

**LUDLUM MODEL 240 SERIES
FLOOR AND WALL MONITOR
USER'S MANUAL**

October 2020

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

STATEMENT OF WARRANTY

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

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

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

RETURN OF GOODS TO MANUFACTURER

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

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

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

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Section

1

Introduction

The Model 240 Alpha-Beta Floor and Wall Monitor allows a user to quickly survey large areas for alpha-beta contamination. Compatible with either gas-proportional or scintillation detectors, the Model 240 cart comes in a version that supports both floor and wall monitoring or a floor-style only version.

Detector-to-surface spacing is adjustable and detectors are positioned for no “dead” zones when scanning.

Gas proportional models come with a gas regulator, flowmeters, and gas lines, but the P-10 gas bottle is not included. The cart also provides two holders for spare detectors, to provide for replacement if a detector becomes damaged.



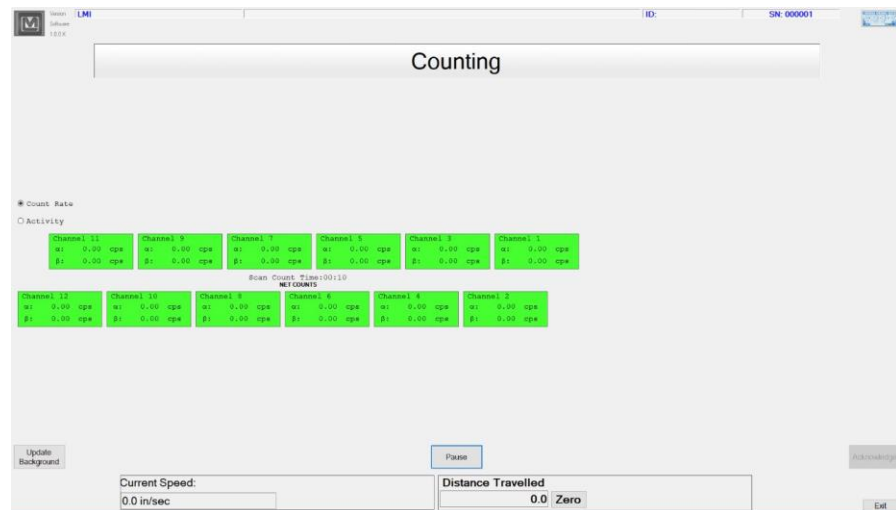
The left photo shows the gas proportional version (without cables) of the Model 240 (part # 48-3956) in the wall monitoring position. Above is the Model 240S (part # 48-413)1, which is the scintillation version of this instrument, shown in the floor monitoring position.

Utilizing an array of detectors instead of a single detector provides several advantages:

1. Smaller detectors have lower backgrounds, thus lower minimum detectable activity (MDA).
2. Smaller detectors allow the user to pinpoint the contamination.
3. Smaller detectors make it easier to maintain and replace fragile metallized polyester windows necessary for alpha detection.

The array of detectors is connected to an electronics box, which has a USB connection to a laptop, each with its own settable high voltage, lower and upper thresholds, and alpha-beta count channels. The laptop display makes it easy to view all 12 detectors simultaneously and provides setup wizards to help with establishing operating points for the detectors. (See the Model 240 Software Manual for more information.)

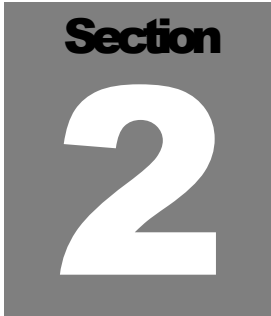
The system initially measures radiation background from the detector array, allowing the operator to see net counts during scanning. While scanning, a rolling average is checked on all 24 channels (12 each, alpha and beta) every half second, and a momentary audible and visual alarm activates if any alarm points are exceeded. Measurements are also automatically logged to a file for subsequent reports.



Shown above is the counting screen, which is displayed on the provided Toughbook ® laptop computer.

The versatile Model 240 Series offers several different combinations for a variety of uses. The following is a list of possible models:

- **Model 240 Floor and Wall Monitor** (part # 48-3956): includes 12 Model 43-198 gas proportional 126 cm² detectors; Toughbook® laptop; gas regulator, input, output, and space (purge) flowmeter (no P-10 gas bottle provided).
- **Model 240S Scintillation Floor and Wall Monitor** (part # 48-4131): includes 12 Model 43-93 scintillation 100 cm² detectors and Toughbook® laptop.
- **Model 240-1 Floor Monitor** (part # 48-4122): gas proportional system as above, floor version only.
- **Model 240-1S Scintillation Floor Monitor** (part # 48-4132): scintillation system as above, floor version only.

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Getting Started

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. The Model 240 serial number is located on a label on the front of the unit.

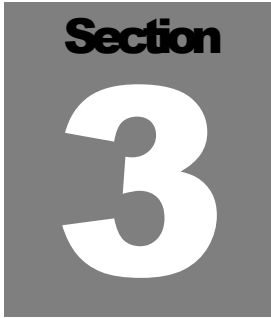
To return an instrument for repair or calibration, provide sufficient packing material to prevent damage during shipment. Every returned instrument must be accompanied by an **Instrument Return Form**, which can be downloaded from the Ludlum website at www.ludlums.com. Find the form by clicking the “Support” tab and selecting “Repair and Calibration” from the drop-down menu. Then choose the appropriate Repair and Calibration division where you will find a link to the form.

Gas Bottle Installation

When using the gas proportional version of the Model 240, you will need to use a bottle of P-10 gas (not included). As given in the Specifications section, the maximum gas bottle size is 22.9 cm (9 in.) diameter by 66 cm (26 in.) tall. The following is the procedure to install the gas bottle.

1. The instrument typically comes with a regulator, a valve, a brass fitting, two white plastic compression nuts, and some vinyl tubing. The valve is in the box with the regulator. The other parts may be in a separate bag.
2. Screw the valve into the output of the regulator. If there is an arrow on the valve, it should point away from the regulator. Screw the fitting onto the valve. Use Teflon tape or sealant on the connections.
3. Set the gas bottle onto the cart and secure with the provided strap. To adjust the strap, open the buckle completely, extend or retract the strap through the latch as necessary, then close the buckle. Attach the regulator onto the bottle.

4. Remove the existing nut from the fitting on the regulator. Insert one end of the vinyl tubing into one of the plastic nuts and screw the nut onto the fitting. Finger tight is sufficient.
5. Cut the tubing to the desired length to reach the top of the box on the handle of the cart that has the flowmeters. Remove the existing nut from the fitting on the quick disconnect above the "IN" flowmeter. Insert the other end of the vinyl tubing into one of the plastic nuts and screw the nut onto the fitting. Finger tight is sufficient.
6. Proceed to the operating procedures section of this manual (Section 4).

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Specifications

Detectors: up to 12 gas proportional or ZnS-plastic scintillation

Detector Height: adjustable from 0.48 to 2.2 cm (0.19 to 0.88 in.) from surface to detector metallized polyester

Detector High Voltage: adjustable from 0 to 2300 Vdc

Detector Alpha-Beta Thresholds: adjustable from 5 to 330 mVdc

Maximum Wall Height: 262 cm (103 in.)

Width of Detection Path: 173 cm (68 in.) with no “dead” area between detectors

Window Material: typically 1.2 mg/cm² (three layers of metallized polyester) for alpha-beta detection

Efficiency (4 π): approximately 20% for both alpha and beta (see detector manuals/data sheets for more specific details)

Speed Resolution: 0.25 cm (0.1 in.) per second

Quick Connects: Swagelock (brand) 1/8 mpt to 1/4 OD tubing

Gas Consumption: approximately 35 cc/min

Flowmeters: both IN and OUT 0-100 cc/min

Flow Rate: 35 cc/min after purging

Battery Life: approximately 6 hours of operations using laptop battery to power both laptop and electronics

Cart:

- Handle Height: 1.07 m (3.5 ft)
- Length: 66 cm (26 in.), including wheels, but excluding handle
- Width: 46.4 cm (18.3 in.)
- Wheel Size: rear 20.3 cm (8 in), front 7.6 cm (3 in.) swivel
- Finish: beige powder-coat paint

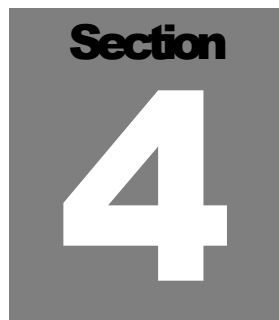
Detector Connectors: Series "C" type is default, others available

Temperature Range: -15 to 50 °C (5 to 122 °F)

Maximum Gas Cylinder Size: 22.9 x 66 cm (9 x 26 in.) (Dia x H); 17.0 L (0.60³ ft) capacity

Size: model specific, but approximately 198 x 53.3 x 122 cm (78 x 21 x 48 in.) (H x W x L)

Weight: model specific, but approximately 68 kg (150 lb)

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Operating Procedures

Note:

Operators of the Model 240S, using scintillation detectors, can skip the steps below involving the gas or gas flow.

Caution:

If the output has a quick-connect fitting, insert a male quick-connect prior to applying the gas supply.

- Turn the flow control valve off. **CAUTION:** Do not over-tighten.
- Turn valve on gas supply bottle to the OPEN position. The high pressure regulator should show the supply pressure from the gas bottle.
- Turn outlet regulator valve clockwise to register between 3 and 5 psi.
- Open the flowmeter valve on the cart's input flowmeter. Adjust the input flowmeter to 100 cc/min to flush the air out of the detector. After flush, flow may be reduced to 35 cc/min. Allow 10 minutes to purge the system.

Note:

The outlet flow indicator on the flowmeter box will not immediately indicate flow when system is first turned ON. The primary purpose of the outlet flowmeter on the flowmeter box is to check for system leaks. This process is addressed in the following Maintenance section.

- Connect the detector to the counting instrument.
- High voltage is preset at the factory to read alpha and beta. Background count will read approximately 1000-1400 cpm.
- Adjust the height of the detector for optimum performance.

Section
5**Maintenance**

Periodic maintenance consists of checking the general condition of the detectors, gas tubing/fittings (if used), signal/high-voltage cable, and the detector windows. Malfunction of the detectors could be caused by a broken metallized polyester window, a broken photomultiplier tube (PMT), or a broken high-voltage wire inside the detector. In general, the most common failure will be of the metallized polyester windows, which are easily punctured or broken.

Gas Proportional Detectors

In case of low count, the gas proportional detectors should be checked for gas leaks. Check the input and output flowmeter on the cart. A reduced or no output flow compared to the input would indicate a gas leak in the system. Any holes in the window will allow counting gas to escape, causing degradation of detector efficiency. If the window needs replacing in the detector, the detector should be checked for both gas leaks and high-voltage shorts before replacing the detector on the cart.

Indication of a broken wire is low or erratic high-voltage reading. Foreign particles, wire tails on the stand-off posts, or solder peaks can cause excessive counts. Loose wires can cause reduced count.

To replace a broken or loose wire, remove the window, being careful not to tear or puncture the window material. Replace the wire and clean the chamber thoroughly. Inspect the gasket for proper condition before replacing the window. Check for gas leaks and proper operation before installing the detector on the cart.

Scintillation Detectors

Scintillators should be checked for torn or punctured metallized polyester windows, which can cause light leaks or PMT saturation.

Section

6

Safety Considerations

Environmental Conditions for Normal Use

Indoor or outdoor use (While rain resistant, user is cautioned to avoid getting water through detector openings.)

No maximum altitude

Temperature Range: -15 to 50 °C (5 to 122 °F)

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

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

Not certified for use in an explosive atmosphere

Warning Markings and Symbols

Caution!

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

The Model 240 is marked with the following symbols:



CAUTION (per ISO 3864, No. B.3.1): designates hazardous live voltage and risk of electric shock. During normal use, internal components are hazardous live. This instrument must be isolated or disconnected from the hazardous live voltage before accessing the internal components. This symbol appears on the side panel. Be sure to take the precautions noted in the next section whenever necessary.



The “**crossed-out wheeie 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 7, “Recycling,” for further information.



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

Cleaning and Maintenance Precautions

The Model 240 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.

Section

7

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 wheeie 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 Model 240, the symbol will be placed on the serial number label located on the side of the instrument.

The symbol appears as such:



Section
8

Drawings

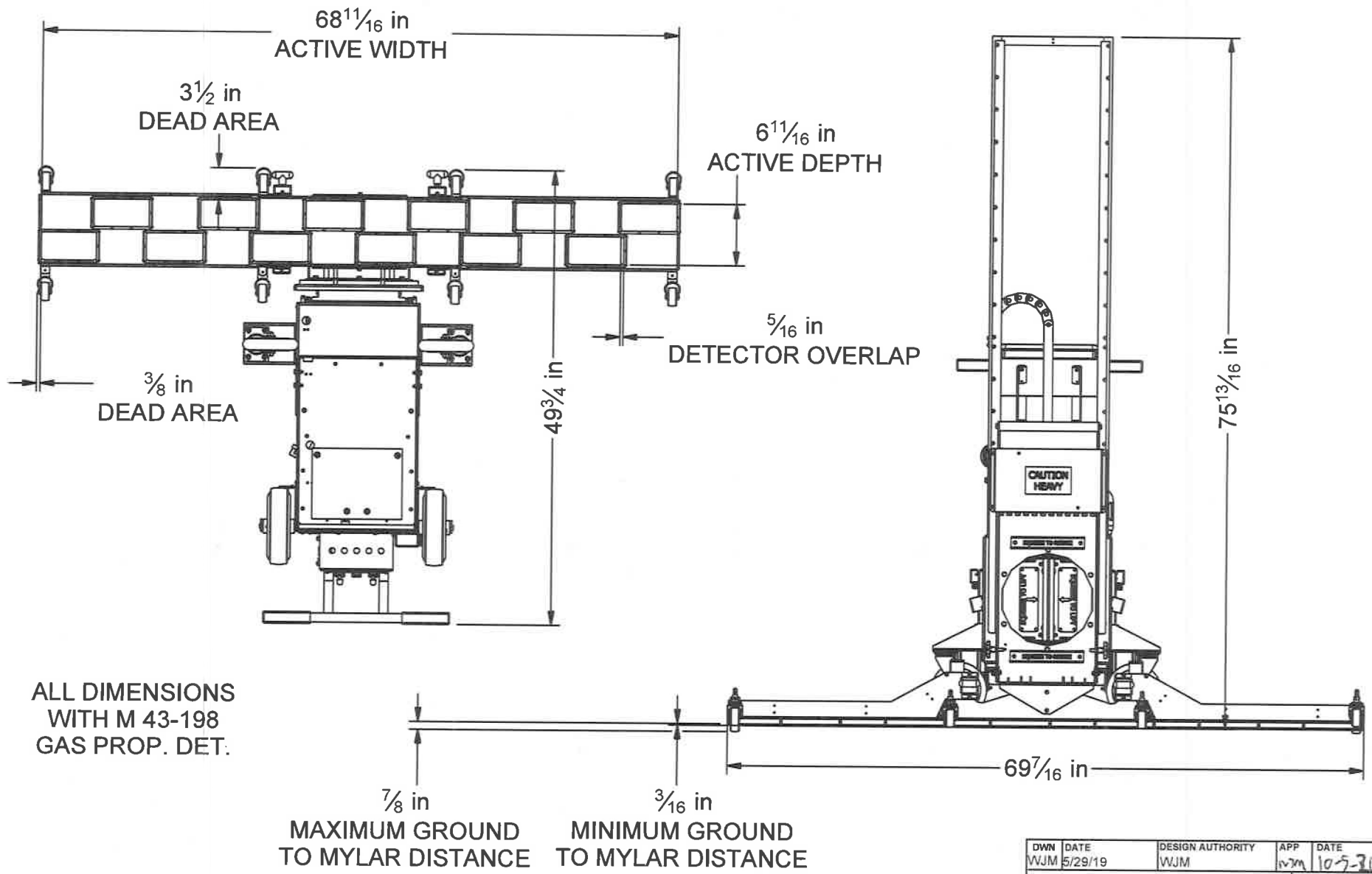
Model 240 Dimensions, Drawing 304 x 193K

Model 240S Dimensions, Drawing 304 x 300F

Model 240-1 Dimensions, Drawing 304 x 279

Model 240-1S Dimensions, Drawing 304 x 306

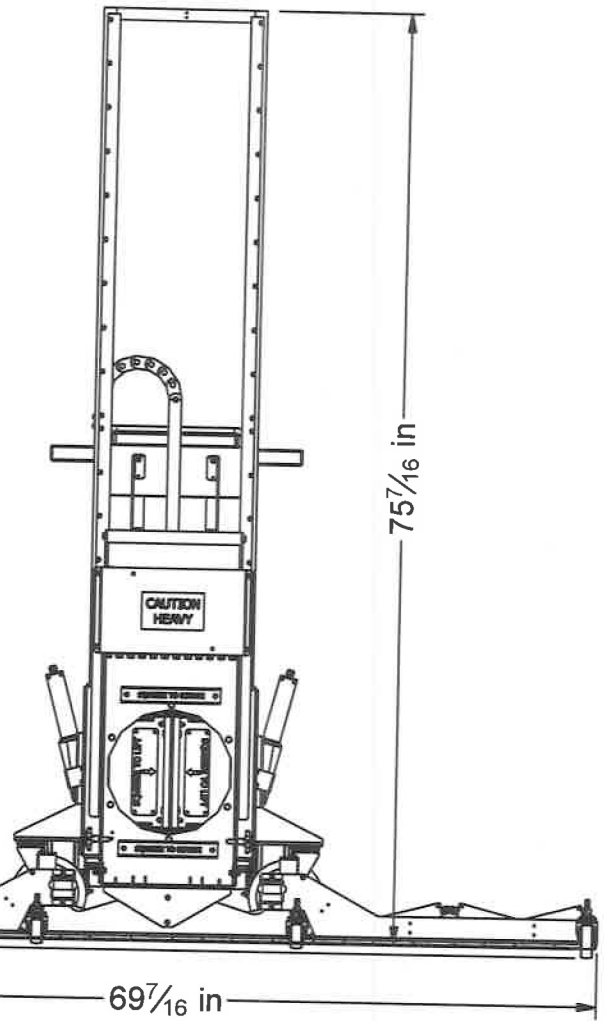
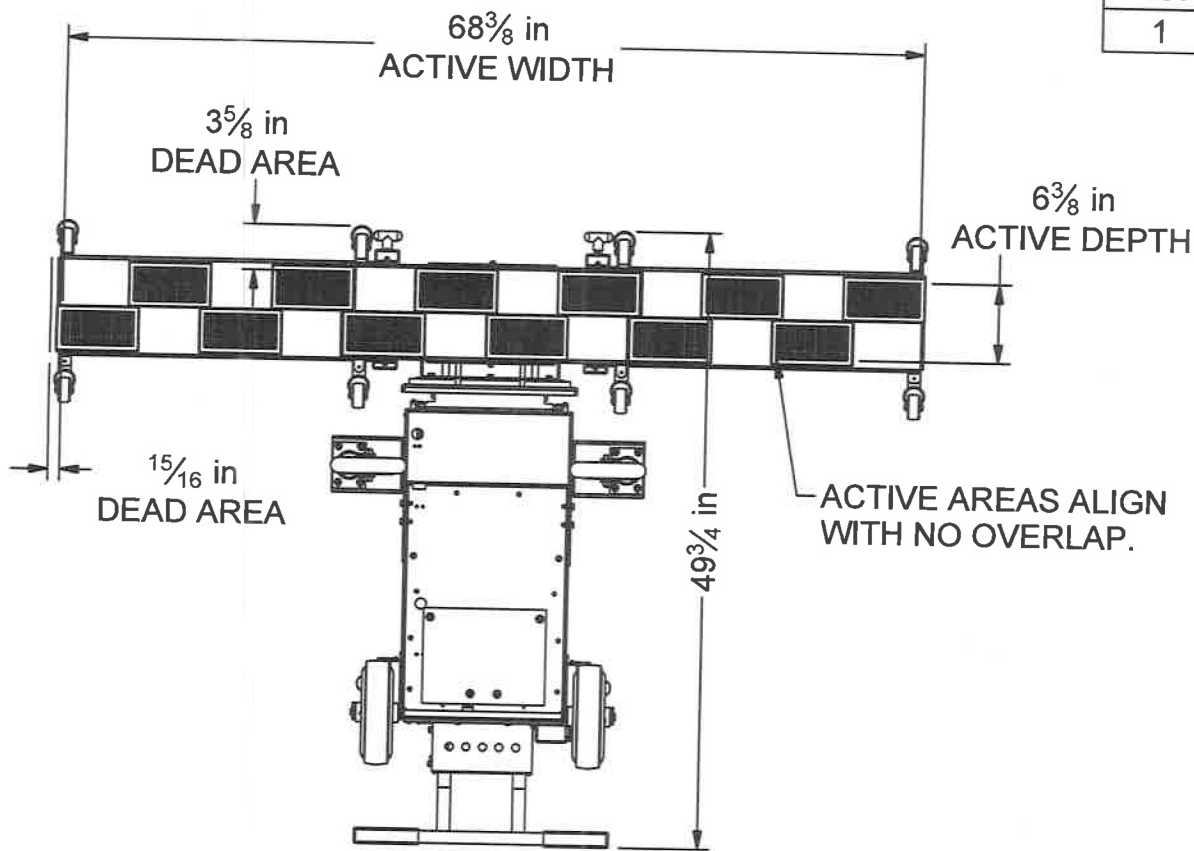
REVISION HISTORY			
REV	DESCRIPTION	DATE	BY
1	VALID	5/9/19	WJM



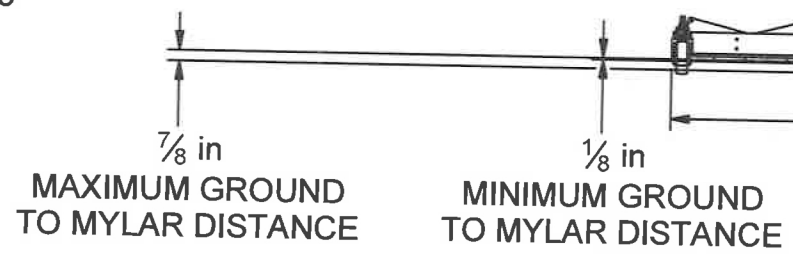
ALL DIMENSIONS
WITH M 43-198
GAS PROP. DET.

DWN	DATE	DESIGN AUTHORITY	APP	DATE
WJM	5/29/19	WJM	WJM	10-5-20
DWG NUM: 4304-193			SCALE: 1/15	
TITLE M 240 DIMENSIONS				
LUDLUM MEASUREMENTS, INC. 501 OAK STREET SWEETWATER, TEXAS 79556		SERIES	SHEET	
		304	193K	

REVISION HISTORY			
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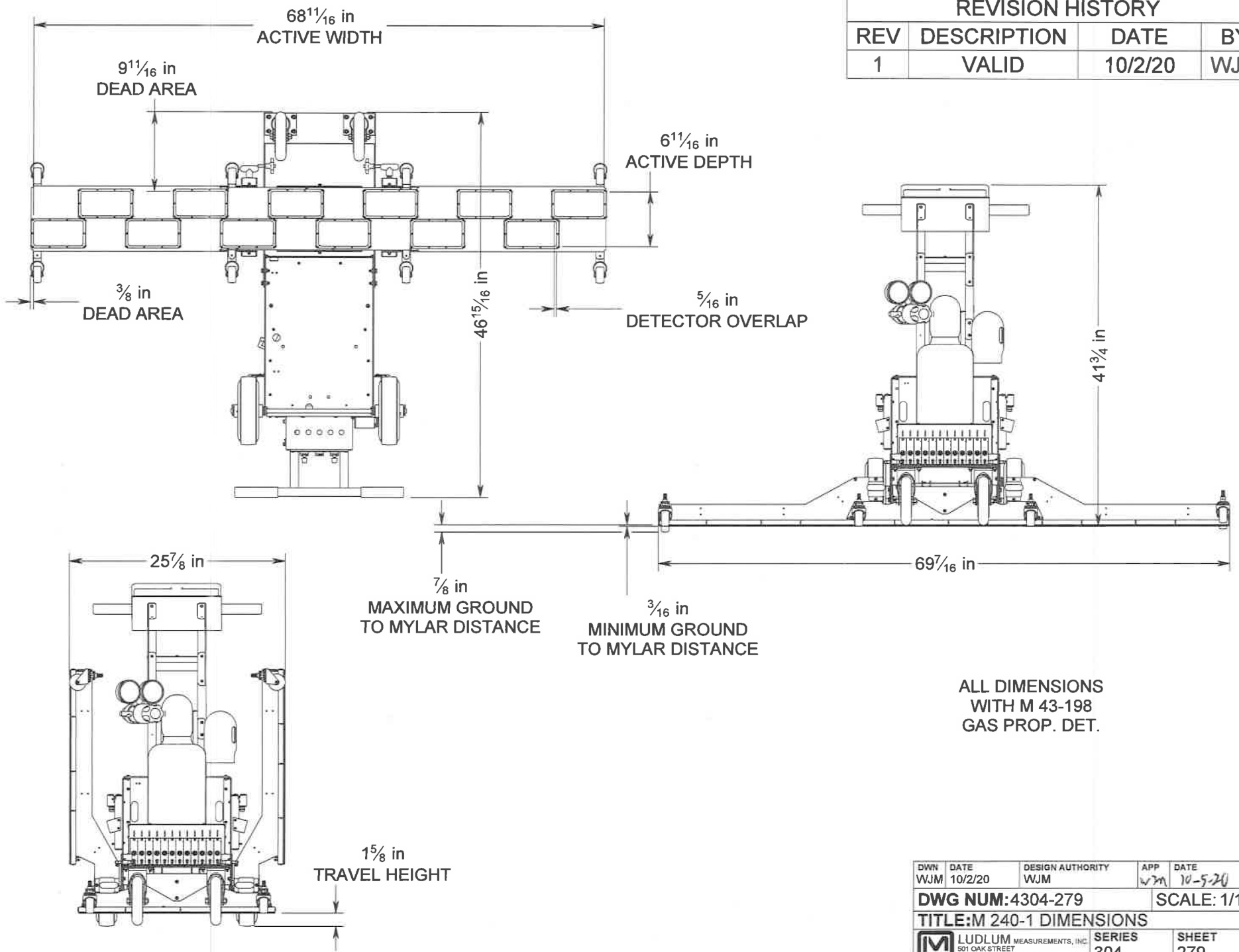


ALL DIMENSIONS WITH M 43-93 DETECTOR



DWN	DATE	DESIGN AUTHORITY	APP	DATE
WJM	5/29/19	WJM	WJM	5-20
DWG NUM: 4304-300			SCALE: 1/15	
TITLE M 240S DIMENSIONS				
LUDLUM MEASUREMENTS, INC. 501 OAK STREET SWEETWATER, TEXAS 79556		SERIES 304	SHEET 300F	

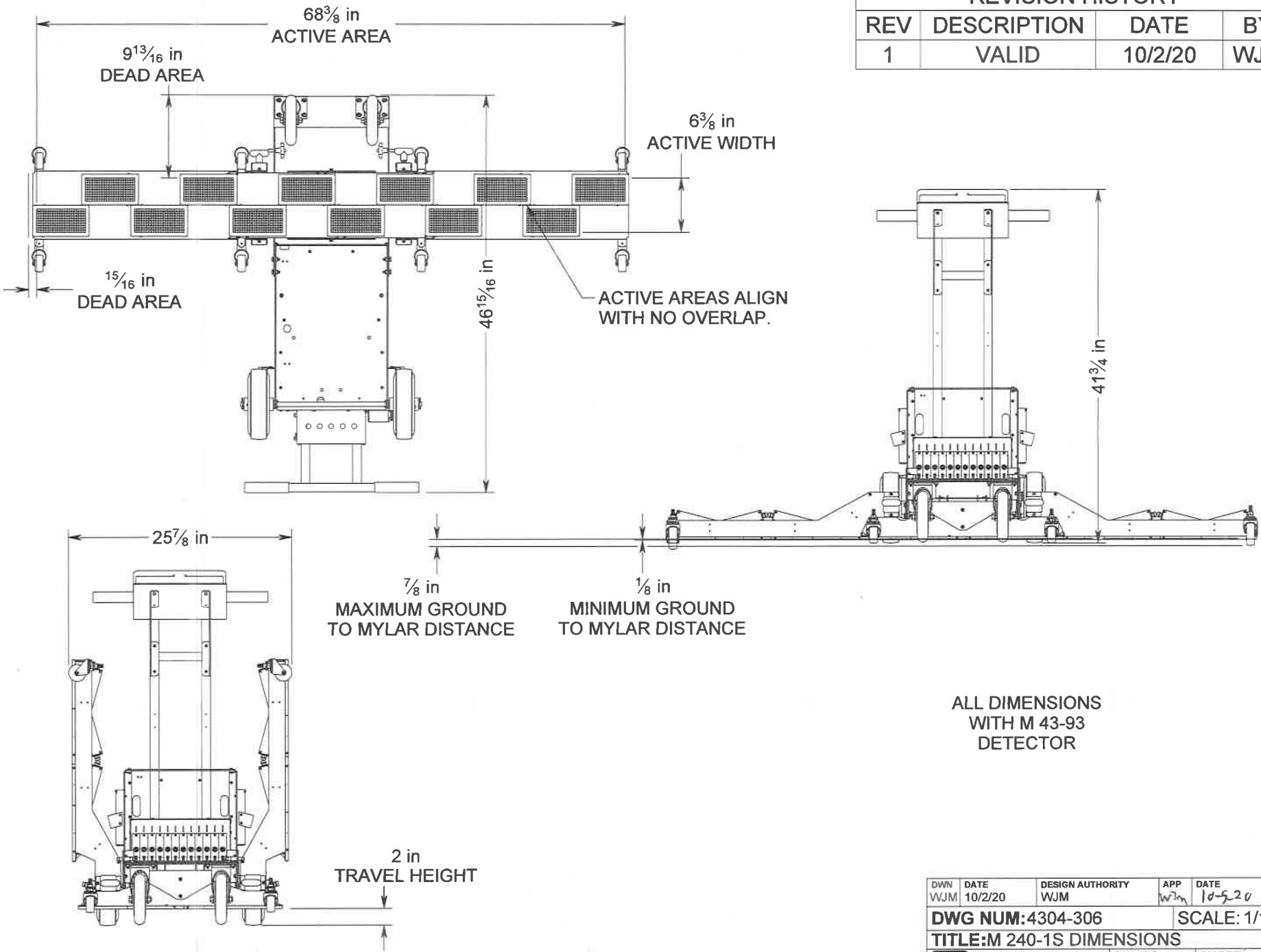
REVISION HISTORY			
REV	DESCRIPTION	DATE	BY
1	VALID	10/2/20	WJM



ALL DIMENSIONS WITH M 43-198 GAS PROP. DET.

DWN	DATE	DESIGN AUTHORITY	APP	DATE
WJM	10/2/20	WJM	WJM	10-5-20
DWG NUM: 4304-279			SCALE: 1/15	
TITLE: M 240-1 DIMENSIONS				
	LUDLUM MEASUREMENTS, INC. 501 OAK STREET SWEETWATER, TEXAS 79556	SERIES 304	SHEET 279	

REVISION HISTORY			
REV	DESCRIPTION	DATE	BY
1	VALID	10/2/20	WJM



ALL DIMENSIONS WITH M 43-93 DETECTOR

DWN WJM	DATE 10/2/20	DESIGN AUTHORITY WJM	APP WJM	DATE 10-9-20
DWG NUM: 4304-306			SCALE: 1/15	
TITLE: M 240-1S DIMENSIONS				
LUDLUM MEASUREMENTS, INC. 501 OAK STREET SWEETWATER, TEXAS 79556		SERIES 304	SHEET 306	