

**LUDLUM MODEL 52-1, 52-4, 52-5, & 52-6 SERIES  
PORTABLE SCINTILLATION PORTAL MONITORS**

**February 2021**

**Serial Number 210041 and Succeeding  
Serial Numbers**

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**LUDLUM MEASUREMENTS, INC**  
501 OAK STREET, P.O. BOX 810  
SWEETWATER, TEXAS 79556  
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## **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.

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501 OAK STREET  
SWEETWATER, TX 79556**

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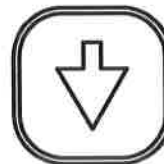
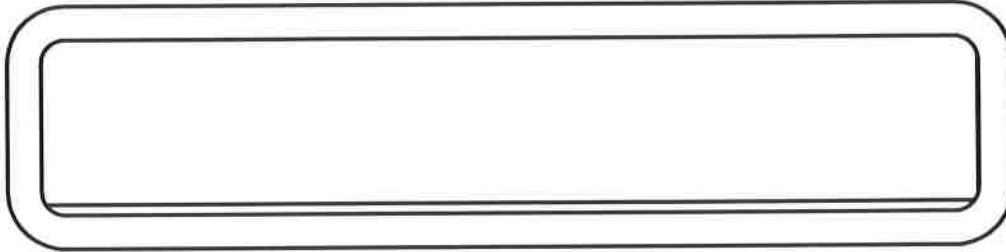
REVISION HISTORY

REV	DESCRIPTION	DATE	APPROVED
1	VALID	3-8-2017	ACK
2	UPDATED DRAWINGS	6-8-18	TKC



LUDLUM MEASUREMENTS, INC.  
SWEETWATER, TEXAS

MODEL 52-1  
PORTAL MONITOR



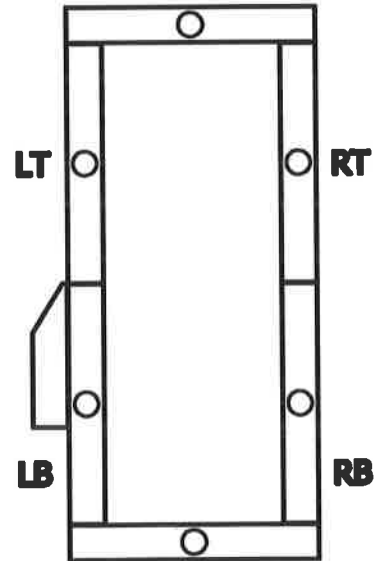
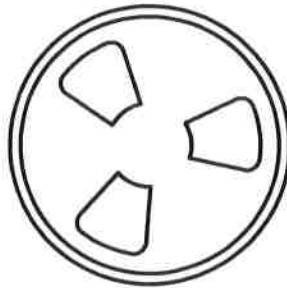
○ ENTER / CHECKING

○ INCOMPLETE / UPDATING

○ RADIATION ALARM

○ INSTRUMENT FAILURE

○ LOW BATTERY



LT

RT

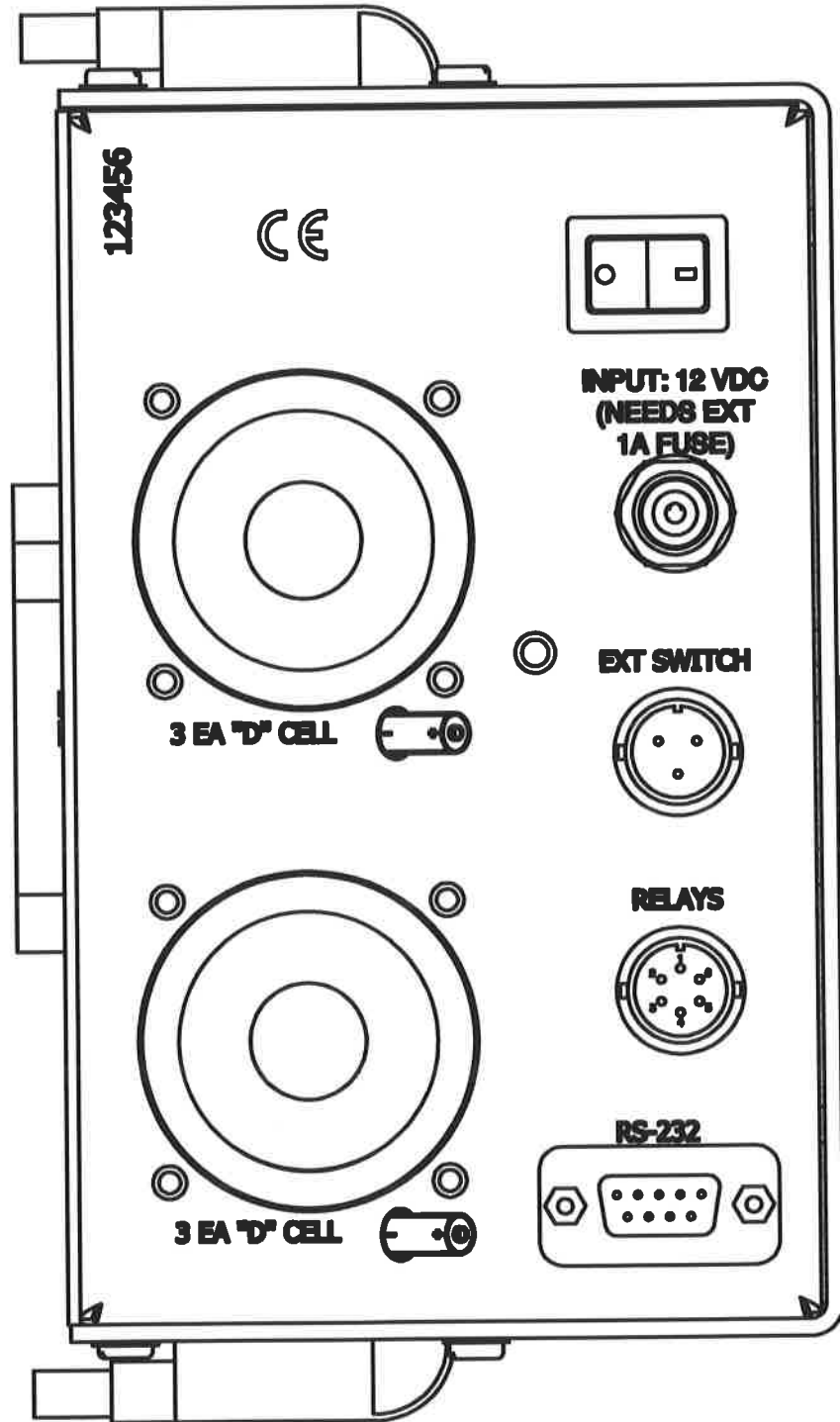
LB

RB

DWN	DATE	CHK	DATE	APP	DATE
TKC	8-11-18			JGW	6-11-18
<b>DWG NUM: 4215-999</b>				<b>SCALE: 1:1</b>	
<b>TITLE M 52-1 FRONT PANEL</b>					
LUDLUM MEASUREMENTS, INC. 501 OAK STREET SWEETWATER, TEXAS 79558			SERIES 215	SHEET 999	

REVISION HISTORY

REV	DESCRIPTION	DATE	APPROVED
1	VALID	3-8-2017	ACK
2	UPDATED DRAWINGS	6-8-18	TKC



DWN	DATE	CHK	DATE	APP	DATE
TKC	6-11-18			<i>TKC</i>	6-13-18
DWG NUM: 4215-999				SCALE: 1:1	
TITLE M 52-1 BOTTOM (6 BATT)					
	LUDLUM MEASUREMENTS, INC. 501 OAK STREET SWEETWATER, TEXAS 79556			SERIES	SHEET
				215	999A

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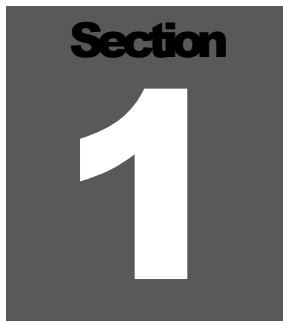
# Table of Contents

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<b><i>Introduction</i></b>	<b><i>1</i></b>
<b><i>Specifications</i></b>	<b><i>2</i></b>
<b><i>User Operation</i></b>	<b><i>3</i></b>
<b>Assembly Instructions</b>	<b>3-1</b>
<b>Operational Check</b>	<b>3-3</b>
<b>Personnel Monitoring</b>	<b>3-3</b>
<b>Vehicle Monitoring</b>	<b>3-5</b>
<b><i>Description of Controls and Functions</i></b>	<b><i>4</i></b>
<b>Front Panel</b>	<b>4-1</b>
<b>AC Panel</b>	<b>4-3</b>
<b>Parameters and Functions</b>	<b>4-3</b>
<b>RS-232 Port</b>	<b>4-5</b>
<b>Water Resistant Sleeve</b>	<b>4-6</b>
<b>Theory of Background Management</b>	<b>4-6</b>
<b><i>Safety Considerations</i></b>	<b><i>5</i></b>
<b>Environmental Conditions for Normal Use</b>	<b>5-1</b>
<b>Cleaning Instructions and Precautions</b>	<b>5-1</b>
<b>Electrical Safety Precautions</b>	<b>5-2</b>
<b>Warning Markings and Symbols</b>	<b>5-3</b>
<b><i>Maintenance and Recalibration</i></b>	<b><i>6</i></b>
<b>Maintenance</b>	<b>6-1</b>
<b>Recalibration</b>	<b>6-1</b>
<b><i>Checkout Procedure</i></b>	<b><i>7</i></b>
<b>General</b>	<b>7-1</b>
<b>Equipment Required</b>	<b>7-1</b>

<b>Checkout Procedure</b>	<b>7-1</b>
<b><i>Recycling</i></b>	<b><i>8</i></b>
<b><i>Parts List</i></b>	<b><i>9</i></b>
<b>Models 52-1, 52-1-1, 52-4, 52-5, 52-5-1, 52-6 and 52-6-1 Portable Scintillation Portal Monitors</b>	<b>9-1</b>
<b>Main Board, Drawing 215 x 342-342E</b>	<b>9-1</b>
<b>Detector Interface Board, Drawing 215 x 347</b>	<b>9-4</b>
<b>Power Supply, Drawing 215 x 1072</b>	<b>9-5</b>
<b>1 1/8 inch Voltage Divider, Drawing 435 x 435</b>	<b>9-6</b>
<b>Resistor Board, Drawing 215 x 782</b>	<b>9-7</b>
<b>Wiring Diagram, Drawing 215 x 1044</b>	<b>9-7</b>
<b>Retrofit Miscellaneous</b>	<b>9-7</b>
<b><i>Drawings and Diagrams</i></b>	<b><i>10</i></b>





## Introduction

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The Model 52-1 family includes the Model 52-1, 52-4, 52-5, and 52-6 series of instruments, as well as those with a “W” in the name (Model 52-1W, for example). They are Portable Scintillation Portal Monitors, which are used for beta/gamma personnel radiation monitoring. They are designed to detect very low levels of radiation coming from personnel who walk through the portal.

### Model 52-1 and 52-1-1

The Model 52-1 and 52-1-1 have four side detectors. The only difference between the Model 52-1 and the Model 52-1-1 is in the width of the portal monitor. The 52-1-1 is 8 inches wider.

Model	# of Detectors	Inside Width	Volume (Total)
52-1	4	24 inches	672 in <sup>3</sup>
52-1-1	4	32 inches	672 in <sup>3</sup>

### Model 52-5, 52-5-1, 52-6, and 52-6-1

The Model 52-5 and 52-6 have the same width dimensions as the Model 52-1. The Model 52-5 is about an inch taller due to the addition of a detector in the base. It has 5 detectors. The Model 52-6 uses 6 detectors, with another additional detector located at the top. Both the 52-5-1 and the 52-6-1 have 8 inches more width in the portal monitor than the 52-5 and 52-6 have.

Model	# of Detectors	Inside Width	Volume (Total)
52-5	5	24 inches	780 in <sup>3</sup>
52-5-1	5	32 inches	780 in <sup>3</sup>
52-6	6	24 inches	888 in <sup>3</sup>
52-6-1	6	32 inches	888 in <sup>3</sup>

**Model 52-4**

The Model 52-4 is similar to the Model 52-1, but with the car base only. The base and top normally supplied with the Model 52-1 are not supplied with the Model 52-4.

**Models with “W” in name**

Any instrument with a “W” in the name, such as the Model 52-1W, means it is similar to the original instrument but is also weather resistant. The design was tested to qualify for an IP rating of 53. There are additional gaskets that protect these instruments from falling rain.

All of the Model 52-1 family of instruments meets the Federal Emergency Management Agency (FEMA) standard for Emergency Response Portal Monitoring (FEMA-REP-21). They are designed to be disassembled for ease of transportation and storage and can be assembled in five minutes or less without tools. All parameters are stored in non-volatile memory, which requires no battery backup. These parameters allow easy operation with minimal setup by minimally trained personnel. The parameters are pre-set at the factory to detect a 1.0  $\mu\text{Ci}$  (37.5 kBq)  $^{137}\text{Cs}$  source in a 10  $\mu\text{R/hr}$  (0.1  $\mu\text{Sv/h}$ ) background field, in accordance with the FEMA standard.

They also comply with the applicable European Standards required for CE marking of the instruments.

The electronics are microprocessor-based for ease of setup and reliability. Status LEDs indicate count cycle status. Audible signals (which may be turned off to avoid alarming the occupants) accompany the LEDs for additional indication. Audio levels can also be controlled by rotating the baffle at the front of the audio device. Detector counts, background, and all parameters may be viewed on the Liquid Crystal Display (LCD). All setup is accomplished by way of push-buttons located below the LCD.

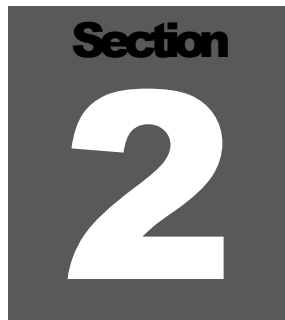
These portal monitors can be operated in a walk-through basis with a quick scan occurring while a person is passing through the portal. In this mode, checking is performed every 200 milliseconds while the portal is occupied and 800 milliseconds after the portal is occupied. A check is also performed before the portal is occupied based on the value of the "# of Samples" parameter. For example, if the "# of Samples" parameter is set to 3, when a person enters the portal, the instrument immediately checks for an alarm based on the last three samples (3 x 200 milliseconds) or 600 milliseconds. This check helps to catch contamination on the foot or hand that passes by the detectors just before the occupancy sensor is triggered.

The portal monitor can also monitor in a stop-and-count mode, allowing for a more sensitive scan. In stop-and-count mode, the fixed count time may be set from 1 to 20 seconds.

This family of portal monitors has automatic background update and dynamic alarm setting capabilities. On startup, it will take a background count and calculate alarm levels for each detector. Self-diagnostic routines check the background count and warn if the background becomes either too high or too low. Alarms are calculated with a user-adjustable sigma parameter and the current background count. During setup, the user can also specify individual alarms only, sum alarm only, or both individual and sum alarms. The sum alarms combine the results of the top detectors and of the bottom detectors.

For vehicle monitoring, the optional car base preference allows for the side detectors to be set further apart. Sensitivity depends on portal width.

All four models are able to operate from 85-250 Vac 50/60Hz. They may also be operated from three or six “D” cell batteries using a supplied power supply or from the supplied cigarette lighter adapter cable. Battery lifetime is approximately 28 hours.

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## Specifications

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**Display (Setup):** 2 line-by-20-character LCD, backlit when operated from AC power

**Display (User):** five large status LEDs on one side of portal, and detector LEDs to show alarm location

**Detector High Voltage:** 700-1200 V

**Detector Threshold:** -4 mV

**Count Time:** adjustable from 0 to 20 seconds ("0" indicates walk-through mode)

**Power:** can be powered from either a 85-250 Vac, 50/60 Hz, using a supplied 12 Vdc wall adapter; supplied 12 Vdc cigarette lighter adapter cable; or from three or six D cell batteries. Typical battery life is 69 hours using six fresh alkaline batteries and 28 hours using three fresh batteries.

**Output:** RS-232 and dry contacts for radiation alarm and failure conditions

**Sensitivity:** 1  $\mu\text{Ci}$  (37.5 kBq)  $^{137}\text{Cs}$  in walk-through mode in 10  $\mu\text{R/hr}$  (0.1  $\mu\text{Sv/h}$ ) background field with a width of 91.4 cm (36 in.) or less. **(When used with the optional car base assembly, sensitivity will depend on portal width.)**

**Energy Response:** 30 keV to 3 MeV

**Audio:** an alarm with an adjustable baffle for portal entry and incomplete audio, and a continuous beeping for radiation alarm and instrument failure audio. The "AUDIO ON?" parameter in setup mode (default Yes or enabled) can be changed to NO to disable the audio.

**Outside Dimensions (when set up):**

**For Model 52-1:** 211 x 81.3 x 45 cm (83 x 32 x 17.5 in.) (H x W x L)

**For Model 52-1-1:** 211 x 102 x 45 cm (83 x 40 x 17.5 in.) (H x W x L)

**For Model 52-5:** 213 x 81.3 x 48 cm (84 x 32 x 19.3 in.) (H x W x L)

**For Model 52-5-1:** 213 x 102 x 49 cm (84 x 40 x 19.3 in.) (H x W x L)

**For Model 52-6:** 217 x 81.3 x 49 cm (85.3 x 32 x 19.3 in.) (H x W x L)

**For Model 52-6-1:** 217 x 102 x 49 cm (85.3 x 40 x 19.3 in.) (H x W x L)

\* With the optional stabilizer legs, add 91.4 cm (36 in.) in length to all models.

**Inside Dimensions (when set up):**

**For Model 52-1:** 206 x 61 cm (81 x 24 in.) (H x W)

**For Model 52-1-1:** 206 x 81 cm (81 x 32 in.) (H x W)

**For Model 52-5:** 206 x 61 cm (81 x 24 in.) (H x W)

**For Model 52-5-1:** 206 x 81 cm (81 x 32 in.) (H x W)

**For Model 52-6:** 206 x 61 cm (81 x 24 in.) (H x W)

**For Model 52-6-1:** 206 x 81 cm (81 x 32 in.) (H x W)

**Case Dimensions:** 122 x 61 x 30.5 cm (48 x 24 x 12 in.) (H x W x D)  
(Same case is used for all four models.)

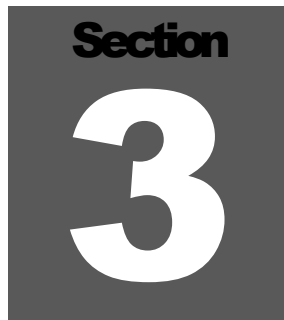
**Detector Size:** Each of the four side detectors has 2753 cm<sup>3</sup> (168 in<sup>3</sup>) of plastic scintillator. The foot (base) and head detectors in the Model 52-5, 52-5-1, 52-6, and 52-6-1 all have 1770 cm<sup>3</sup> (108 in<sup>3</sup>) of plastic scintillator.

**Weight:**

**Models 52-1 and 52-1-1:** approximately 32 kg (70 lb), 45 kg (100 lb) in case

**Models 52-5 and 52-5-1:** approximately 36 kg (80 lb), 50 kg (110 lb) in case

**Models 52-6 and 52-6-1:** approximately 41 kg (90 lb), 54 kg (120 lb) in case

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## User Operation

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This section gives instructions how to set up and use the instrument to monitor a person for radiation.

### Assembly Instructions

This section gives instructions on how to assemble these instruments and get them ready for use.

The portal monitor comes in a container that can be used for shipping and storage. The pieces and quantities that make up the system are:

- 1 - Base
- 1 – Bottom Left (Section L1)
- 1 – Top Left (Section L3)
- 1 - Top Section
- 1 - Electronics Section
- 1 - Power Cord
- 1 - Remote electronics extension cable (optional)
- 2 – Stabilizer Legs (optional)

Unpack the container and inventory to ensure that all pieces are present.

Any of the four models of the portal monitor can be assembled without tools. All connections are made with latches. To connect a latch, lift up the bottom tab, hook the top cross bar into the hook on the piece that you are attaching, and push tab back down until it snaps into place.

#### Caution!

Exercise care when unlatching pieces, as the latches can spring open violently.

To unlatch, lift up the tab and unhook the top cross bar.

Set the **BASE** on the ground with the rectangular tubes pointing up.

If optional stabilizer legs are provided, attach to the **BASE**, front and rear, with screws provided.

Insert the male end of the Bottom Right section into the female side bracket of the base marked **RIGHT SIDE BASE** and attach the latches. The detector screens must be facing the middle of the portal.

Insert the male end of the Top Right section into the female end of the Bottom Right section and attach the latches.

Repeat the process for the **LEFT** side.

Insert the **TOP** into the tops of the side sections and attach the latches. The top can be installed in either direction. It does not matter which end goes to the right.

Plug the **connector end** onto the back of the Bottom Left section with the blank end facing down. First, engage the black connectors. Then ensure that the pin on the back of the Bottom Left section goes into the hole on the electronics. Attach the latches. If you are using the optional Remote Electronics Extension Cable, connect one end of the cable to the Bottom Left section and the other end to the Electronics. Locate the electronics as desired.

If you have line voltage available, plug the **POWER CORD** into the connector on the bottom of the electronics marked INPUT. If not, install 3 “D” Cell batteries into the battery compartment. The power cord and batteries may both be installed at the same time, but the portal monitor does not charge the batteries.

**Turn on** the **POWER** switch located on the bottom of the electronics and allow the instrument to finish updating. If the preprogrammed settings are acceptable, it is ready for use. Proceed to the next section. If the settings need to be changed or checked, proceed to Parameter Setup, Section 4.

Disassembly is reverse of assembly.

## Operational Check

To ensure that these instruments are functioning correctly, an operational check should be performed routinely or before using the instrument. This check verifies that the instrument is turned on, that the settings are appropriate, and that the system alarms when the detectors are exposed to excess radiation (above background level). Ludlum Measurements suggests that this operational check be performed after setup and before use. As long as the system passes the operational check, no calibration or other checks are necessary. If the response or any function of the portal monitor changes, the instrument should be checked and brought into compliance with the manufacturer's original specifications.

Check each of the detectors for sensitivity to beta/gamma radiation. Verify that you get a RADIATION ALARM, using the check source supplied with the instrument (normally a  $^{137}\text{Cs}$ , 1  $\mu\text{Ci}$  or 37.5 kBq activity source, approximately 45.7 cm {18 in.} from the detector face in the middle of the portal).

In walk-through mode, simply walk through the portal, holding the source in proximity to a detector. This action should cause the portal to enter the RADIATION ALARM status until the alarm time parameter is complete. In stop-and-count mode, you should stand in the portal for the duration of the count time. At the end of the count time, the portal should enter the RADIATION ALARM status until the alarm time parameter is complete.

Repeat alarm checks for all four sections to confirm that all detectors are functioning.

To also provide assurance that the instrument meets the FEMA emergency response criteria prior to operation of this portal, do the following: Pass the 1  $\mu\text{Ci}$  (37.5 kBq)  $^{137}\text{Cs}$  checksource through the center of the portal at several points between 15.2 and 168 cm (0.5 and 5.5 ft) from the floor of the portal and verify that the alarm is triggered each time. If the portal does not alarm each time, the user may need to adjust the count time, the alarm points, or move the portal to a location with lower background radiation.

## Personnel Monitoring

A count starts when someone blocks the infrared beam. A count can only be started when the system is in the **ENTER** mode. Do not enter the portal while the yellow **UPDATING** status LED is flashing.



Prior to personnel monitoring, the monitor must be allowed to update the background count. This mandatory update occurs just after power-up and takes one minute. New background data is compared to the low and high background setpoints that have been programmed into the unit. If the setpoints have been exceeded, an **INSTRUMENT FAILURE** alarm is given, and the unit attempts to update background. The value displayed represents the sum of counts every 0.2 seconds (200 msec), when unoccupied. The instrument will continue to update the background until the alarm condition has been corrected; that is, when the background goes down or failed detectors are repaired. Please note, however, that high levels of external radiation can cause the **INSTRUMENT FAILURE** alarm.

To check someone for radiation, follow the steps below:

- The green **ENTER** light must be illuminated in order to use the instrument. A yellow **UPDATING** light may be flashing, indicating that a background update is taking place. When the **UPDATING** light is flashing, the system should not be used, and all people to be checked should remain at least 1.8 m (6 ft) away until the **ENTER** light is illuminated.
- The subject steps into the portal, breaking the infrared beam, and the green **READY** light will start flashing, indicating that the portal is now **CHECKING**. A soft, low-pitched beep will also occur. While occupied, the numbers shown for each channel represent the peak value, in sigma, above background.
- In walk-through mode, the subject may simply continue walking through the portal. In stop-and-count mode, the yellow **INCOMPLETE** light will illuminate if the subject leaves the portal before the count is complete. A soft, low-pitched beeping will also warn the subject to return to the portal to finish the count.
- When the count is complete, the green **ENTER** light or the red **RADIATION ALARM** light will be illuminated. In stop-and-count mode, a second soft, low-pitched beep will occur.
- The subject then steps out of the portal.

During operation, a buffer zone of at least 3 m (9.8 ft) (in all directions) should be established around the monitor, to reduce the possibility of measurement interferences from external sources. Subjects waiting to be measured should remain outside the buffer zone until it is their turn to be measured.

If a measurement results in an alarm, the subject should walk through the monitor a second time from the opposite direction (and possibly a third time) to validate the alarm. This alarm validation process minimizes the possibility the alarm was caused by a momentary, coincidental high-background event.

Once an alarm has been validated after one (or two) confirming measurements, the subject can be moved away (>10 m) from the monitor, and a secondary scan with a hand-held meter can be performed to identify the location(s) of the contamination or point source.

**Note:**

The red detector alarm light LEDs will offer guidance as to the probably location(s) of the radioactivity on the subject.

## Vehicle Monitoring

The optional car base assembly (part # 4215-374) (see Drawings 215 x 332, 215 x 332A, 215 x 374, and 215 x 374B in back of manual) allows the detectors to be spaced further apart. In this configuration, vehicles or other items may be passed through a wider width. Sensitivity will depend on portal width.

# Section 4

## Description of Controls and Functions

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### Front Panel

**Readout:** Liquid Crystal Display (LCD), 2-line, 20-character alphanumeric display. Background and alarm data is displayed. The value displayed represents the sum of counts every 0.2 seconds (200 msec), when unoccupied. While occupied, the numbers shown for each channel represent the peak value, in sigma, above background.

**Increment (Up Arrow ↑) Button:** increases or changes a parameter when in setup mode. To enter setup mode, press and hold the Up Arrow button while turning ON the instrument at the switch under the control box. Instrument parameters may only be changed while in the setup mode.

**Decrement (Down Arrow ↓) Button:** decreases or changes a parameter when in setup mode. During instrument operation, pressing this key will show the number of alarms and the number of passages since power-up.

**Enter Key:** selects or advances display. If the ENTER key is pressed while turning the instrument ON, the instrument is loaded with a set of default parameters. The parameters that are set are:

Default Value	
Language	English
Month	1 (January)
Day	2
Year	00
Hour	8
Minute	15
Count Time	0 sec
Alarm Time	15 sec
Incomplete Time	10 sec
RDA Size	500
Low Bkgnd (background)	20
High Bkgnd (background)	2000
Sigma	4.5

LT Active	Y
LB Active	Y
RT Active	Y
RB Active	Y
*HD Active	Y (* for Models 52-5 and 52-6 only)
*FT Active	Y (* for Models 52-5 and 52-6 only)
Individual Alarms	Y
Sum Alarms	Y
# of Samples	2
Bkgnd Update	8
LT Attenuation	0.0%
LB Attenuation	0.0%
RT Attenuation	0.0%
RB Attenuation	0.0%
*HD Attenuation	0.0% (* for Models 52-5 and 52-6 only)
*FT Attenuation	0.0% (* for Models 52-5 and 52-6 only)
Audio On	Y

The default condition is for all detectors to be active.

**Detector LEDs:** indicate location of radiation alarm (see front panel drawing in front of manual for LED layout).

**Status LEDs (side of portal):** (see front panel drawing in front of manual for LED layout).

**Enter/Checking green LED:** normally illuminated prior to any personnel entry, indicating that the system is ready to take a count. It flashes to indicate the system is checking for excess radiation. It stops flashing at the end of the count time in stop-and-count mode or whenever the user leaves the portal in walk-through mode.

**Incomplete/Updating yellow LED:** indicates that a count was in progress and the subject stepped out of the portal before the count was complete. The **INCOMPLETE** LED stays on for the incomplete time or until the subject steps back into the portal. An **INCOMPLETE** resets the count time.

If no one steps back into the portal during the incomplete time, the portal monitor goes back to the ready state, illuminating the **ENTER** LED. This LED also indicates **UPDATING** background while flashing. Do not enter or allow personnel within 1.8 m (6 ft) while the unit is updating background.

**Radiation Alarm red LED:** indicates that the system has detected radiation levels above background.

**Instrument Failure red LED:** indicates that the system has detected a high- or low-background condition. If there is a background problem, the **UPDATING** LED will also be illuminated.

**Low Battery red LED:** indicates the batteries are low and must be replaced immediately.

## AC Panel

**Line Fuse:** fuses to limit current from the AC outlet. The fuses are Littlefuse F-1A or equivalent.

**Input:** line voltage input, 85-250 Vac, 50/60 Hz, 250 W

**RS-232:** RS-232 port so that instrument can be connected to a printer or a computer

**Batteries:** instrument may be powered using three or six each “D” cell batteries

**Relay:** 6-pin connector to connect internal relays

Relay pinouts:

P1	Alarm Normally Closed
P2	Alarm Common
P3	Alarm Normally Open
P4	Instrument Fail Normally Closed
P5	Instrument Fail Common
P6	Instrument Fail Normally Open

**EXT Switch:** 3-pin connector for an external activation switch. External switch can be a passive push-button switch, or can be an NPN-transistor output infrared sensor.

## Parameters and Functions

This section lists the different parameters of these instruments and their functions. To enter setup mode, press and hold the **Increment (Up Arrow) Button** while turning ON the instrument at the switch under the control box. This will allow the user to change the parameters.

**Language:** The language is set to English.

**Month:** adjustable from 1 to 12, which indicates the month.

**Day:** represented by one number, from 1 to 7.

**Year:** represented by two numbers.

**Count Time:** adjustable from 0 to 25 seconds, where 0 sets the portal in the walk-through mode.

**Alarm Time:** adjustable from 1 to 255 seconds. This parameter controls the duration of the RADIATION ALARM and is indicated by a steady tone from audio.

**Incomplete Time:** adjustable from 1 to 255 seconds. This parameter controls the duration of INCOMPLETE, which is indicated by a low-pitched, beeping sound.

**RDA Size:** This number, in nCi, indicates the size of the source used during the automatic RDA calculation. (The Model 52-1 does not utilize the automatic RDA feature, and the RDA size is set to 500.)

**Low Background (BKGND) Alarm:** This parameter sets the number of counts per 0.2-second interval that the background should not fall below in normal operation. If background falls below this level, an INSTRUMENT FAILURE alarm will occur. This alarm indicates if a detector has failed or is not connected. This alarm will also indicate if the ambient background has decreased significantly.

**High Background (BKGND) Alarm:** This alarm is the opposite of the LOW BACKGROUND alarm. This alarm will indicate that background radiation has increased or that a detector has failed.

**Sigma:** This parameter sets the number of standard deviations above background that it takes to set off an alarm. A standard deviation is assumed to be equal to the square root of the background count. As a simple example, a 3-sigma alarm of a detector with a background count rate of 100 counts is calculated as 3.0 times the square root of 100, or 30. In this simple example, a sudden count of 130 counts would cause an alarm.

**Detector Activity:** This parameter notifies the user whether or not the detector is active, indicated with a “Y” for “yes” or an “N” for “no.”

**Individual Alarms:** An alarm can be set individually for each detector. This parameter indicates whether one is set and informs the user with a “Y” for “yes” or an “N” for “no.”

**Sum Alarms:** This parameter informs the user whether a sum alarm, a contribution from multiple detectors, is set, indicated with a “Y” for “yes” or an “N” for “no.”

**# of Samples:** In walk-through mode, this number determines how many 0.2-second samples to group for each alarm calculation.

**BKG Update:** This number, adjustable from 1 to 9, adjusts how fast the background is updated while the portal is unoccupied. The BKG UPDATE number, multiplied by 18 seconds, gives the response time of the internal background accumulation.

**Attenuation:** This parameter is used in the stop-and-count mode to compensate for the shielding effect of a human body inside the portal. This parameter will vary depending on local background radiation. Typical setpoints might be 0.5% to 2.0%. To determine this parameter, find the percentage decrease in background with an average-sized person inside the portal. Alternatively, measure the percentage decrease of several different people, and then determine the average decrease. Although the shielding effect is slight, this parameter is very useful for highest sensitivity applications. If not being used, this parameter should be set to 0.0%.

**AUDIO ON (Y/N):** "Yes" enables the audio, "No" disables the audio

## RS-232 Port

The RS-232 port allows the instrument to be connected to a printer or a computer so that a record can be kept of the activity of the instrument.

**When connected to a printer** - When the instrument is first turned on, the printer will print the parameter settings. From then on, when an alarm occurs, the printer will print out the time and date, the background counts, and the number of sigma above background for all channels. See the example below.

**When connected to a computer** - The instrument will send the same data to a computer that it sends to a printer (see above).

The RS-232 port operates at 9600 baud, 8 data bits, 1 stop bit, no parity (9600,8,N,1).

An example print-out from the Model 52-1 RS-232 port after power-on is shown here:

```
LU DLUM MODEL 52-1 PORTAL
02-JAN-00 14:52
SETUP REPORT
SIGMA= 4.5
COUNT TIME=000
ALARM TIME= 015
INCOMPLETE= 010
RDA SOURCE = 500
LOW BKG= 20
HIGH BKG= 2000
ACTIVE DET: LT LB RT RB
IND. ALARM=Y
SUM ALARM= Y
# OF SAMPLES=2
BKG UPDATE=8
```

An example print-out from the Model 52-5 and the 52-5-1 RS-232 port after a complete count is shown in the following paragraphs. Note that the BKG column is expressed in counts per 0.2-second intervals, while the COUNT column is expressed in terms of sigma above background. Note also that the final line item (for “FT”) does not apply to the Model 52-1 or 52-1-1.

```
LU DLUM MODEL 52-5 PORTAL
02-JAN-00 14:53
RADIATION ALARM
SIGMA=4.5 COUNT TIME= 0
CHAN BKG COUNT ALARM
LT 78 6.2 YES
LB 85 0.0 NO
RT 72 5.0 YES
RB 81 0.0 NO
FT 45 0.8 NO
```

## Water Resistant Sleeve

In order to provide a degree of protection against rain, a water-resistant sleeve is available for the instrument. To install, simply slide the sleeve over the bottom R1 section before installing the rest of the sections. After all detector sections have been installed, stretch the sleeve over all sections. Cut a hole in the sleeve over the connector for the electronics. Slide a short piece of sleeving over the electronics, and cut a hole over that connector. Fold the sleeve over the top of the electronics, and then attach the electronics to the detector section. Proceed with operation of the instrument.

## Theory of Background Measurement

These Ludlum instruments are designed to detect very small increases in radiation above the ambient “background” radiation. The ambient background fluctuates due to variations in cosmic radiation, radon gas buildup, etc. Therefore, these instruments must constantly be aware of what the background is, in order to decide if any extra radiation is present. So, measuring the “true” background radiation level is of utmost importance to determine the baseline for setting an alarm point.

On power-up, the portal monitor takes a 60-second background count and checks to see if the counts are excessively low or excessively high. If the background counts are normal, then the instrument calculates the alarm points, and is ready to monitor personnel. For every six seconds, if no person is detected in the portal, the instrument takes the background count from three seconds prior and updates the background count. Using the three-second prior count ensures that someone walking up to the monitor or leaving the monitor is at least three seconds away. When a person is detected in the portal, the background updating



process is stopped immediately and restarted after the person leaves the portal.

One very important consideration for the background measurement process is accounting for the shielding effect of a human body. A human body inside or next to the portal actually lowers the background by several percent. This drop in background can seriously affect the alarm point, which can either increase the false alarm rate or decrease the sensitivity.

For example, suppose the alarm point is equivalent to 4% above background. A large person entering the portal might drop the background count by 5%. Therefore, if that person had radiation contamination on his clothes, the contamination would have to be at least 9% above background to trigger the alarm. Alternatively, suppose the same person is standing next to the portal when it is updating background at power-up. Next to the portal, that person might reduce background by 2.5%.

If that person leaves and a smaller person enters the portal, then the possibility for a false alarm is much higher than normal. These problems can be avoided by ensuring that people stay back at least two meters from the portal while it is updating background and by using the attenuation parameter to compensate for the attenuation of a person inside the portal. During setup, have an average-sized person stand in the portal while the initial background is calculated. Figure the average percentage change in background between unoccupied and occupied background, and use that number for the attenuation parameter.

During setup, another parameter that can be chosen that affects background is the Update Background parameter. This number, which can be set from 1 to 9, controls how fast or slow the background is updated. Background counts are averaged in order smooth out background fluctuations. The time required to fully change the background is the Update Background parameter times 18 seconds. Thus you can set the Update Background parameter to vary the update time from 18 to 162 seconds.

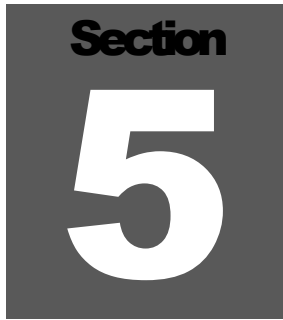
There are two modes for checking personnel with these instruments. The walk-through mode, chosen by setting the CountTime parameter to 0, allows personnel to simply walk through the portal. Checking is performed every 200 milliseconds while the portal is occupied, 600 milliseconds before, and 600 milliseconds after the portal is occupied. The stop-and-count mode, chosen by setting the CountTime parameter to a number of seconds that personnel must stand in the center of the portal, allows greater sensitivity. The stop-and-count mode also has an extended count time that extends the original count twice as long in

order to make a determination on questionable counts. For example, an original count time of two seconds may get extended another four seconds if the count during the original two seconds is not clearly less than the alarm point or clearly more than the alarm point. The requirement for extending a count time is that the count is 2.5 standard deviations above the background without being above the alarm point. (The following paragraph gives more information on standard deviations.)

The alarm parameter Sigma is the number of standard deviations above background to set the alarm point. The standard deviation is equal to the square root of the background count for the time period in question. For example, if the 200-millisecond background count is 300, the standard deviation for a 2-second count is the square root of 3000, or 54.8. How high the alarm should be set depends on the desired sensitivity and the nuisance alarm rate. Nuisance alarm rates may be found by utilizing a statistical table that details the area under the standard normal curve. An abbreviated table that shows the percentage of counts above a certain number of standard deviations is shown below:

1.0 Sigma = 15.87%	or 15.87 nuisance alarms in 100 chances
2.0 Sigma = 2.28%	or 2.28 nuisance alarms in 100 chances
3.0 Sigma = 0.13%	or 13 nuisance alarms in 10,000 chances
3.1 Sigma = 0.10%	or 1 nuisance alarms in 1,000 chances
3.7 Sigma = 0.01%	or 1 nuisance alarms in 10,000 chances
4.0 Sigma = 0.003%	or 3 nuisance alarms in 100,000 chances
5.0 Sigma = 0.00003%	or 3 nuisance alarms in 10,000,000 chances
6.0 Sigma = 0.0000001%	or 1 nuisance alarm in 1,000,000,000 chances

As can be seen from this table, nuisance alarm rates decrease rapidly as the Sigma setting increases above 3.0 Sigma. Another factor to consider is how many chances there are to alarm with each passage through the portal. In walk-through mode there are five chances to alarm every second, while in stop-and-count mode there is only one chance per passage. There is also the number of detectors and sum alarms to consider. If there are five detectors, and the individual alarms are set, then there are 25 chances to alarm every second in walk-through mode, and five chances to alarm in stop-and-count mode for each passage. Setting both individual alarms and sum alarms means there are 10 chances to alarm in stop-and-count mode, and 50 chances to alarm per second while in walk-through mode. Note the big difference between “1/1000 nuisance alarm rate” and 1 nuisance alarm per 1000 passages. It is important to account for how many chances for alarm are made per passage.

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## **Safety Considerations**

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### **Environmental Conditions for Normal Use**

Indoor or outdoor use (element weather only)

No maximum altitude

Temperature range of -20 to 50 °C (-4 to 122 °F)

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

Mains supply voltage range 85-265 Vac

Maximum transient voltage of 1500 Vac

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

Pollution Degree 3 (as defined by IEC 664)

### **Cleaning Instructions and Precautions**

The Model 52-1, 52-5, and 52-6 series of instruments may be cleaned externally with a damp cloth, using only water as the wetting agent. Do not immerse the instrument in any liquid. Observe the following precautions when cleaning:

1. Turn the instrument OFF and disconnect the instrument power cord.
2. Allow the instrument to sit for one minute before cleaning.

## Electrical Safety Precautions

### Warning!

Please follow the instructions below. If you do not, a potentially hazardous situation could develop, which could result in death or serious personal injury.

- Do not expose the unit to rain or an environment where it may be splashed by water or other liquids, as doing so may result in fire or electric shock.
- Use the unit only with the voltage specified on the unit. Using a voltage higher than that which is specified may result in fire or electric shock.
- Do not cut, kink, otherwise damage nor modify the power supply cord. In addition, avoid using the power cord in close proximity to heaters, and never place heavy objects – including the unit itself – on the power cord, as doing so may result in fire or electric shock.
- Avoid installing or mounting the unit or its power supply in unstable locations, such as a rickety table or a slanted surface. Doing so may result in the unit falling down and causing personal injury and/or property damage.

### Caution!

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.

## 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 52-1, 52-1-1, 52-5, 52-5-1, 52-6, and 52-6-1 Portable Scintillation Portal Monitors are marked with the following symbols:**



**ALTERNATING CURRENT (AC)** (IEC 417, No. 5032) - designates an input receptacle that accommodates a power cord intended for connection to AC voltages. This appears on AC panel, bottom side.



**PROTECTIVE CONDUCTOR TERMINAL** (per IEC 417, No. 5019) – designates the central grounding point for the safety ground. This symbol is visible inside the chassis.



**CAUTION** (per ISO 3864, No. B.3.1) – designates hazardous live voltage and risk of electric shock. During normal use, the stabilizer legs must be installed to avoid a tip-over of the unit. Without the stabilizer legs, a substantial impact to the front or back of the unit could cause the unit to tip and fall. This symbol appears on the side panels near the stabilizer leg attachment points. **Note the following precautions:**

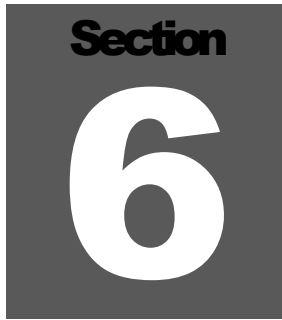
### Warning!

The operator is strongly cautioned to take the following precautions to avoid contact with internal hazardous live parts that are accessible using a tool:

1. Turn the instrument power OFF and disconnect the power cord.
2. Allow the instrument to sit for one minute before accessing internal components.



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

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## Maintenance and Recalibration

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### Maintenance

Instrument maintenance consists of keeping the instrument clean and periodically checking the calibration. The Model 52-1, 52-5, and 52-6 Series of instruments may be cleaned externally with a damp cloth, using only water as the wetting agent. Do not immerse the instrument in any liquid. Observe the following precautions when cleaning:

1. Turn instrument OFF and disconnect the instrument power cord.
2. Allow the instrument to sit for one minute before cleaning.

### Recalibration

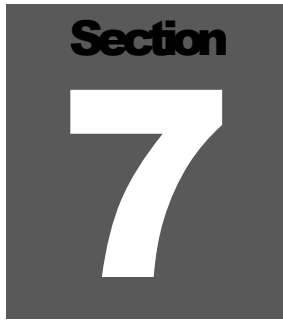
Recalibration is required after any repairs or adjustments have been made to the instrument. Recalibration is not normally required following instrument cleaning, battery replacement, or detector cable replacement.

**Note:**

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

Ludlum Measurements offers a full-service repair and calibration department. We not only repair and calibrate our own instruments, but most other manufacturers' instruments.

Calibration procedures are available upon request for customers who choose to calibrate their own instruments.

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## Checkout Procedure

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### General

These models are set for -4 mV sensitivity (pulse height) for their plastic scintillation detectors.

### Equipment Required

1. Ludlum Model 500 Pulser or equal.
2. High-impedance voltmeter for high-voltage measurements (1000 megohm)
3. 8 to 15 Vdc power supply
4. Digital counter or oscilloscope for negative-going 5 Vdc pulses

### Checkout Procedure

Checkout of the portal monitor is accomplished by determination of the pulse threshold and high voltage of each detector interface board located on each detector of the portal frame. No adjustments are possible to the threshold voltage level, which is fixed by component values. The design threshold level is -4 mV and operating high voltage is approximately 700-1200 Vdc.

Proper high-voltage setting is determined by completing a high-voltage plateau with the isotope(s) of interest. The best point of operation may be selected by calculating a figure of merit (FOM) for each high voltage point. The FOM can be defined as either the net source counts divided by the square root of the background, or as the net source counts squared divided by the background.

- Connect the cable from the Model 500 Pulser to one of the detector interface boards. Apply power to the board by supplying +12 Vdc and ground on the two-pin connector on the detector interface board.
- Attach the counter or oscilloscope to pin 1 of the Max 985 comparator (U2). Adjust pulser amplitude to approximately  $-4 \text{ mV} \pm 1 \text{ mV}$ , until pulses just appear.
- Adjust R18 until the Model 500 Pulser reads within 5% of the correct high voltage. The correct high voltage should be determined by running a voltage plateau with the detector and one or more radioactive isotopes.



# Section 8

## Recycling

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

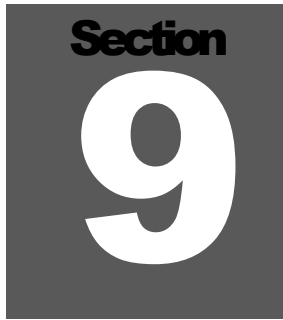
The following types of recyclable materials are present in Ludlum Measurements, Inc. electronics products, and should be recycled separately. The list is not all-inclusive, nor does it suggest that all materials are present in each piece of equipment:

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

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

The symbol appears as such:





## Parts List

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**Models 52-1, 52-1-1,  
52-4, 52-5, 52-5-1,  
52-6, and 52-6-1  
Portable  
Scintillation Portal  
Monitors**

Reference	Description	Part Number
UNIT	Completely Assembled Model 52-1 Portal Monitor	48-3172
UNIT	Completely Assembled Model 52-1-1 Portal Monitor	48-3258
UNIT	Completely Assembled Model 52-4 Portal Monitor	48-4183
UNIT	Completely Assembled Model 52-5 Portal Monitor	48-3393
UNIT	Completely Assembled Model 52-5-1 Portal Monitor	48-3571
UNIT	Completely Assembled Model 52-6 Portal Monitor	48-3611
UNIT	Completely Assembled Model 52-6-1 Portal Monitor	48-3603
BOARD	Completely Assembled Main Circuit Board	5215-340
CAPACITORS		
C1	68 $\mu$ F, 6.3V	04-5654
C2-C4	0.1 $\mu$ F, 50V	04-5663
C5	10 $\mu$ F, 25V	04-5655
C6	0.1 $\mu$ F, 50V	04-5663
C7	10 $\mu$ F, 25V	04-5655
C8	0.01 $\mu$ F, 50V	04-5664
C9	27pF, 100V	04-5658
C10	0.01 $\mu$ F, 50V	04-5664
C11	10 $\mu$ F, 25V	04-5655
C12	27pF, 100V	04-5658

**Main Board,  
Drawing 215 x  
342-342E**

	Reference	Description	Part Number
	C13-C14	0.01 $\mu$ F, 50V	04-5664
	C15	10 $\mu$ F, 25V	04-5655
	C16-C18	0.01 $\mu$ F, 50V	04-5664
	C21	0.1 $\mu$ F, 50V	04-5663
	C22	0.01 $\mu$ F, 50V	04-5664
	C24	0.01 $\mu$ F, 50V	04-5664
	C25	10pF, 100V	04-5673
	C26-C28	0.01 $\mu$ F, 50V	04-5664
	C29-C34	1 $\mu$ F, 35V	04-5656
TRANSISTORS			
	Q1-Q5	2N7002L	05-5840
	Q6	MMBT4403LT1	05-5842
	Q7	2N7002L	05-5840
	Q9	2N7002L	05-5840
	Q11-Q21	2N7002L	05-5840
INTEGRATED CIRCUITS			
	U1	CD74HC138M	06-6339
	U2	PCF8593TD	06-6403
	U3	CD74HC00M	06-6308
	U4	MAX232D	06-6382
	U5	27C512-15N DIP28	06-6264
	U6	HM62256ALP-10SL	06-6301
	U7	ICL7660SCBA	06-6437
	U8	24C65ISM	06-6401
	U9	N80C51FA	06-6332
	U10	CD74HC573M	06-6298
	U11	PCF8574TD	06-6402
	U15-U16	N82C54	06-6309
	U17	TLC372ID	06-6290
	U18	PCF8574TD	06-6402
	U19-U20	TLC372ID	06-6290
DIODES			
	CR1	MMBD914LT1	07-6353
	CR2-CR3	CMPD2004S	07-6402
	CR4-CR6	MMBD914LT1	07-6353
	CR7-CR12	CMPD2004S	07-6402

	Reference	Description	Part Number
RESISTORS	R1	5k TRIMMER	09-6918
	R2	4.75k	12-7858
	R3-R4	1.5 OHM	12-7602
	R7	8.25k	12-7838
	R8	4.75k	12-7858
	R9	10k	12-7839
	R10	1k	12-7832
	R12-R13	10k	12-7839
	R14	100k	12-7834
	R23	100k	12-7834
	R24-R29	2.21k	12-7835
	R32-R37	1k	12-7832
	RESISTOR NETWORK	RN1	NETWORK-220k
RN2		NETWORK-22k	12-7917
RN3		NETWORK-220k	12-7923
RN4		NETWORK-4.7k	12-7918
CRYSTALS	Y1	6.144MHZ	01-5262
	Y2	32.768Khz	01-5305
INDUCTORS	L1-L6	470 $\mu$ H	21-9699
CONNECTORS	P1-P2	640456-5 MTA 100	13-8057
	P3-P4	640456-3 MTA 100	13-8081
	P5	640456-2 MTA 100	13-8073
	P6	1-640456-6	13-8134
	P7	640445-3 MTA 156	13-8125
	P8	640456-7 MTA 100	13-8115
	P9	640456-2 MTA 100	13-8073
	P10	1-640456-0 MTA 100	13-8066
	P17-P18	640456-2 MTA 100	13-8073
	P19	1-640456-1 MTA 100	13-8059
	P20-P22	640456-2 MTA 100	13-8073
MISCELLANEOUS	B1	BATT-3V LITHIUM	22-9986

	Reference	Description	Part Number	
<b>Detector Interface Board, Drawing 215 x 347</b>	BOARD	Completely Assembled Detector Interface Board	5215-347	
CAPACITORS	C1	10 $\mu$ F, 25V	04-5655	
	C2	4.7 $\mu$ F, 25V	04-5653	
	C3	0.001 $\mu$ F, 100V	04-5659	
	C4	10 $\mu$ F, 25V	04-5655	
	C5	47 $\mu$ F, 10V	04-5666	
	C6	0.001 $\mu$ F, 10V	04-5659	
	C7	0.01 $\mu$ F, 50V	04-5664	
	C8	1 $\mu$ F, 35V	04-5656	
	C9-C10	0.01 $\mu$ F, 50V	04-5664	
	C11	0.001 $\mu$ F, 2kV	04-5703	
	C12	10 pF, 100V	04-5673	
	C13	0.01 $\mu$ F, 50V	04-5664	
	C14	0.01 $\mu$ F, 2KV	04-5722	
	C15	47 pF, 100V	04-5660	
	C16	10 $\mu$ F, 25V	04-5655	
	C17	0.01 $\mu$ F, 2kV	04-5722	
	C18-C22	0.001 $\mu$ F, 2kV	04-5703	
	C23-C27	0.01 $\mu$ F, 500V	04-5696	
	DIODES	CR1	CMSH1-40M	07-6411
		CR2-CR8	CNOD2004S	07-6402
TRANSISTORS	Q1	MTD2N50E	05-5855	
RESISTORS	R1-R4	150 OHM	12-7965	
	R5-R6	47.5 OHM	12-7966	
	R7	100k	12-7834	
	R8	1.82k	12-7030	
	R9	10k	12-7839	
	R10	4.75k	12-7858	
	R11	100 OHM	12-7840	
	R12	1k	12-7832	
	R13-R15	10k	12-7839	
	R16	4.75k	12-7858	

	Reference	Description	Part Number
	R17	392k	12-7841
	R18	1 M TRMR	09-6911
	R19-R20	1 M	12-7844
	R21	1 G	12-7686
	R23	1 M	12-7844
INTEGRATED CIRCUITS			
	U1	ICL7667CBA	06-6510
	U2	MAX985EUK-T	06-6459
	U3	CA3096M	06-6288
	U4	MAX641ACSA-5	06-6388
VOLTAGE REGULATOR			
	VR1	LT1460KCS3-2.5TR	05-5867
	VR2	LM78L05ACM	05-5864
INDUCTORS			
	L1-L2	470 $\mu$ H	21-9224
CONNECTORS			
	P20	640456-2 MTA-100	13-8073
	P34	640456-2 MTA-100	13-8073
	W1	COAXIAL CONNECTOR	21-9463
LEDs			
	DS1	LED-SML-LX1206SRC-TR RED 1206	07-6648
<b>Power Supply, Drawing 215 x 1072</b>	BOARD	Completely Assembled Power Supply	5215-1071
CAPACITORS			
	C1-C5	68 $\mu$ F, 25V	04-5828
	C6-C7	0.1 $\mu$ F, 100V	04-5792
	C8	100pF, 100V	04-5661
INTEGRATED CIRCUITS			
	U1	LT1304CS8	06-6434
	U3	MAX1771	06-6845
DIODES			
	CR1-CR5	CMSH1-40M	07-6411
	CR6	SSA34-E3/61T	07-6610
	CR7-CR10	CMSH1-40M	07-6411

	Reference	Description	Part Number
TRANSISTORS	Q1	FDS6612A	05-5742
RESISTORS	R1	499k, 250mW	12-7037
	R2	365k, 250mW	12-7049
	R3	499k, 250mW	12-7037
	R4	22k, 100mW	12-7179
	R5-R6	1.5Ohm, 3W	12-7602
	R7	499k, 250mW	12-7037
	R8	86.6k, 250mW	12-8275
	R9	0.04Ohm, 1W	12-8276
INDUCTORS	L1-L2	22 $\mu$ H	21-9208
CONVERTER	VR1	OKI-78SR-5	21-8637
CONNECTORS	P1	640456-6 MTA100X6	13-8095
	P15	640456-5 MTA100X5	13-8057
	P16	640456-2 MTA100X2	13-8073
	P33	640445-2 MTA156X2	13-8098
<b>1 1/8 inch Voltage Divider, Drawing 435 x 435</b>	BOARD	Completely Assembled Voltage Divider	5435-182
CAPACITORS	C1-C3	0.01 $\mu$ F, 200V	04-5725
	C4	0.0047 $\mu$ F, 3KV	04-5547
RESISTORS	R1	10M, 1/8W, 1%	12-7996
	R2	7.5M, 1/8W, 5%	12-7971
	R3-R10	10M, 1/8W, 1%	12-7996
	R11	2.21M, 1/8W, 1%	12-7002
	R12-R13	6.04M, 1/8W, 1%	12-7071

**Resistor Board,  
Drawing 215 x 782**

	Reference	Description	Part Number
	BOARD	Completely Assembled Model 52-1 Resistor Board	5215-781
CAPACITORS	C1-C3	0.1 $\mu$ F, 25V	04-5744
RESISTORS	R1	332 OHM	12-7854
	R3-R4	150 OHM	12-7062
	R5-R12	332 OHM	12-7854

CONNECTORS

	Reference	Description	Part Number
	P100	640456-2 MTA-100	13-8073
	P101	640456-7 MTA-100	13-8115
	P102	640456-4 MTA-100	13-8088
	P103	640456-6 MTA-100	13-8095
	P104-P105	640456-2 MTA-100	13-8073
	P106	640456-5 MTA-100	13-8057
	P107	640456-4 MTA-100	13-8088
	P108	640456-7 MTA-100	13-8115

**Wiring Diagram,  
Drawing 215 x 1044**

CONNECTORS

	S1	DM62J12S205PQ	08-6715
	J12	L712AS	21-8795
	J29	RM12BRD-3PH(71)3PM	13-8546
	J31	RS-232 9-PIN "D"	13-8556
	J38	IR RECEIVER	2310737
	J40	IR TRANSMITTER	2310738

MISCELLANEOUS

	B1-B6	BATTERY – "D"	21-9313
	FP5	MEMBRANE SWITCH KEYPAD	7215-779
	SP1	ALARM-TXC-V86-515-Q 5-15VDC XLOUD	21-8802

**Miscellaneous  
Parts**

	Model 52-1 12 Vdc Car Power Cable	8515-819
	Model 52-1 +12V Wall Transformer Cable	8303-1029



A dark gray square with the word "Section" in white at the top and the number "10" in large white font below it.

## Drawings

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### Front of Manual

Front Panel, Drawing 215 x 999

AC Panel Assembly, Drawing 215 x 999A

### Back of Manual

#### **Boards and Wiring Diagram**

Main Board, Drawing (6 sheets), 215 x 342-342E

Main Board Layout, Drawing 215 x 343

Detector Interface Board, Drawing 215 x 347

Detector Interface Board Layout, Drawing 215 x 348A

Power Supply Board, Drawing 215 x 1071

Power Supply Board Layout, Drawing 215 x 1072

1 1/8 inch Voltage Divider, Drawing 435 x 435

1 1/8 inch Voltage Divider Component Layout, Drawing (2 sheets)  
435 x 436A

Resistor Board, Drawing 215 x 782

Resistor Board Layout, Drawing 215 x 781A (2 sheets)

Wiring Diagram-Electronics, Drawing 215 x 1044 (2 sheets)

#### **Assembly and Setup**

Model 52-1 & 52-5 Series Packing Instructions, Drawing 215 x 225C

Model 52-6 Series Packing Instructions, Drawing 215 x 633B

Model 52-1 & 52-5 Series Overall Assembly, Drawing 215 x 225A

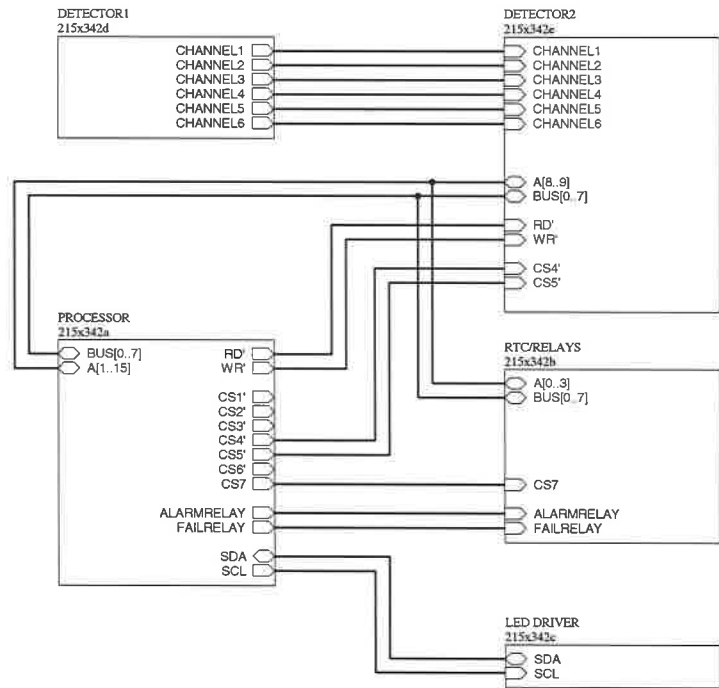
Model 52-6 Overall Assembly Drawing 215 x 633A

Model 52-1 & 52-5 Series Dimensions, Drawing 215 x 225

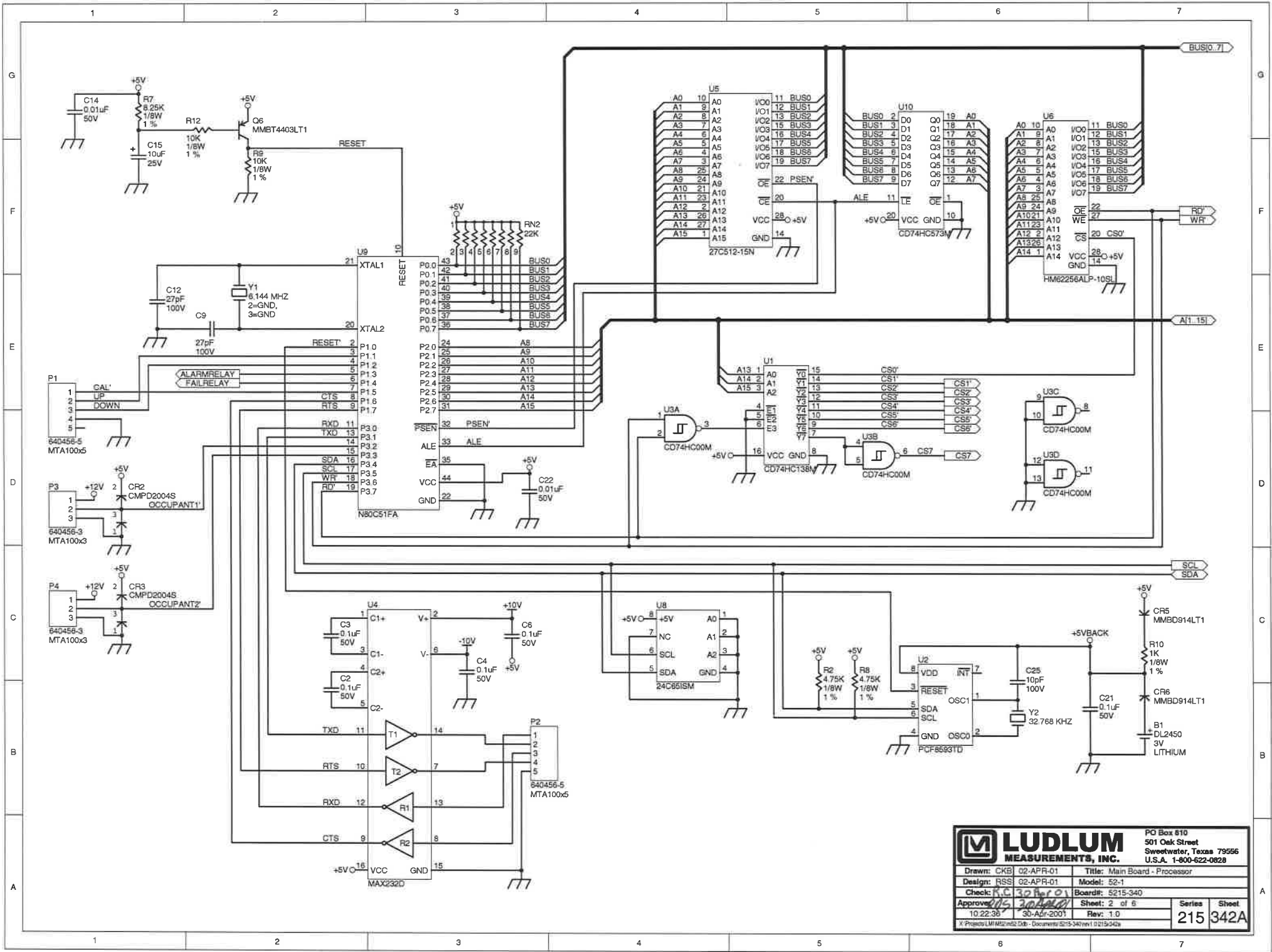
Model 52-6 Series Dimensions, Drawing 215 x 633

Car Base Assembly, Drawings 215 x 332 & 332A

Car Base Setup, Drawing 215 x 374 & 374B



		PO Box 810 501 Oak Street Sweetwater, Texas 79556 U.S.A. 1-800-622-0628	
Drawn: CKB	02-APR-01	Title: Main Board	
Design: RSS	02-APR-01	Model: 52-1	
Check: K.C. 308	01	Board#: 5215-340	
Approved: [Signature]	10-29-01	Sheet: 1 of 8	Series
	30-Apr-2001	Rev: 1.0	Sheet
X:\Project\LM\MS2.m2\Doc - Documents\215-340\rev1.0\MASTER SHEET		215	342

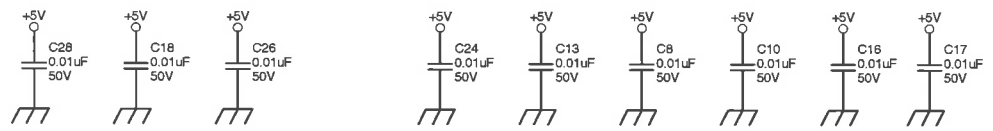
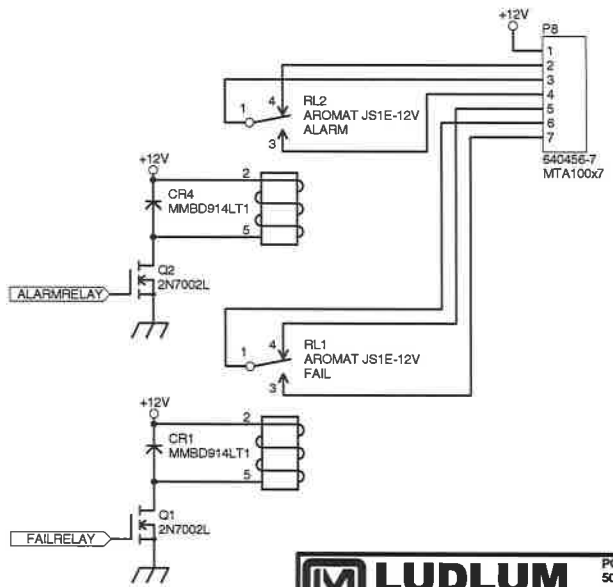
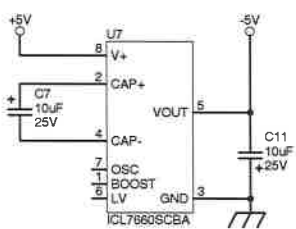
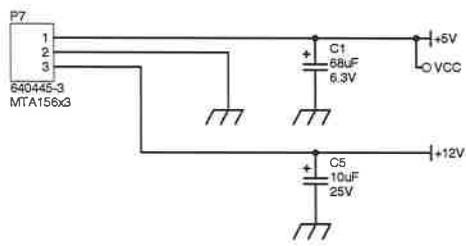
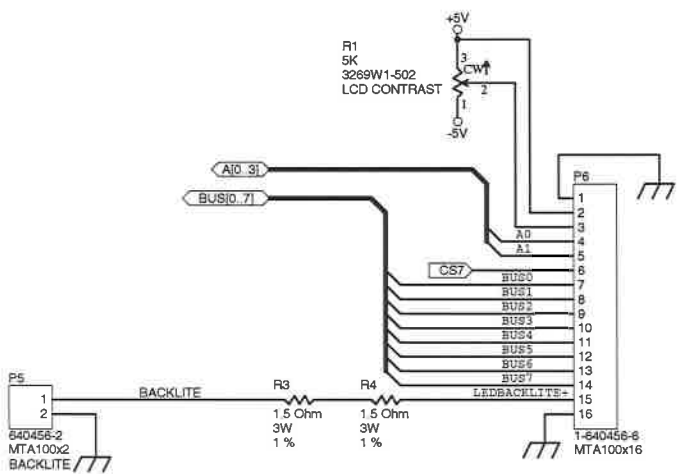


**LUDLUM MEASUREMENTS, INC.**

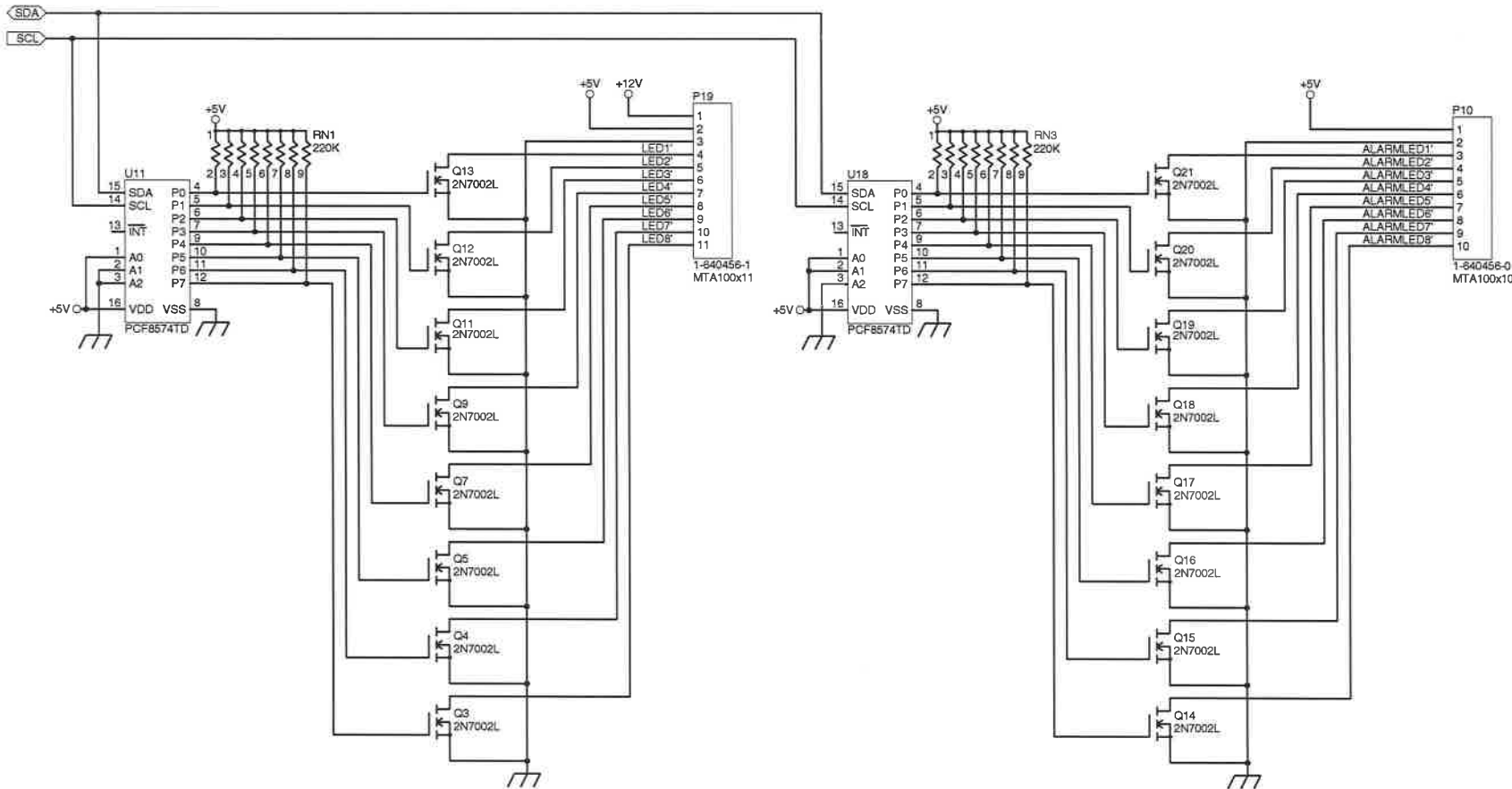
PO Box 610  
501 Oak Street  
Sweetwater, Texas 79556  
U.S.A. 1-800-622-0828

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Design: RSS	02-APR-01	Model: 52-1
Check: <i>R.C. 3/28/01</i>		Board#: 5215-340
Approved: <i>[Signature]</i>		Sheet: 2 of 6
10.22.38	30-Apr-2001	Rev: 1.0
		Series
		Sheet
		<b>215 342A</b>

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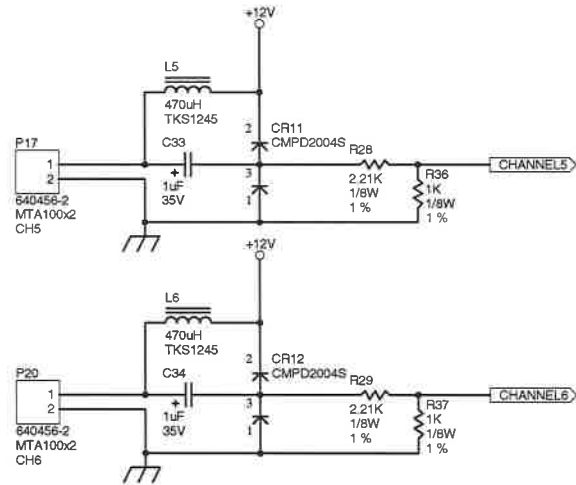
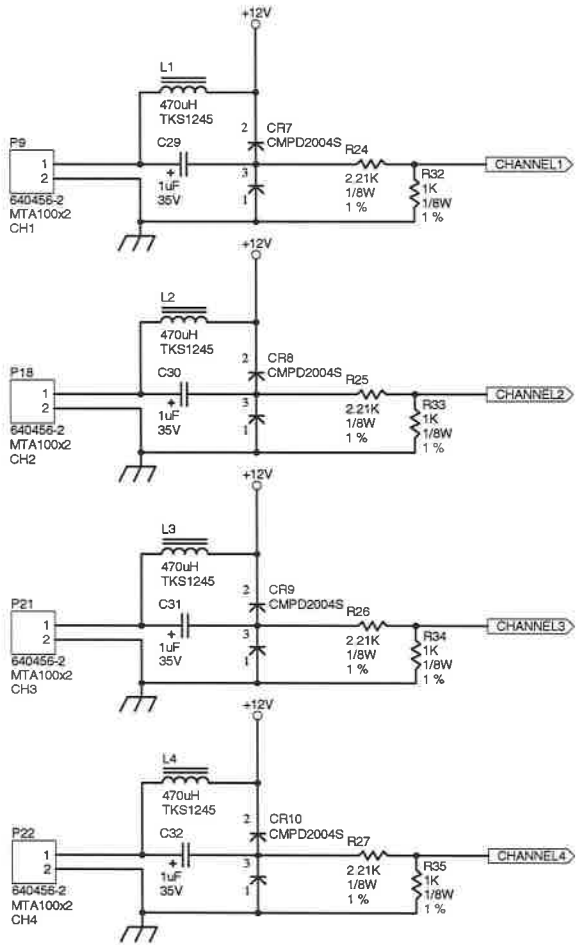


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		Drawn: CKB 02-APR-01 Design: RSS 02-APR-01 Check: <i>[Signature]</i> 5-4-01 Approve: <i>[Signature]</i> 8-May-01 11:38:22	Title: Main Board - RTC, Relays, Power Model: 52-1 Board#: 5215-340 Sheet: 3 of 8 Rev: 1.0 8-May-2001
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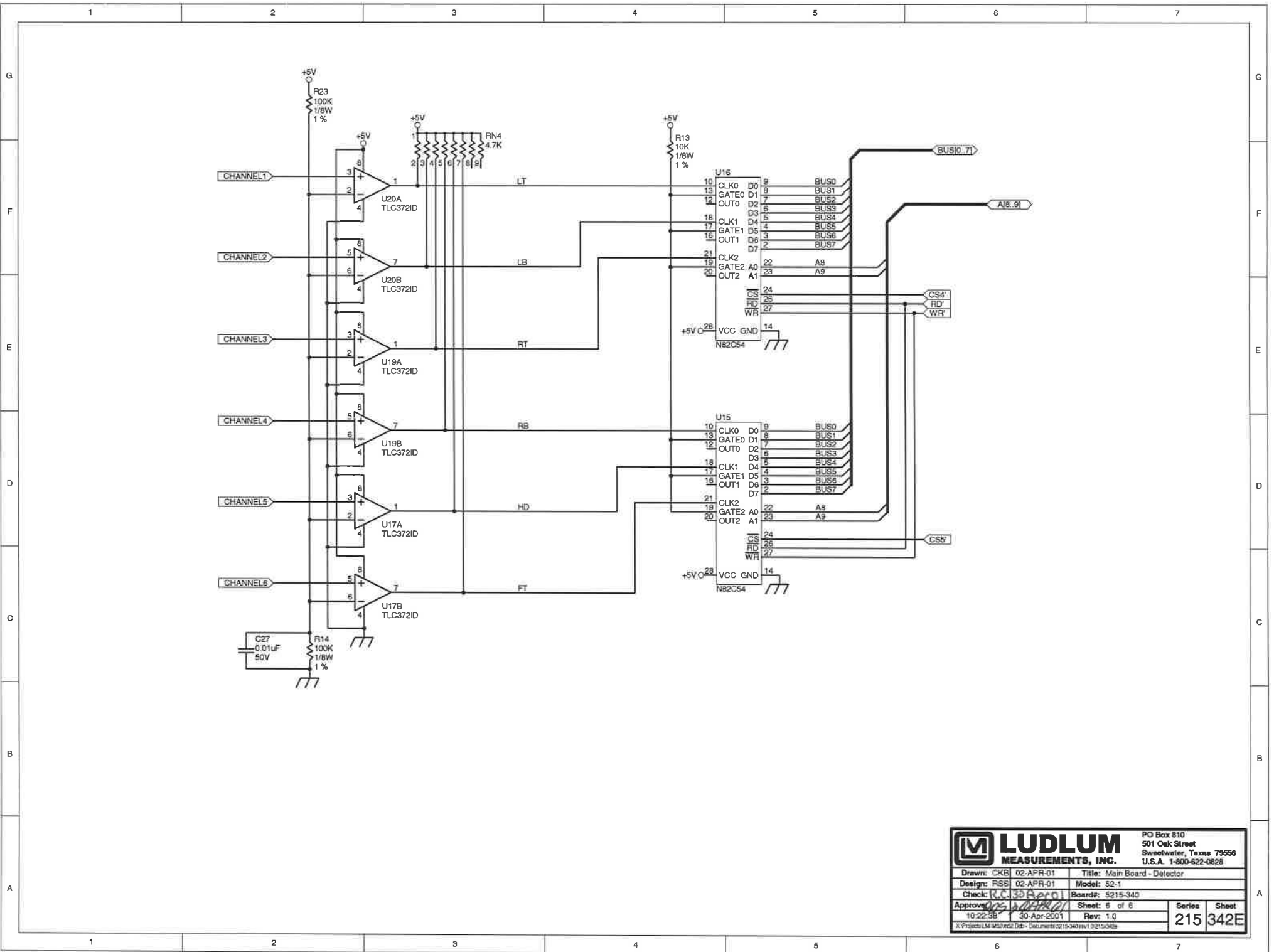
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X:\Projects\LM1982\m22.Dbl - Documents\5215-340\rev1.0215342c



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MEASUREMENTS, INC.		501 Oak Street	
		Sweetwater, Texas 79556	
		U.S.A. 1-800-622-0828	
Drawn: CKB	02-APR-01	Title: MAIN BOARD - DETECTOR INPUT	
Design: RSS	02-APR-01	Model: 52-1	
Check: <i>RW</i>	5-9-01	Board: 5215-340	
Approve: <i>RW</i>	7-May-2001	Sheet: 5 of 6	Series
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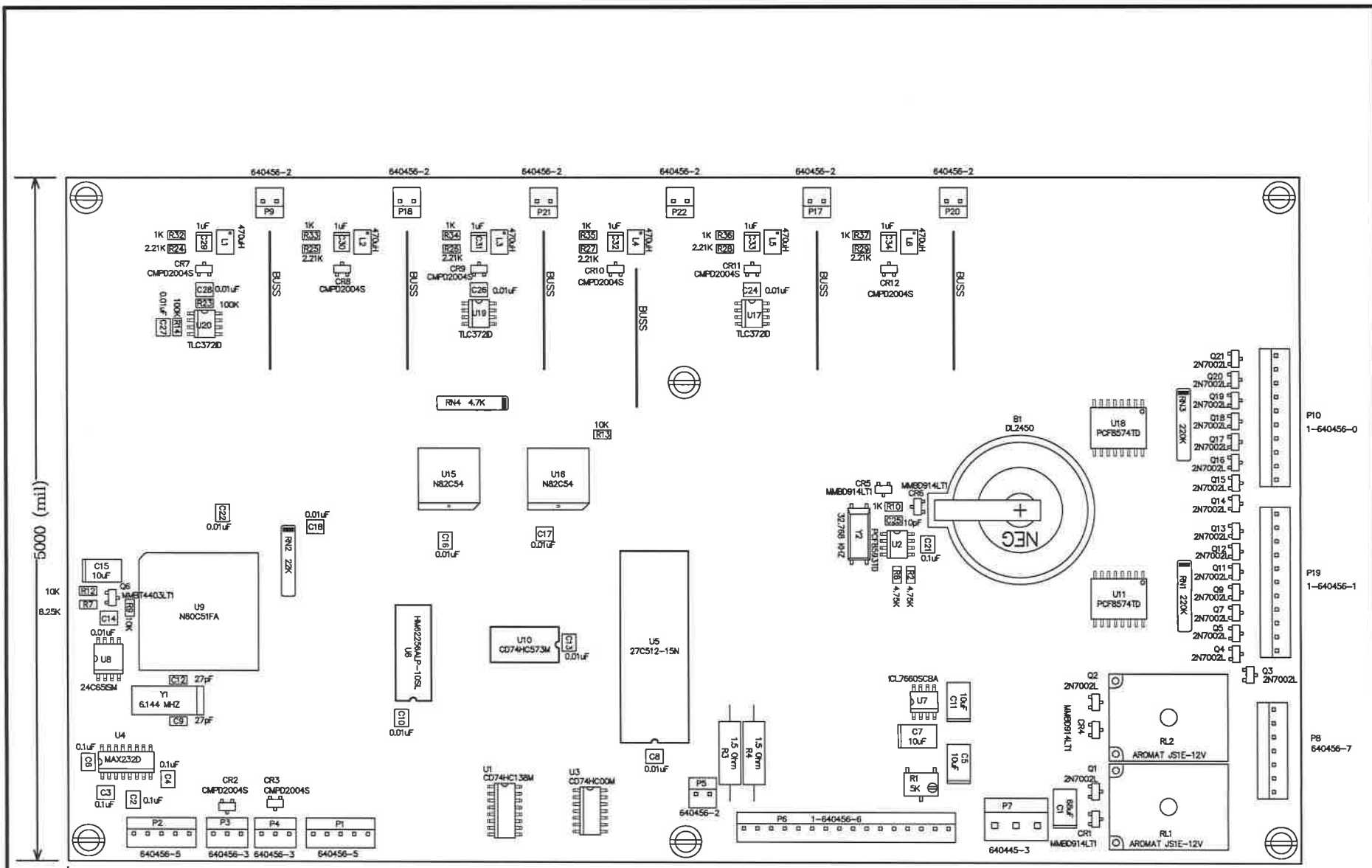
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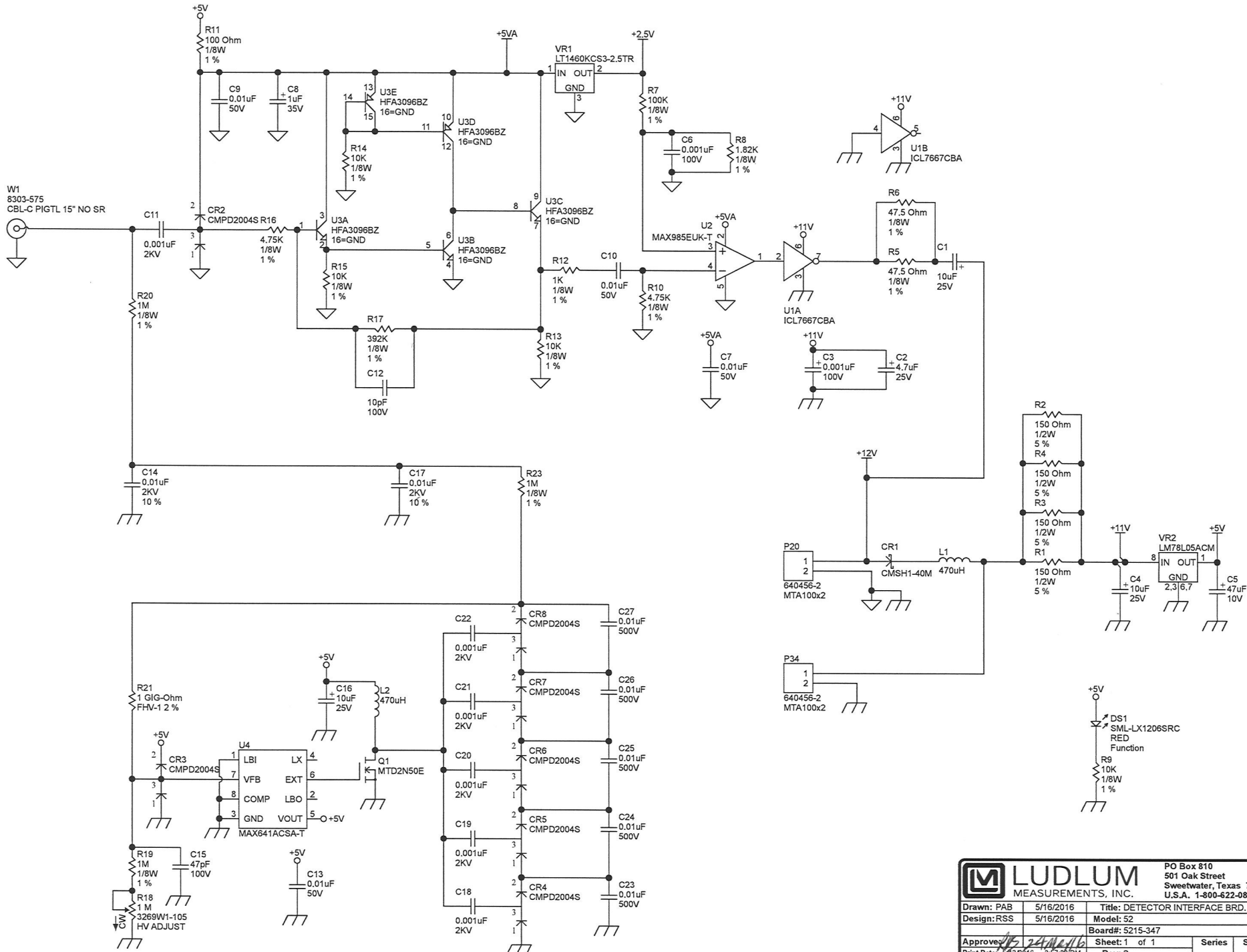
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Approve: <i>[Signature]</i>	10-22-98	30-Apr-2001	Sheet: 6 of 6	Series	Sheet
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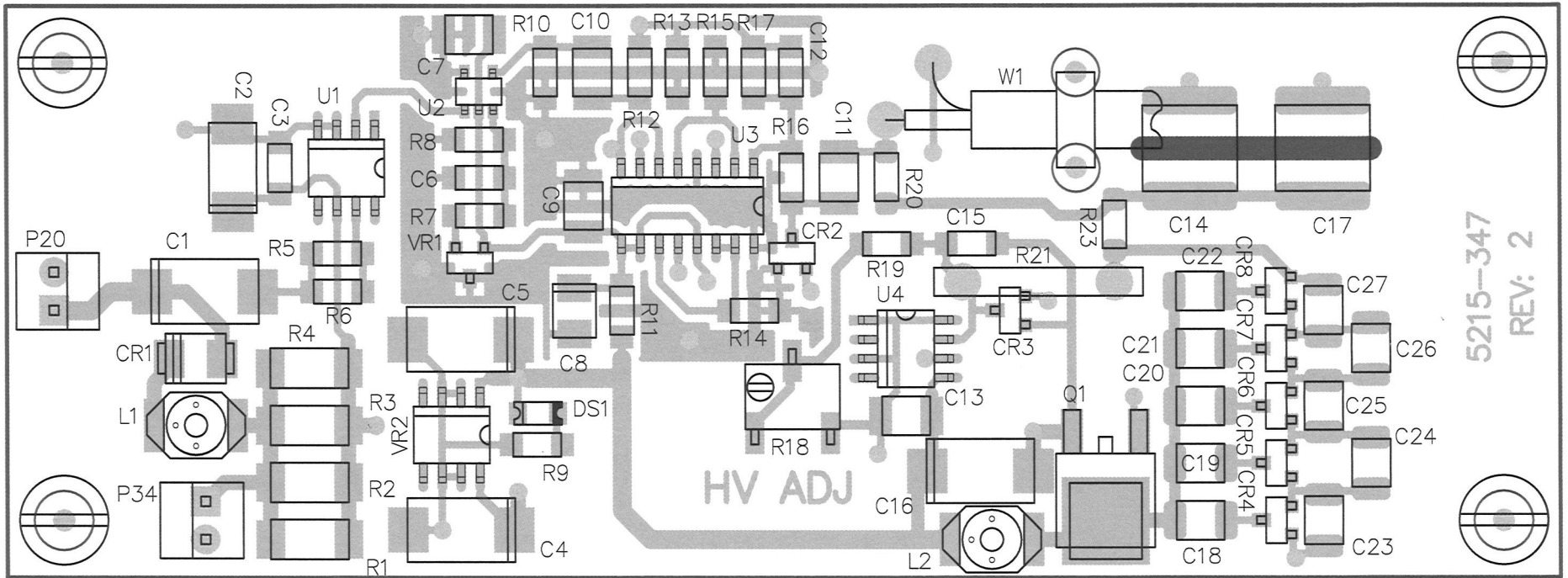





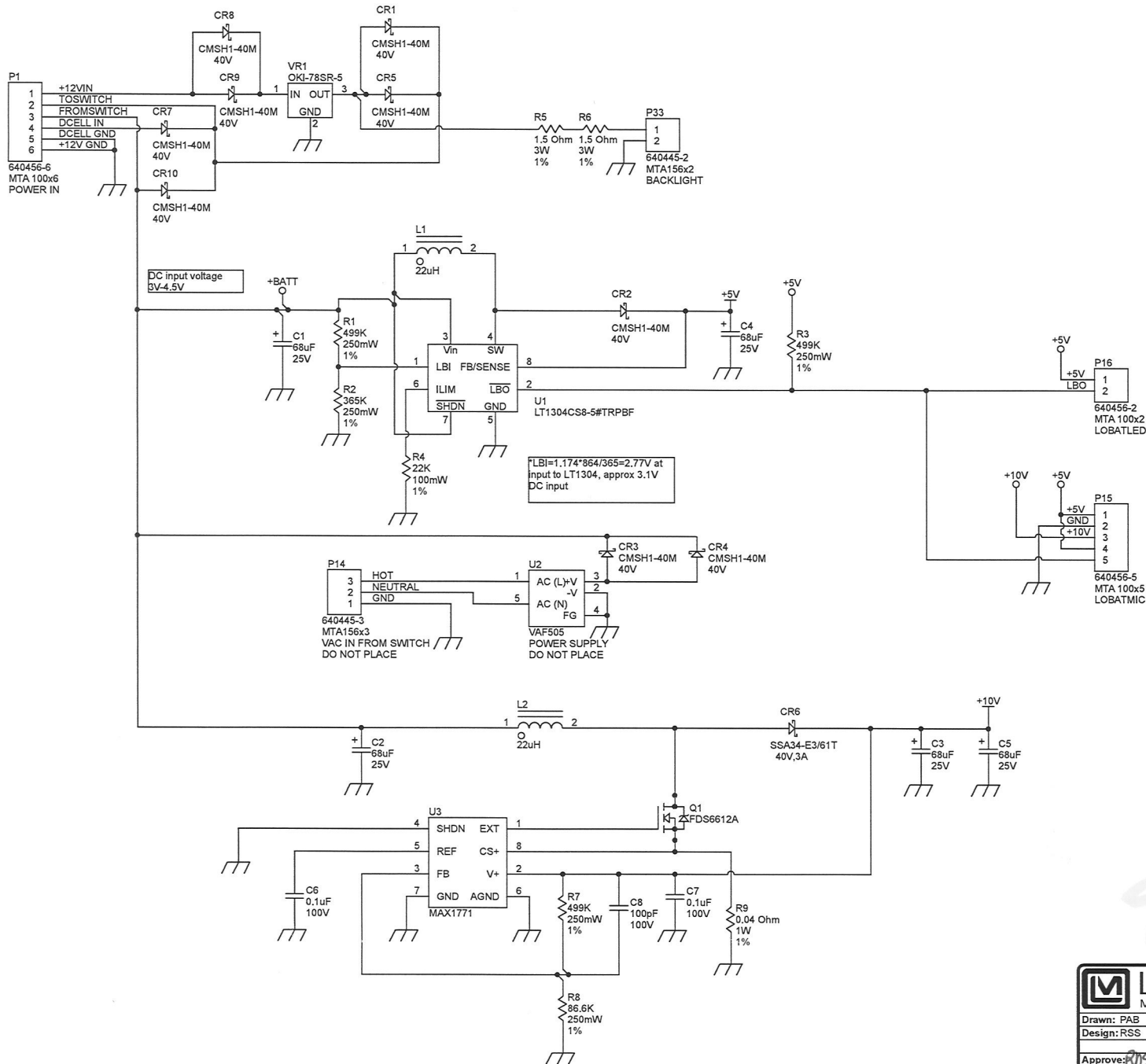
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Approve:	<i>RDS</i>	<i>8May01</i>	Board#: 5215-340		
Layer:	Top Overlay		Rev: 1.0	Series	
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Mech.3	16:49:25	7-May-2001			
Mech.4					



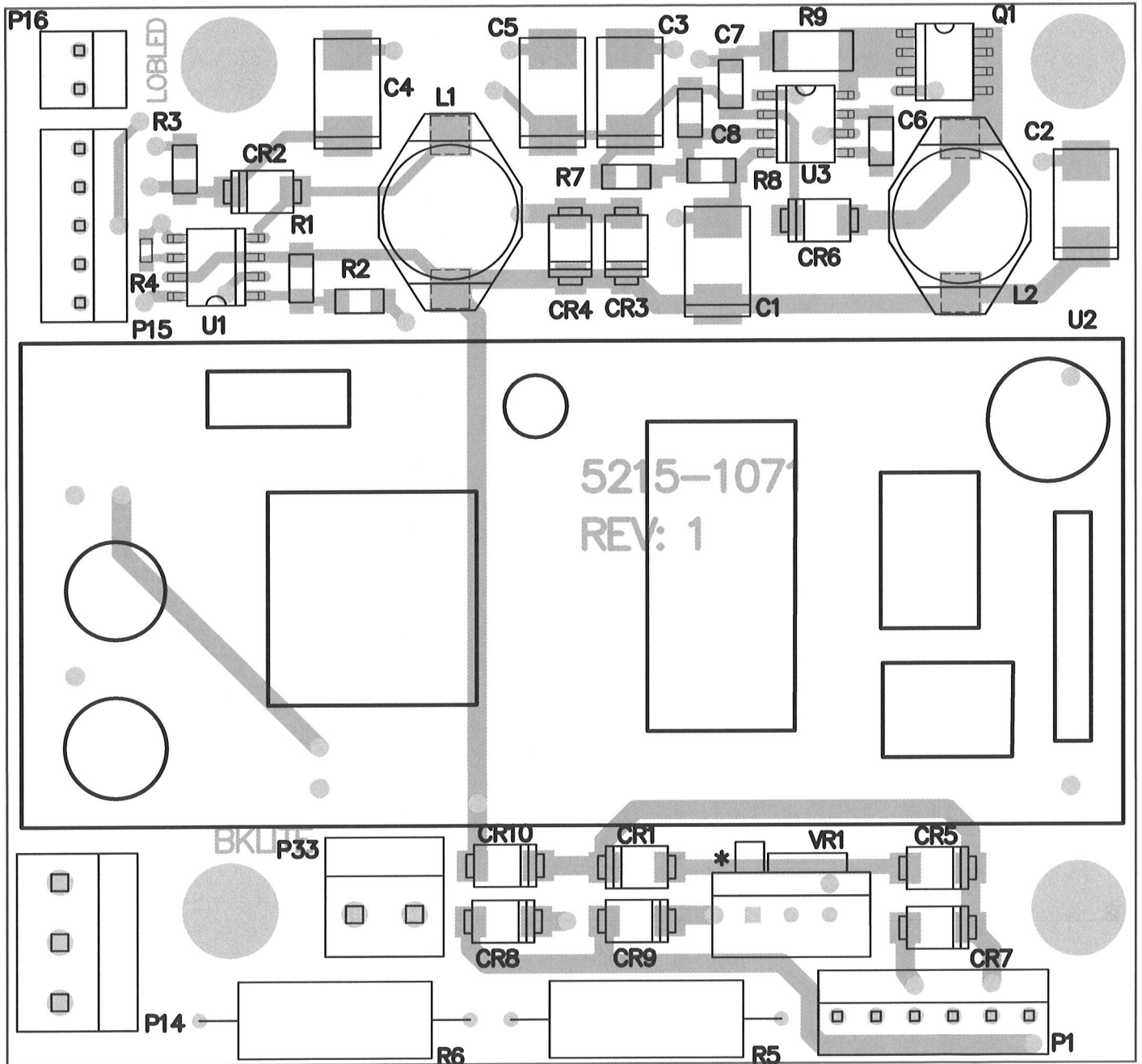
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 <b>LUDLUM MEASUREMENTS, INC.</b>		PO Box 810 501 Oak Street Sweetwater, TX 79556 U.S.A. 1-800-622-0828		
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Design: RSS	5/16/2016	Board#: 5215-347		
Approve: <i>[Signature]</i>		Rev: 2		
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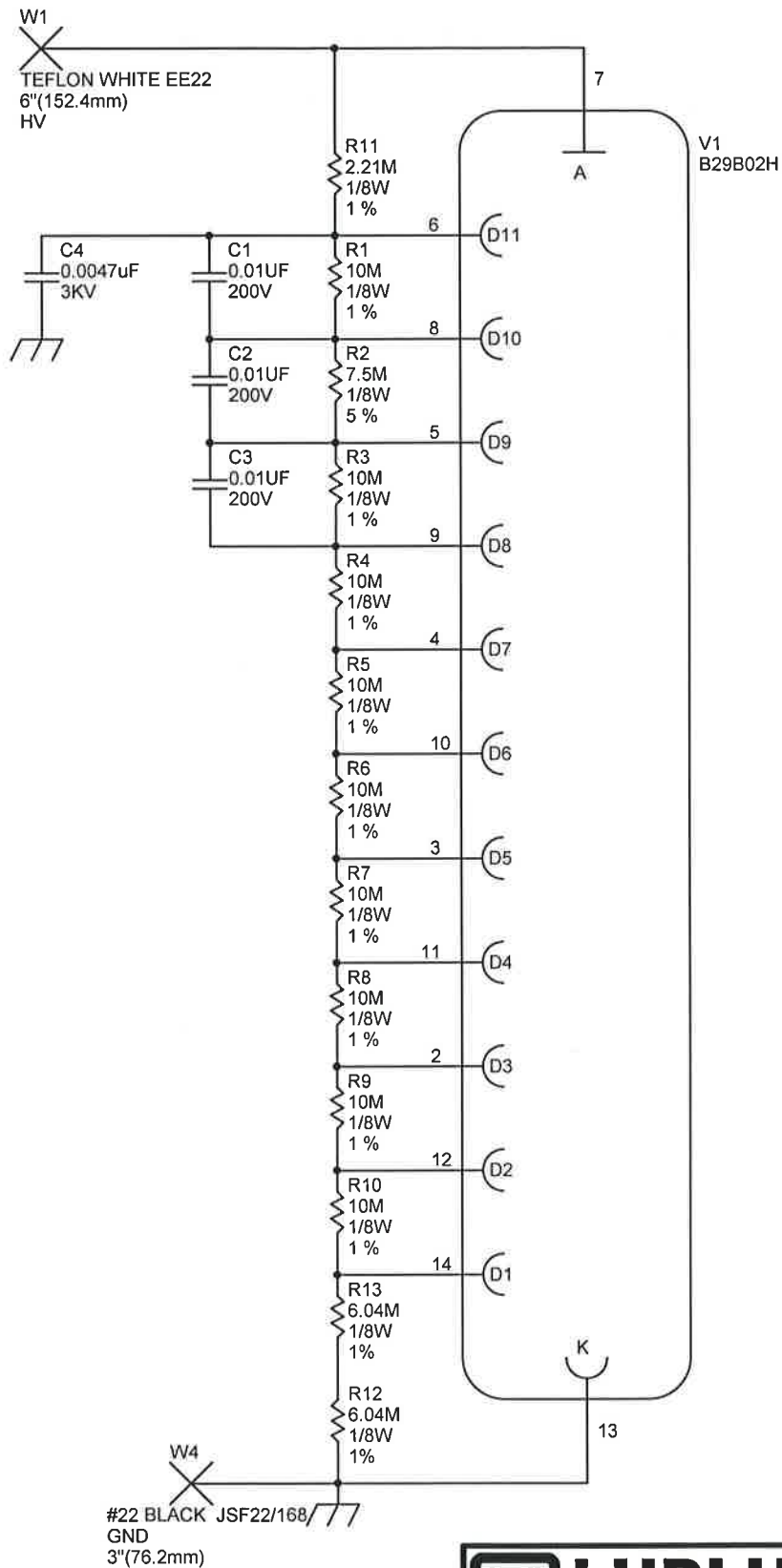
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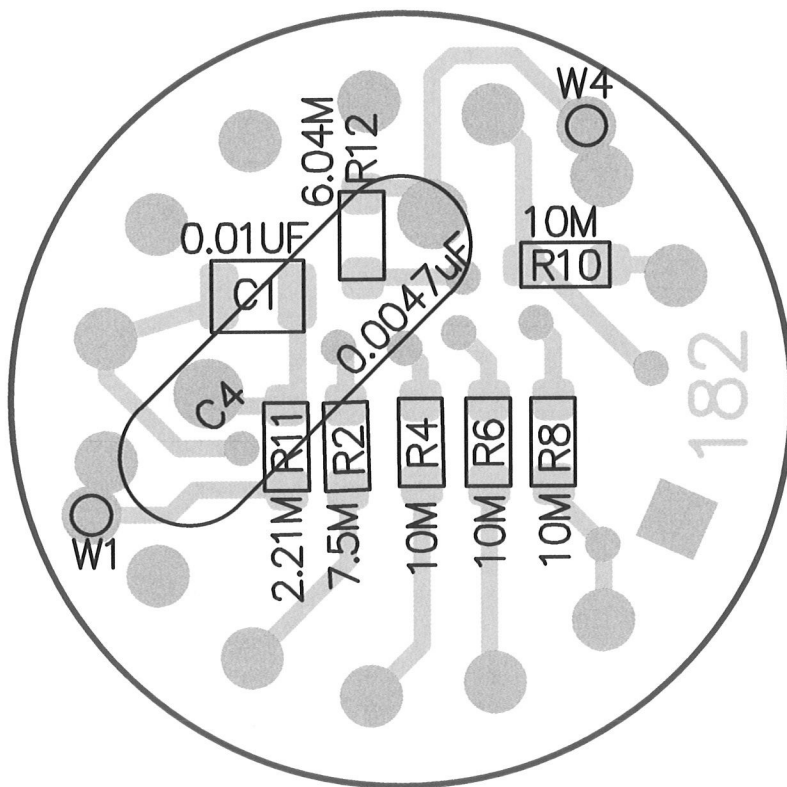
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Approve: <i>RDS</i>	<i>22 Sep 17</i>	Rev: 1	
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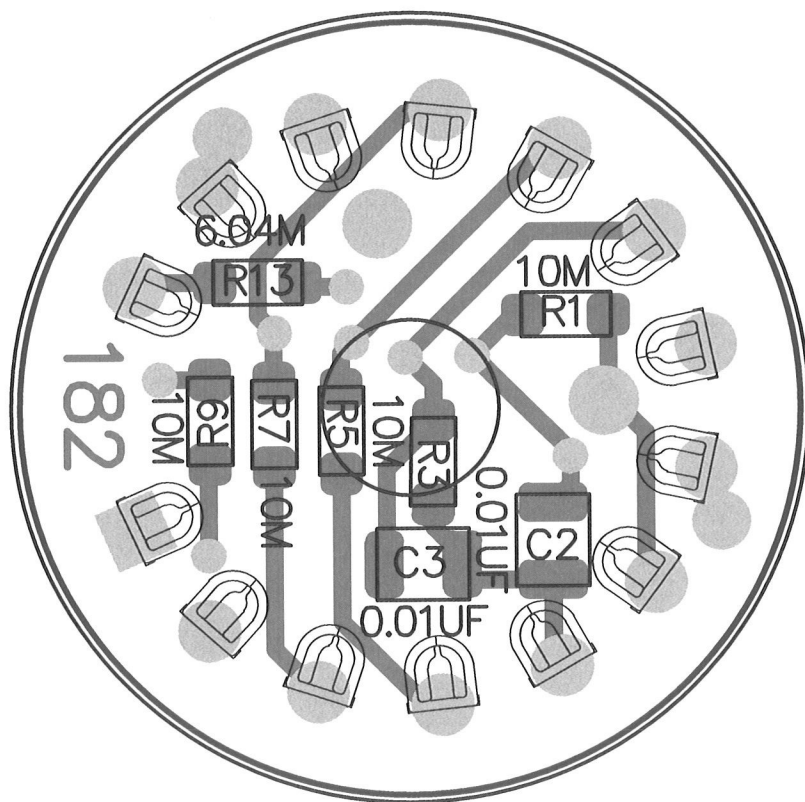



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Design: RSS	08-Jan-03	Model: M53 / M4500	
		Board#: 5435-182	
Approve: <i>JSS</i>	10:33:24	Sheet: 1 of 1	Series: 435
	22-Oct-2010	Rev: 1.0	Sheet: 435
435x435			

V1  
B29B02H



		PO Box 810 501 Oak Street Sweetwater, TX 79556 U.S.A. 1-800-622-0828	
		Title: 1 1/8" VOLTAGE DIVIDER	
Drawn: PAB	1/27/2014	Model: B29B10H	
Design: LL	3/24/2003	Board#: 5435-182	
Approve: <i>RL</i>	<i>2/20/14</i>	Rev: 2	
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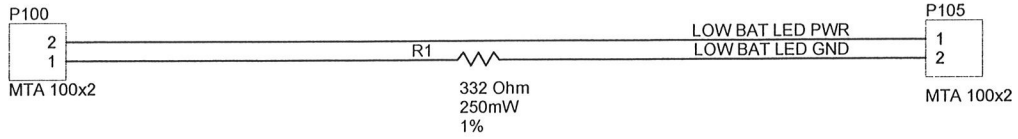


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		<b>Title:</b> 1 1/8" VOLTAGE DIVIDER	
<b>Drawn:</b> PAB	1/27/2014	<b>Model:</b> B29B10H	
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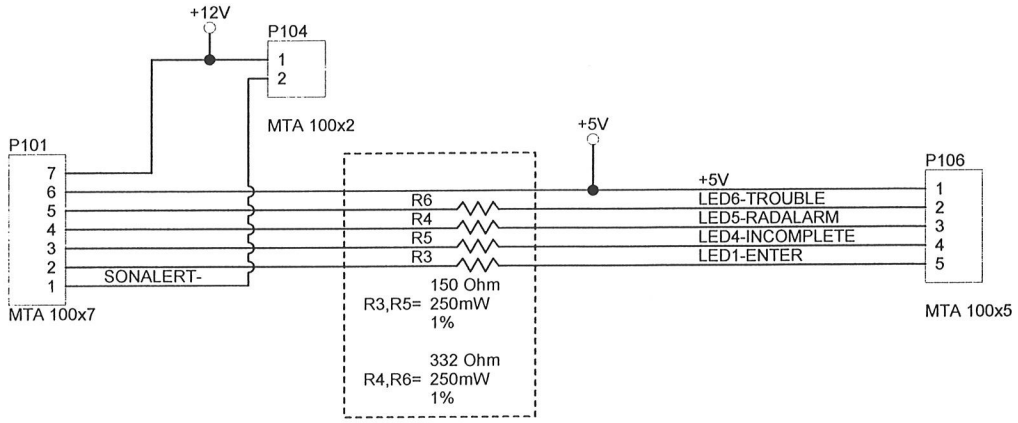
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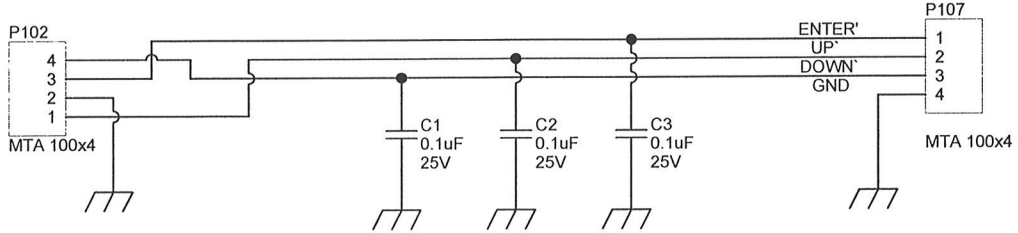
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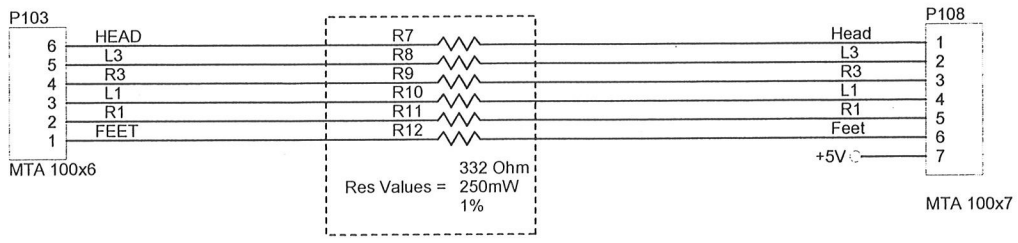
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D

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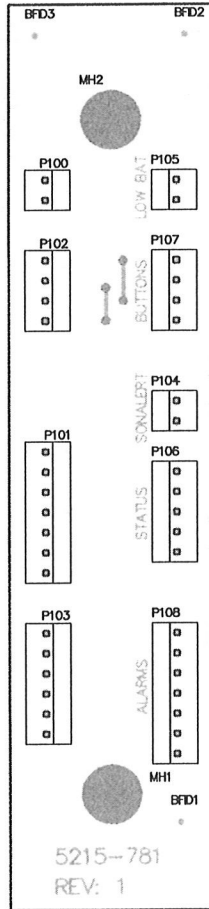
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MH2  
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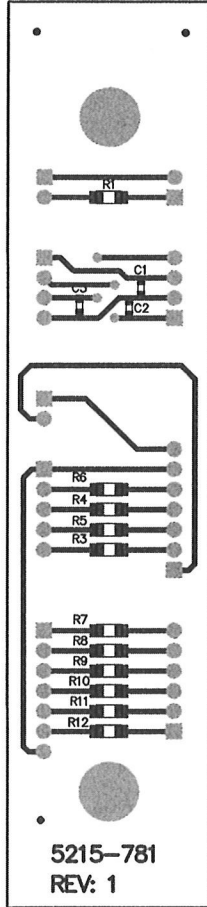
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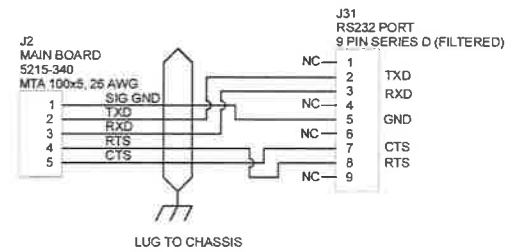
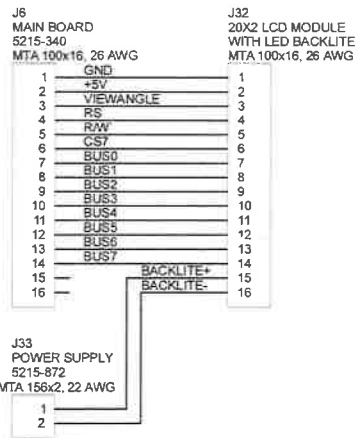
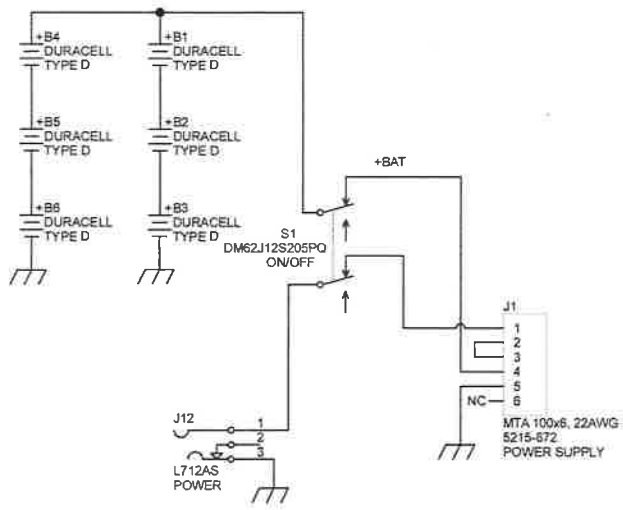
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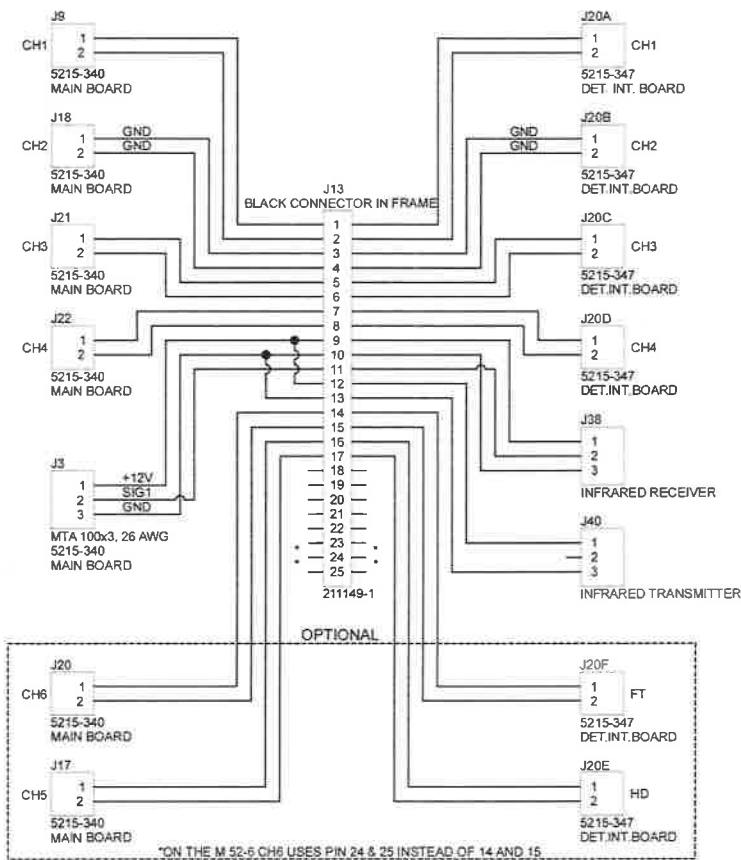
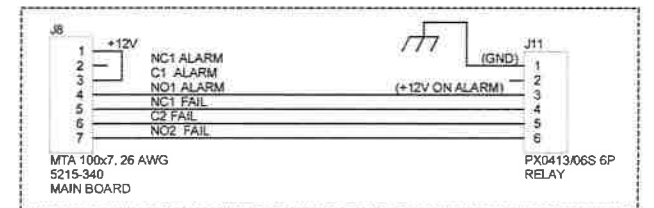
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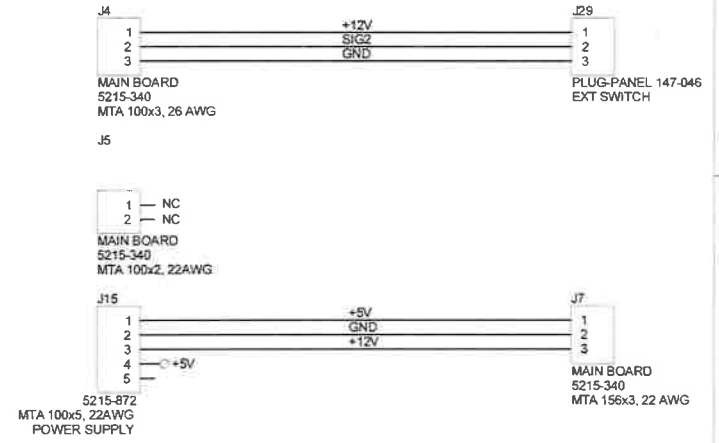
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MODIFICATION FOR 4215-440  
REMOTE ALARM BOX



\*ON THE M 52-5 CH6 USES PIN 24 & 25 INSTEAD OF 14 AND 15



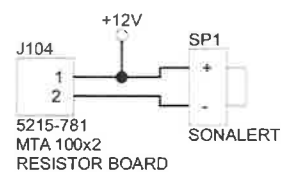
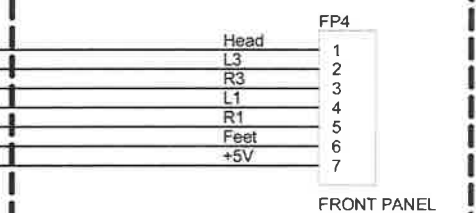
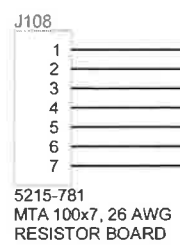
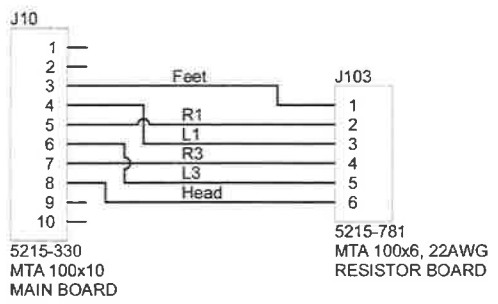
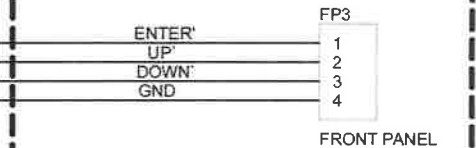
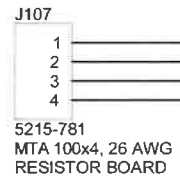
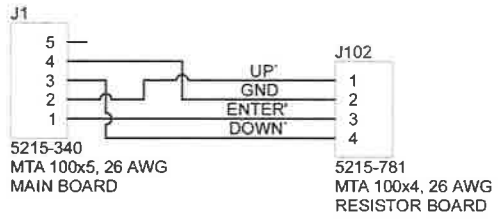
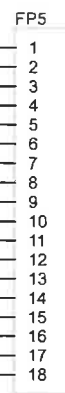
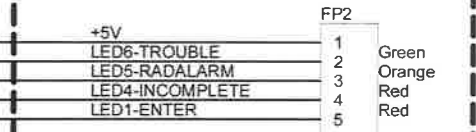
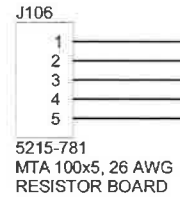
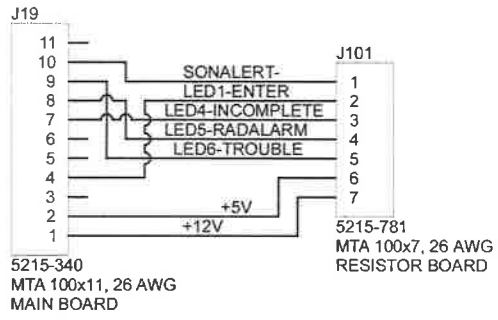
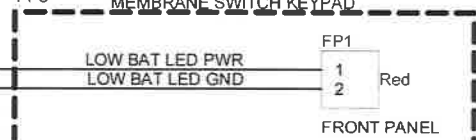
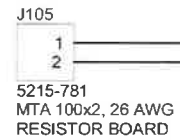
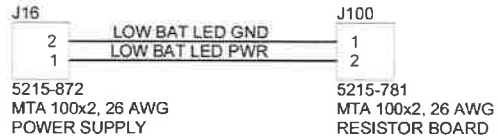
		PO Box 810 501 Oak Street Sweetwater, Texas 79556 U.S.A. 1-800-622-0828	
		Drawn: PAB 3/3/2017	Title: Wiring Diagram
Design: RSS 3/3/2017	Model: 52-1 52-1-1 52-5 (2017)	Board#: 215-1044	Sheet: 1 of 2
Approve:	Rev: 1	Series	Sheet
Print Date: 2/2/2021 3:33:22 PM	Rev: 1	215	1044

1 2 3 4 5

52-1 FRONT PANEL

7215-779

MEMBRANE SWITCH KEYPAD



		PO Box 810 501 Oak Street Sweetwater, Texas 79556 U.S.A. 1-800-622-0828	
		Title: Wiring Diagram	
Drawn: PAB	3/3/2017	Model: 52-1 52-1-1 52-5 (2017)	
Design: RSS	3/3/2017	Board#: 215-1044	
Approve: <i>[Signature]</i>	Sheet: 2 of 2	Series	Sheet
Print Date: 2/2/2021 3:33:22 PM	Rev: 1	215	1044
\\freedom\pcb\Projects\LMIM 5215-1044\Rev2151044R2P2.SchDoc			

1 2 3 4 5

A

B

C

D

E

A

B

C

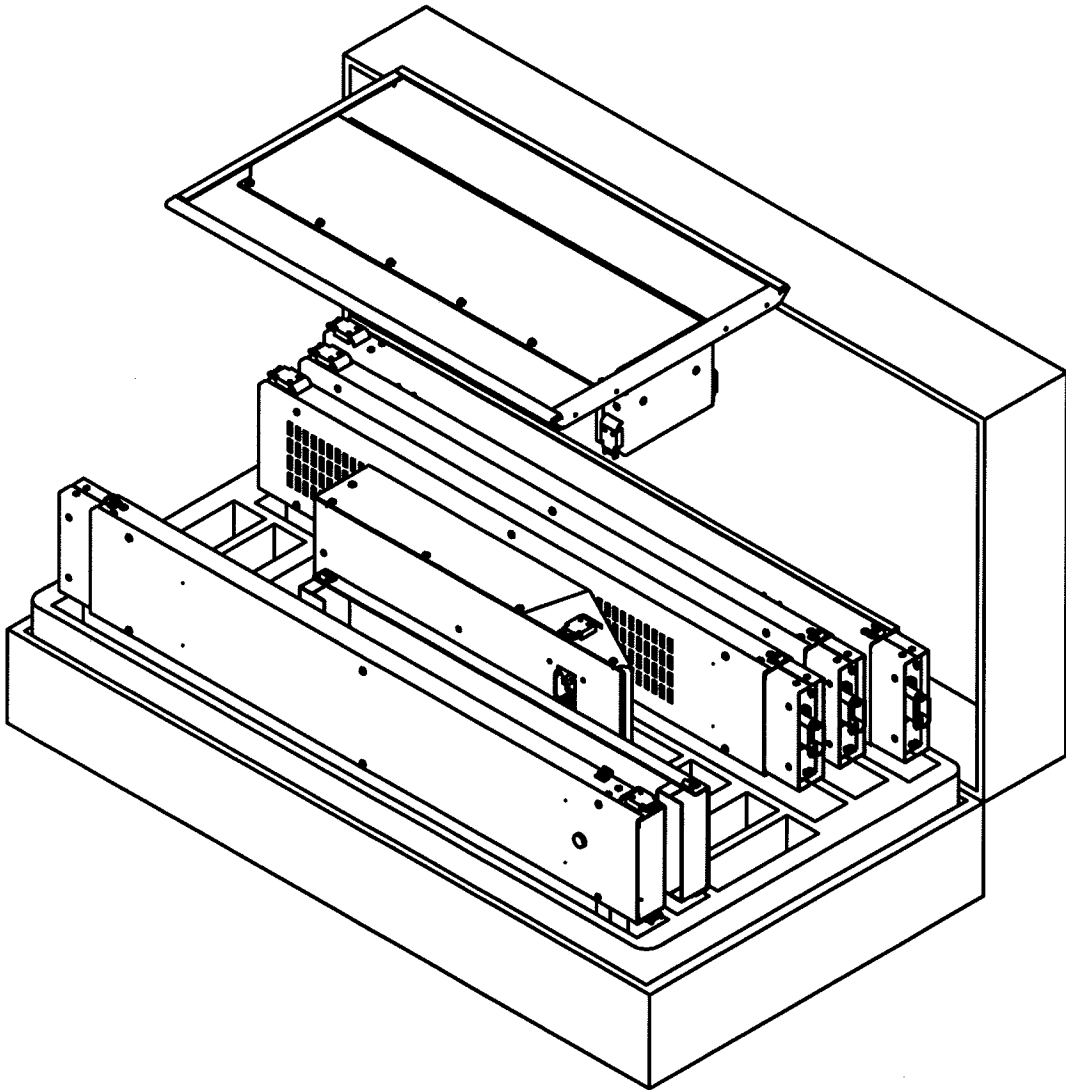
D


E

REVISION HISTORY			
REV	DESCRIPTION	DATE	BY
1	VALID	11-8-00	WJM

# PACKING INSTRUCTIONS:

1. PLACE TOP SECTION IN IT'S MATCHING HOLE.
2. PLACE TOP RIGHT AND TOP LEFT SECTIONS IN HOLES.
3. PLACE ELECTRONICS IN PROPER HOLE.
4. PLACE BOTTOM SECTIONS IN HOLES.
5. TURN BASE UPSIDE DOWN AND PLACE IN HOLE.



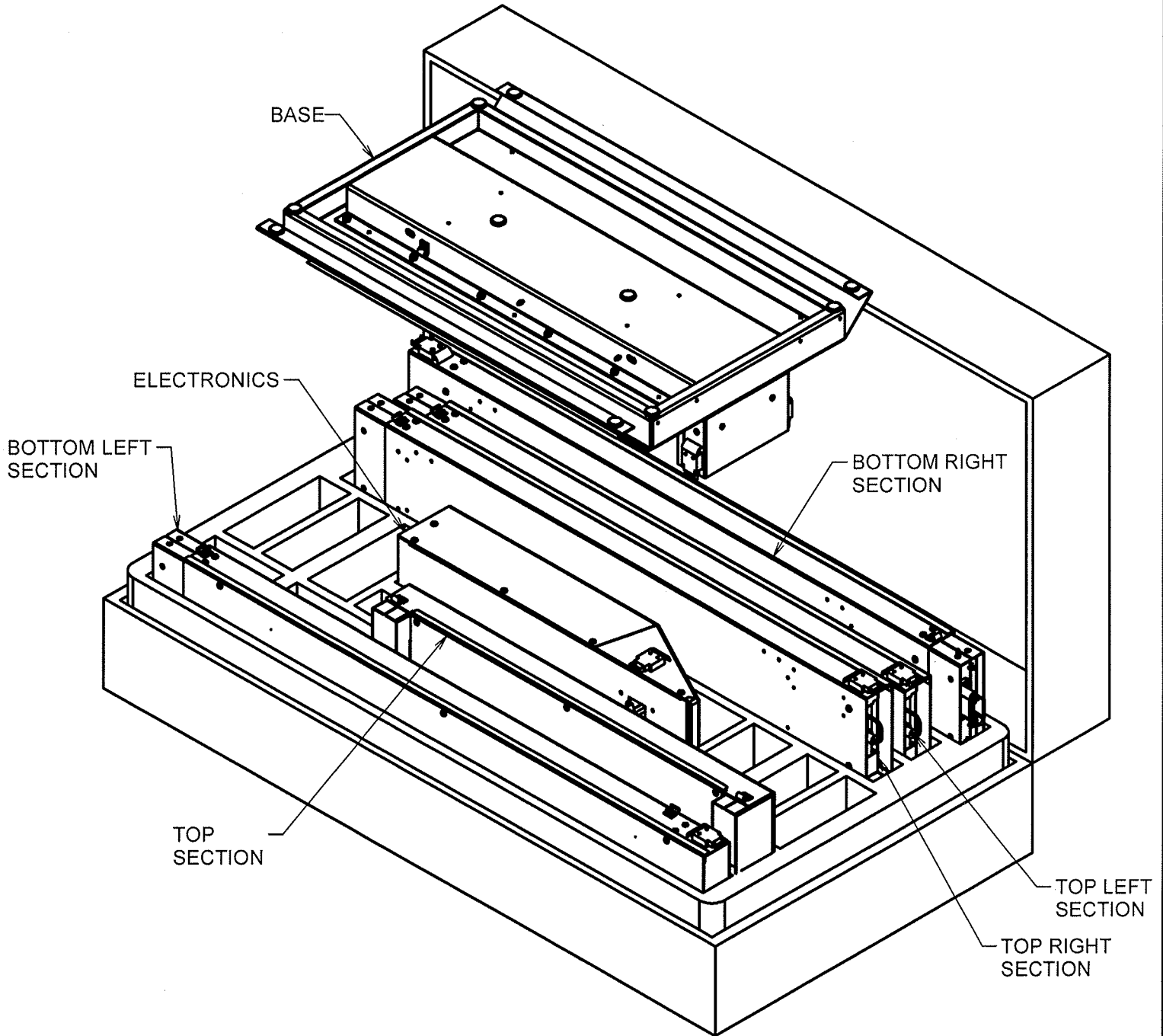
DWN	DATE	CHK	DATE	APP	DATE
WJM	10/10/16			WJM	10-10-16
<b>DWG NUM: 4215-225</b>				SCALE: 1:10	
<b>TITLE M 52-1 SERIES PACKING INSTR</b>					
 LUDLUM MEASUREMENTS, INC. 501 OAK STREET SWEETWATER, TEXAS 79556				SERIES	SHEET
				215	225C


115

REVISION HISTORY			
REV	DESCRIPTION	DATE	BY
1	VALID	6/4/2007	DDW

# PACKING INSTRUCTIONS:

1. PLACE TOP SECTION IN ITS MATCHING HOLE.
2. PLACE TOP RIGHT & TOP LEFT SECTIONS IN HOLES.
3. PLACE ELECTRONICS IN PROPER HOLE.
4. PLACE BOTTOM SECTIONS IN HOLES.
5. TURN BASE UPSIDE DOWN AND PLACE IN HOLES.



DWN	DATE	CHK	DATE	APP	DATE
WJM	10/10/16			v-Jr	10-10-16
<b>DWG NUM:4215-633</b>				<b>SCALE: 1:8</b>	
<b>TITLE M 52-6 SERIES PACKING INSTR</b>					
 <b>LUDLUM MEASUREMENTS, INC.</b> 501 OAK STREET SWEETWATER, TEXAS 70556			<b>SERIES</b> 215	<b>SHEET</b> 633B	

## REVISION HISTORY

REV	DESCRIPTION	DATE	BY
1	VALID	11-8-16	WJM
2	INST CHANGE	5/19/17	JAC

Set the BASE on the ground with the rectangular tubes pointing up.

If supplied with the optional stabilizer legs, attach them to the sides of the base with screws. Position them as shown.

Insert the male end of the section labeled R1 into the female side bracket of the base marked, also labeled R1, and attach the latches. The detector screens must be facing the middle of the portal.

Insert the male end of the section labeled R2 into the female end of the section labeled R2 and attach the latches.

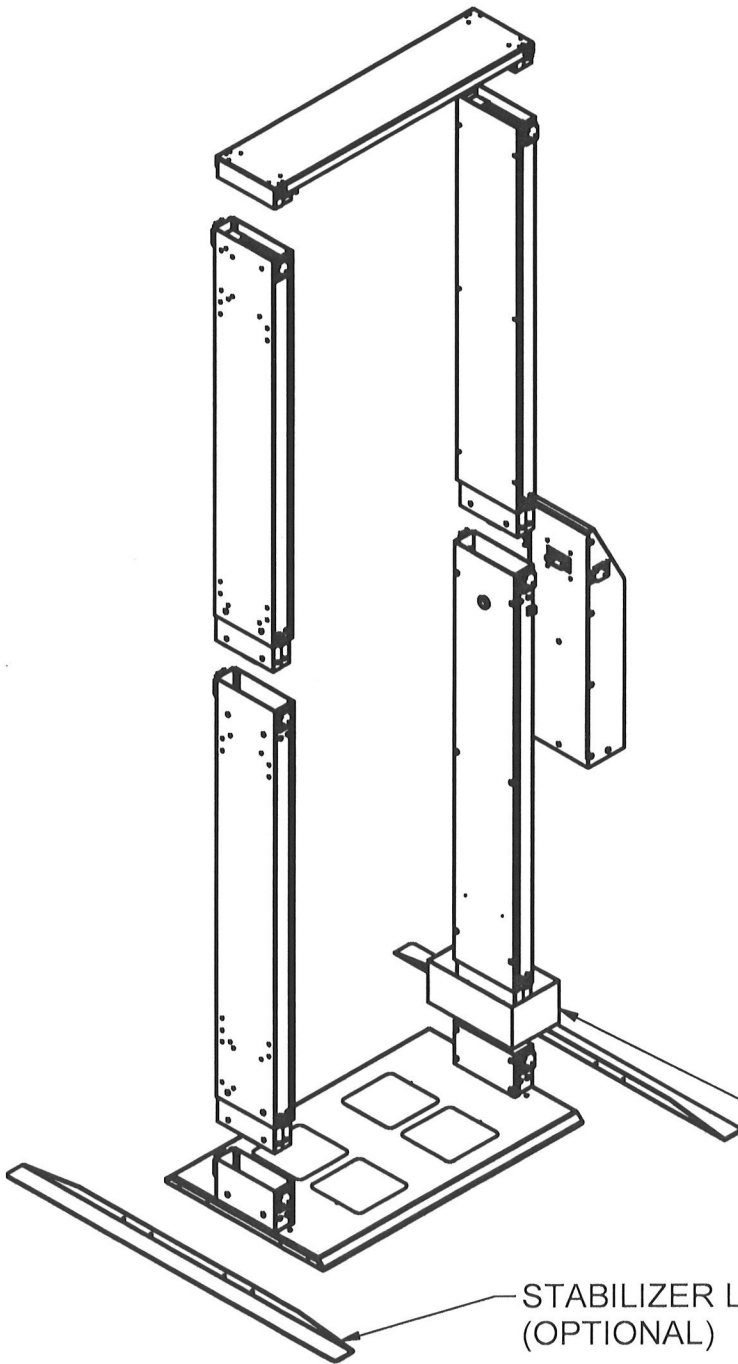
Repeat the process for the LEFT side.

Insert the R3 and L3 sections of the TOP into the tops of the side sections with corresponding labels and attach the latches.

Plug the ELECTRONICS section onto the back of the Bottom Left section with the blank end facing up. First, engage the black connectors. Then ensure that the pin on the back of the Bottom Left section goes into the hole on the electronics. Attach the latches. If you are using the optional Remote Electronics Extension Cable, connect one end of the cable to the Bottom Left section and the other end to the Electronics. Locate the electronics as desired.

For power, choose between three or six D-Cell batteries, +12 V power, or using the wall adapter cable.

Turn on the POWER switch.



WATER RESISTANT SLEEVE  
SEE MANUAL FOR  
INSTALLATION INSTRUCTIONS

STABILIZER LEGS  
(OPTIONAL)

DWN	DATE	CHK	DATE	APP	DATE
JAC	5/19/17			J6W	5-26-17
<b>DWG NUM: 4215-225</b>				SCALE: 1/15	
<b>TITLE M 52-1, -1-1, &amp; -5 ASSEMBLY</b>					
LUDLUM MEASUREMENTS, INC. 501 OAK STREET SWEETWATER, TEXAS 79556				SERIES	SHEET
				215	225A



REVISION HISTORY			
REV	DESCRIPTION	DATE	BY
1	VALID	6/4/2007	DDW
2	INST CHANGE	5/26/17	JAC

Set the Base on the ground with the rectangular tubes pointing up.

If supplied with the optional stabilizer legs, attach them to the sides of the base with screws. Position them as shown.

Insert the male end of the section labeled R1 into the female side bracket of the base marked, also labeled R1, and attach the latches. The detector screens must be facing the middle of the portal.

Insert the male end of the section labeled R2 into the female end of the section labeled R2 and attach the latches.

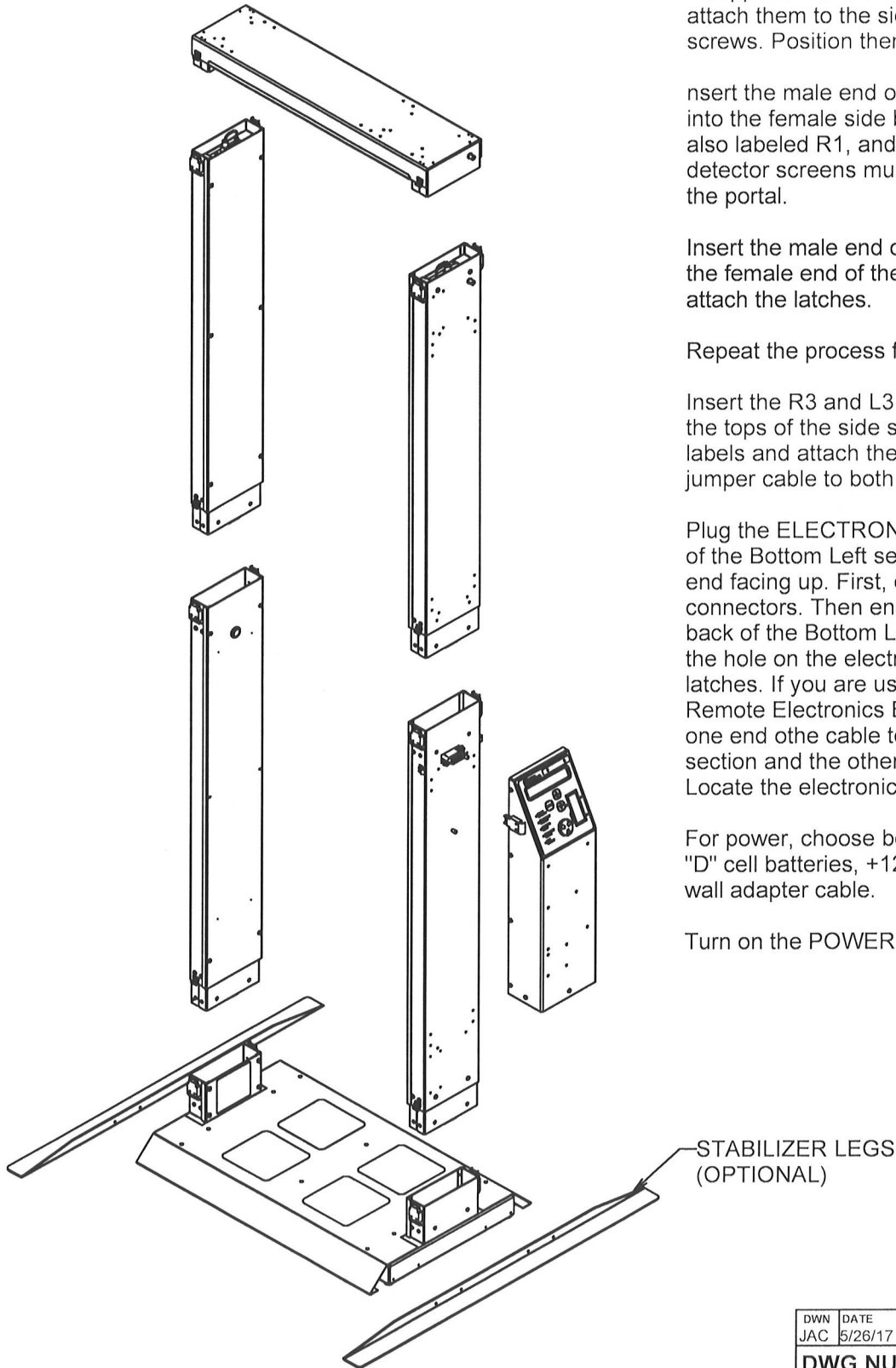
Repeat the process for the LEFT side.


Insert the R3 and L3 sections of the TOP into the tops of the side sections with corresponding labels and attach the latches. Attach the BNC jumper cable to both sections.

Plug the ELECTRONICS section onto the back of the Bottom Left section with the blank end facing up. First, engage the black connectors. Then ensure that the pin on the back of the Bottom Left section goes into the hole on the electronics. Attach the latches. If you are using the optional Remote Electronics Extension Cable, connect one end of the cable to the Bottom Left section and the other end to the Electronics. Locate the electronics as desired.

For power, choose between three or six "D" cell batteries, +12V power, or using the wall adapter cable.

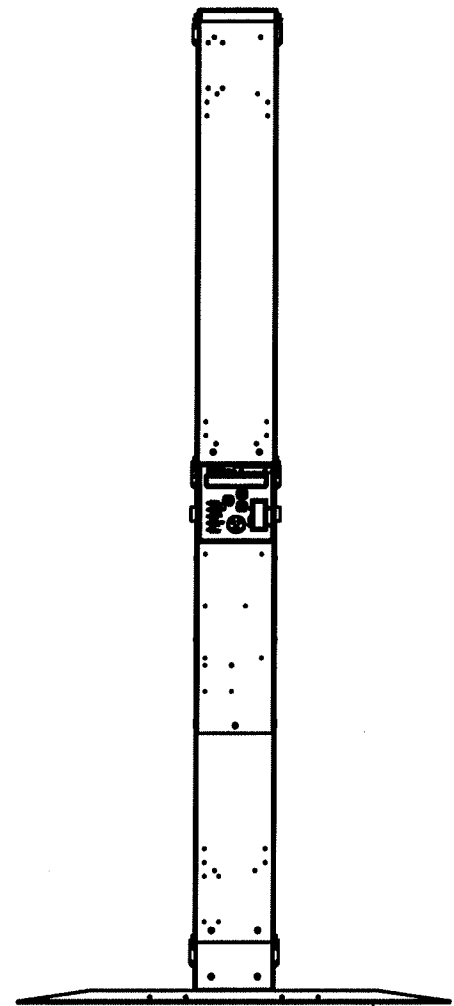
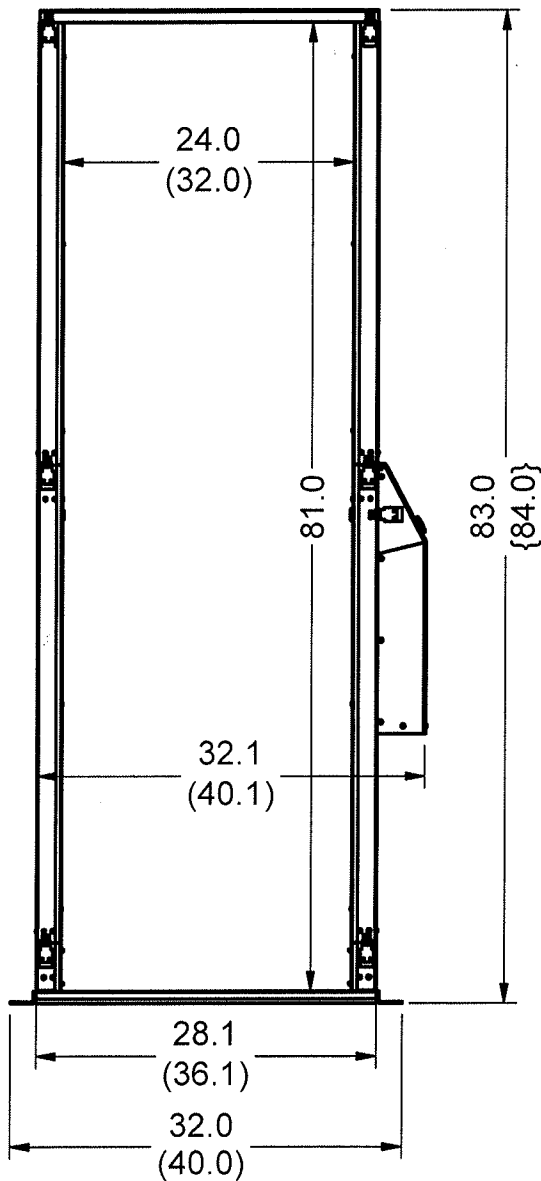
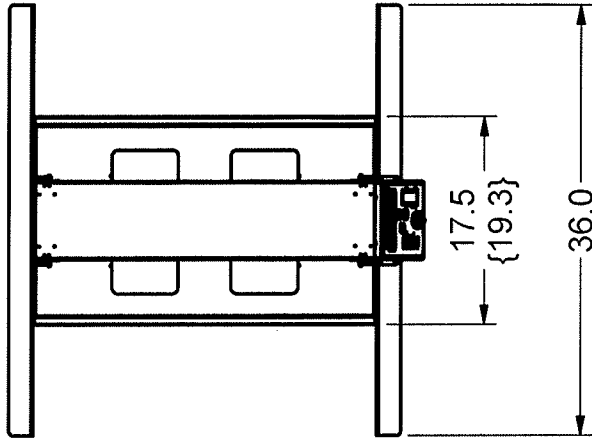
Turn on the POWER switch.



DWN JAC	DATE 5/26/17	CHK	DATE	APP Jbw	DATE 5-30-17
DWG NUM:4215-633				SCALE: 1:8	
TITLE M 52-6, -1 ASSEMBLY					
 LUDLUM MEASUREMENTS, INC. 501 OAK STREET SWEETWATER, TEXAS 79556			SERIES 215	SHEET 633A	

WEIGHT: APPROX. 100 LBS

REVISION HISTORY			
REV	DESCRIPTION	DATE	BY
1	VALID	11-8-00	WJM



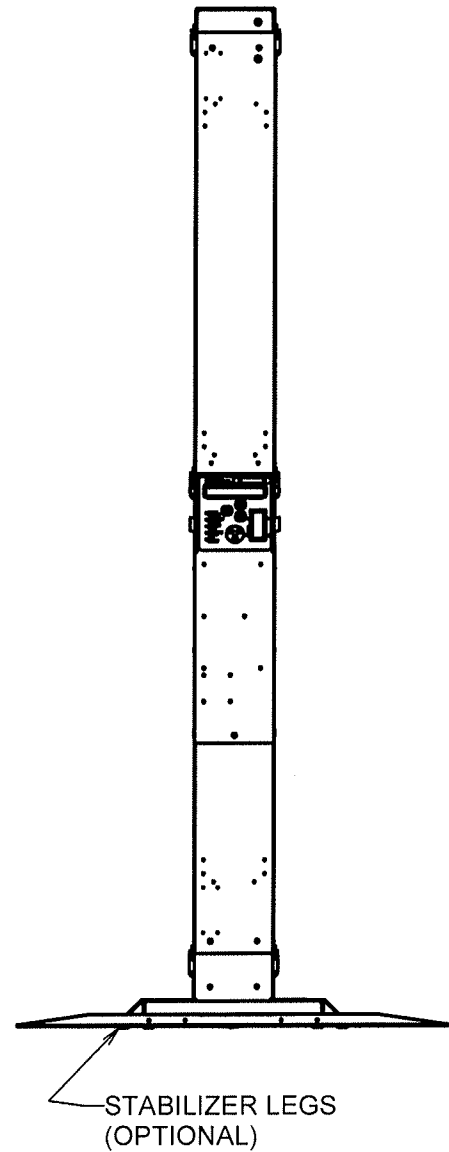
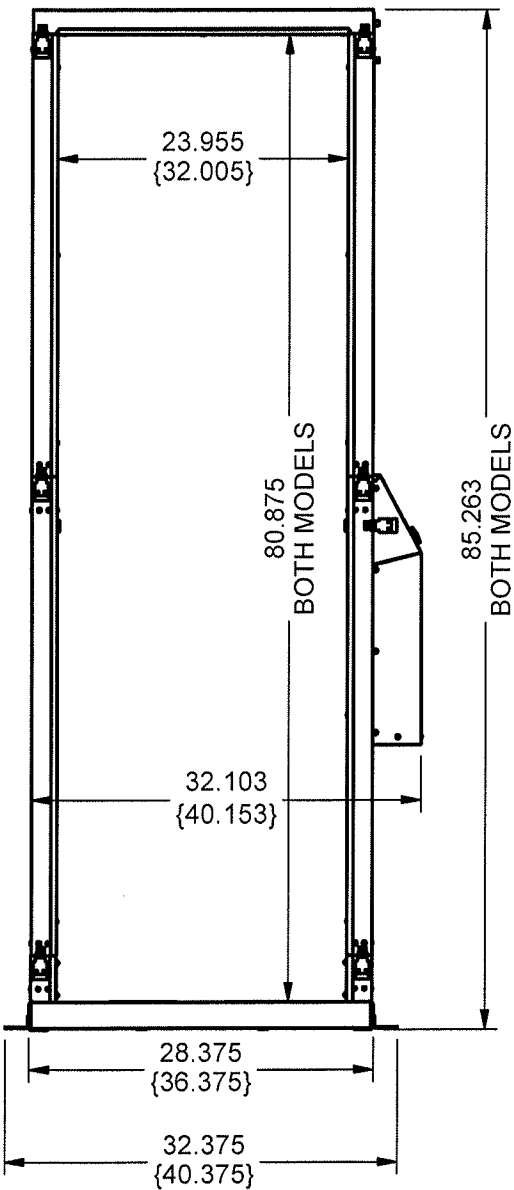
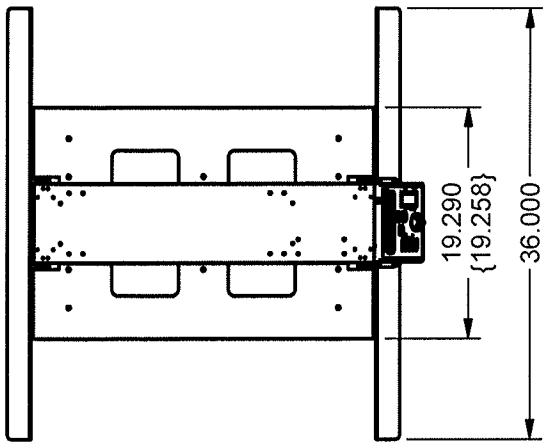
STABILIZER LEGS  
(OPTIONAL)

M 52-1-1 DIMENSIONS SHOWN IN PARENTHESIS ().  
M 52-5 SAME AS M 52-1 EXCEPT DIMENSIONS  
SHOWN IN BRACKETS {}.

DWN	DATE	CHK	DATE	APP	DATE
WJM	10/10/16			WJM	10-10-16
DWG NUM: 4215-225				SCALE: 1/16	
TITLE M 52-1, -1-1, & -5 DIMENSIONS					
LUDLUM MEASUREMENTS, INC. 501 OAK STREET SWEETWATER, TEXAS 79556			SERIES 215	SHEET 225	

WEIGHT: APPROX. 100 LBS

REVISION HISTORY			
REV	DESCRIPTION	DATE	BY
1	VALID	6/1/2007	DDW



MODEL 52-6-1 DIMENSIONS SHOWN IN BRACKETS {}.

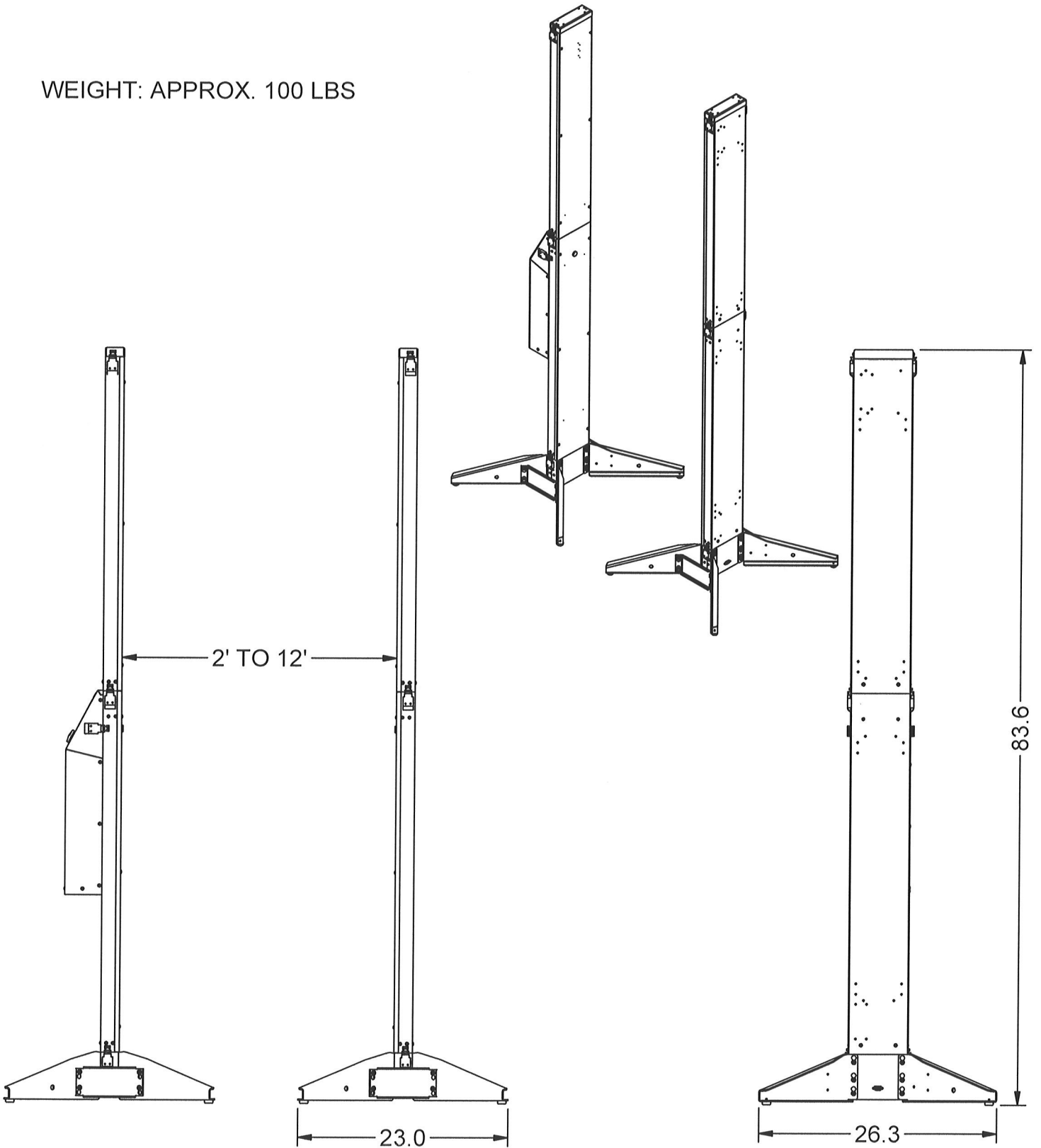
DWN	DATE	CHK	DATE	APP	DATE
WJM	10/10/16			WJM	10-10-16
<b>DWG NUM: 4215-633</b>				<b>SCALE: 1:8</b>	
<b>TITLE M 52-6-1 OVERALL DRAWINGS</b>					
LUDLUM MEASUREMENTS, INC. 501 OAK STREET SWEETWATER, TEXAS 79556				SERIES 215	SHEET 633

VP

REVISION HISTORY

REV	DESCRIPTION	DATE	BY
1	VALID	11/20/00	JGW
2	REPLACED 4215-327 WITH 4215-374	1/7/04	CMC

WEIGHT: APPROX. 100 LBS



DWN	DATE	CHK	DATE	APP	DATE
WJM	2/12/16			WJM	2-12-16
<b>DWG NUM: 4215-332</b>				<b>SCALE: 1/15</b>	
<b>TITLE M 52-1 CAR BASE DIMENSIONS</b>					
LUDLUM MEASUREMENTS, INC. 501 OAK STREET SWEETWATER, TEXAS 79556		SERIES	SHEET		
		215	332		

REVISION HISTORY

REV	DESCRIPTION	DATE	BY
1	VALID	11/20/00	JGW
2	REPLACED 4215-327 WITH 4215-374	1/7/04	CMC
3	INST CHANGES	5/26/17	JAC

See sheet 215 x 374 for base assembly.

Set the **Bases** on the ground with the rectangular tubes pointing up. Set them in place where the unit is to be operated.

Insert the male end of the section labeled R1 into the base with the corresponding R1 label and attach the latches. The detector screens must be facing the middle of the portal. Make sure the green and red R1 stickers match with their corresponding colors.

Insert the male end of the section labeled R2 into the female end of the section labeled R2 and attach the latches.

Repeat the process for the **LEFT** side.

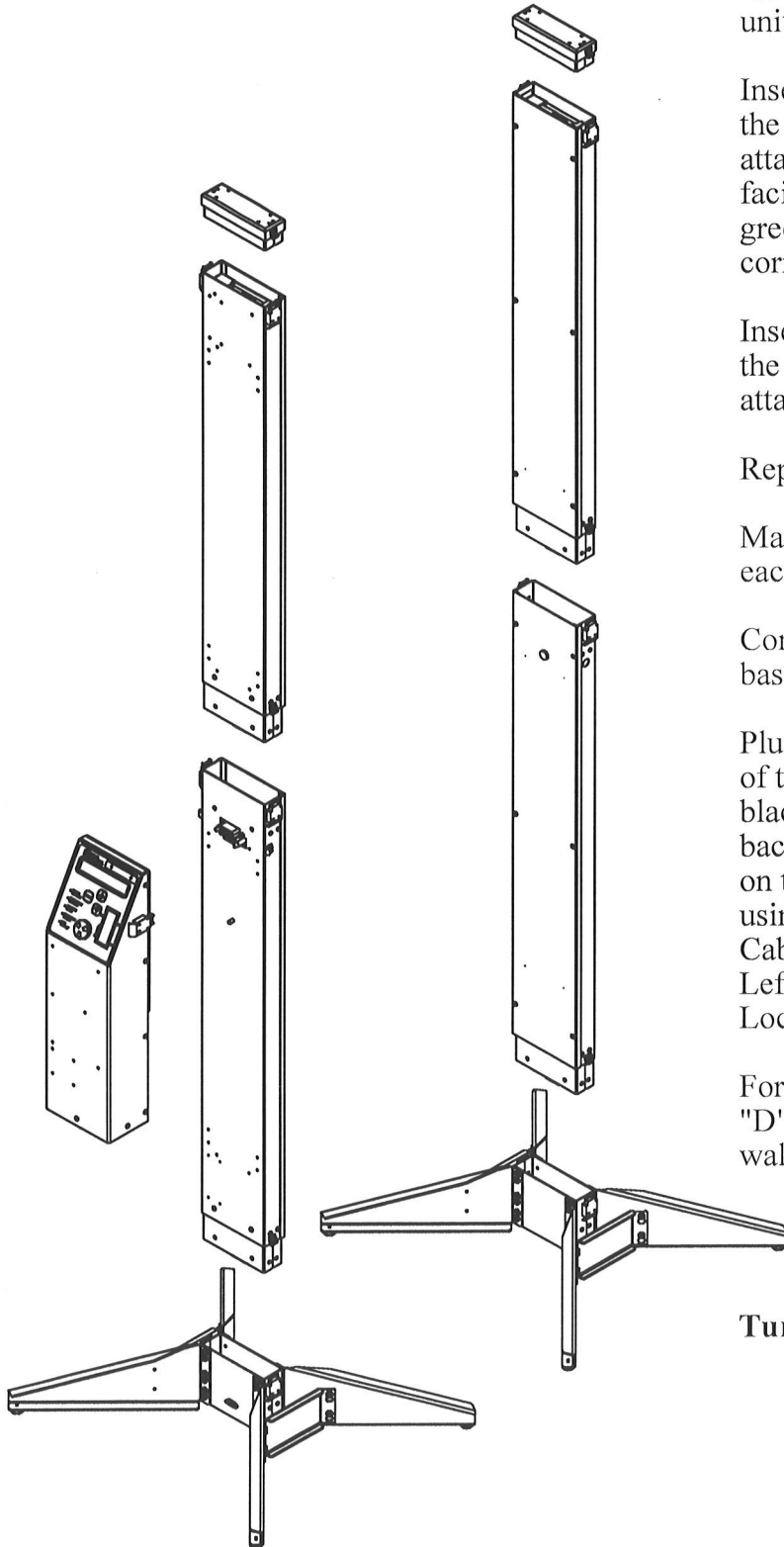
Make sure that the sensors are pointing toward each other.


Connect the cable that goes between the two bases.

Plug the **ELECTRONICS** section onto the back of the Bottom Left section. First, engage the black connectors. Then ensure that the pin on the back of the Bottom Left section goes into the hole on the electronics. Attach the latches. If you are using the optional Remote Electronics Extension Cable, connect one end of the cable to the Bottom Left section and the other end to the Electronics. Locate the electronics as desired.

For power, choose between three or six "D" cell batteries, +12V power, or using the wall adapter cable.

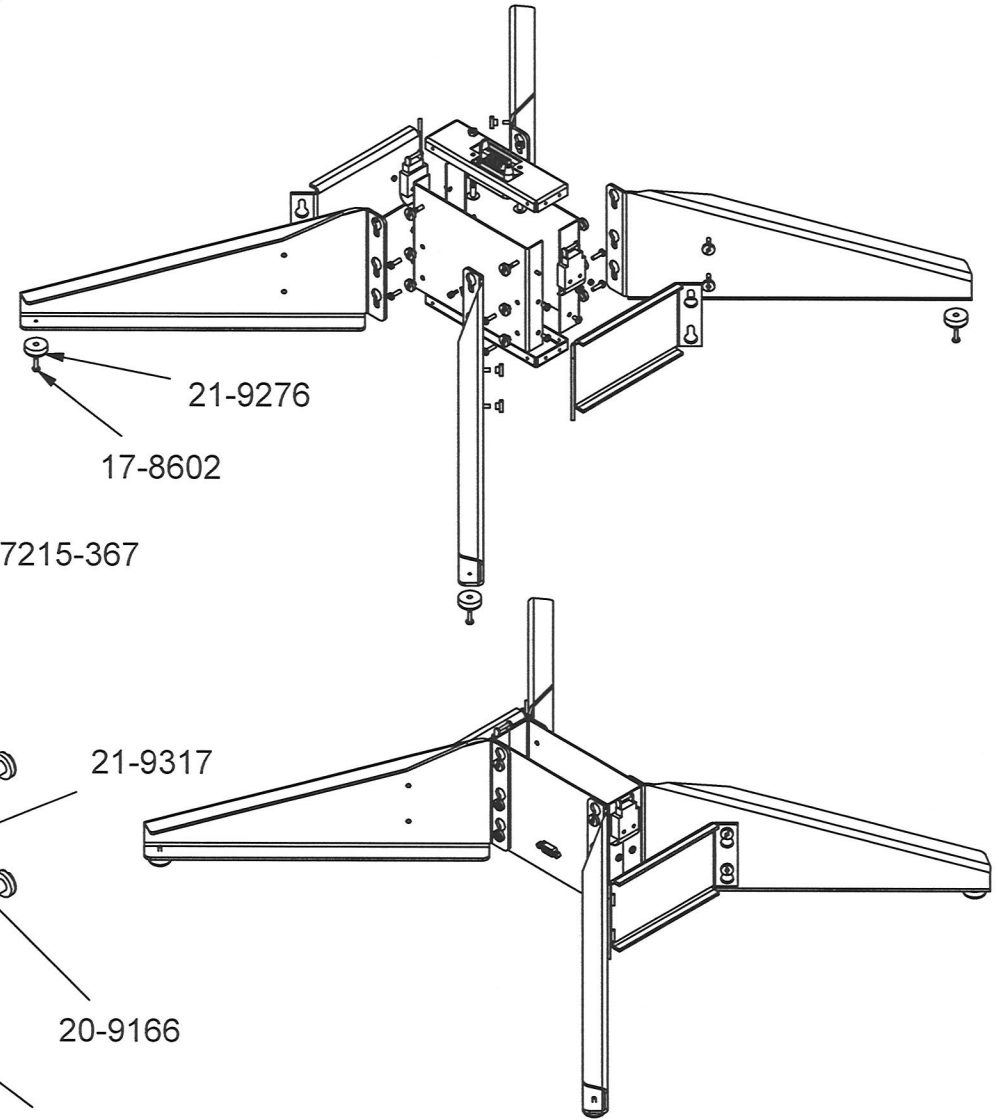
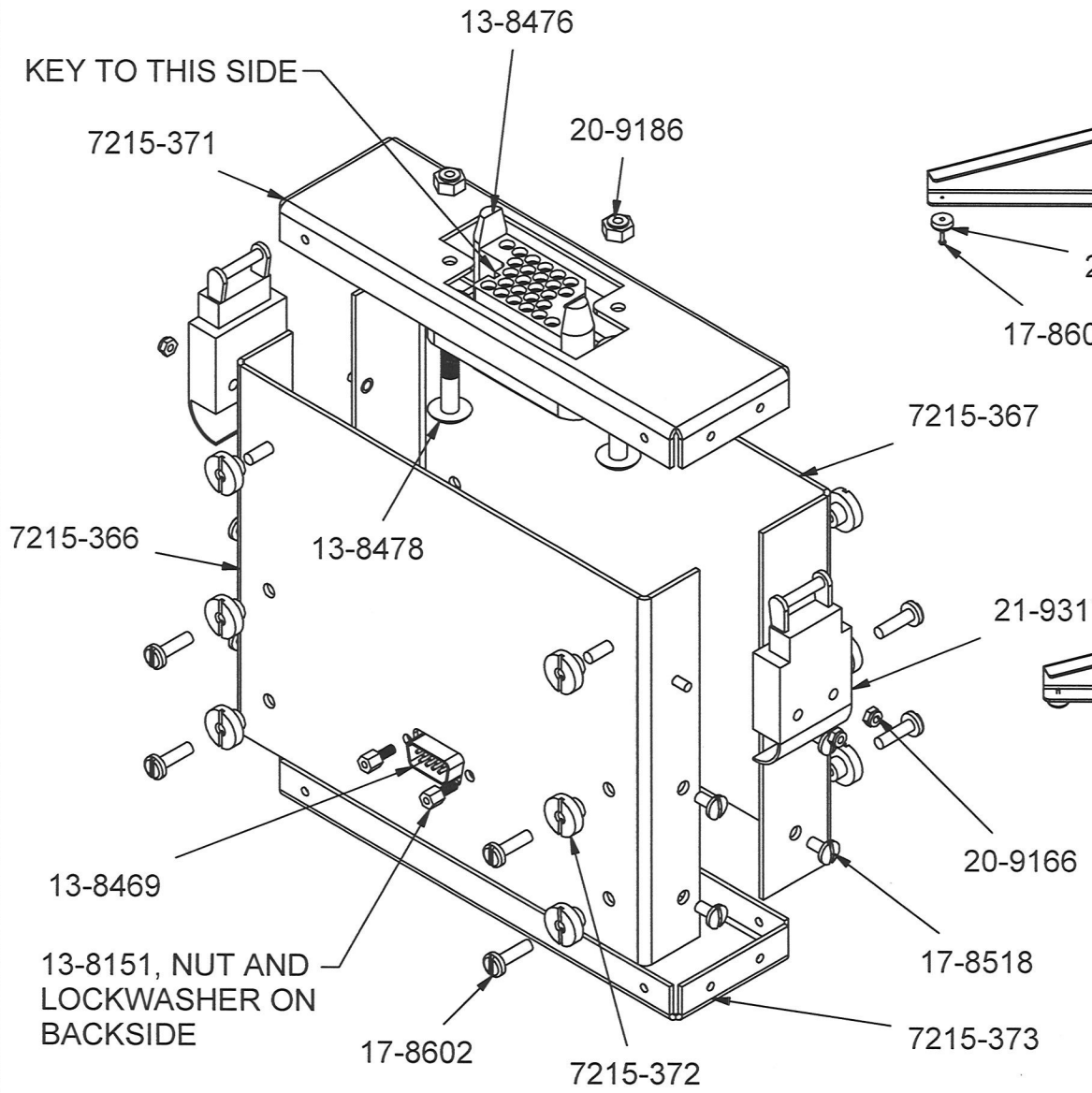
**Turn on the POWER switch.**



DWN JAC	DATE 5/26/17	CHK	DATE	APP JGW	DATE 5-30-17
DWG NUM: 4215-332				SCALE:	
TITLE M 52-1 CAR BASE ASSEMBLY					
 LUDLUM MEASUREMENTS, INC. 501 OAK STREET SWEETWATER, TEXAS 79556			SERIES 215	SHEET 332A	

REVISION HISTORY

REV	DESCRIPTION	DATE	BY
1	VALID	9/12/01	JGW
2	ECF# 3727	9/8/15	WJM



DWN	DATE	CHK	DATE	APP	DATE
WJM	9/8/15			WJM	9-8-15
DWG NUM: 4215-374				SCALE: 1/2	
TITLE M 52-1 CAR BASE					
LUDLUM MEASUREMENTS, INC. 501 OAK STREET SWEETWATER, TEXAS 79556			SERIES	SHEET	
			215	374	

**ASSEMBLY INSTRUCTIONS:**

1. ATTACH THE 4 LEGS BY INSERTING THE KEYHOLES OVER THE PINS AND PULLING UP.

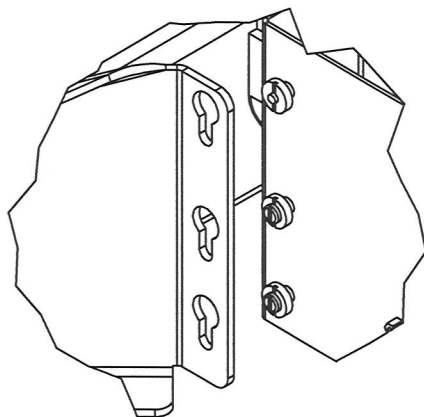
2. ATTACH THE LEG BRACE BETWEEN TWO LEGS BY INSERTING THE KEYHOLES OVER THE PINS AND PUSHING DOWN.

3. SET THE BASES IN THE DESIRED LOCATION APPROXIMATELY 12 FEET APART WITH THE CABLE CONNECTORS TO THE OUTSIDE.

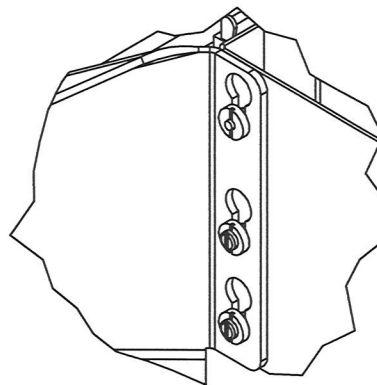
4. ATTACH THE CABLE TO THE BASES.

5. INSTALL THE SIDE SECTIONS AND ELECTRONICS IN NORMAL MANNER AND PROCEED WITH OPERATION. TOP SECTION IS NOT USED.

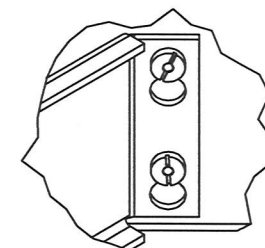
REVISION HISTORY			
REV	DESCRIPTION	DATE	BY
1	VALID	9/12/01	JGW
2	ECF# 3727	9/8/15	WJM



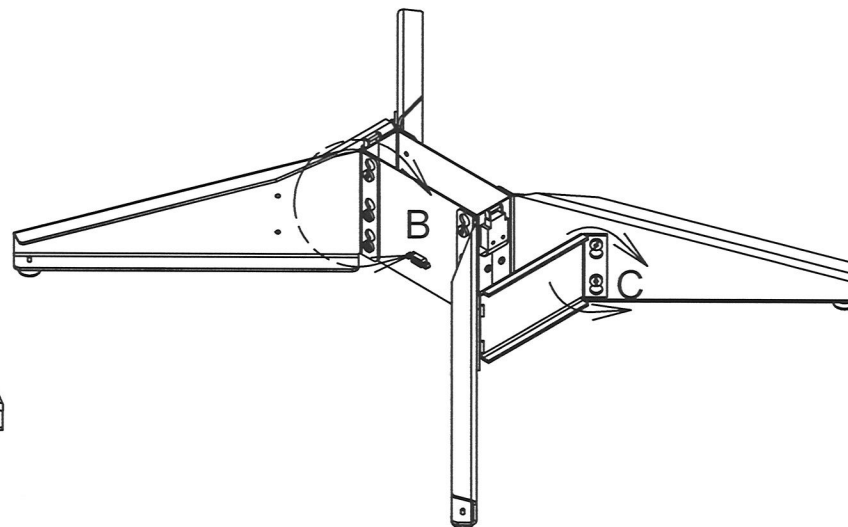
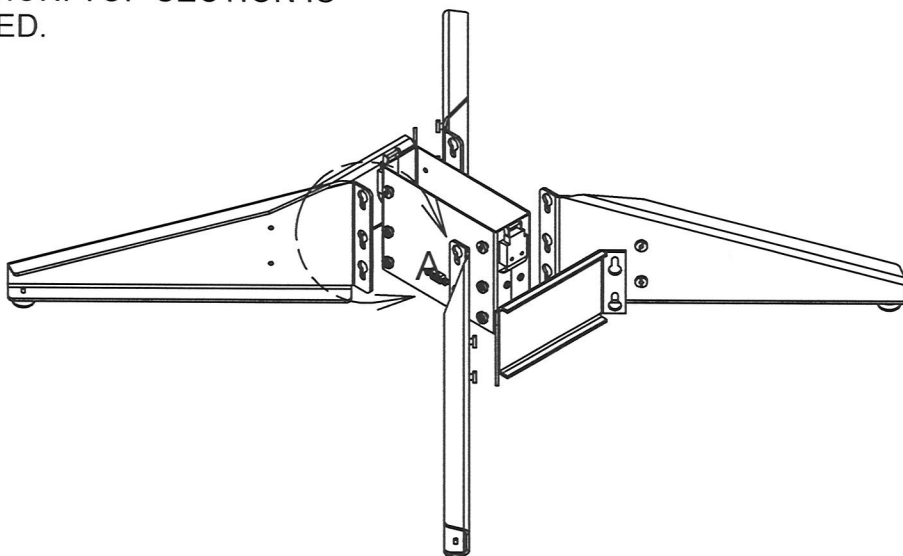
DETAIL A  
SCALE 3/8




DETAIL B  
SCALE 3/8



DETAIL C  
SCALE 3/8



DWN	DATE	CHK	DATE	APP	DATE
WJM	9/8/15			WJM	9-8-15
DWG NUM: 4215-374				SCALE: 3/8	
TITLE M 52-1 CAR BASE SETUP					
 LUDLUM MEASUREMENTS, INC. 501 OAK STREET SWEETWATER, TEXAS 79556		SERIES	SHEET		
		215	374B		