentarily pressing the OK button will silence the tone and acknowledge the currently displayed fault if applicable.

If the cause of a fault condition is removed, the instrument will automatically clear the fault and continue normal operation.

### 6.1.1 Detector Loss of Counts

If the detector stops detecting radiation for a settable number of seconds, the instrument will flash "LoC" or Loss of Counts. This indication is common if the unit is powered up without a detector connected. If this indication is observed with a connected detector, remove the unit from service and have it evaluated by a qualified repair and calibration technician.

Figure 6.1: Fault - Loss of Counts.

### 6.1.2 Detector Over Range

If the detector is exposed to high levels of radiation or has an internal malfunction that causes it to count beyond its count rate ability or dead time correction causes a math error, the unit flashes "or." The user should ensure whether a high radiation filed, internal malfunction, or invalid settings are causing this fault by observing the instrument's behavior in a known radiation field.

Figure 6.2: Fault - Over Range.

### 6.1.3 Detector Overload

If a current overload threshold is enabled, the instrument can detect when there are some forms of detector failure, a cable failure, or a high level of radiation. In this event, the unit will flash "oL."

Figure 6.3: Fault - Overload.

### 6.1.4 Calibration Expiration

If the calibration expiration lockout is enabled, the instrument will flash "CAL" when calibration is past due.

DIP switch must be enabled. See Chapter 8, Calibration Lockout on page 56 for more information.

Figure 6.4: Fault - Calibration Expired.

### 6.1.5 Date (Real Time clock) Reset

If the calibration expiration is enabled, the instrument will display "dAt" if the internal clock has been reset. Software is required to reset the clock.

Figure 6.5: Fault - Date Reset.

### 6.1.6 Defaults Loaded

If the device settings become corrupted due to firmware updates, memory failure, or software clearing, the device will solidly display or flash "dEF" (depending on which settings invalid) to indicate that at least some settings are running on firmware default values. If the display is solid, the fault can be acknowledged and the device will continue to run. In either case, a professional should review calibration and other settings.

Figure 6.6: Fault - Defaults Loaded.

CHAPTER 7

# CONFIGURATION

Only advanced users or administrators should consider changing any of the parameters in the following section. Incorrect settings could jeopardize the safety of users depending on this instrument.

Your instrument has been shipped from Ludlum Measurements only after passing electronic checkout, a 24-hour burn-in process, and a careful calibration process. Calibration papers are supplied with each instrument shipped from Ludlum Measurements.

Recalibration should be accomplished after maintenance or adjustments have been performed on the instrument. Recalibration is not normally required following instrument cleaning or battery replacement. Recalibration does not typically require any special tools or software to perform.

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

Ludlum Measurements, Inc. recommends recalibration at intervals no greater than one year, assuming that regular operational checks are performed. Check the appropriate local, state, and federal regulations to determine required recalibration intervals.

## 7.1 Setup Overview

This instrument features an on-device setup menu that can be accessed to view or modify the primary operational settings. These settings are detailed below.

Further settings are accessible through the Lumic Calibration software available from Ludlum Measurements, Inc.

There are also four DIP switches on the instrument. Their functionality is described at the end of this section

## 7.2 Setup Menu Introduction

The on device setup menu allows configuration through the three buttons on the front of the device. Some setup functions require two types of button presses. A "**regular**" (short) press is the normal momentary **press and release** of the button. A "**long**" press is a **press and hold** for approximately **one second** before releasing. A short button press can be identified by a dot next to the button icon (See figure 7.1a) A long button press can be identified by a dash next to the button icon (See figure 7.1b)

(a) Short Button Press (b) Long Button Press

Figure 7.1: Button Press

## 7.3 Entering Setup Menu

To enter the setup menu:

1. Power down the instrument.
2. Turn the instrument back on.
3. Following the display of the battery voltage, when the instrument has begun normal operation, press the **MODE** button three times (within four seconds) to enter the **setup menu**.

Entry to the **setup menu** can be confirmed when the display shows "dEt", indicating the first setup group is selected.

## 7.4 Entering Setup Menu (Alternative)

This device can be configured to quickly enter the setup menu. Lumic Calibration software is required to enable this feature, but once the "Setup Menu Shortcut" is enabled, it can be accessed at any time.

To enter setup mode through the quick access method, long press the **UNIT** and **MODE** buttons (see figure 7.2). The last accessed setup group will be displayed. All other functions of setup mode will be normal.

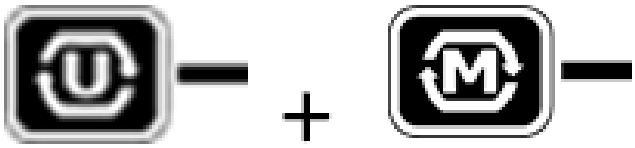


Figure 7.2: Menu Short Cut

Quick access to setup mode is not available while in any fault condition.

## 7.5 Exit Setup Mode

There are two ways to exit setup mode.

1. Long press **UNIT** button to exit from page selection. **Changes are saved in non-volatile memory.**
2. Power off device by holding **OK** button until power-off countdown finishes. **Changes are NOT saved to non-volatile memory.**

When viewing a page, two long presses of the UNIT button are needed to exit the setup menu.

## 7.6 Setup Mode Operation

The setup menu is arranged into two levels - **groups** and **pages.** Each group contains several related pages. Each page controls a particular setting.

While in the **group** selection level, the bar graph displays a tick mark for every **page** in the group. When in a **page**, the bar graph flashes the segment that corresponds to the page's location in the group.

Button Functions at **group** level:

**UNIT button:** Enter **page** selection on the current **group.**

**MODE button:** Advance to next **group.**

**LONG UNIT:** Exit setup menu. **Any changes will be saved.**

Button Functions at **page** level:

**UNIT:** Advance to next **page** within current **group.**

**MODE:** Modify the selected position (digits, etc.). **If the PROTECT DIP switch is enabled, (See DIP Switches on page 53), this is not allowed. A "dIP" message will briefly appear to indicate this. (See figure below.)**

**OK:** Select the next position on the current **page.**

**LONG UNIT:** Exit page. Return to **group** selection.

Figure 7.3: Setup - DIP switch protection enabled.

## 7.7 Setup Menus

### 7.7.1 Menu Map

Detector - "dEr"

1. HV
2. Current Overload
3. Response Time/Auto Response Rate
4. User Defined Count Time
5. Enabled Modes
6. Audio Divide

Channel 1 - "Ch1"

1. Cal Constant Mantissa

2. Cal Constant Exponent
3. DTC1
4. DTC2 Mantissa
5. DTC2 Exponent
6. Threshold
7. Loss of Count Time

Unit 1 - "U-1"

1. Rate Unit and Minimum Display Exponent
2. Rate Maximum Display Exponent
3. Rate/Max Alert
4. Rate/Max Alarm
5. Count Unit and Minimum Display Exponent
6. Count Alert
7. Count Alarm
8. Icon

Unit 2 - "U-2"

1. Rate Unit and Minimum Display Exponent
2. Rate Maximum Display Exponent
3. Rate/Max Alert
4. Rate/Max Alarm
5. Count Unit and Minimum Display Exponent
6. Count Alert
7. Count Alarm
8. Icon

Instrument - "InS"

1. Audio Mode

2. Audio Volume
3. Automatic Shutdown Time
4. Green LED

Real Time Clock - "rtc"

1. Month
2. Day
3. Year
4. Hour
5. Minute
6. Second

### 7.7.2 Setup Group (dEt) - Detector

Figure 7.4: Setup Group - Detector.

**High Voltage** - Controls the operating voltage of the detector. Value is in volts.

Configurable positions are:

- Ones Place (0-9)
- Tens Place (0-9)
- Hundreds Place (0-9)
- k Multiplier (on/off)

**Range:** 300-1600 V

The k multiplier also activates left-most decimal point. If the k multiplier is used, the Hundreds Place value is limited to 0 and 1 (showing thousands value)

**Detector Current Overload Threshold** - Defines the current limit of the detector. If the detector pulls more current from the high voltage, the over-current fault is activated. Setting the detector current overload threshold to 0 disables the current overload fault.

Configurable positions are:

- Ones Place (0-9)
- Tens Place (0-9)
- Hundreds Place (0-9)
- Decimal (right most on/off)

**Range:** 00.0-999 µA

Long-pressing the MODE button will toggle to live value display. Long-press MODE button again to return threshold setting.

**Response Time** - The response time can be fixed, or it can operate in one of two auto modes.

When operating in fixed response mode, response time is a very predictable response. Setting the Response Time to a fixed value is useful primarily when performing surveys to a fixed MDA (Minimum Detectable Activity) level.

When operating in Auto-Response mode, the instrument will vary the Response Time based on the Auto-Response Rate selected (Fast or Slow) and the current Count Rate. When the instrument detects a sudden change in count rate from the detector, the response time is reduced to 1 second to quickly show the new value.

If all characters are flashing, the mode is being selected. The mode must be changed to fixed (all numbers flashing) before fixed time can be set. Once fixed mode is selected, pressing the OK button will allow for normal digit selection.

Configurable positions are:

- Modes (F[ixed]-F[ast], F[ixed]-S[low], A[uto]-F, and A[uto]-S)
- Ones Place (0-9)
- Tens Place (0-6, 6 forces max Response Time of 60)

**Range:** Auto or Fixed Fast and Slow, or 0-60

**User Defined Count Time** - Defines the user configurable count time of the COUNT mode in seconds. Setting Count Time to 0 enables continuous count until reset.

Configurable positions are:

- Ones Place (0-9)
- Tens Place (0-9)
- Hundreds Place (0-9)

**Range:** 0-3600

**Operational Modes** - Defines modes enabled for the detector. The leftmost character "r" signifies RATE mode, the "MAX" icon signifies MAX mode, and the rightmost character "c" signifies COUNT mode. If the character/icon is flashing, the mode will be available. If it is not flashing, the mode is disabled.

Configurable positions are:

- Mode

**Range:** Any combination

**Audio Divide** - Defines the audio divide associated with the click audio. For exampe, an Audio Divide of 100 will result in one audio click being emitted for every 100 pulses detected. Note: Audio is enabled for this menu item to allow the user to hear the effects of adjusting this value while the detector (or a pulser) is connected.

Configurable positions are:

- Audio Divide 1, 10, 100, and 1.00k

### 7.7.3 Setup Group (Ch1) Channel 1

Figure 7.5: Setup Group - Channel 1.

**Calibration Constant Mantissa** - Value is used with Calibration Constant Exponent to express counts per R. This setting is only used if a display unit of R, R/h, Sv, Sv/h, rem, or rem/h are selected. This is the decimal portion of the value.

Configurable positions are:

- Ones Place (0-9)

- Tens Place (0-9)
- Hundreds Place (0-9)

**Combined Range of Calibration Constant Mantissa and Exponent:** 100E0-999E10

It may be possible to input 010 or some number less than 100, and then change the exponent to 00. The instrument will automatically correct this to 100E00.

**Calibration Constant Exponent** - Value is used with Calibration Constant Mantissa to express counts per R. This setting is only used if a display unit of R, R/h, Sv, Sv/h, or rem, rem/h is selected. This is the exponential portion of the value. An "E" is always visible on the leftmost character (not flashing) to help signify this is the exponent.

Configurable positions are:

- Exponent (0-10)

**Range:** See Calibration Constant Mantissa

**Dead Time Correction** - This parameter is used to correct for dead time in the detector. Value is in microseconds (µs). Correction is disabled if value is set to 0 (see Dead Time Correction on page 55.)

Configurable positions are:

- Ones Place (0-9)
- Tens Place (0-9)
- Hundreds Place (0-9)
- Decimal Place (rightmost on/off)

**Range:** 00.0-999 µs

This should be disabled when checking instrument with pulser or function generator; otherwise, higher count rates will result in non-linearities.

**Second Order Dead Time Correction Mantissa** - Value is used with Second Order Dead Time Correction Exponent to provide a second order linearization in extremely high fields. Correction is disabled if value is set to 0 (see Dead Time Correction on page 55).

Configurable positions are:

- Ones Place (0-9)
- Tens Place (0-9)
- Hundreds Place (0-9)

**Combined Range of Second Order Dead Time Correction Mantissa and Exponent:** 000E-12 - 999E-6

This should be set disabled when checking instrument with pulser or function generator; otherwise, higher count rates will result in non-linearities.

**Second Order Dead Time Correction Exponent** - Value is used with Second Order Dead Time Correction Mantissa to provide a second order linearization in high fields. An "-" is always visible on the leftmost character (not flashing) to help signify this is a negative exponent (see Dead Time Correction on page 55).

Configurable positions are:

- Exponent (-6 to -12)

**Range:** See Second Order Dead Time Correction Mantissa

**Efficiency** - Defines the efficiency of the detector. Value is only used when the selected display units are dpm, Bq, or disintegrations. Units are in percentage.

Normally the efficiency is used on a per detector basis or 4pi basis, i.e. the efficiency of the detector is calculated by dividing the count rate received from a source by the total disintegration rate of the source. When either dpm or Bq units are chosen, the use of the 4pi efficiency allows the display of the source size or activity on the display.

But if the user desires to have the instrument show results in terms of dpm/100 $cm^2$, the user could manipulate the efficiency to produce this result by multiplying the efficiency times the ratio of the detector area to 100 $cm^2$. For example, using a detector with an area of 15 $cm^2$, if we start with the 10% efficiency to measure in dpm, then the parameter could be changed to 1.5% to measure in dpm/100 $cm^2$.

Or likewise for Bq/$cm^2$, efficiency could be calcuated as efficiency + count rate/disintegration rate*detector area (in $cm^2$). For example, with the same detector as above with an area of 15 $cm^2$, and starting with and efficiency value of 10%, then the parameter could be changed to 150% to measure in Bq/$cm^2$.

Configurable positions are:

- Ones Place (0-9)
- Tens Place (0-9)

- Hundreds Place (0-9)
- Number of Decimal Place (0 or 1)

**Range:** 00.1 to 999%

**Discriminator Threshold** - Defines the discriminator threshold voltage for counting. Pulses above this level will be counted. Value is represented in mV. Configurable positions are:

- Ones Place (0-9)
- Tens Place (0-9)
- Hundreds Place (0-9)
- Decimal (0, 1, or 2)

**Range:** 0.00 to 500 mV

**Loss of Count Alarm Time** - Defines the amount of time with no counts that can lapse before the loss of count fault is activated. Setting the Loss of Count Alarm Time to 0 disables the fault. Value is in seconds. Configurable positions are:

- Ones Place (0-9)
- Tens Place (0-9)
- Hundreds Place (0-9)
- Decimal (0 or 2)

**Range:** 000 to 9.99 ks

### 7.7.4 Setup Group (U-1) - Display Unit

Figure 7.6: Setup Group - Display Unit 1.

**Display Unit 1 RATE/MAX Units and Minimum Display** - Sets the unit for RATE and MAX modes, as well as the minimum displayable value (see Units on page 55). Since the range for minimum display is dependent on the units, the setting is broken into two parts.

The first portion that can be modified is the unit. While selecting the unit, the unit will be the only thing on the screen.

Changing to the next portion (pressing the OK button) will show the unit as well as 000 with a possible decimal point and a possible prefix on the unit. Modifying the position (pressing the MODE button) will cycle through all available decimal positions and prefixes.

Configurable positions are:

- Units (R/h, Sv/h, dpm, Bq, cpm, cps, rem/h)
- Decimal point and prefix (see the following table)

Table 7.1: Display Unit RATE/MAX Minimum Values

| **Units** | **Available decimal points/prefix combinations** | | |
|---|---|---|---|
| R/h | 0.00µ | 00.0µ | 000µ |
| Sv/h | 0.00m | 00.0m | 000m |
| rem/h | 0.00 | 00.0 | 000 |
| dpm Bq | 0.00 | 00.0 | 000 |
| cpm cps | 0.00k | 00.0k | 000k |

**Display Unit 1 RATE/MAX Maximum Display** - This determines the maximum displayable value for the display unit 1 or RATE mode and MAX mode. If the calculated value is higher than this, this value will flash and a forced alarm will activate. The unit will be the same as selected minimum display unit.

Configurable positions are:

- Ones Place (0-9)
- Tens Place (0-9)
- Hundreds Place (0-9)
- Decimal Point and Prefix (see the following table)

Table 7.2: Display Unit RATE/MAX Maximum Values

| **Units** | **Available decimal points/prefix combinations** | | |
|---|---|---|---|
| R/h | X.XX µ | XX.X µ | XXX µ |
| Sv/h | X.XX m | XX.X m | XXX m |
| rem/h | X.XX | XX.X | XXX |
| dpm Bq | X.XX | XX.X | XXX |
| cpm cps | X.XX k | XX.X k | XXX k |

X's can be replaced with any number for 0 to 9.

Range must provide at least two orders of magnitude between minimum and maximum value.

**Display Unit 1 RATE/MAX Mode Alert Point** - Defines the value of the display unit 1 in RATE or MAX modes. When this level is exceeded, the yellow LED will be on and alert tone will sound.

This value should be above the minimum display value and below the maximum display value. If an alarm is also enabled, the alert level should be below the alarm level. Set this to 000 to disable.

Configurable positions are:

- Ones Place (0-9)
- Tens Place (0-9)
- Hundreds Place (0-9)
- Decimal Point and Prefix (see previous table)

**Display Unit 1 RATE/MAX Mode Alarm Point** - Defines the value of the display unit 1 alarm in RATE or MAX modes. When this level is exceeded, the red LED will flash, an alarm tone will sound, and the ALARM icon will flash.

This value should be above the minimum display value and below the maximum display value. If an alert is also enabled, the alarm level should be above the alert level. Set this to 000 to disable.

Configurable positions are:

- Ones Place (0-9)
- Tens Place (0-9)
- Hundreds Place (0-9)
- Decimal Point and Prefix (see previous table)

**Display Unit 1 Count Units and Minimum Display** - Sets the unit for COUNT mode as well as the minimum displayable value (see Units on page 55). Since the range for minimum display is dependent on the units, the setting is broken into two parts.

The first position that can be modified is the unit. While selecting the unit, the unit will be the only thing on the screen.

Changing the next position will show the unit as well as 000 with a possible decimal point and a possible prefix on the unit. Modifying this position will cycle through all available decimal positions and prefixes.

Configurable positions are:

- Units (R/h, R, Sv/h, Sv, dpm, Bq, d, cpm, cps, c, rem/h, rem)
- Decimal Point and Prefix (see following table)

Table 7.3: Display Unit Count Minimum Values

| **Units** | **Available decimal points/ prefix combinations** | | |
|---|---|---|---|
| R/h, Sv/h, | 0.00µ | 00.0µ | 000µ |
| rem/h, R, Sv, | 0.00m | 00.0m | 000m |
| rem | 0.00 | 00.0 | 000 |
| dpm, Bq, cpm, cps, | 0.00 | 00.0 | 000 |
| disintegrations, counts | 0.00k | 00.0k | 000k |

**Display Unit 1 Count Alert Point** - Defines the value of the display unit 1 alert in COUNT mode. When this level is exceeded, the yellow LED will be on and alert tone will sound.

This value should be above the minimum display value. If an alarm is also enabled, the alert level should be below the alarm level. Set this to 000 to disable.

Configurable positions are:

- Ones Place (0-9)
- Tens Place (0-9)
- Hundreds Place (0-9)
- Decimal Point and Prefix (see following table)

Table 7.4: Display Unit Count Maximum Values

| **Units** | **Available decimal points/ prefix combinations** | | |
|---|---|---|---|
| R/h, Sv/h, | X.XXµ | XX.Xµ | XXXµ |
| rem/h, R, Sv, | X.XXm | XX.Xm | XXXm |
| rem | X.XX | XX.X | XXX |
| dpm, Bq, cpm, cps, | X.XX | XX.X | XXX |
| disintegrations, counts | X.XXk | XX.Xk | XXXk |

**Display Unit 1 Count Alarm Point** - Defines the value of the display unit 1 alarm in COUNT mode. When this level is exceeded, the red LED will be on, an alarm tone will sound, and the ALARM symbol will flash.

This value should be above the minimum display value. If an alert is also enabled, the alarm level should be above the alert level. Set this to 000 to disable.

Configurable positions are:

- Ones Place (0-9)
- Tens Place (0-9)
- Hundreds Place (0-9)
- Decimal Point and Prefix (see previous table)

**Display Unit Radiation Icon** - Configures the radiation icon that will be active when display unit 1 is selected. This setting has no other effect.

Configurable positions are:

- Icon (Off, $\alpha$, $\beta$, $\gamma$, n, $\alpha\beta$, $\alpha\gamma$, $\beta\gamma$, $\alpha\beta\gamma$, $\alpha$n, $\beta$n, $\gamma$n, $\alpha\beta$n, $\alpha\gamma$n, $\beta\gamma$n, $\alpha\beta\gamma$n)

When the radiation icon is set for gamma ($\gamma$), X-rays will also be measured when that icon is illuminated.

### 7.7.5 Setup Group (U-2) - Display Unit 2

Figure 7.7: Setup Group - Display Unit 2.

**Display Unit 2 RATE/MAX Units and Minimum Display** - See Display Unit 1 RATE/MAX Units and Minimum Display. This has all the same options with one addition. Unit positions can also be "oFF."

If this unit is turned off, the next page will be Display Unit 2 Count Units and Minimum Display.

**Display Unit 2 RATE/MAX Maximum Display** - See Display Unit 1 RATE/MAX Maximum Display.

If Display Unit 2 RATE/MAX unit is set to "oFF," this setting will be skipped.

**Display Unit 2 RATE/MAX Mode Alert Point** - See Display Unit 1 RATE/MAX Mode Alert Point.

If Display Unit 2 RATE/MAX unit is set to "oFF," this setting will be skipped.

**Display Unit 2 RATE/MAX Mode Alarm Point** - See Display Unit 1 RATE/MAX Mode Alarm Point.

If Display Unit 2 RATE/MAX unit is set to "oFF," this setting will be skipped.

**Display Unit 2 Count Units and Minimum Display** - See Display Unit 1 COUNT Units and Minimum Display. This has all the same options with one addition. Unit positions can also be "oFF."

If this unit is turned off, the next page will be Display Unit 2 Radiation Icon.

**Display Unit 2 Count Alert Point** - See Display Unit 1 Count Alert Point.

If Display Unit 2 Count unit is set to "oFF," this setting will be skipped.

**Display Unit 2 Count Alarm Point** - See Display Unit 1 Count Alarm Point.

If Display Unit 2 Count unit is set to "oFF," this setting will be skipped.

**Display Unit 2 Radiation Icon** - See Display Unit 1 Radiation Icon.

### 7.7.6 Setup Group (InS) - Instrument

Figure 7.8: Setup Group - Instrument.

**Audio Mode** - Defines the enabled activity audio mode. This instrument has three audio modes to choose from.

- "cLc" - Standard click audio. This mode will produce a cluck for every detected pulse. If pulses are too fast, this can become a solid tone. Click audio is best for continuous feedback.
- "SIG" - Sigma audio. Sigma audio takes a baseline reading at startup. If any subsequent readings are one sigma above the baseline, a steady pulse pattern will be heard. The baseline can be taken if the OK button is pressed long enough for the shutdown countdown to start. As soon as the shutdown countdown begins, the OK button can be released and a new baseline reading will be taken. Sigma audio is best for finding low-level increases from background radiation typically used with more sensitive scintillator detectors.
- "F d" - Floating Delta. In this audio mode, the immediate reading is compared to the running average. The running average is controlled by the response time. If the immediate value is above or below n sigma (n is settable by software) from the average, a pulse will be heard. Floating delta is best for finding changes, increases, or decreases from existing readings.

Configurable positions are:

- Modes: ("cLc," "SIG," "F d")

**Audio Volume** - Simultaneously sets the audio volume of click audio (or other activity audio) and alert/alarm volume. 0 mutes click and alert/alarm (see Audio on page 57).

Configurable positions are:

- Volume (0, 1, 2, 3)

Activity audio and alert/alarm audio are available as separate settings via software. Modifying the settings here will force them to the same value.

**Shutdown delay on transition to external power** - Determines the length of time before the instrument turns off when external power is removed. Time is in seconds.

This setting is intended only for use when the instrument will primarily be used with external power. If the external power is frequently turned on and off in a vehicle for example, the instrument may need to auto-power off to conserve internal battery power.

A delay can be configured in the event engine cranking of the vehicle temporarily causes the voltage to sag far enough that the instrument thinks power has been removed. This can prevent unintentional power-off of the instrument.

A "—" message means the auto-power off delay feature is disabled and the instrument will remain on when external power is removed.

Each digit can advance to the "—" state.

Configurable positions are:

- Ones (0-9, and "—")
- Tens (0-6, and "—")

**Range:** 0-60 s or disabled

**Green LED Mode** - This setting controls the behavior of the green LED on the front panel of the instrument. Typically, the green LED will be configured for always off to conserve battery power. However, if a very simple, safe, marginal, and dangerous indicator is desired, the green LED can be used in conjunction with the alert and alarm levels to provide this functionality.

There are three states it can be activated - on, off, and blink. Blink mode is intended to mitigate the battery life problem while still providing a simple interface.

The green LED states can also be varied on the current power source.

- "oFF" - Off all the time
- "on" - on all the time
- "bL" - blink all the time
- "E:on" - on while powered externally
- "E:bL" - blink while powered externally
- "I:on" - on while powered internally
- "I:bL" - blink while powered internally
- "E:Ib" - on while powered externally, blink while powered internally

Configurable positions are:

Modes: ("oFF," "on," "bL," "E:on," "I:on," "I:bL," and "E:Ib")

### 7.7.7 Setup Group (rtc) - Real Time Clock

Figure 7.9: Setup Group - Real Time Clock.

**Month** - Only view the current month setting in the device clock.

**Day** - Only view the current day setting in device clock.

**Year** - Only view the current year setting in device clock.

**Hour** - Only view the current hour setting in device clock.

**Minute** - Only view the current minute setting in device clock.

**Second** - Only view the current second setting in device clock.

## 7.8 DIP Switches

DIP switches are located inside the instrument on the mother board. The switches are in the "on" position when they are switched towards the "ON lettering printed on the face of the switch (towards the top of the instrument). With the switches at the bottom left of the board, the order from left to right is SW1.1, SW1.2, SW2.1, and SW2.2.

Dip Switches control the following:

**SW1.1 - Cal Protect:** Protects calibration from changes in the device setup menu. Values can still be viewed, but an attempt to modify these settings will cause the device to briefly show a "dIP" message (see Figure 7.3

**SW1.2 - Backlight Always On:** Forces the backlight into the always-on state and will no longer turn off under bright ambient lighting conditions. This will significantly reduce battery life.

**SW2.1 - Cal Expire Timer:** Enables calibration expiration timer feature (see Calibration Expiration Lockout on page 56). The due date for the calibration can be programmed through software. When the due date has passed, the device will lock out of normal operation if this is enabled. Software will be required to reset the calibration expiration date. This causes the "CAL" fault (see Figure 6.5).

**SW2.2 - N/A:** Reserved for future use.

CHAPTER 8

# ADVANCED FEATURES

## 8.1 Dead Time Correction

All pulse counting detectors have a "dead time" in which the detector is unable to register another event. In relatively low fields this is not an issue. However, as the field strength approaches the high end of the detector's range, dead time causes the pulse rate to become non-linear with respect to the real radiation field. Dead time correction is used to linearize the measurements, allowing a wider linear response range for a given detector.

This instrument uses a second order dead time correction using the below equation:

$rate_c = rate_m / [1 - (DTC_1 * rate_m) + (DTC_2 * rate_m^2)]$

Where $DTC_1$ and $DTC_2$ are the dead time correction coefficients, $rate_m$ is the measured count rate, and $rate_c$ is the corrected rate.

Dead time correction coefficients are configured through the device setup menu or through Lumic Calibration software. Lumic Calibration software also includes a wizard that will automate finding and setting the correct coefficients.

$DTC_1$ is represented in microseconds (µs) on the device setup menu and in the software. The equation must be calculated in terms of seconds (s) and must be scaled appropriately. $DTC_2$ has more complex units and are not shown. However, the representation of the coefficient on the setup menu and in software do not require scaling.

Setting the $DTC_2$ to zero will disable the second order correction, while setting $DTC_1$ to zero will disable both, regardless of the value of $DTC_2$.

## 8.2 Units

Depending on the chosen display units, different features will affect value of the reading. The following table lists the features that apply to each of the display units.

Table 8.1: Features That Affect Units in All Modes

| UNITS | Feature |
|---|---|
| cpm, cps, counts | Deadtime Correction |
| Bq, dpm, disintegrations | Dead Time Correction, Efficiency |
| R/h, R | Dead Time Correction, Calibration Constant |
| Sv/h, Sv, rem/h, rem | Dead Time Correction, Calibration Constant, R to Sv Conversion |

These apply to all modes.

### 8.2.1 R to Sv Conversion

The R to Sv conversion is a setting available in Lumic Calibration software. It defines the conversion factor between R and Sv. Since the calibration constant is directly tied to R (counts per R), calibrating Sv requires a correct setting of both calibration constant and R to Sv conversion.

The rem unit is also affected by the R to Sv conversion. A rem is defined in firmware as being 100x the value of Sv.

Example: An R to Sv conversion factor of 0.0106 will cause a reading of 10.6 mSv/h (1.06 rem/h) while in a 1 R/h field.

## 8.3 Calibration Expiration Lockout

Calibration expiration lockout timer is a feature that can be configured in the Lumic Calibration software. It allows setting a date and time that will cause the device to lock out due to expired calibration.

To enable this feature, the calibration expiration lockout timer DIP switch must be turned on (see DIP Switches on page 53). The real time clock and the calibration expiration lockout must also be set correctly in Lumic Calibration software.

A calibration expiration fault (see Calibration Expiration on page 32) that cannot be acknowledged away will persist on the display after the calibration expiration lockout time has elapsed. The device will not be usable until the lockout timer is reset (during calibration) or the DIP switch is disabled inside the device.

The real time clock is also required to be set correctly for this feature to function. This instrument utilizes a super capacitor to retain the clock settings for a short time during battery changes. If the batteries are allowed to go completely dead to the point where the device will not attempt to turn on and the display is completely blank, the real time clock will probably require being reset. The user will be notified of a reset clock by the date fault (see page 33) upon power-on after new batteries are installed.

## 8.4 Variable LED Brightness

This instrument uses s sensor that detects the ambient light level. The ambient light is then converted into three states - dark, medium, and bright. Each state affects the brightness of the device LEDs to provide daytime visibility as well as prevent blinding nighttime viewing. A bright state will cause maximum intensity of the status indicator LEDs if they are on. A dark state will set the indicator LEDs to the dimmest setting as well as activate the automatic backlight. While the preset values should be sufficient, in an unusual configuration, Lumic Calibration allows setting the thresholds, with hysteresis, of the ambient light states.

### 8.4.1 Backlight

The intensity of the backlight is configurable on this instrument through Lumic Calibration software. This setting is preset to optimize battery life and viewability. However, if a change is made, the thresholds for the ambient light levels may need to be modified due to self-illumination from the backlight.

### 8.4.2 Ambient Light Value

In Lumic Calibration software, the ambient light parameter shows the current value of the ambient light sensor. This is a raw reading from the ambient light sensor used to assist in redefining the ambient light state thresholds.

## 8.5 Audio

This instrument utilizes software controlled audio. There are three types of tones that can be generated - a low tone used for clicks and alert audio, a high tone used for alarms, and a tone for buttons. Each of the settings is configurable in the Lumic Calibration software.

The volume can also be controlled for click volume, alert/alarm volume, and for button volume. The click and alert/alarm volumes are a combined setting in the device setup menu. If using Lucmic Calibration software, all three volumes are configurable independently. There are four levels of volume: 0, 1, 2, and 3 with 0 being off.

The audio chime during the power-on sequence uses the three tones in the order of button tone, low tone, and high tone. The volume of all three tones is the alert/alarm audio volume; therefore, if no chime is heard on power-on, alert/alarm volume may be set to 0.

## 8.6 Low-Battery Alarm Interval

This feature is intended for use when the device is normally externally powered but needs to be ready to run on internal power. Externally powered applications tend to rely on alerts and alarms to get the user's attention. A low-battery state can go unnoticed in a typically uneventful environment.

The low-battery alarm interval is only active when the device is externally powered. If enabled and the battery falls below the low-battery level, a low-battery chime will occur. The low-battery alarm interval setting defines the number of minutes separating each chime. A value of 0 will disable the low-battery alarm. This setting can only be configured through Lumic Calibration software.

## 8.7 Software Calibration Tools

Lumic Calibration software includes wizards that will assist in calibrating and plateauing detectors. After configuring the wizard for a specific detector, the wizard will automate much of the data collection and calculation required for calibration.

## 8.8 Instrument Calibration

This instrument provides the ability to digitally enter a voltage for both high voltage and threshold. As such, the instrument itself needs to be calibrated. This happens at the factory when the instrument is built and should not require re-calibration. However, if calibration is required (due to board rework, etc.), the calibration settings are available in Lumic Calibration software.

## 8.9 DIP Switch Viewing

The current setting of the DIP switches can be viewed from Lumic Calibration software. This allows the user to check the current DIP switch setting without opening the instrument.

## 8.10 Other Device Data

The following parameters on the instrument allow recording important device information within the device:

**Firmware Version:** This is a read-only representation of the firmware version. With a version of F:x.y.zzz, the F:x.y will show up on the device screen during the power-on sequence and signifies the released version.

**Device - Model Name:** This should match the model name on the front face of the instrument.

**Device - Serial Number:** This should match the serial number of the instrument.

**Detector - Model:** This can store the model of the detector the instrument was calibrated for.

**Detector - Serial Number:** This can store the serial number of the detector the instrument was calibrated for.

## 8.11 Real-time Streaming

Lumic Calibration software and this instrument have the ability to stream data from the instrument to a computer. The data can be viewed live inside software or can be recorded to a file.

Multiple user-selected parameters can be streamed simultaneously, including:

- Remote display of the screen
- All unit values
- Device status
- Live HV current measurement

CHAPTER 9

# SPECIFICATIONS

## 9.1 Instrument

**HV Range:** 400-1500 Vdc

**Threshold:** 2-200 mVdc (calibrated range)

**Resolving Time:** approximately 5 µsec as defined by IEC 60325

**Overload:** 5-100 µA

**Loss of Count Timeout:** 0-9.99 k seconds (0 to disable)

**On Device Setup:** Check or configure primary operating parameters without the need of a computer

**Display Range:** all auto-rangeable maximum displays can be set to limit the display to calibrated range

Table 9.1: Instrument Display Range

| Unit | Range | Rate Mode | Count Mode |
|---|---|---|---|
| R/h | 0.00 µ - 999 | x | x |
| Sv/h | 0.00 µ - 999 | x | x |
| rem/h | 0.00 µ - 999 | x | x |
| R | 0.00 µ - 999 | | x |
| Sv | 0.00 µ - 999 | | x |
| rem | 0.00 µ - 999 | | x |
| cpm | 0.00 - 999 k | x | x |
| cps | 0.00 - 999 k | x | x |
| c (counts) | 0.00 - 999 k | | x |
| Bq | 0.00 - 999 k | x | x |
| dpm | 0.00 - 999 k | x | x |
| d (disintegration) | 0.00 - 999 k | | x |

**LCD Display:** 3-digit with 13.4 mm (0.53 in.) digits

**Backlight:** low-power LED display illumination

**Ambient Light Sensor:** automatically turns on backlight and varies status LED intensity

**Response Time:** programmable to fixed (1-60 seconds), fixed fast (4 seconds), fixed slow (22 seconds), auto fast, or auto slow

Table 9.2: Auto Response Times (in seconds)

| Test | Auto Fast | Auto Slow |
|---|---|---|
| **Background to > 30 kcpm** | <3 | <6 |
| **>30 kcpm → Background** | <3 | <6 |
| **Background to ≤ 30 kcpm** | 4 | 7 |
| **≤ 30 kcpm → Background** | 5.5 | 12 |
| **Background to ≤ 12 kcpm** | 6 | 12 |
| **≤ 12 kcpm → Background** | 8.5 | 17 |
| **Background to ≤ 6 kcpm** | 7.5 | 18.5 |
| **≤ 6 kcpm → Background** | 9 | 21 |
| **Background to ≤ 4020 cpm** | 11 | 20 |
| **≤ 4.02 kcpm → Background** | 10 | 22 |
| **Background to ≤ 3000 cpm** | 10 | 22 |
| **≤ 3 kcpm → Background** | 11 | 22 |

Average time of 10-90% measurements.

**Real-time Streaming Rate:** 1/16th to 15 seconds (1/16th second resolution)

**Real-time Streaming Parameters:** 8

**Warm-up Time:** less than 2 minutes

**Power:** two alkaline or rechargeable "AAA" batteries (does not support in-device charging)

**Battery Life:** approximately 100 hours of operation, 24-hour low-battery warning

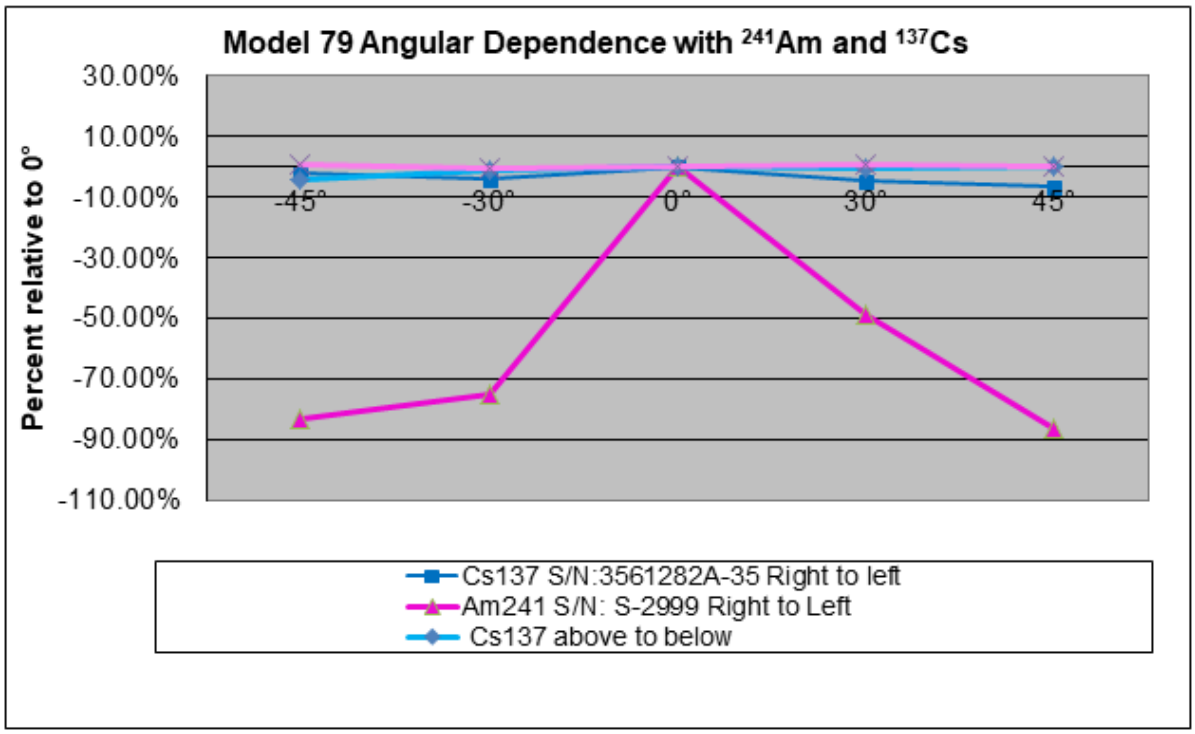
**Temperature Range:** -20 to 50 °C (-4 to 122 °F), may be certified for operation from -40 to 65 °C (-40 to 150 °F)

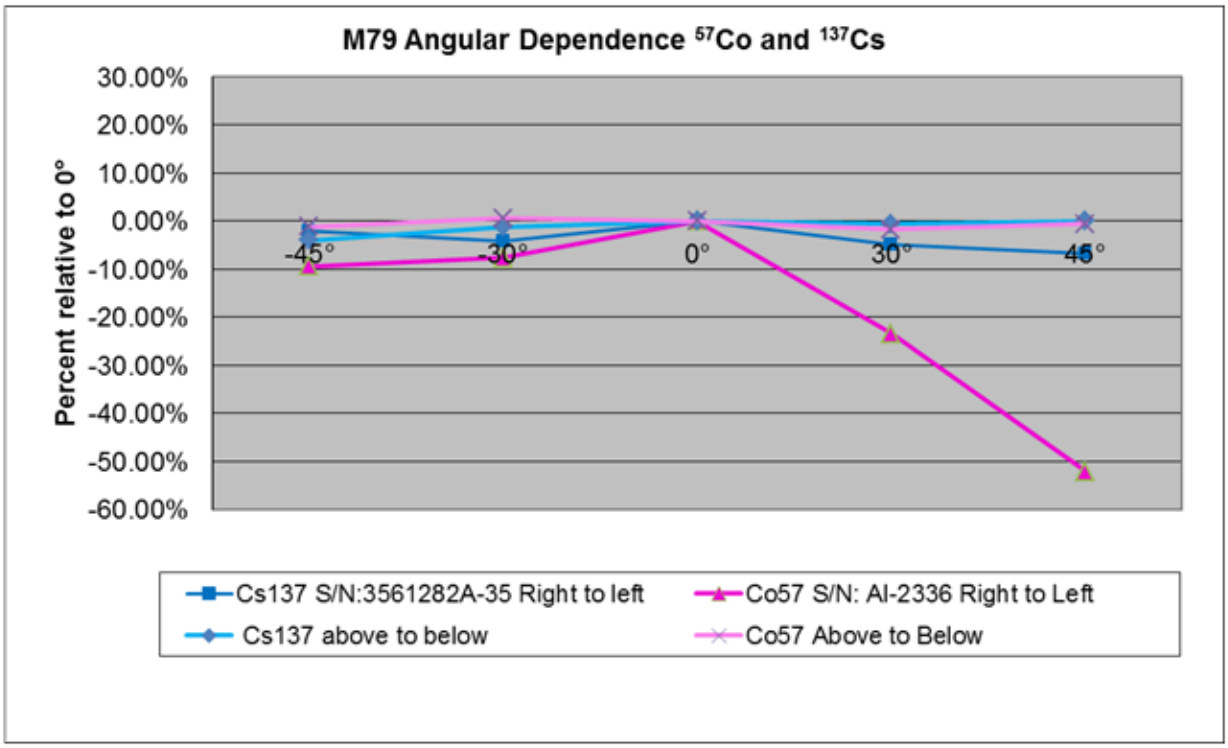
**Environmental Rating:** NEMA (National Electrical Manufacturers Association) rating of 3x or IP (Ingress Protection) rating of 52 with audio seal option

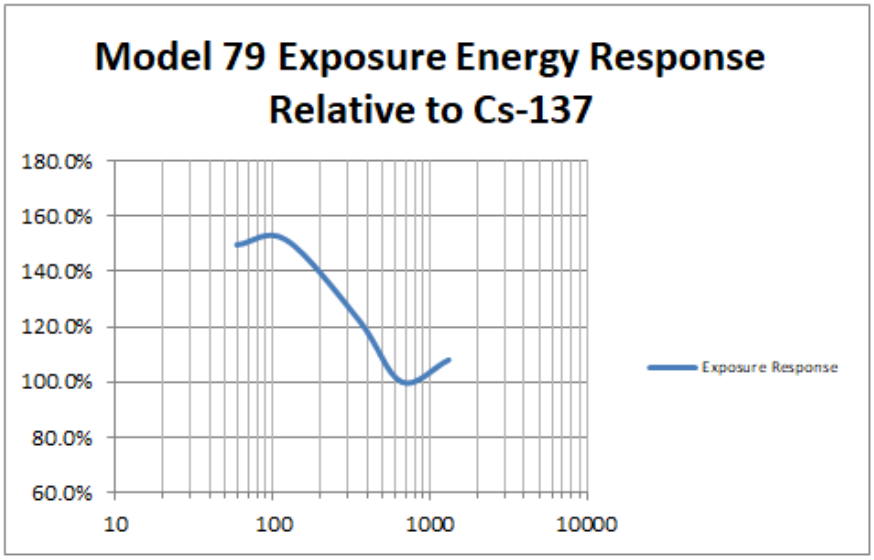
**Size:** 8.5 x 8 x 4.7 cm (3.45 x 3.1 x 1.9 in.) instrument only

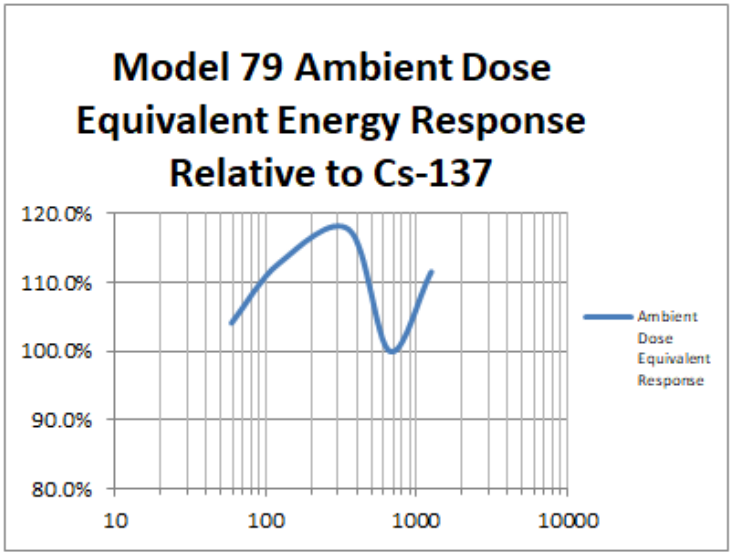
**Weight:** 174 g (0.38 lb) instrument only, including batteries

**Construction:** high-impact plastic with water-resistant rubber seals and separate battery compartment


Model 79 Angular Dependence with 241Am and 137Cs
Percent relative to 0°
30.00%
10.00%
-10.00%
-30.00%
-50.00%
-70.00%
-90.00%
-110.00%
-45°
-30°
0°
30°
45°
Cs137 S/N:3561282A-35 Right to left
Am241 S/N: S-2999 Right to Left
Cs137 above to below


M79 Angular Dependence 57Co and 137Cs
Percent relative to 0°
30.00%
20.00%
10.00%
0.00%
-10.00%
-20.00%
-30.00%
-40.00%
-50.00%
-60.00%
-45°
-30°
0°
30°
45°
Cs137 S/N:3561282A-35 Right to left
Co57 S/N: AI-2336 Right to Left
Cs137 above to below
Co57 Above to Below




## 9.2 Scope Assembly

**Probe:** LND 71616 energy-compensated GM detector with diameter of 19 mm (0.75 in.)

**Resolution Time:** 18 µs

**HV:** 550 Vdc

**Threshold:** 35 mVdc

**Environmental Rating:** NEMA rating of 3x or IP rating of 52 with audio seal option

**Size:** 20.3 x 8.1 x 114 cm (8 x 3.2 x 45 in.) retracted; 450 cm (177 in.) fully extended; handle length adjustable < 30.5 cm (12 in.)

**Weight:** 1.4 kg (3 lb), including batteries and shoulder strap

**Construction:** carbon fiber telescope

CHAPTER 10

# SAFETY CONSIDERATIONS

## 10.1 Environmental Conditions for Normal Use

Indoor use (While splash resistant, user is cautioned to avoid getting water through instrument openings.)

No maximum altititude

Temperature range of -40 to 65 °C (-40 to 150 °F)

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

Pollution Degree 3 (as defined by IEC 644): Occurs when conductive pollution or dry non-conductive pollution becomes conductive due to condensation. This is typical of industrial or construction sites.

Not certified for use in an explosive atmosphere

## 10.2 Warning Markings and Symbols

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.

Verify instrument voltage input rating before connecting to a power converter. If the wrong power converter is used, the instrument and/or power converter could be damaged.

The instrument is marked with the following symbols:

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 battery cover.

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 on the label located on the side panel. See section 10, "Recycling," for further information.

The "CE" mark is used to identify this instrument as being acceptable for use within the European Union.

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 voltage before accessing the internal components. This symbol appears on the battery cover. Be sure to take the precautions noted in the next section whenever necessary.

## 10.3 Cleaning and Maintenance Precautions

The instrumetn may be cleaned externally with a damp cloth, using only water as the wetting agent. Observe the following precautions when cleaning or performing maintenance on the instrument:

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

CHAPTER 11

# REVISION HISTORY

This section of the manual will be updated with each revision of the manual in order to document changes over time. Ludlum Measurements' policy is to provide free software upgrades to instruments for the life of the instrument.

**July 2016:** new manual.

**September 2016:** added parts list to Appendix 16. Updated Drawing 272 x 576.

**Marcy 2017:** On page 19, added a note and reference to Chapter 8 Calibration Expiration Lockout. Deleted part 2312316 on page 76 in the parts list for the Detector and Scope assembly. Updated grip part under Detector and Scope assembly parts list on page 76, replaced 2312974 with 2312317.

**July 2017:** To satisfy IEC 60325 requirements, added a note to page 38 regarding radiation icon for gamma, added warm-up time to Specification Chapter 9 page 53, added angular dependence and energy response graphs to Specifications Chapter 9 page 54 and 55.

**May 2018:** Model 79/1 and 79/2 added to this manual - information in Section 1 and detection ranges in Section 2.

**October 2018:** changed instrument color from yellow to black - pictures changed throughout and some part s ("B" added to those part s). Updated Drawing 498 x 951.

**April 2019:** updated Detector Range for Model 79 on page 3.

**May 2019:** added the Model 79/4 version to this manual - information in Section 1 and detection ranges in Section 2.

**July 2019:** added Overall View and Dimensions Drawing 272 x 565 on page 75.

**June 2022:** Increased loss of count time to 9.99 K seconds and modified Channel 1 and Channel 2 Setup Menu to reflect new feature limits. Added click audio divide feature to instrument and updated Detector Setup Menu to reflect new feature. Modified Unit Setup Menu to reflect new radiation icon combinations. Added response rate change on the fly feature and updated Normal Operation Buttons section to reflect the addition of the new feature. Added

Fixed Fast and Fixed Slow response times and modified Setup Menu Detector Menu to reflect new feature. Added new feature to adjust COUNT mode times using the Mode button. Updated Normal Operation Buttons and COUNT Mode to reflect new feature.

CHAPTER 12

# 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 that have been placed on the market after August 13, 2005, have been labeled with a symbol recognized internationally as the “crossed-out wheelie bin,” which notifies the consumer that the product is not to be mixed with unsorted municipal waste when discarding. Each material must be separated. On the instrument, the symbol will be placed on the serial number label located on the side of the instrument.

The symbol appears as such:

APPENDIX A

# TYPICAL VALUES

The following table describes the typical values for various Ludlum's detectors. These values can **NOT** be used as a replacement for real calibration. They may be used as a starting point for manual calibration.

| **Setting** | **Setup Parameter** | **Typical Value** | Note |
|---|---|---|---|
| dEt1 | High Voltage Setpoint | 550 | V |
| dEt2 | Detector Current Overload Threshold | 0 (disabled) | µA |
| dEt3 | Response Time/Auto Response Rate | F | Fast Auto Response |
| dEt4 | Count Time | 60 | s |
| dEt5 | Enabled Modes | Rate/Max/Count | Selectable Modes |
| Ch1:1 | Calibration Constant Mantissa | 122 | 122 e04 Counts/R |
| Ch1:2 | Calibration Constant Exponent | 04 | 122 e04 Counts/R |
| Ch1:3 | Dead Time Correction 1 | 36 | µs |
| Ch1:4 | Dead Time Correction 2 Mantissa | 360 | 360 e-12 |
| Ch1:5 | Dead Time Correction 2 Exponent | -12 | 360 e-12 |
| Ch1:6 | Efficiency | 100 | % |
| Ch1:7 | Discriminator Threshold | 35 | mV |
| Ch1:8 | Loss of Count Alarm Time | 999 | s |
| U-1:1 | Unit 1 - Units and Minimum Display | 00.0 mR/h | |
| U-1:2 | Unit 1 - Units and Maximum Display | 999 R/h | |
| U-1:3 | Unit 1 - Units RATE/MAX Mode Alert Point | 20.0 mR/h | |
| U-1:4 | Unit 1 - Units RATE/MAX Mode Alarm Point | 50.0 mR/h | |
| U-1:5 | Unit 1 - Count Units and Minimum Display | 00.0 mR/h | |
| U-1:6 | Unit 1 - Count Units Alert Point | 000 R (disabled) | |
| U-1:7 | Unit 1 - Count Units Alarm Point | 000 R (disabled) | |
| U-1:8 | Radiation Icon | $\gamma$ | gamma |
| U-2:1 | Unit 2 - Units and Minimum Display | 000 cpm | |

| Setting | Setup Parameter | Typical Value | Note |
|---|---|---|---|
| U-2:2 | Unit 2 - Units and Maximum Display | 999 kcpm | |
| U-2:3 | Unit 2 - Units RATE/MAX Mode Alert Point | 2.00 kcpm | |
| U-2:4 | Unit 2 - Units RATE/MAX Mode Alarm Point | 5.00 kcpm | |
| U-2:5 | Unit 2 - Count Units and Minimum Display | 000 counts | |
| U-2:6 | Unit 2 - Count Units Alert Point | 0 counts (disabled) | |
| U-2:7 | Unit 2 - Count Units Alarm Point | 0 counts (disabled) | |
| U-2:8 | Radiation Icon | $\gamma$ | gamma |
| InS:1 | Audio Mode | cLc | "Click" |
| InS:2 | Click and Alarm Volume | 3 | |
| InS:3 | Green LED Behavior | oFF | LED will stay off |
| InS:4 | Shutdown on External to Internal Power Switch | –(disabled) | Device will stay on when external power is removed |
| rtc:1 | Real Time Clock Month | | |
| rtc:2 | Real Time Clock Day | | |
| rtc:3 | Real Time Clock Year | | |
| rtc:4 | Real Time Clock Hour | | |
| rtc:5 | Real Time Clock Minute | | |
| rtc:6 | Real Time Clock Second | | |

APPENDIX B

# ALL PARAMTERS

The following table is a list of all settings available on the device. Many of these can only be accessed through Lumic Calibration software.

| Setup Menu | Name | Min. Value | Max. Value | Description |
|---|---|---|---|---|
| rtc:1 | Month | 1 | 12 | Month for the real-time clock on the instrument. |
| rtc:2 | Day | 1 | 31 | Day for the real-time clock on the instrument. |
| rtc:3 | Year | 2014 | 3000 | Year for the real-time clock on the instrument. |
| rtc:4 | Hour | 0 | 23 | Hour for the real-time clock on the instrument. |
| rtc:5 | Mins | 0 | 59 | Minutes for the real-time clock on the instrument. |
| rtc:6 | Seconds | 0 | 59 | Seconds for the real-time clock on the instrument. |
| dEt:1 | High Voltage | 300 | 1600 | Defines the operating voltage of the detector. |
| Ch1:8 | Loss of Count Timer | 0 | 999 | Defines the amount of time in seconds it takes before the instrument triggers a loss of count fault. A value of 0 disables this feature. |
| dEt:2 | Overload | 0 | 100 | Defines the high-voltage current required to trigger an over-current fault. A value of 0 disables this feature. |
| dEt:3 | Response Time | 1 min. 60 max. slow and fast | | Determines how quickly RATE mode changes values. |
| Ch1:7 | Threshold | 0 | 500 | Defines the voltage in millivolts (mV) that the discriminator uses to count pulses. |
| Ch1:3 | Dead Time Correction | 0 | 0.000999 | Defines the first order correction coefficient for the dead time correction algorithm. |
| Ch1:4 and Ch1:5 | Dead Time Correction Second Order | 0 | 0.000999 | Defines the second order correction coefficient for the dead time correction algorithm. |

| Setup Menu | Name | Min. Value | Max. Value | Description |
|---|---|---|---|---|
| Ch1:1 and Ch1:2 | Calibration Constant | 100 | 9.99E+12 | Defines the relationship between detector counts and field strength in R. Used by R, R/h, Sv, Sv/h, rem, and rem/h display units. |
| Ch1:6 | Efficiency | 0.1 | 999 | Defines the efficiency of the detector. Used by the dpm, Bq, and disintegration units. |
| | Enabled Units | 1 | 2 | Determines how many display units are enabled. |
| | Display Unit 1 Icon | 0 | 18 | Determines the icon used while display unit 1 is active. |
| U-1:1 | Display Unit 1 Rate Units | R/h, Sv/h, rem/h, cpm, cps, dpm, Bq | | Defines the display units used for RATE and MAX modes. |
| | Display Unit 1 RATE Minimum Display Exponent | -8 | 3 | Defines the minimum exponent allowed for a given display unit. Ex. -6 with a display unit of R/h would yield a minimum display of 000 µR/h. Software simplified this setting. |
| U-1:2 | Display Unit 1 RATE Maximum Value | 1.00E-06 | 999000 | Defines the maximum value allowed for a given display unit. Ex. 999 with display unit of R/h will yield a maximum display of 999 R/h. If the rate exceeds this value, a forced alarm will engage. This value must be at least two orders of magnitude greater than the minimum display value. |
| U-1:3 | Display Unit 1 RATE Alert Threshold | 0 | 999000 | Defines the alert threshold for RATE and MAX rate modes. A value of 0 will disable this alert. |
| U-1:4 | Display Unit 1 RATE Alarm Threshold | 0 | 999000 | Defines the alarm threshold for RATE and MAX rates modes. A value of 0 will disable this alarm. |
| U-1:5 | Display Unit 1 Count Units | R/h, Sv/h, rem/h, cpm, cps, dpm, Bq, R, Sv, rem, counts, disintegrations | | Defines the display units used for COUNT mode. |

| Setup Menu | Name | Min. Value | Max. Value | Description |
|---|---|---|---|---|
| U-1:5 (cont.) | Display Unit 1 COUNT Minimum Display Exponent | -8 | -3 | Defines the minimum exponent allowed for a given display unit. Ex. 0 with a display unit of cpm would yield a minimum display of 000 cpm. Software simplifies this setting. |
| U-1:6 | Display Unit 1 COUNT Alert Threshold | 0 | 999000 | Defines the alert threshold for COUNT mode. A value of 0 will disable this alert. |
| U-1:7 | Display Unit 1 COUNT Alarm Threshold | 0 | 999000 | Defines the alarm threshold for COUNT mode. A value of 0 will disable this alarm. |
| U-1:8 | Display Unit 2 Icon | 0 | 18 | Determines the icon used while display unit 1 is active. |
| U-2:1 | Display Unit 2 Rate Units | R/h, Sv/h, rem/h, cpm, cps, dpm, Bq | | Defines the display units used for RATE and MAX modes. |
| | Display Unit 2 RATE Minimum Display Exponent | -8 | 3 | Defines the minimum exponent allowed for a given display unit. Ex. An exponent of -6 with a display unit of R/h would yield a minimum display of 000 µR/h. Software simplifies this setting. |
| U-2:2 | Display Unit 2 RATE Maximum Value | 1.00E-06 | 999000 | Defines the maximum value allowed for a given display unit. Ex. 999 with a display unit of R/h will yield a maximum display of 999 R/h. If the rate exceeds this value, a forced alarm will engage. This value must be at least two orders of magnitude greater than the minimum display value. |
| U-2:3 | Display Unit 2 RATE Alert Threshold | 0 | 999000 | Defines the alert threshold for RATE and MAX rate modes. A value of 0 will disable this alert. |
| U-2:4 | Display Unit 2 RATE Alarm Threshold | 0 | 999000 | Defines the alarm threshold for RATE and MAX rate modes. A value of 0 will disable this alarm. |

| Setup Menu | Name | Min. Value | Max. Value | Description |
|---|---|---|---|---|
| U-2:5 | Display Unit 2 Count Units | R/h, Sv/h, rem/h, cpm, cps, dpm, Bq, R, Sv, rem, counts, disintegrations | | Defines the display units used for COUNT mode. |
| | Display Unit 2 COUNT Minimum Display Exponent | -8 | 3 | Defines the minimum exponent allowed for a given display unit. Ex. An exponent of 0 with a display unit of cpm would yield a minimum display of 000 cpm. Software simplifies this setting. |
| U-2:6 | Display Unit 2 COUNT Alert Threshold | 0 | 999000 | Defines the alert threshold for COUNT mode. A value of 0 will disable this alert. |
| U-2:7 | Display Unit 2 COUNT Alarm Threshold | 0 | 999000 | Defines the alarm threshold for COUNT mode. A value of 0 will disable this alarm. |
| U-2:8 | COUNT Time | 0 | 999 | Determines the amount of time COUNT mode will count for in seconds. A value of 0 will cause count mode to have unlimited count time. |
| | OK Button | 0 | 1 | Virtual press of the OK button. |
| | UNIT Button | 0 | 1 | Virtual press of the UNIT button. |
| | MODE Button | 0 | 1 | Virtual press of the MODE button. |
| | OK Button Long | 0 | 1 | Virtual long press of the OK button. |
| | UNIT Button Long | 0 | 1 | Virtual long press of the UNIT button. |
| | MODE Button Long | 0 | 1 | Virtual long press of the MODE button. |
| | Battery Voltage | (read only) | | Operating voltage of the processor. |
| | (Vcc) Supply Voltage | (read only) | | Operating voltage of the processor. |

| Setup Menu | Name | Min. Value | Max. Value | Description |
|---|---|---|---|---|
| | Temperature | (read only) | | Temperature of the instrument. |
| | Ambient Light | (read only) | | Ambient light reading of the instrument. |
| | Instrument Name | (16 characters) | | Stores the model name of the instrument. |
| | Instrument Serial Number | (16 characters) | | Stores the serial number of the instrument. |
| | Detector Model | (16 characters) | | Stores the model name of the detector the instrument is calibrated for. |
| | Detector Serial Number | (16 characters) | | Stores the serial number of the detector the instrument is calibrated for. |
| | Back Light | 0 | 255 | Defines the brightness of the backlight when it is on. |
| | Audio Tone Hi | 2500 | 6000 | Determines the frequency of Alarms. |
| | Audio Tone Low | 2500 | 6000 | Determines the frequency of clicks and alerts. |
| | Audio Tone Button | 2500 | 6000 | Determines the button press frequency. |
| InS:2 | Audio Click Volume | 0 | 3 | Sets the volume of the click audio (or other activity audio). 0 is silent. |
| | Audio Alarm Volume | 0 | 3 | Sets the volume of Alerts and Alarms. 0 is silent. |
| | Audio Button Volume | 0 | 3 | Sets the volume of the button presses. 0 is silent. |
| Ins:1 | Audio Mode | Click, Sigma, Floating Delta | | Sets the activity audio mode. |
| | Audio Delta Sensitivity | 1 | 10 | Defines the sensitivity of the floating delta audio. |
| | Active Unit | 0 | 1 | Determines currently active display unit. |
| | Measured Voltage | (read only) | | Self-measured high voltage value. Not calibrated, for diagnostics only. |
| | Measured Current | (read only) | | Self-measured high voltage current. This value is referenced to the overload threshold. |
| | Firmware Version | 0 | 16 | Firmware number. |

| Setup Menu | Name | Min. Value | Max. Value | Description |
|---|---|---|---|---|
| | Active Detector | (read only) | | Determines the active detector. There is only one detector possible for this instrument. |
| | Raw Count Time | 0 | 604800 | Instructs the device to take a raw count for a specific amount of time. Results will be available in the Raw Counts parameter when the count time reaches 0. |
| | Raw Counts | (read only) | | Raw count result with no modification (no dead time, etc.). Results available when Raw Count Time reaches 0. |
| | Revision | (read only) | | Displays the revision number of the circuit board. |
| | Instrument Discrimi-nator Channels | (read only) | | Displays the number of channels the instrument is capable of. This instrument is only capable of 1 channel. |
| | Dark to Medium | 0 | 2500 | Ambient light threshold to transition from dark state to medium state. |
| | Medium to Dark | 0 | 2500 | Ambient light threshold to transition from medium state to dark state. |
| | Medium to Bright | 0 | 2500 | Ambient light threshold to transition from medium state to bright state. |
| | Bright to Medium | 0 | 2500 | Ambient light threshold to transition from bright state to medium state. |
| dEt:5 | Rate Mode Enabled | 0 | 1 | Determines if RATE mode is enabled. |
| | Max Rate Mode Enabled | 0 | 1 | Determines if MAX rate mode is enabled. |
| | Count Mode Enabled | 0 | 1 | Determines if COUNT mode is enabled. |
| | HV Calibration Rate | -1 | 1 | Second order calibration coefficient for instrument high voltage calibration. |
| | HV Calibration Slope | 0.1 | 2 | First order calibration coefficient for instrument high voltage calibration. |
| | HV Calibration Offset | -75 | 75 | Calibration offset for instrument high voltage calibration. |
| | Threshold Calibration Rate | -1 | 1 | Second order calibration coefficient for instrument threshold calibration. |

| Setup Menu | Name | Min. Value | Max. Value | Description |
|---|---|---|---|---|
| | Threshold Calibration Slope | 0.1 | 2 | First order coefficient for instrument threshold calibration. |
| | Threshold Calibration Offset | -.005 | .005 | Calibration offset for instrument threshold calibration |
| InS:3 | Automatic Shutdown Time | 0 | 60 | Delay in seconds the instrument will wait if transitioning from internal to external power. |
| | Low-Battery Alarm Interval | 0 (disabled - stay on ) | 120 (disabled - stay on ) | Delay in minutes between low-battery reminder chimes. Only function when powered externally. If disabled, it stays on. |
| InS:4 | Green LED Mode | | | Mode of the green LED. See green LED section for details. |
| | Calibration Expire Month | 1 | 12 | Month for the calibration expiration date of the instrument. |
| | Calibration Expire Day | 1 | 31 | Day for the calibration expiration date of the instrument. |
| | Calibration Expire Year | 2015 | 3000 | Year for the calibration expiration date of the instrument. |
| | Calibration Expire Hour | 0 | 23 | Hour for the calibration expiration date of the instrument. |
| | Calibration Expire Minute | 0 | 59 | Minute for the calibration expiration date of the instrument. |
| | DIP SW1.1 | (read only) | | Current state of DIP switch 1.1 |
| | DIP SW1.2 | (read only) | | Current state of DIP switch 1.2 |
| | DIP SW2.1 | (read only) | | Current state of DIP switch 2.1 |
| | DIP SW2.2 | (read only) | | Current state of DIP switch 2.2 |
| | R to Sv Ratio | 1.00E-05 | 0.1 | Defines the coefficient used to convert from calibration R or R/h to Sv, Sv/h, Also determines rem and rem/h with additional x100. |
| | Menu Shortcut Enable | 0 | 1 | Enables shortcut into on-device setup menu. |
| | Status | 0 | 0 | Consolidates device status into one parameter. Intended for streaming only. |
| | Display | 0 | 0 | Data needed to mirror display on device. Intended for streaming only. |

| Setup Menu | Name | Min. Value | Max. Value | Description |
|---|---|---|---|---|
| | Display Unit 1 Measured Rate | 0 | 0 | Access to measured RATE that is updated every 1/16th second. Intended for streaming only. Floating-point number only, does not include unit. Does not have to be active on device display. |
| | Display Unit 1 Measured Max Rate | 0 | 0 | Access to measured MAX rate that is updated every 1/16th second. Intended for streaming only. Floating-point number only, does not include unit. Does not have to be active on device display. |
| | Display Unit 1 Rate Unit | 0 | 0 | Unit for streaming measured RATE and MAX rates. |
| | Display Unit 1 Measured Count | 0 | 0 | Access to measured COUNT rate that is updated every 1/16th second. Intended for streaming only. Floating-point number only, does not include unit. Does not have to be active on device display. |
| | Display Unit 1 Count Unit | 0 | 0 | Unit for streaming measured COUNT rates. |
| | Display Unit 2 Measured Rate | 0 | 0 | Access to measured RATE that is updated every 1/16th second. Intended for streaming only. Floating-point number only, does not include unit. Does not have to be active on device display. |
| | Display Unit 2 Measured Max Rate | 0 | 0 | Access to measured MAX rate that is updated every 1/16th second. Intended for streaming only. Floating-point number only, does not include unit. Does not have to be active on device display. |
| | Display Unit 2 Rate Unit | 0 | 0 | Unit for streaming measured RATE and MAX rates. |
| | Display Unit 2 Measured Count | 0 | 0 | Access to measured COUNT rate that is updated every 1/16th second. Intended for streaming only. Floating-point number only, does not include unit. Does not have to be active on device display. |
| | Display Unit 2 Count Unit | 0 | 0 | Unit for streaming measured COUNT rates. |

APPENDIX C

# ERRATA

## C.1 Firmware Known Issues

F1.9.4268

| | |
|---|---|
| Issue | Date fault triggered every time batteries are removed. |
| Description | When battery power is removed long enough for clock to reset, device will show date fault ("dAt") even if calibration expiration DIP switch is turned off. |
| Workaround | Acknowledge fault. Device will continue normal operation. |
| Issue | Instrument always starts in rate mode. |
| Description | Instrument always starts in rate mode, even if rate mode is disabled. |
| Workaround | Change modes once after power-on. Instrument will then follow configured mode pattern. |
| Issue | Button and low tone frequencies cannot be changed. |
| Description | The frequency of the high tone, low tone, and button tone are configurable through software. A bug prevents writing changes to high tone and button tone. |
| Workaround | None. Will be fixed in a future release. |

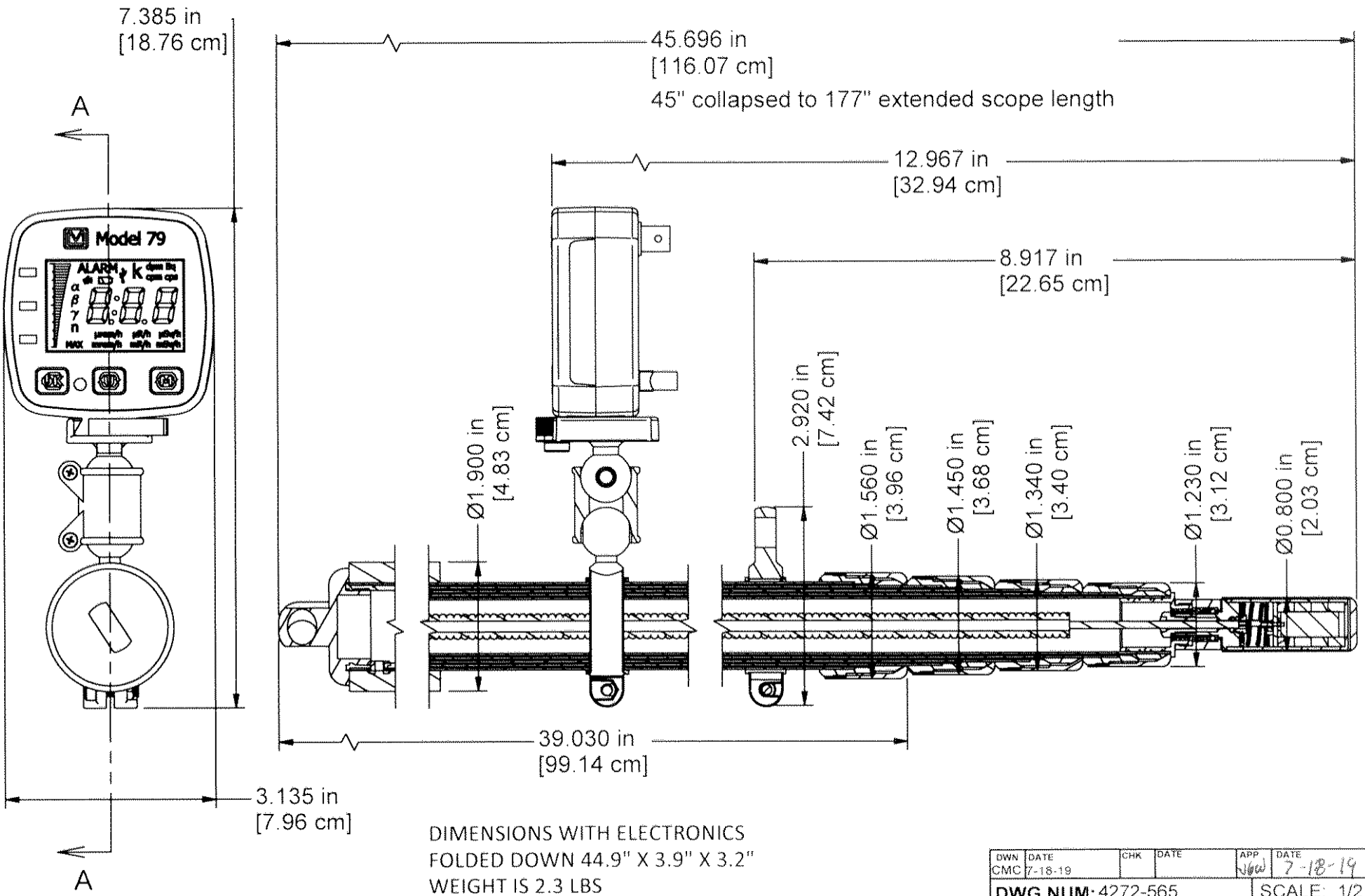
APPENDIX D

# ASSEMBLY PARTS LISTS AND DRAWINGS

If replacement parts are needed, call Ludlum Measurements, Inc. One of our salespeople will be happy to assist you. The following drawings are provided to assist in finding the correct part.


| Drawing/Part | Description | Page |
|---|---|---|
| Drawing 272 x 565 | Overall View and Dimensions | 86 |
| Drawing 272 x 565A | Overall Assembly | 87 |
| Part # 4272-576 | Detector and Scope Assembly Parts List | 88 |
| Drawing 272 x 576 | Detector and Scope Assembly | 89 |
| Part # 4498-951 | Clamp Assembly Parts List | 90 |
| Drawing 498 x 951 | Clamp Assembly | 91 |
| Part # 4272-557 | High Range Detector Assembly Parts List | 92 |
| Drawing 272 x 557 | Detector Assembly | 93 |
| Part # 4498-383 | Electronics Assembly Parts List | 94 |
| Drawing 498 x 383A and 498 x 383B | Electronics Assembly | 95 |

| REVISION HISTORY | | | |
|---|---|---|---|
| REV | DESCRIPTION | DATE | BY |
| 1 | VALID | 11-20-15 | CMC |




DIMENSIONS WITH ELECTRONICS
FOLDED DOWN 44.9" X 3.9" X 3.2"
WEIGHT IS 2.3 LBS

| DWN | DATE | CHK | DATE | APP | DATE |
|---|---|---|---|---|---|
| CMC | 7-18-19 | | | JGW | 7-18-19 |

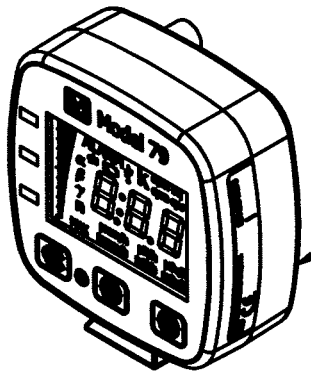
**DWG NUM:** 4272-565 | SCALE: 1/2

**TITLE** M 79 OVERALL

LUDLUM MEASUREMENTS, INC
501 OAK STREET
SWEETWATER, TEXAS 79556

| SERIES | SHEET |
|---|---|
| 272 | 565 |

| REVISION HISTORY | | | |
|---|---|---|---|
| REV | DESCRIPTION | DATE | BY |
| 1 | VALID | 11-20-15 | CMC |



4498-383

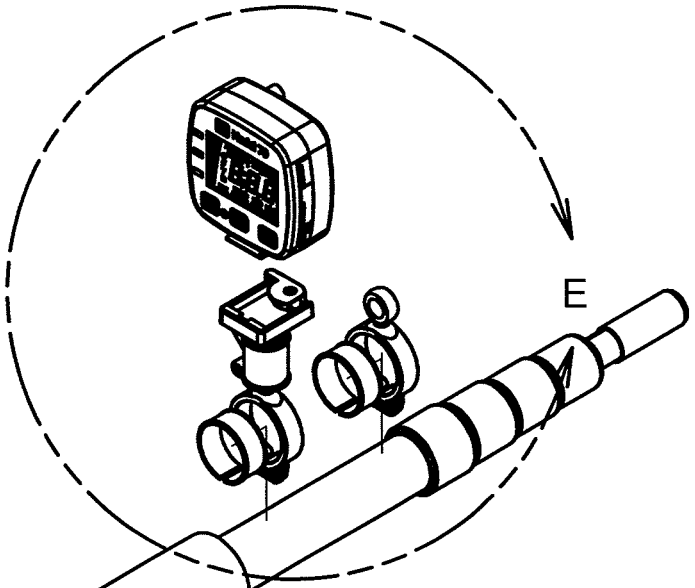
4498-951

7498-919

7498-759

7498-759

DETAIL E
SCALE 1 / 2



E

7498-919

7498-759

4272-576

| DWN | DATE | CHK | DATE | APP | DATE |
|---|---|---|---|---|---|
| WJM | 4/27/16 | | | WJM | 4-27-16 |

**DWG NUM:** 4272-565 SCALE: 1/4

**TITLE** M 79 ASSEMBLY

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

**SERIES** 272

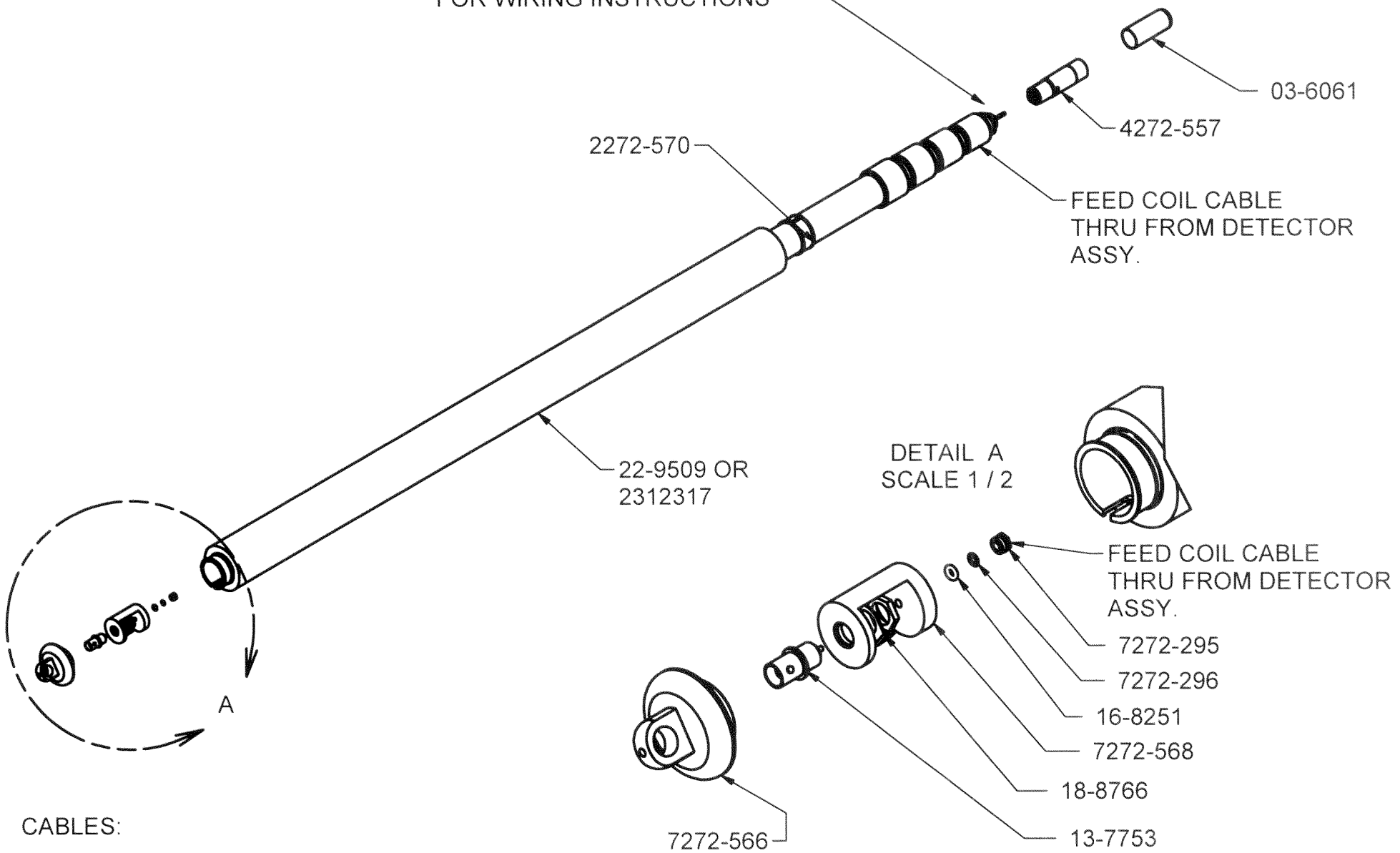
**SHEET** 565A

## D.3 Model 79 Detector and Scope Assembly 4272-576

| Part Number | Description | Quantity |
|---|---|---|
| 13-7753 | BNC Connector, RECPT-UG1094/U SCREW BNC | 1 each |
| 16-8251 | O-Ring-2-005 | 1 each |
| 18-8766 | Lug-#14 N/L 1HL 1497; 7107-1774 | 1 each |
| 18-8883 | Grommet-91114 1/8 x 1/4 | 1 each |
| 2272-570 | Model 79 CF Scope with Insert | 1 each |
| 2312317 | Grip-329/01/30.00 in. L/UNML/1.375 in. ID | 1 each |
| 7272-559 | Model 79 CF Tube Cap | 1 each |
| 7272-567 | Model 79 CF Scope Cable End Insert | 1 each |
| 7272-295 | Model 78 Cable Nut | 1 each |
| 7272-296 | Model 78 Cable Washer | 1 each |
| 7272-566 | Model 79 CF Scope Cable Plug | 1 each |
| 7272-568 | Model 79 BNC Connector Mount | 1 each |
| 8303-962 | Cable-BNC to RA BNC RG174 41 inches NSR | 1 each |

WIRE-UP
SCALE 1:1

| REVISION HISTORY | | | |
|---|---|---|---|
| REV | DESCRIPTION | DATE | BY |
| 1 | VALID | 5/16/16 | JGW |
| 2 | ADDED WIRING NOTE | 6/10/20 | ZJM |




CABLES:

COILED CABLE - 21-9363
BNC CABLE - 8303-962

| DWN | DATE | CHK | DATE | APP | DATE |
|---|---|---|---|---|---|
| ZJM | 6/10/2020 | | | WA | 6-10-20 |

**DWG NUM:** 4272-576 SCALE:VARIOUS

**TITLE** M 79 DETECTOR AND SCOPE ASSY

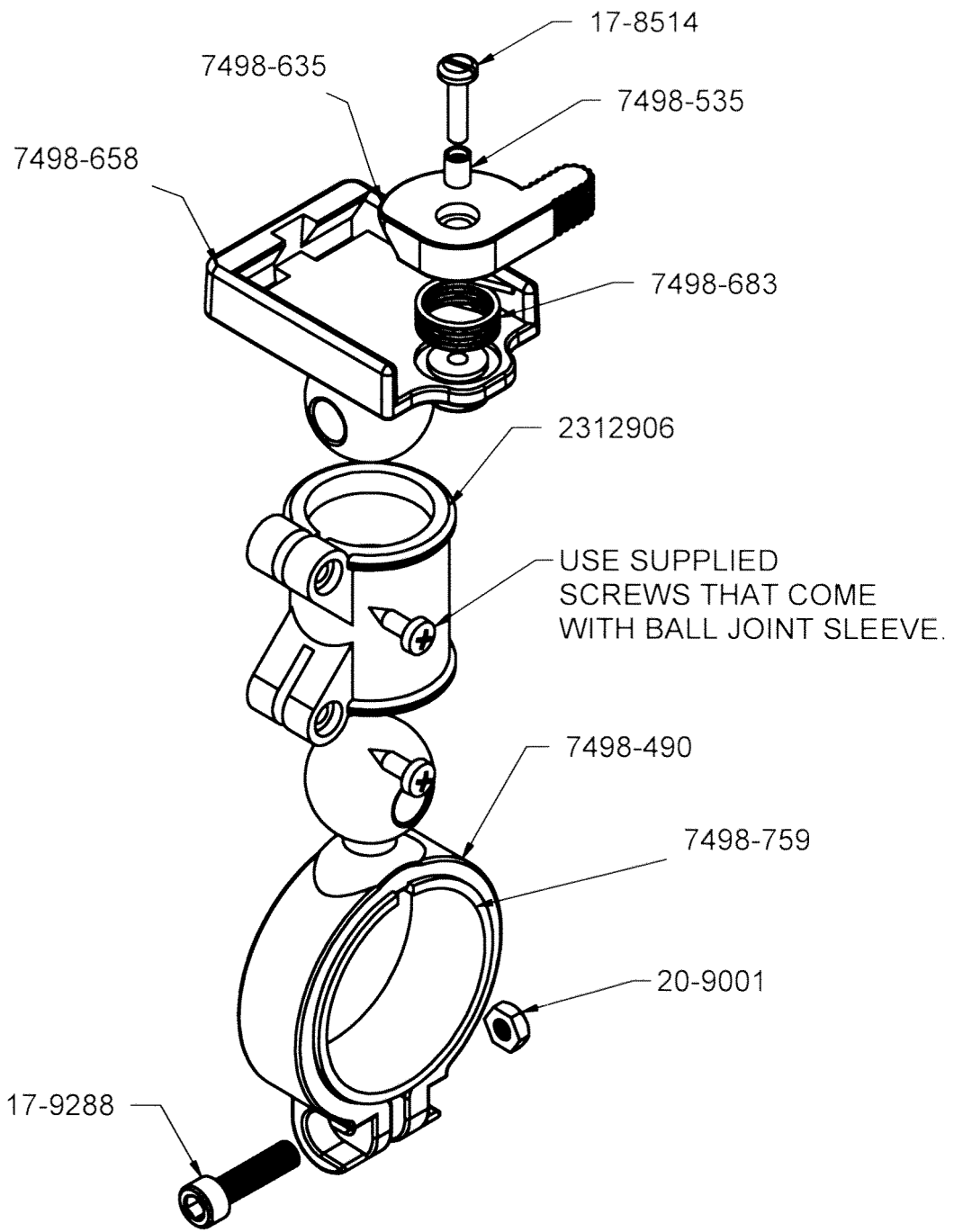
LUDLUM MEASUREMENTS, INC.
501 OAK STREET
SWEETWATER, TEXAS 79556

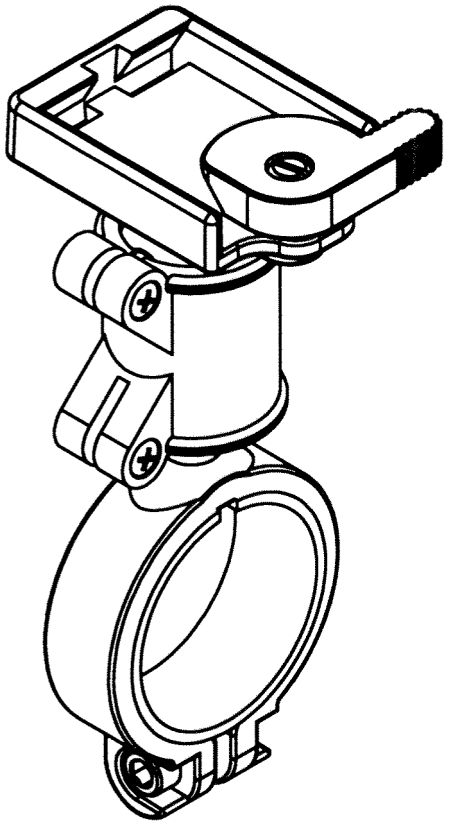
SERIES 272 SHEET 576

## D.5 Model 79 Clamp Assembly 4498-951

| Part Number | Description | Quantity |
|---|---|---|
| 17-8514 | Screw-4-40 x 7/16 BH | 1 each |
| 17-9288 | Screw-8-32 x 5/8 SOC CAP BLK ALLOY | 1 each |
| 20-9001 | Nut-8-32 X-SM PATT .250 | 1 each |
| 21-8514 | Cable Clamp .125 MWSB-1-01A-RT NYL AD | 1 each |
| 21-9097 | Grip-1.44 in. OD x 4 in. x .125 BLK FOAM | 1 each |
| 2312906 | Ball Joint, Double Female Rap-SB-275-FFU | 1 each |
| 7498-490 | Model 30 Clamp for Model 43-93 | 1 each |
| 7498-535 | Model 30 Arm Spacer | 1 each |
| 7498-635 | Model 30 Shoe Cam Arm | 1 each |
| 7498-658 | Model 30 Shoe with Ball | 1 each |
| 7498-683 | Model 30 Torsion Spring | 1 each |
| 7498-759 | Model 30 Clamp Spacer for Model 79 Scope | 1 each |

| REVISION HISTORY | | | |
|---|---|---|---|
| REV | DESCRIPTION | DATE | BY |
| 1 | VALID | 11-20-15 | CMC |



| DWN | DATE | CHK | DATE | APP | DATE |
|---|---|---|---|---|---|
| TKC | 7-11-18 | | | JVT | 7-11-18 |

**DWG NUM:** 4498-951 SCALE: 1

**TITLE** M 79 CLAMP ASSY

LUDLUM MEASUREMENTS, INC
501 OAK STREET
SWEETWATER, TEXAS 79556

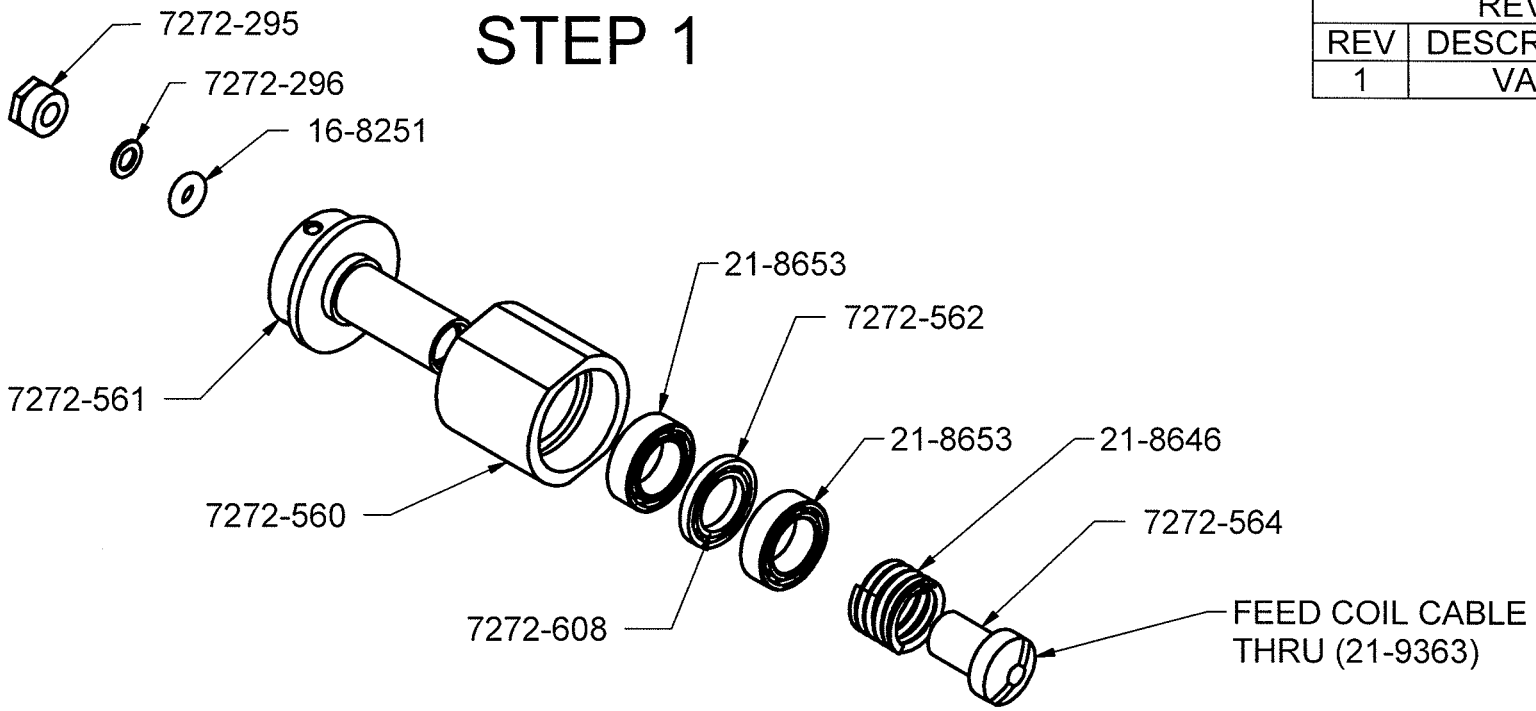
| SERIES | SHEET |
|---|---|
| 498 | 951 |

## D.7 Model 79 High Range Detector Assembly 4272-557

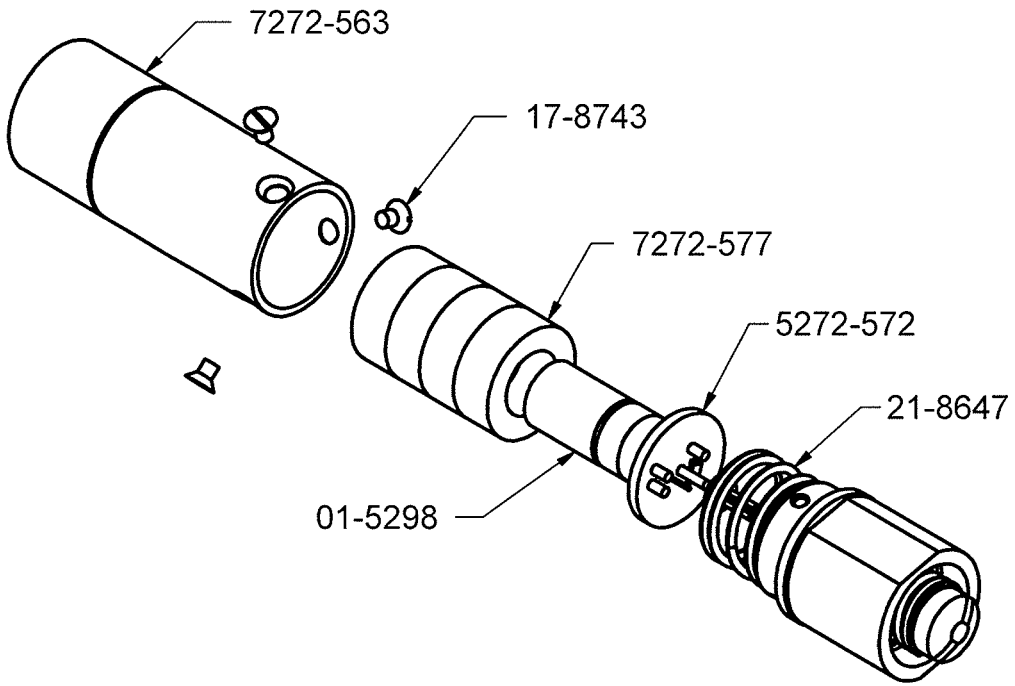
| Part Number | Description | Quantity |
|---|---|---|
| 01-5298 | GM Tube-LND 71616 | 1 each |
| 03-6061 | Cap-Model 79 Push on 3/4 OD x 2 Ht Yellow | 1 each |
| 16-8251 | O-Ring-2-005 | 1 each |
| 17-8743 | Screw-2-56 x 1/8 FH | 3 each |
| 21-8646 | Spring-C420-048-630; 71373 | 1 each |
| 21-8647 | Spring-0.625 x 0.048 x .69 SS XX-56 | 1 each |
| 21-8653 | Bearing-Ball 5/16 in. ID x 1/2 in. OD SS | 2 each |
| 5272-572 | Model 79 Detector Ballast Board | 1 each |
| 7272-295 | Model 78 Cable Nut | 1 each |
| 7272-296 | Model 78 Cable Washer | 1 each |
| 7272-560 | Model 79 Bearing Housing | 1 each |
| 7272-561 | Model 79 Bearing Axle | 1 each |
| 7272-562 | Model 79 Bearing Outer Spacer | 1 each |
| 7272-563 | Model 79 Detector Cover | 1 each |
| 7272-564 | Model 79 Bearing Screw | 1 each |
| 7272-577 | Model 79 Detector Foam | 4 each |
| 7272-608 | Model 79 Bearing Inner Spacer | 1 each |
| 8272-603 | Model Cable-Coil 15 ft Extended | 1 each |

| REVISION HISTORY | | | |
|---|---|---|---|
| REV | DESCRIPTION | DATE | BY |
| 1 | VALID | 11-16-15 | CMC |

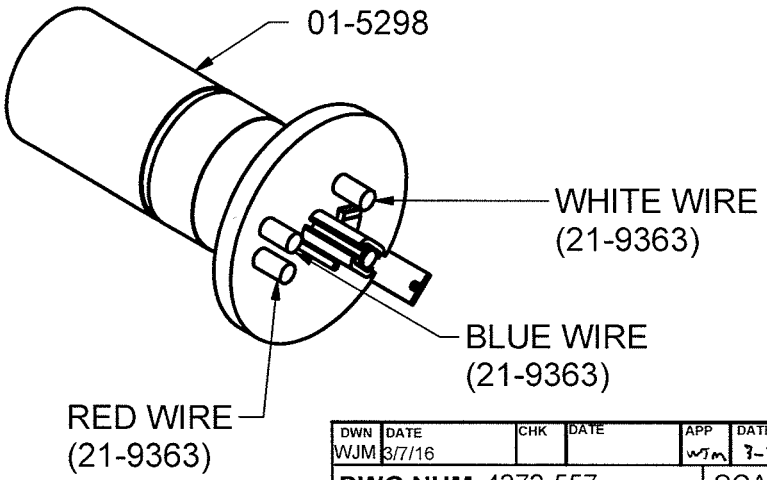
# STEP 1




# STEP 2




# WIRE-UP
# SCALE 2:1




| DWN | DATE | CHK | DATE | APP | DATE |
|---|---|---|---|---|---|
| WJM | 3/7/16 | | | WJM | 3-8-16 |

**DWG NUM:** 4272-557 SCALE: 1

**TITLE** M 79 DETECTOR ASSY

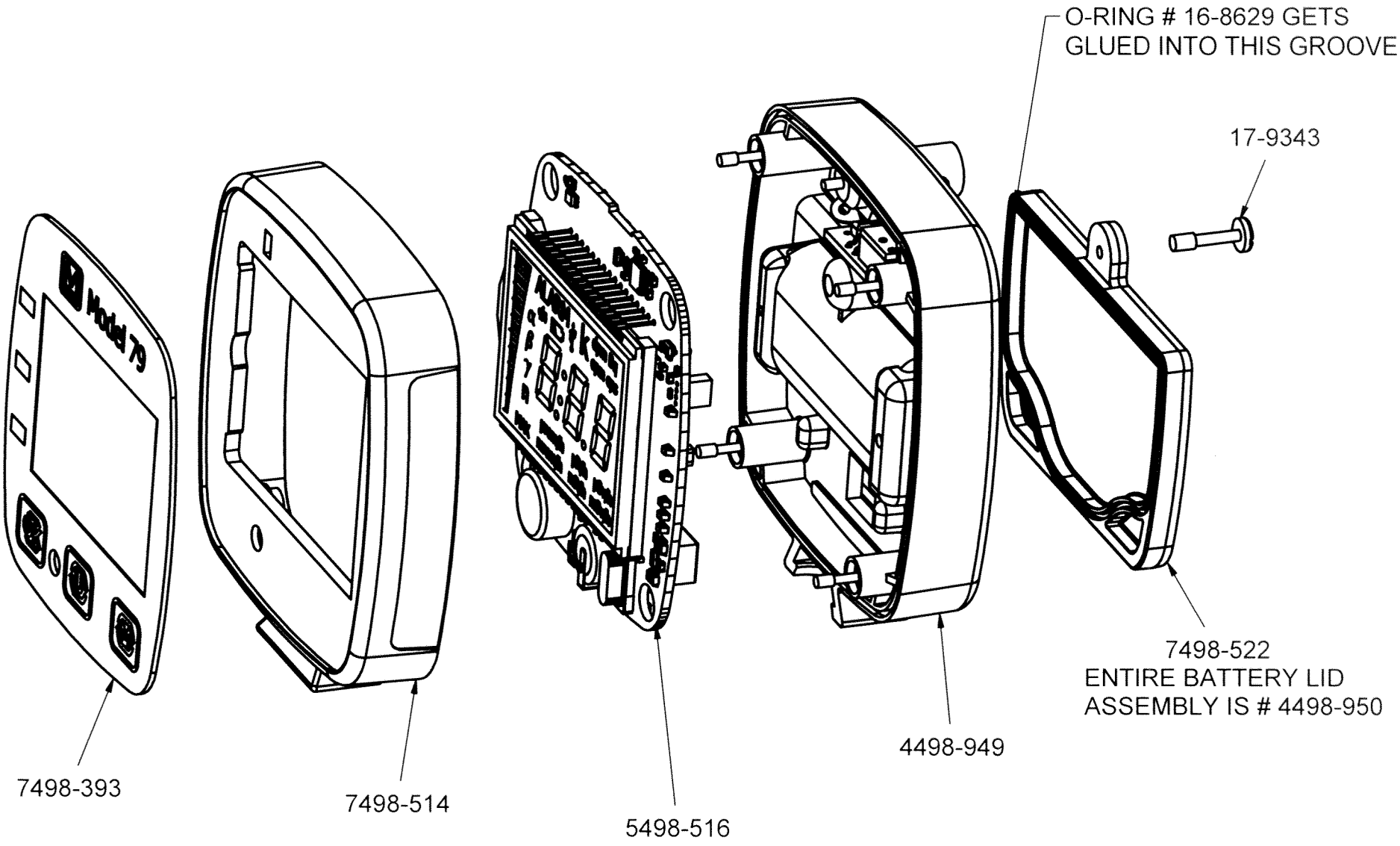
LUDLUM MEASUREMENTS, INC.
501 OAK STREET
SWEETWATER, TEXAS 79556

SERIES 272 SHEET 557

## D.9 Electronics Assembly 4498-383

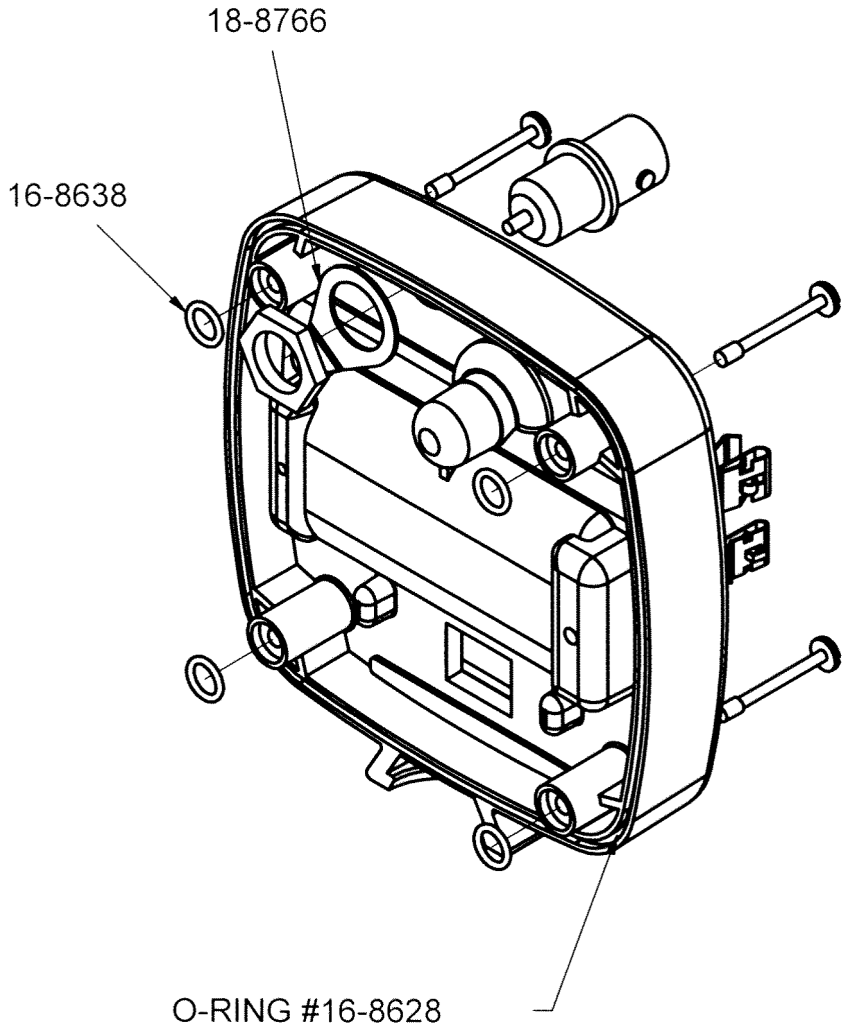
| Part Number | Description | Quantity |
|---|---|---|
| **4498-948** | **Front Chassis Assembly** | 1 each |
| 03-5630 | Serial Number/Calibration Label-Yellow 2.098 x 0.360 Laminated | 2 each |
| 5498-516 | Model 30 Main Board | 1 each |
| 7498-393 | Model 79 Membrane Switch Panel | 1 each |
| 7498-514B | Model 30 Front Chassis | 1 each |
| **4498-949** | **Rear Chassis Assembly** | 1 each |
| 13-7753 | BNC Connector-RECPT-UG1094/U Screw BNC | 1 each |
| 16-8628 | O-Ring-B1118-1X83 Yellow | 1 each |
| 16-8638 | O-Ring-1MM x 4.5 MM B70 9262K611 | 4 each |
| 17-9342 | Screw-2-56 x 3/4 BH SS Captive | 4 each |
| 18-8766 | Lug-#14 N/L 1HL 1497; 707-1774 | 1 each |
| 22-9192 | Contact-AAA 1 Cell #238 | 1 each |
| 22-9193 | Contact-AAA 1 Cell #204 | 1 each |
| 22-9194 | Contact-AAA 2 Cell #296 | 1 each |
| 7498-758B | Model 30 Rear Chassis Modifed | 1 each |
| 7498-817 | Model 30 Battery Pull Strap D123962 | 1 each |
| 8498-537 | Model 30 Battery Harness | 1 each |
| **4498-950** | **Model 30 Battery Lid Assembly** | 1 each |
| 16-8629 | O-Ring-B1118-1X60.5 Yellow | 1 each |
| 17-9343 | Screw-4-40 x 1/2 BH SS Captive | 1 each |
| 7498-522B | Model 30 Battery Lid | 1 each |

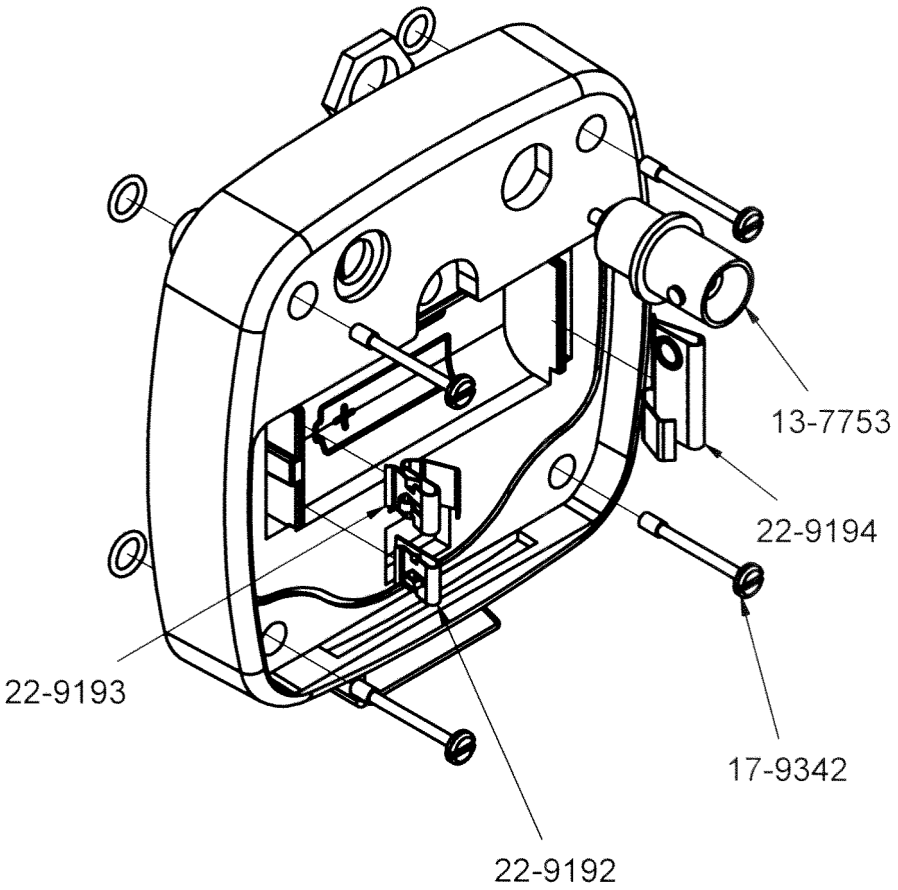
| REVISION HISTORY | | | |
|---|---|---|---|
| REV | DESCRIPTION | DATE | BY |
| 1 | VALID | 11-12-15 | CMC |




| | | | | | |
|---|---|---|---|---|---|
| DWN WJM | DATE 4/27/16 | CHK | DATE | APP WJM | DATE 4-28-16 |
| **DWG NUM:** 4498-383 | | | | SCALE: 1:1 | |
| **TITLE** M 79 EXPLOSION | | | | | |
| LUDLUM MEASUREMENTS, INC 501 OAK STREET SWEETWATER, TEXAS 79556 | | | | SERIES 498 | SHEET 383A |

| REVISION HISTORY | | | |
|---|---|---|---|
| REV | DESCRIPTION | DATE | BY |
| 1 | VALID | 11-12-15 | CMC |




| | | | | | |
|---|---|---|---|---|---|
| DWN WJM | DATE 4/27/16 | CHK | DATE | APP WJM | DATE 4-29-16 |
| **DWG NUM:** 4498-383 | | | | SCALE: 1:1 | |
| **TITLE** M 79 REAR CHASSIS EXPLOSION | | | | | |
| LUDLUM MEASUREMENTS, INC 501 OAK STREET SWEETWATER, TEXAS 79556 | | | SERIES 498 | SHEET 383B | |

1/1