

**LUDLUM MODEL 375P-336 & 375P-1000
RADIATION DETECTOR SYSTEMS**

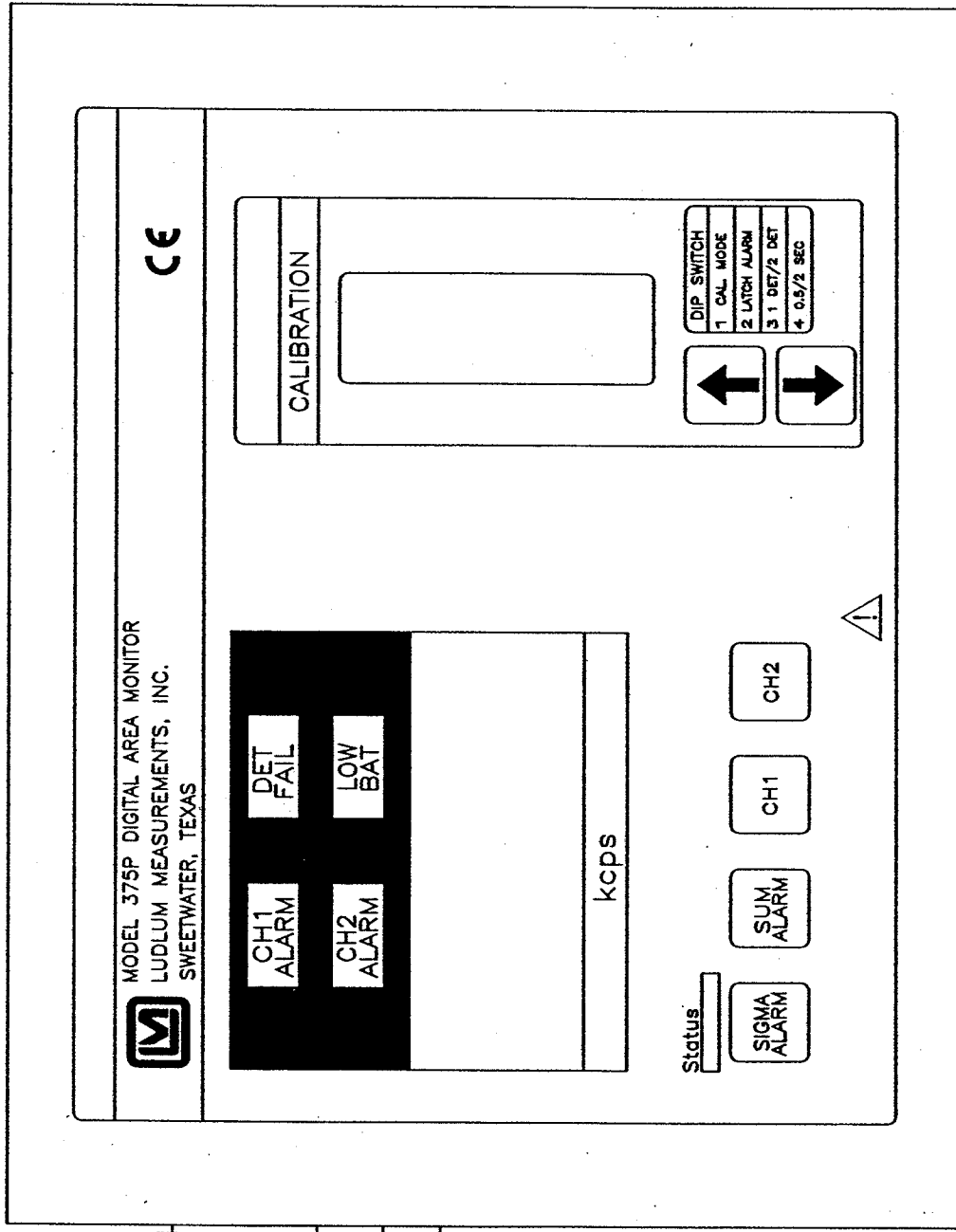
September 2006

**Serial Number 219546 and Succeeding
Serial Numbers**



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

REV #	ALTERATIONS	DATE	BY
	VALID	2/7/05	DDW
2	UPDATED FRONT PANEL	7/28/05	DDW
3	ADDED CONNECTORS	8/5/05	DDW



MODEL 375P DIGITAL AREA MONITOR
 LUDLUM MEASUREMENTS, INC.
 SWEETWATER, TEXAS



CH1 ALARM

DET FAIL

CH2 ALARM

LOW BAT

kcps

Status

SIGMA ALARM

SUM ALARM

CH1

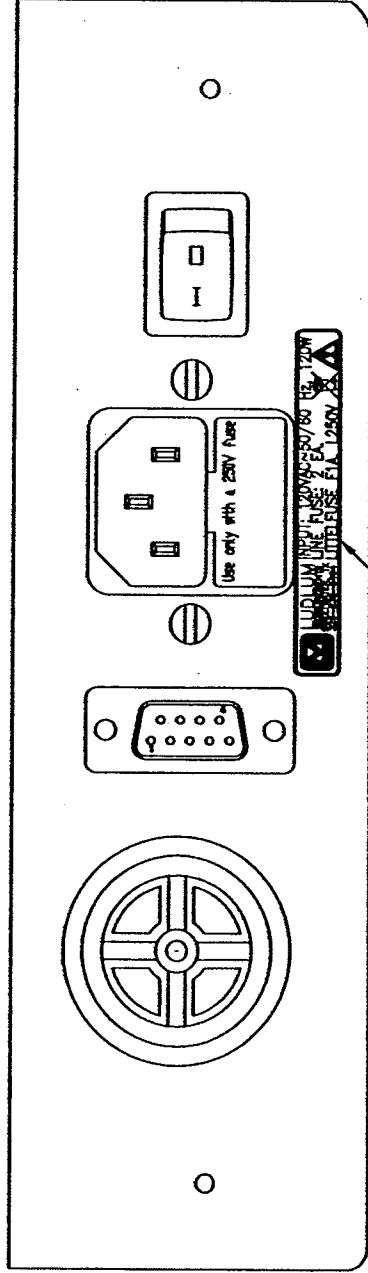
CH2



DWN DDW	DATE 8/5/05	CHECKED	APPROVED <i>[Signature]</i>
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TITLE: M 375P FRONT PANEL		SERIES 396	SHEET 725
LUDLUM MEASUREMENTS, INC. 501 DAK STREET SWEETWATER, TEXAS 75556			

REV #	ALTERATIONS	DATE	BY
2	VALID	8/10/05	DDV



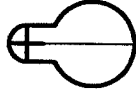
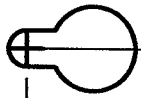
 LUDLUM INPUT: 120VAC~50/60 Hz, 120W
 MEASUREMENTS LINE FUSE: 2 EA.
 SWEETWATER, TX
 325-235-5494
 LITTELFUSE F1A, L250V 

ISSUE DATE	CHK DATE	ISSUE DATE	BY
DDV 8/10/05		8/10/05	B. Reyes
DWG NUM:	SCALE:	FULL	OTHER
TITLE M 375 SIDE PANEL			
LUDLUM MEASUREMENTS, INC. PO BOX STREET SWEETWATER, TEXAS 75088		SHEET	725A
		396	

DRAWING TO ACTUAL SIZE
MAY BE USED AS TEMPLATE

2 11/16

USE #6 SCREWS



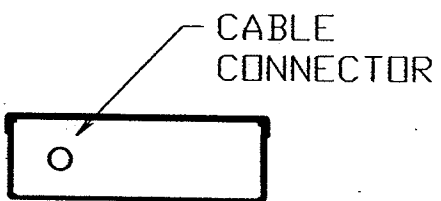
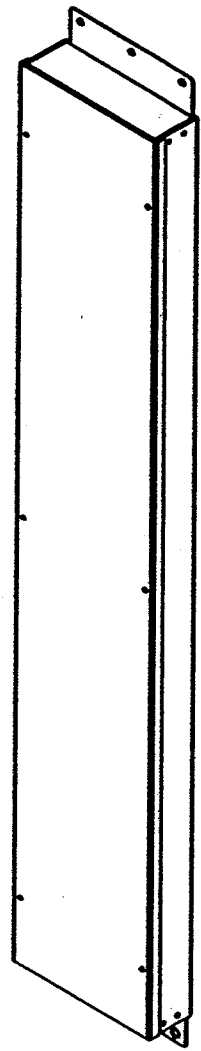
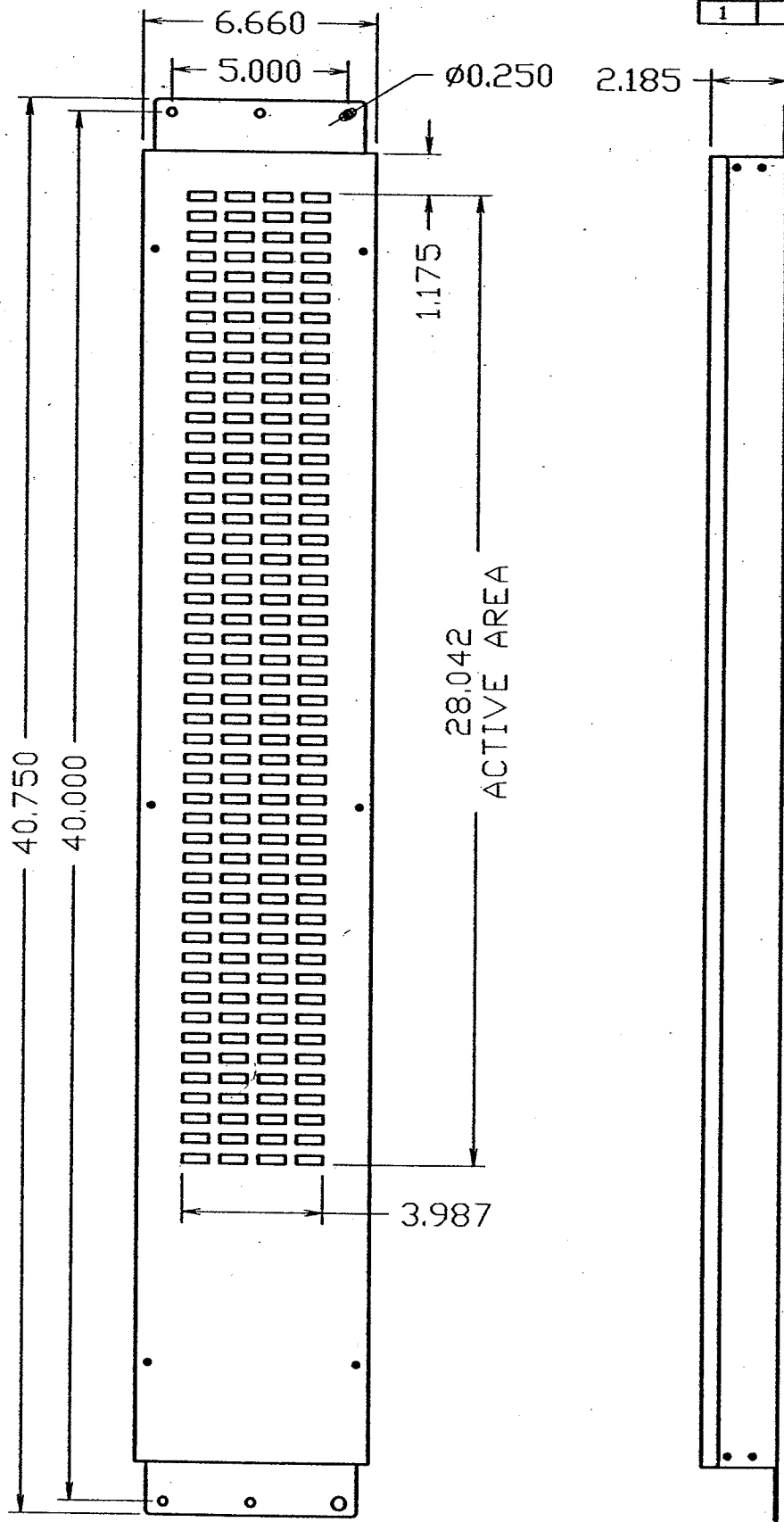
1 5/8

6

1 5/8

DESC: WALL MOUNTING GUIDE					
MODEL NO.: M 375					
DRW: JR	DATE: 11-11-99	CHK: JCB	DATE: 11-11-99	APP: RES	DATE: 3/1/02
TOL: SHOP STD		SCALE: FULL		OTHER: <input checked="" type="checkbox"/>	
LUDLUM MEASUREMENTS, INC. 501 OAK STREET SWEETWATER, TEXAS 79556			SERIES: 396	SHEET: 166	

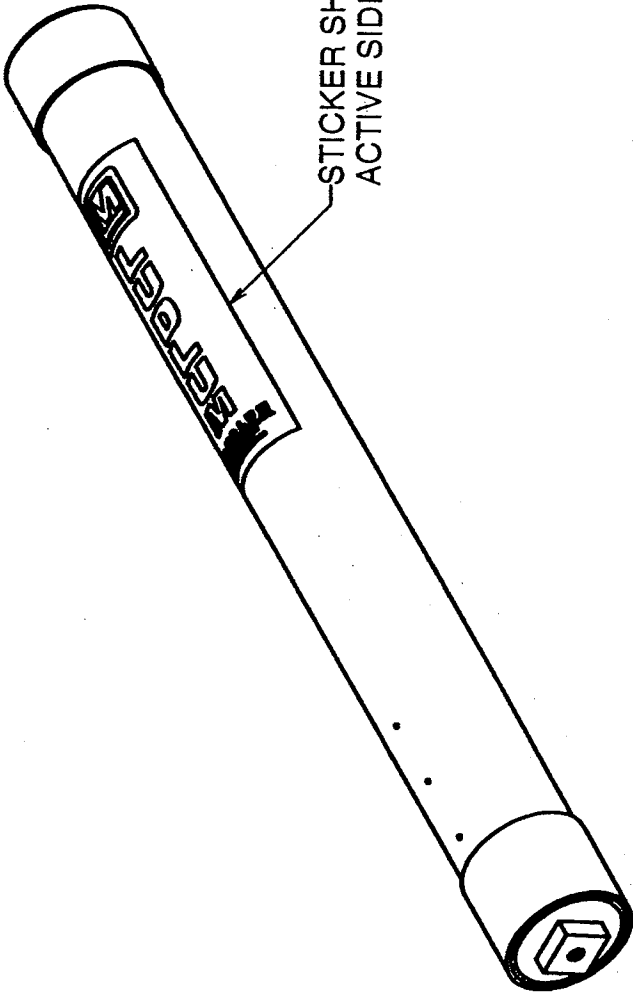
REV #	ALTERATIONS	DATE	BY
1	VALID	4-10-03	JGV



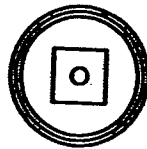
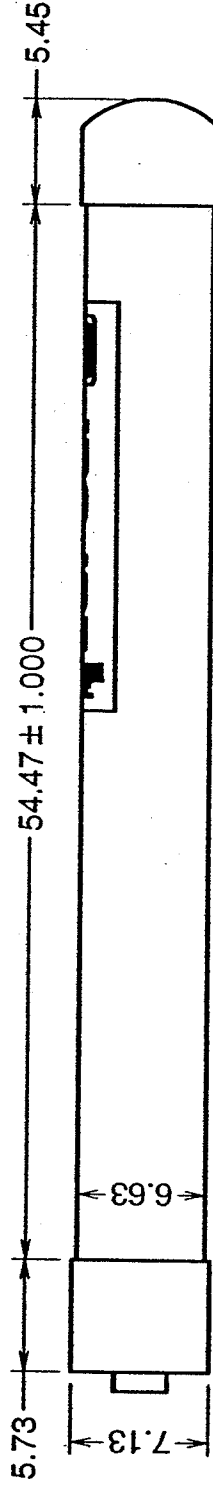
DWN	DATE	CHK	DATE	APP	DATE
JGV	4-10-03			JGV	4-10-03
DWG NUM: 4215-415			SCALE: FULL @=10 OTHER		
TITLE M 44-151 DIMENSIONAL DRAWING					
LUDLUM MEASUREMENTS, INC. 301 OAK STREET SWEETWATER, TEXAS 75555			SERIES 215	SHEET 415	

REVISION HISTORY

REV	DESCRIPTION	DATE	BY
1	VALID	1-20-98	JGW
2	CHANGED STICKER	8/6/2005	DDW



STICKER SHOWING
ACTIVE SIDE

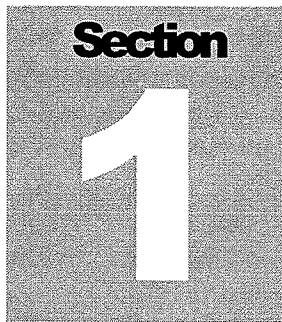


DWN DATE DDW/6/5/05	CHK	DATE 8/27/05	SCALE: FULL OTHER
DWG NUM: 4385-302		TITLE: M 44-128 DIMENSIONS	
LUDLUM MEASUREMENTS, INC. 501 OAK STREET SWEETWATER, TEXAS 75584		SERIES 385	SHEET 302

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Introduction

The Model 375P Radiation Detector System is designed for visibility and ease of use. Featuring a wall-mount chassis, the Model 375P has a four-digit LED display that is readable from thirty feet away. Backlit indicators warn of low radiation alarm (yellow), channel 1 radiation alarm (red), channel 2 radiation alarm (red), and low battery (yellow). A green status light is a positive indication of instrument operation. Parameters are protected under a calibration cover. Change of alarm points are easily accomplished by using the pushbuttons to increment and decrement the parameters.

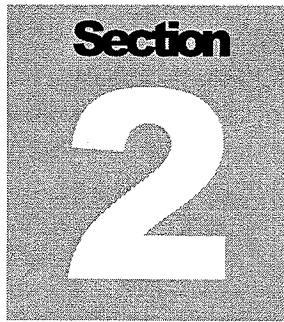
Parameters are stored in non-volatile memory and are retained even with power disconnected. The battery backup provides 24 hours of additional use after the primary power is removed (in a non-alarming condition). Relay output to power a horn and/or strobe light is available by way of a 3-pin connector.

Two common Model 375P systems are:

The Model 375P-336, utilizing two plastic detectors; suitable for indoor mounting, as in a hallway or other entry point.

The Model 375P-1000, utilizing two plastic detector; suitable for outdoor mounting.

These two Model 375P detector configurations are detailed in this manual. Consult the accompanying detector manual and/or Ludlum Measurements Engineering Department for questions relating to detector configurations not listed in this manual.

A graphic consisting of a dark grey square with a white border. Inside the square, the word "Section" is written in a bold, black, sans-serif font at the top. Below it, the number "2" is written in a large, white, sans-serif font.

Getting Started

The Model 375P Radiation Detector System is designed for ease of use. This section of the manual is designed to help the first-time user get started. Initial power-up and basic features of the Model 375P will be discussed in this section. Other sections of the manual provide more detailed information.

External Detectors

The Model 375P utilizes a low voltage interface (nominally 12 Vdc) for connection of one or more external detectors. The detectors used are often large plastic scintillators which typically connect to the Model 375P by way of cables with BNC type connectors.

If you have an external detector, use the cable provided to connect it to the Model 375P.

Note:

Splicing or re-terminating cables must be done carefully. Improper termination will result in the "shorting-out" of the detector voltage, a DET FAIL and/or blown-fuse condition.

Power Up

Plug the power cord into a suitable 120 VAC outlet. If the RS-232 feature is used, plug in a suitably wired 9-pin connector cable. (See Page 3-3 for the pin assignment of the 9-pin connector.) Turn power ON with the left side panel switch. Do not turn power OFF unless the unit is to be removed from service.

Initial power-up will momentarily turn on the internal front panel lights, sound the audio, and display "8888" on the 4-digit LED display. The

firmware version number (39665Nyy) is then displayed as "396" and "65yy" (where yy represents the current version number). The readout will be blanked, and will then display a 60-second countdown (60 to 0) while a background count is taken.

When the instrument has finished measuring background, it will display the current radiation reading (summed from both detectors) and begin checking for an alarm condition.

Alarm Calculations

The Model 375P has two alarm set points, one for SIGMA ALARM and one for SUM ALARM.

The SUM ALARM is most useful as an upper limit for background radiation. If the "summed" detector reading increases above the set SUM ALARM point, then both CH1 ALARM and CH2 ALARM will activate.

Note:

Since its response time (from 10-90% full response) is approximately 60 seconds, the SUM ALARM is not good for detecting sources that are moving quickly through the detectors.

In contrast, the SIGMA ALARM is a fast acting alarm. Depending on the fourth dipswitch setting, readings will be based on either 0.5 or 2.0 seconds. The SIGMA ALARM is based on the square root of background radiation for each detector.

Example:

$$\text{ALARM POINT} = \text{Bkg} + (\text{SIGMA ALARM} \times \text{SQROOT}(\text{Bkg})).$$

Very Important!

When calculating the ALARM POINT, ensure that the Bkg number is in counts per 0.5 or 2.0 seconds (set by the fourth dipswitch).

Operational Check

The operational check is an important assurance that the radiation detectors and electronics are working correctly.

Note:

Ludlum Measurements suggests that an operational check be performed on a daily basis; local procedures may supersede. Ludlum Measurements foresees no need for complete instrument recalibration as long as the instrument passes this check without indications of failure.

For the operational check it is necessary to use the radiation check source provided with the instrument to ensure proper alarm function. When not being used, store the check source in a secure area.

Note:

LMI check sources present very minimal risks and are therefore unlicensed (Exempt Quantity Sources reference: 10 CFR 30.71 Schedule B). The radioactive element is sealed (permanently bonded or fixed inside a capsule) so you need not wash your hands after handling. Radiation exposure while handling this source is very minimal with no identified long or short term risks. Although the amount of radiation given off by exempt sources is so low that it presents no significant hazard, they should be handled with care and respect. Time, distance and shielding are the best ways to control exposure.

1. Taking the source in hand, place it so that it is located on the front part of the detector. Hold it there for approximately 5 seconds and then remove the source from the detector.

Note:

The alarm circuit should activate causing the audio to sound and the CH1 ALARM and/or CH2 ALARM lights to illuminate. Any remote alarm indicators should also be activated (*ie. strobe or horn if applicable*).

2. Press any front panel button and all alarm indicators should go off, including any remote strobe or horn that is connected (if applicable).

Note:

If the alarm is unlatched, the alarm condition will clear automatically when the source is removed.

3. Repeat the procedure for the other detector if it was not triggered by the first test.

Checking Parameters

Check the sigma alarm point setting by pressing the SIGMA ALARM button. The sigma alarm point will be displayed as long as the button is pressed. The sigma alarm point can be set from 0.1 to 9999 sigma. A setting of 5.0 is normally about as low as can be set without having too many false alarms.

Check the sum alarm point setting by pressing the SUM ALARM button. The sum alarm point will be displayed as long as the button is pressed. The high alarm point is in units of kcps (kilo counts per second). The high alarm point can be set from 0.1 to 9999 kcps.

Check the current detector reading on channel 1 by pressing the CH1 button. The current reading will be displayed as long as the button is pressed. The reading is in units of kcps (kilo counts per second).

Check the current detector reading on channel 2 by pressing the CH2 button. The current reading will be displayed as long as the button is pressed. The reading is in units of kcps (kilo counts per second).

Options

When the calibration cover is removed, a four-pole dipswitch becomes accessible which is used to activate or deactivate options. The four options are: CAL MODE, LATCH ALARM, # OF DET, and ½SEC-2SEC.

1. Switching the top CAL MODE switch to the right places the instrument into calibration mode. Parameters can only be

changed while the instrument is in calibration mode. In addition, when in CAL MODE the display will not blank when using the battery. Moving the CAL MODE switch back to the left locks the current parameters preventing further changes.

2. The second switch, LATCH ALARM, changes the alarm to a latching alarm. When switched to the left, the alarm is non-latching, that is, it automatically turns off when the radiation level drops below the alarm point. When switched to the right, the alarm light and audio is latched until either the SIGMA ALARM or SUM ALARM button is pressed.
3. The third switch, # OF DET, selects the number of detectors used. To use only one detector, switch the # OF DET switch to the left. To use two detectors, switch the # OF DET switch to the right. This switch can be useful if one detector of a two-detector system is damaged. If that becomes the case, put the working detector into the first channel, move the switch to the left and the system will operate with the remaining working detector.
4. The fourth switch, ½SEC-2SEC, selects the calculation time for the alarm. The ½SEC position means that the alarm is calculated every ½ second, which gives a fast response. The 2SEC position means that the alarm is calculated more slowly (every 2 seconds). The tradeoff between these two positions is speed versus sensitivity.

RS-232 Output

With the CALMODE dipswitch switched to the right, the Model 375P may be attached to a printer. The raw alarm printer output looks like this:

```
0023.4 ALARM
BKG 0210 0238
ALM 0350 0388
MAX 0750 0295
```

The first line shows the display reading (normally in kcps).

The next three lines show the individual detector readings. These readings are in counts per 0.5 or 2.0 seconds, depending on the fourth dipswitch setting.

The BKG line shows the radiation background level, or “baseline”.

The next line, ALM, shows the alarm point.

The last line, MAX, shows the readings that caused the alarm.

In this example, the SIGMA ALARM is 10.0. So, for CH1:

$$\text{ALM} = 10 \times \text{SQROOT}(\text{BKG}) + \text{BKG}, \text{ and } 350 = 10 \times 14 + 210$$

Furthermore, when the system alarmed, CH1 had a “MAX” reading of 750, or nearly twice the alarm point.

With a time/date-equipped printer, the time and date can be added automatically after each line.

With the CAL MODE dipswitch in the left position the Model 375P dumps RS-232 data onto pin 4 of the 9-pin connector every two seconds.

An example program which shows how an IBM compatible PC can be used to collect the data is given on following page.

'Demonstration Program
 'Model 375P RS-232 communication program written for QuickBasic
 'This program causes the computer screen to display the data being dumped from the Model 375P.
 'Needs the following cable:

'	Model 375P	PC (9-pin)	PC (25-pin)
'	pin 4 TXD	pin 2	pin 3
'	pin 2 GND	pin 5	pin7

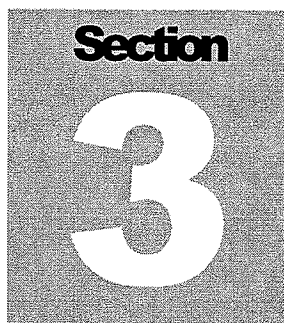
'Cable connector has male pins on Model 375P side
 'Cable connector has female pins on PC side

```

                                'open up communications with serial port #1
                                'at 2400 bps (baud), no parity, 8 data bits, 1 stop bit
                                'no handshaking, buffer size of 8k
OPEN "COM1:2400,n,8,1,bin,CS0,DS0,CD0, RB0" FOR INPUT AS #1
                                'open up filename• for output
                                'clear the screen
CLS
LOCATE 1
PRINT                                'Press Esc key to stop reading data."
COM(1) ON                            'enable com1 trapping
ON COM(1) GOSUB Getcomport          'if something comes in com1, then get it
WHILE (1)                            'loop until Esc key is hit
comment• = INKEY•
IF comment• = CHR• (27) THEN GOTO endloop
WEND
endloop:
COM (1) OFF
CLOSE #1                                'CLOSE COM port.
END
Getcomport:
WHILE LOC(1) <> 0
    ComPortInput• = INPUT•(1 ,#1)    'bring in data from serial port
    PRINT ComPortInput•;            'print data to screen
WEND
RETURN
    
```

The RS-232 data includes the current radiation readings and the current condition of the status lights. The data is presented in the following format:

}	BYTE1	0	x
	BYTE2	x	x
	BYTE3	x	OR x
	BYTE4	x	x
	BYTE5	.	.
	BYTE6	x	0
	BYTE7	Audio Status	=1=on
	BYTE8	High Alarm Status	=1=on
	BYTE9	Low Alarm Status	=1=on
	BYTE10	Over Range Status	=1=on
	BYTE11	Monitor Status	=1=on
	BYTE12	Error Code	
	BYTE13	Carriage Return (ODH)	
	BYTE14	Line Feed (0AH)	



Specifications

Sensitivity: The Model 375P incorporates very sensitive detectors and sensitivity sophisticated electronics. The following tests were performed at Ludlum Measurements, Inc. and the results of these tests should be considered typical of the Model 375P.

Dynamic Sensitivity Test: The dynamic sensitivity test was conducted with the detectors mounted on either side of a 5 foot hallway, with a 5 μCi ^{137}Cs source passed down the center of the hallway at approximately 3 mph. The results were as follows:

<u>SYSTEM</u>	<u>ALARMPT</u>	<u>SOURCE DETECTED</u>
375P-336	6 Sigma	5 out of 5 passes
375P-1000	6 Sigma	5 out of 5 passes

Static Sensitivity Test: The following test was conducted by making a slow approach towards a single detector. Distance stated is measured from source to detector at time of alarm.

<u>SYSTEM</u>	<u>SOURCE</u>	<u>ALARMPT</u>	<u>DISTANCE</u>
375P-336	84 μCi ^{241}Am	6 Sigma	30 feet
375P-1000	84 μCi ^{241}Am	6 Sigma	11 feet (60' w/o PVC enclosure)
375P-336	5 μCi ^{137}Cs	6 Sigma	60 inches
375P-1000	5 μCi ^{137}Cs	6 Sigma	72 inches

Theoretical Sensitivity: Given the following typical data:

<u>SYSTEM</u>	<u>BKGND</u>	<u>^{137}Cs Sensitivity</u>
375P-336	0.8 kcps	0.2 kcps per $\mu\text{R/hr}$
375P-1000	2.0 kcps	0.4 kcps per $\mu\text{R/hr}$

...a six sigma alarm point (with the #4 dipswitch on S512 to the right, or 2 second position) results in the following sensitivity:

<u>SYSTEM</u>	<u>μR/hr at detector to cause alarm</u>
375P-336	1.2 μR/hr above background
375P-1000	0.95 μR/hr above background

Power: Input power is by way of the IEC 320 AC power receptacle. Required power is 120 VAC at less than 10 watts. Non-alarm battery current consumption at 6 Vdc is 90 mA. Alarming current consumption at 6 Vdc is 250 mA.

Range: The Model 375P operates within a four-decade display range of 0.1 to 999.9 kcps. Variable from 200 to 2500 volts.

Battery Backup: The battery backup is a 3,000 mA sealed-lead rechargeable battery. The battery is recharged by way of an onboard trickle charger. Battery life is 24 hours under non-alarm conditions, and 6 hours under alarm conditions. The display is blanked under non-alarm conditions when under battery power. Blanking is suppressed while the CAL MODE switch is switched to the right.

Status: A green light indicates proper instrument operation. A red DET FAIL light warns of improper operation: internal failure or no counts within a fifteen-second period. A yellow LOW BAT light warns of a low battery and will also trigger the DET FAIL light.

Audio Output: The Model 375P has an audible alarm on either SIGMA ALARM or SUM ALARM. The audio intensity can be changed by rotating the baffle on the audio device.

RS-232 Output: The Model 375P has two modes of RS-232 output (see section 2, subsection "RS-232 Output" for further information):

1. A two second dump (for computer data logging)
2. An alarm printout (for a hardcopy printer).

Over-range: When dead time correction accounts for more than 75% of the displayed reading, the instrument is in over-range. During over-range the display will show "----" and the low alarm and high alarm will be activated.

Calibration Controls: Remove the calibration cover to expose the calibration controls. The calibration controls include the up/down buttons, a calibration potentiometer, and the option dipswitch. The calibration potentiometer is detailed on the following page.

BAT CHARGE: Used to set the backup battery trickle charging voltage. It is set to 6.9 Vdc while the battery is disconnected.

Connector Wiring and Pin Assignments

9-pin Data Connector: The 9-pin connectors provide for output signals from the instrument and input voltage to the instrument. The assignments are as follows:

pin1-	+BATTERY
pin2-	GND IN
pin3-	FAIL_L
pin4-	RS232 DUMPOUT
pin5-	(not used)
pin6-	ALARM2_L
pin7-	ALARM1_L
pin8-	EXT RESET_L
pin9-	+5VDC OUT

The FAIL and ALARM digital signal outputs are open drain 2N7002 outputs, able to sink about 50 mA each.

Mains Relay Out: Supplies mains voltage (normally 120VAC) to alarm on 3-pin connector. This 3 pin connector is wired as follows:

Pin 1-	black HOT 120VAC on HIGH ALARM
Pin 2-	white NEUTRAL
Pin 3-	green EARTH GROUND

Detectors

Model 375P-336: 168 in.³ shielded plastic scintillation detector (2 each)

Model 375P-1000: 480 in.³ shielded plastic scintillation detector (2 each)

Dimensions

Model 375P Electronics: 10.3" (26.2 cm) H × 9.7" (24.6 cm) W × 3.3" (8.4 cm) D.

Model 375P-336 Detectors: 41" (104.1 cm) H × 6.75" (17.1cm) W × 2.125 (5.4 cm) Diameter, Overall: 168 in³ (2753 cm³).

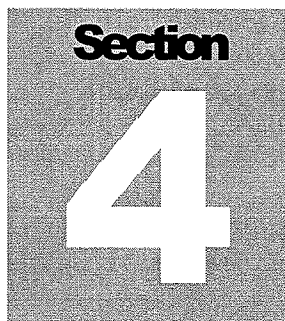
Model 375P-1000 Detectors: 72" (183 cm) H × 8"(20.3cm) Diameter, Overall: 480 in³ (7866 cm³).

Weights

Model 375P Electronics: 9.3 lbs (4.2 kg).

Model 375P-336 Detectors: 23.5 lbs (10.7 kg) each.

Model 375P-1000 Detectors: 65 lbs (29.5 kg) each.

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Safety Considerations

Environmental Conditions for Normal Use

Indoor use only (except for Model 375P-1000 detectors)

No maximum altitude

Temperature range of -15°C to 50°C (5°F to 122°F)

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

Mains supply voltage range of 95-135 VAC (178-240 VAC available),
50/60Hz single phase (less than 100 mA typical, 1 amp max).

Maximum transient voltage of 1500 VAC

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

Pollution Degree 1 (as defined by IEC 664)

Cleaning Instructions and Precautions

The Model 375P 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 1 minute before cleaning.

Warning Markings and Symbols

Caution!

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

The Model 375P is 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 symbol appears on the side panel.



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, internal components are hazardous live. This instrument must be isolated or disconnected from the hazardous live voltage before accessing the internal components. This symbol appears on the front panel. **Note the following precautions:**

Warning!

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

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

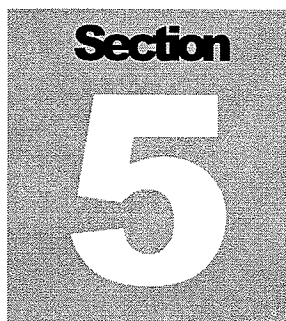


The “crossed-out wheelee bin” symbol notifies the consumer that the product is not to be mixed with unsorted municipal waste when discarding; each material must be separated. The symbol is placed near the AC receptacle. See section 6, “Recycling” for further information.

Replacement of Main Fuse (Side Panel)

Warning!

For continued protection against risk of fire, replace only with fuse of the specified type and current rating!

A graphic for Section 5, featuring the word "Section" in a bold, sans-serif font above a large, white, stylized number "5" on a dark, textured background.

Calibration

Battery Charge

The potentiometer labeled BAT, located under the calibration cover, is used to set the backup battery trickle charge voltage. This is typically set to 6.9 Vdc with the battery disconnected.

Alarm Parameters

The calibration parameters, SIGMA ALARM and SUM ALARM can only be changed while in calibration mode. Switch the top dipswitch CAL MODE to the right to switch into calibration mode.

Changing either parameter is done by holding down the parameter key and pressing the up or down arrow buttons. Either parameter can be set in the range of 0.1 to 9999. If a parameter is changed, the instrument will beep to confirm the saving of the parameter, and then return to displaying the current radiation level.

Once parameters are set, it is important to switch the CAL MODE switch back to the left; this protects the parameters from inadvertent changes. Alternatively, in order to preserve the alarm printout (by keeping the CAL MODE switch to the right), simply reattach the calibration cover.

Section
6**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.

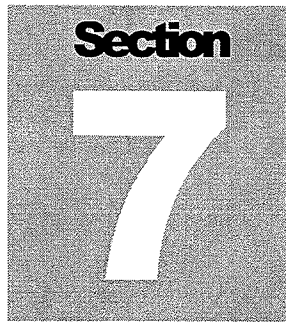
The following types of recyclable materials are present in Ludlum Measurements, Inc. electronics products, and should be recycled separately. The list is not all-inclusive, nor does it suggest that all materials are present in each piece of equipment:

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 wheelee 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:




 A graphic consisting of a dark gray square with the word "Section" in a bold, black, sans-serif font at the top. Below the word is a large, white, stylized number "7" centered within the square.

Parts List

	<u>Reference</u>	<u>Description</u>	<u>Part Number</u>
Model 375P-336 & 375P-1000 Radiation Detector Systems	UNIT	Completely Assembled Model 375P	48-3478
Main Board, Drawing 396 × 792	BOARD	Completely Assembled Main Circuit Board	5396-792
CRYSTAL	Y211	6.144 MHZ	01-5262
CAPACITORS	C1	1uF, 35V	04-5656
	C2	68uF, 10V	04-5654
	C3	0.01uF, 50V	04-5664
	C4	10UF, 25V	04-5728
	C5-C6	27pF, 100V	04-5658
	C7-C9	10UF, 25V	04-5728
	C10	1uF, 35V	04-5656
	C11	0.1uF, 16V	04-5730
	C12	68uF, 10V	04-5654
	C13	100uF, 16V-T	04-5794
	C14-C15	0.01uF, 50V	04-5664
	C16	68uF, 10V	04-5654
	C17	0.01uF, 50V	04-5664
	C18	68uF, 10V	04-5654
	C19	1uF, 35V	04-5656
	C20	0.01uF, 50V	04-5664
	C21-22	10UF, 25V	04-5728
	C23	0.01uF, 50V	04-5664
	C24	47pF, 100V	04-5660
	C25	0.01uF, 50V	04-5664
	C26	1uF, 35V	04-5656
	C27	10UF, 25V	04-5728

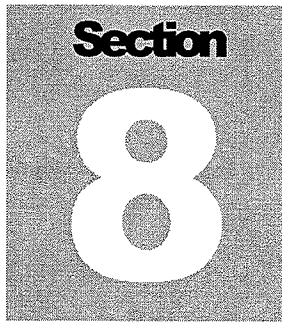
	<u>Reference</u>	<u>Description</u>	<u>Part Number</u>
	C28	100uF, 16V-T	04-5794
	C29	47pF, 100V	04-5660
	C30	100uF, 16V-T	04-5794
	C31	0.01uF, 50V	04-5664
	C32	1uF, 35V	04-5656
	C33	2700uF, 35V	04-5621
TRANSISTORS	Q1-Q5	2N7002L	05-5840
	Q6	MJD200 RL	05-5844
	Q7	2N7002L	05-5840
	Q9-Q10	2N7002L	05-5840
VOLTAGE REGULATOR	VR1	LT1129CQ-5	06-6372
INTEGRATED CIRCUITS	U1	SA08-11EWA	07-6389
	U2-U3	KB-2685EW RED	07-6400
	U4	SA08-11EWA	07-6389
	U5	ICM7218CIQI	06-6311
	U6	SA08-11EWA	07-6389
	U7	KB-2785YW YELLOW	07-6371
	U8	KB-2685EW RED	07-6400
	U9	TLC372ID	06-6290
	U10	MAX220CSE	06-6329
	U11	SA08-11EWA	07-6389
	U12	S87C51FB-4A44	06-6331
	U13	X24C02S8I	06-6299
	U14	ICL7663SCBA-T	06-6302
	U15	CD74HC4538M	06-6297
	U16	LT1304CS8	06-6394
	Q8	MAX810LEUR	06-6424
DIODES	CR1-CR2	CMSH1-40M	07-6411
	CR3	MMBD914LT1	07-6353
	CR4-CR5	CMSH1-40M	07-6411
	CR6	BZX84C4V7LT1, 4.7V, 225mW	07-6459
	CR7	CMSH1-40M	07-6411
	CR8	BZX84C4V7LT1, 4.7V, 225mW	07-6459
LED	DS1	KB-2550SGD GRN RECT	07-6370
SWITCHES	S1-S6	1241.1619	08-6728
	S7	90HBW045	08-6709

	<u>Reference</u>	<u>Description</u>	<u>Part Number</u>
POTENTIOMETER	R26	1M (BAT)	09-6778
RESISTORS	R1	100 Ohm, 1/4W, 1%	12-7840
	R2	60.4 Ohm, 1/4W, 1%	12-7962
	R3	100K, 1/4W, 1%	12-7834
	R4	60.4 Ohm, 1/4W, 1%	12-7962
	R5	100K, 1/4W, 1%	12-7834
	R6	10 Ohm, 1W, 1%	12-7952
	R7	100K, 1/4W, 1%	12-7834
	R8	60.4 Ohm, 1/4W, 1%	12-7962
	R9	2.21K, 1/4W, 1%	12-7835
	R10	22.1K, 1/4W, 1%	12-7843
	R11	68.1K, 1/4W, 1%	12-7881
	R12	10K, 1/4W, 1%	12-7839
	R13	22.1K, 1/4W, 1%	12-7843
	R14	24.3K, 1/4W, 1%	12-7867
	R15	82.5K, 1/4W, 1%	12-7849
	R16	2.2 Ohm, 1/4W, 5%	12-7932
	R17	1K, 1/4W, 1%	12-7832
	R18	165K, 1/4W, 1%	12-7877
	R19	10K, 1/4W, 1%	12-7839
	R20	1K, 1/4W, 1%	12-7832
	R21	1M, 1/4W, 1%	12-7844
	R22	4.75K, 1/4W, 1%	12-7858
	R23	1M, 1/4W, 1%	12-7844
	R24-R25	50 Ohm, 5W	12-7515
	R27	2.21K, 1/4W, 1%	12-7835
	R29	100K, 1/4W, 1%	12-7834
	R30-R31	50 Ohm, 5W	12-7515
	R32-R33	100K, 1/4W, 1%	12-7834
	R34	1.5K, 1/4W, 1%	12-7878
	R35	10K, 1/4W, 1%	12-7839
	R36	2.21K, 1/4W, 1%	12-7835
RESISTOR NETWORK	RN1	220K	12-7831
CONNECTORS	P1- P2	640457-3, MTA100×3RA	13-8165
	P3	640457-2, MTA100×2RA	13-8147
	P4	1-640457-3, MTA100×13RA	13-8113
	P5	640457-2, MTA100×2RA	13-8147

	<u>Reference</u>	<u>Description</u>	<u>Part Number</u>
INDUCTORS	L1	220uH	21-9678
	L2-L3	470uH, TKS1245	21-9699
	L4	22uH, CD43-220 SM	21-9208
RELAY	RL1	JS1-5V, AROMAT	22-9893
Detector Interface Board, Drawing 215 x 347	BOARD	Completely Assembled Detector Interface Board	5215-347
CAPACITORS	C1	10uF, 25V	04-5655
	C2	4.7uF, 25V	04-5653
	C3	0.001uF, 100V	04-5659
	C4	10uF, 25V	04-5655
	C5	47uF, 10V	04-5666
	C6	0.001uF, 10V	04-5659
	C7	0.01uF, 50V	04-5664
	C8	1uF, 35V	04-5656
	C9-C10	0.01uF, 50V	04-5664
	C11	0.001uF, 2kV	04-5703
	C12	10 pF, 100V	04-5673
	C13	0.01uF, 50V	04-5664
	C14	0.01uF, 2KV	04-5722
	C15	47 pF, 100V	04-5660
	C16	10uF, 25V	04-5655
	C17	0.01uF, 2kV	04-5722
	C18-C22	0.001uF, 2kV	04-5703
	C23-C27	0.01uF, 500V	04-5696
DIODES	CR1	CMSH1-40M	07-6411
	CR2-CR8	CMPD2004S	07-6402
TRANSISTOR	Q1	MTD2N50E	05-5855
POTENTIOMETER	R18	1 M, 3269W1-105, HV ADJUST	09-6911
RESISTORS	R1-R4	150 Ohm, 1/2W, 5%	12-7965
	R5-R6	47.5 Ohm, 1/8W, 1%	12-7966
	R7	100K, 1/8W, 1%	12-7834
	R8	1.82K, 1/8W, 1%	12-7030
	R9	10K, 1/8W, 1%	12-7839

	<u>Reference</u>	<u>Description</u>	<u>Part Number</u>
	R10	4.75K, 1/8W, 1%	12-7858
	R11	100 Ohm, 1/8W, 1%	12-7840
	R12	1K, 1/8W, 1%	12-7832
	R13-R15	10K, 1/8W, 1%	12-7839
	R16	4.75K, 1/8W, 1%	12-7858
	R17	392K, 1/8W, 1%	12-7841
	R19-R20	1M, 1/8W, 1%	12-7844
	R21	1 GIG-Ohm FHV-1, 2%	12-7686
	R23	1M, 1/8W, 1%	12-7844
INTEGRATED CIRCUITS	U1	ICL7667CBA	06-6510
	U2	MAX985EUK-T	06-6459
	U3	CA3096M	06-6288
	U4	MAX641ACSA-T	06-6388
VOLTAGE REGULATORS	VR1	LT1460KCS3-2.5TR	05-5867
	VR2	LM78L05ACM	05-5864
INDUCTORS	L1-L2	470uH	21-9224
CONNECTORS	P20	640456-2 MTA100x2	13-8073
	P34	640456-2 MTA-100x2	13-8073
	W1	COAXIAL CONNECTOR, SIGNAL X"	21-9463
Wiring Diagram, Drawing 396 x 726			
AUDIO	DS1	MC-V09-530-S	21-9730
CONNECTORS	J1	CONN-1-640441-2	13-8431
	J2	FILTER CORCOM-3EHG1-2	21-9830
	J3	D RECPT-RD9F000V3 9PIN	13-8003
	J5	CONN-640457-3	13-8165
	J17	CONN-640441-2	13-8196
	J20	CONN-640441-2	13-8196
SWITCH	S1	DM62J12S205PQ W/LEGEND	08-6715
BATTERY	B1	BATTERY-PS630	21-9705
TRANSFORMER	T1	CFP302 115/230V	22-9908

	<u>Reference</u>	<u>Description</u>	<u>Part Number</u>
Model 375P-336			
Radiation Detector System			
	1 EA	10 μ Ci ¹³⁷ Cs Check Source	01-5231
SYSTEM	1 EA	Adapter BNC/BNC MILESTEK	13-8481
MISCELLANEOUS	1 EA	Power Cord – BELDEN 7.5' LONG	21-9394
	2 EA	Model 44-151 Plastic Detectors	47-3347
	2 EA	CBL-BNC CRIMP 200', RG58	8303-668
1 1/8" Voltage Divider, Drawing 435 x 435			
	BOARD	Completely Assembled Circuit Board (x2)	5435-182
CAPACITORS	C1-C3	0.01 μ F, 200V	04-5725
	C4	0.0047 μ 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, 1/4W, 1%	12-7002
	R12-R13	6.04M, 1/4W, 1%	12-7071
MISCELLANEOUS	W1	TEFLON WHITE EE22 6" HV	21-9759
	W4	#22 BLACK UL1430 GND 6"	21-9154
Model 375P-1000			
Radiation Detector System			
	1 EA	10 μ Ci ¹³⁷ Cs Check Source	01-5231
SYSTEM	1 EA	Power Cord- BELDEN, 7.5' LONG	21-9394
MISCELLANEOUS	2 EA	Model 44-128-1 Plastic Detectors	47-3319
	2 EA	CBL-BNC CRIMP 200', RG58	8303-668
1.125" Voltage Divider, Drawing 002 x 191			
	BOARD	Completely Assembled Circuit Board (x2)	5002-241
CAPACITOR	C2	0.01 μ F, 2KV	04-5525
RESISTORS	R1	1Meg, 1/3W, 1%	12-7609
	R2-R12	10M, 1/3W, 1%	12-7749



Drawings

Main Circuit Board, Drawing 396 × 792 (4 sheets)

Main Circuit Board Component Layout (Top side), Drawing 396 × 793

Main Circuit Board Component Layout (Bottom side),
Drawing 396 × 793

Detector Interface Board, Drawing 215 × 347

Detector Interface Board Component Layout, Drawing 215 × 348

1 1/8" Voltage Divider, Drawing 435 × 435

1 1/8" Voltage Divider Component Layout (Top side),
Drawing 435 × 436

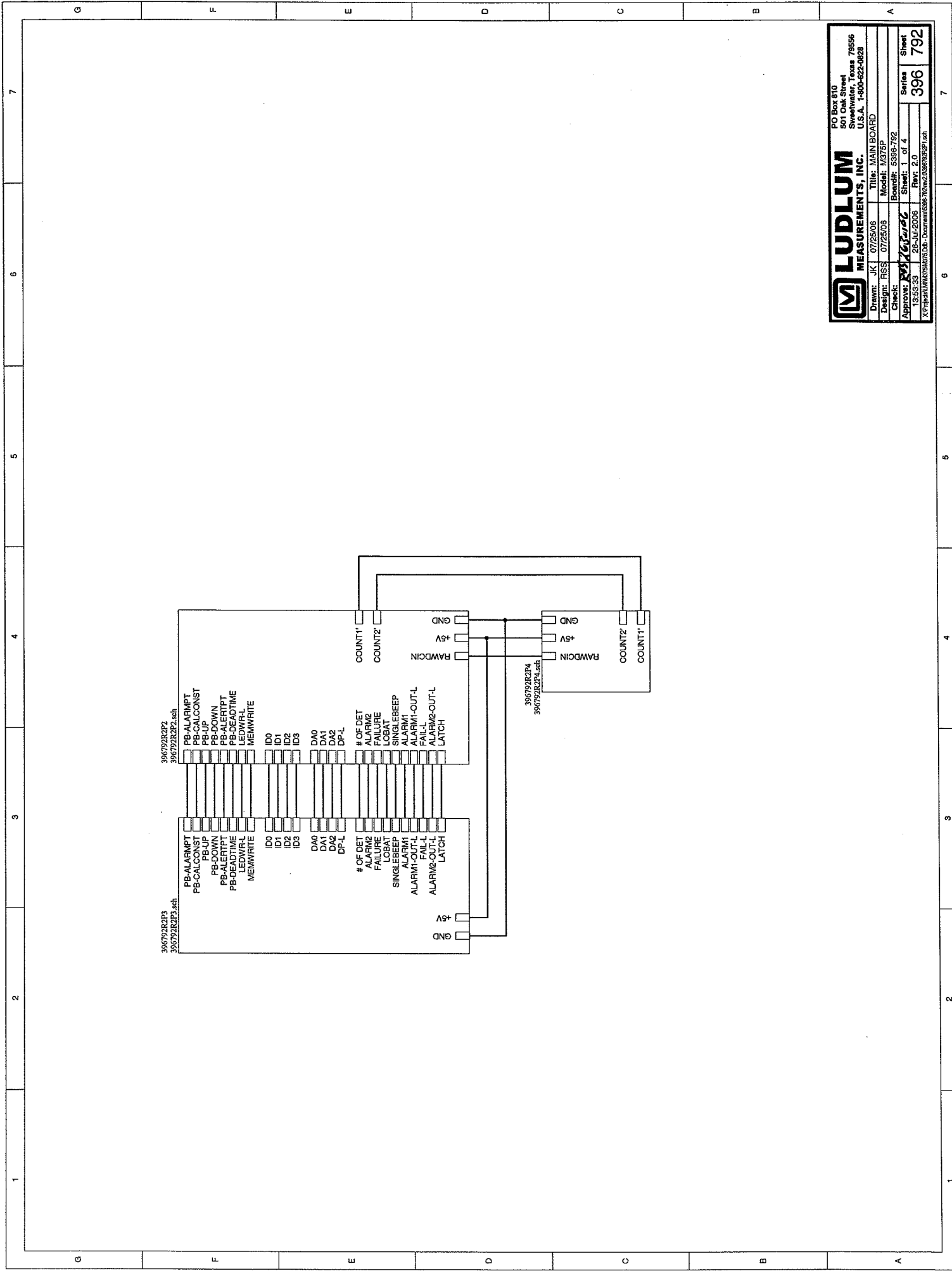
1 1/8" Voltage Divider Component Layout (Bottom side),
Drawing 435 × 436

1.125" Voltage Divider, Drawing 002 × 191

Wiring Diagram, Drawing 396 × 726

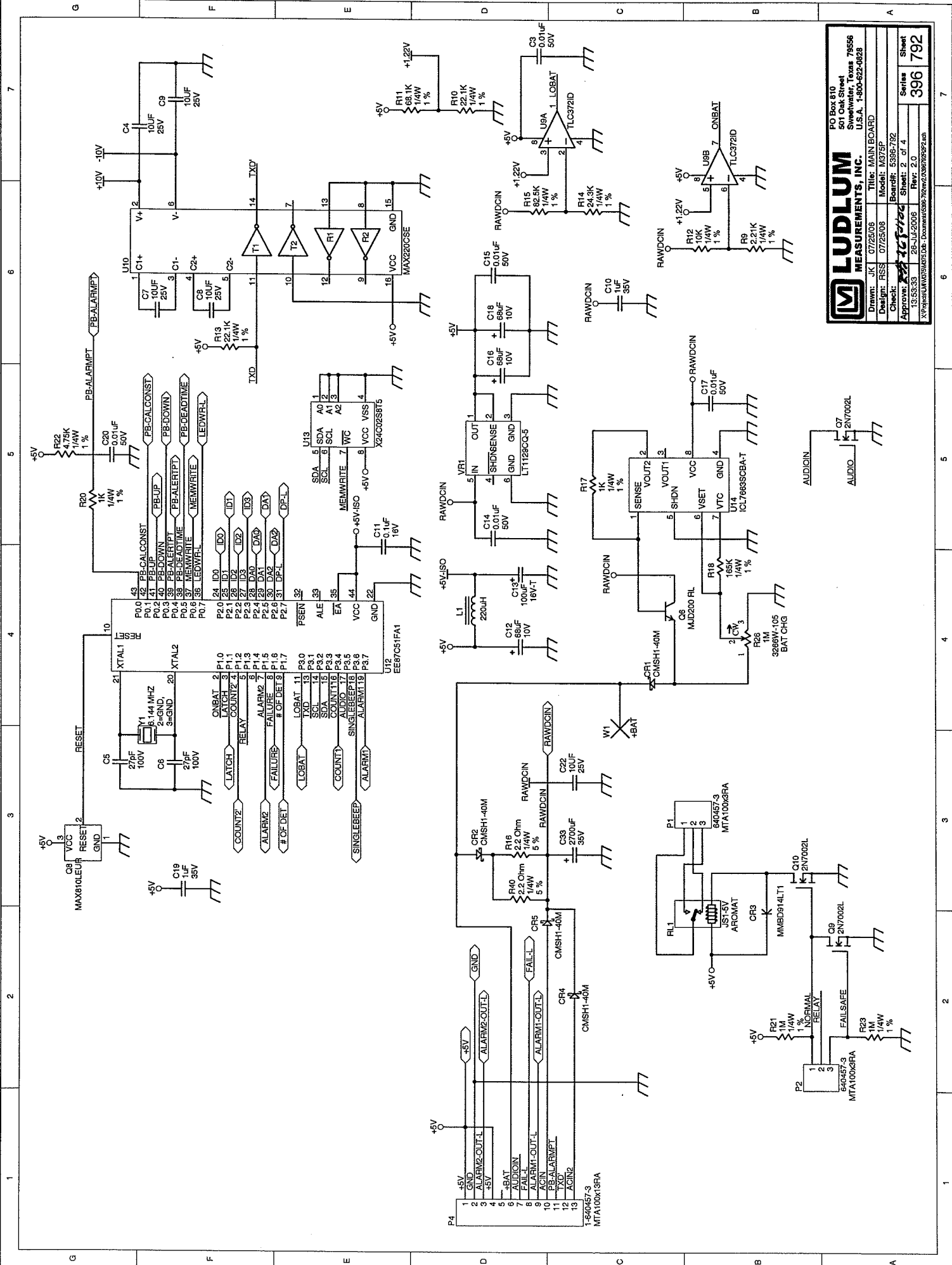
M 375P-336 Installation, Drawing 396 × 864

M 375P-1000 Installation, Drawings 396 × 272A – 272D



LUDLUM MEASUREMENTS, INC.
 PO Box 810
 501 Oak Street
 Newburgh, NY 12550
 U.S.A. 1-800-322-8828

Drawn: JK	07/25/08	Title: MAIN BOARD
Design: RSS	07/25/08	Model: M375P
Check: <i>RSS</i>	07/25/08	Board: 5356-792
Approved: <i>RSS</i>	26-JUL-2008	Sheet: 1 of 4
13:53:33		Rev: 2.0
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		792

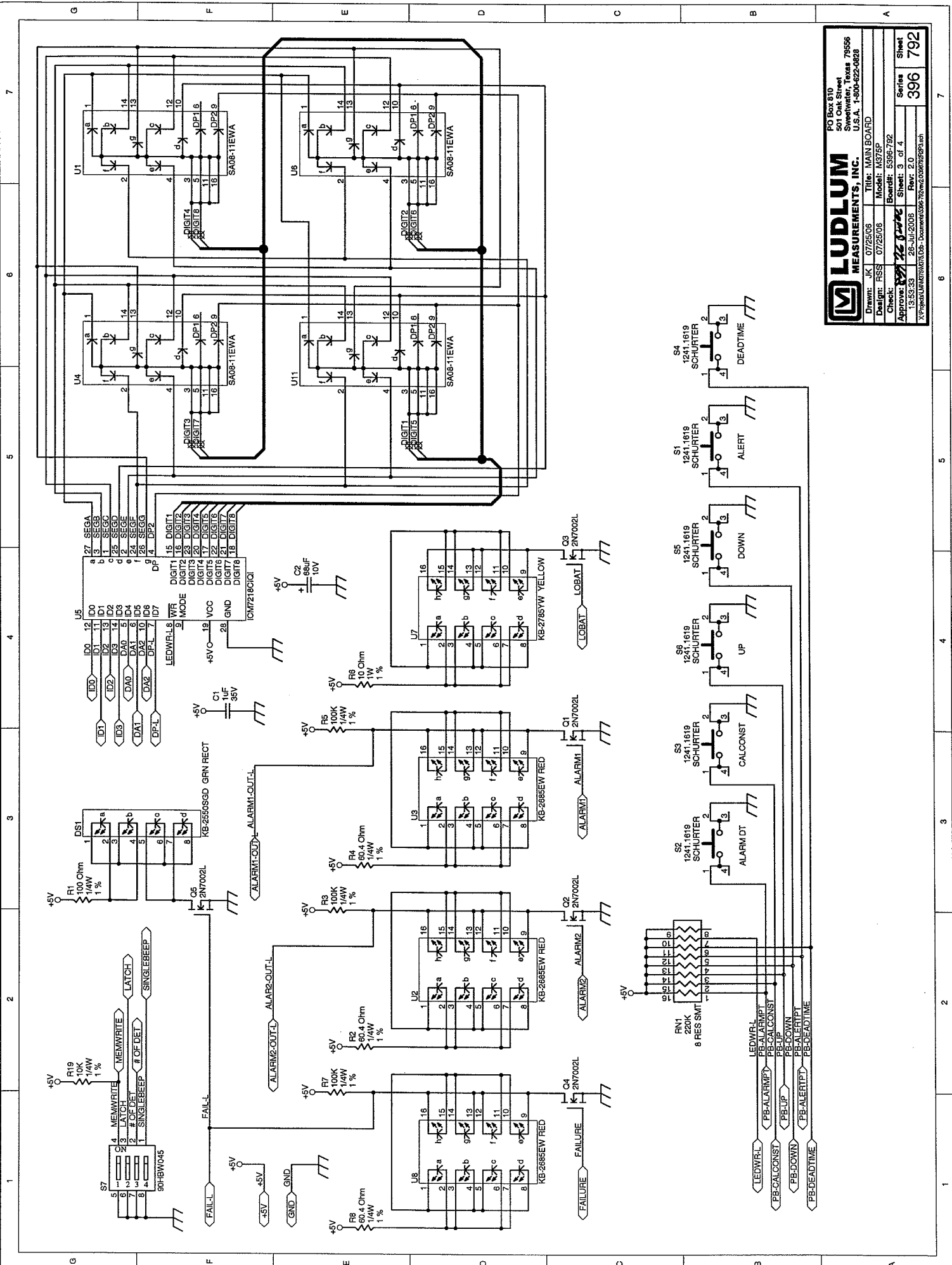


LUDLUM MEASUREMENTS, INC.

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

Drawn: JIK 07/25/06 Title: MAIN BOARD
Design: RSS 07/25/06 Model: M375P
Check: RSS 07/25/06 Board#: 5395-792
Appove: *[Signature]* Sheet: 2 of 4
13:53:33 28-JUL-2006 Rev: 2.0
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Sheet 396 792



LUDLUM MEASUREMENTS, INC.
 PO Box 810
 501 Oak Street
 Sweetwater, Texas 75556
 U.S.A. 1-800-422-0628

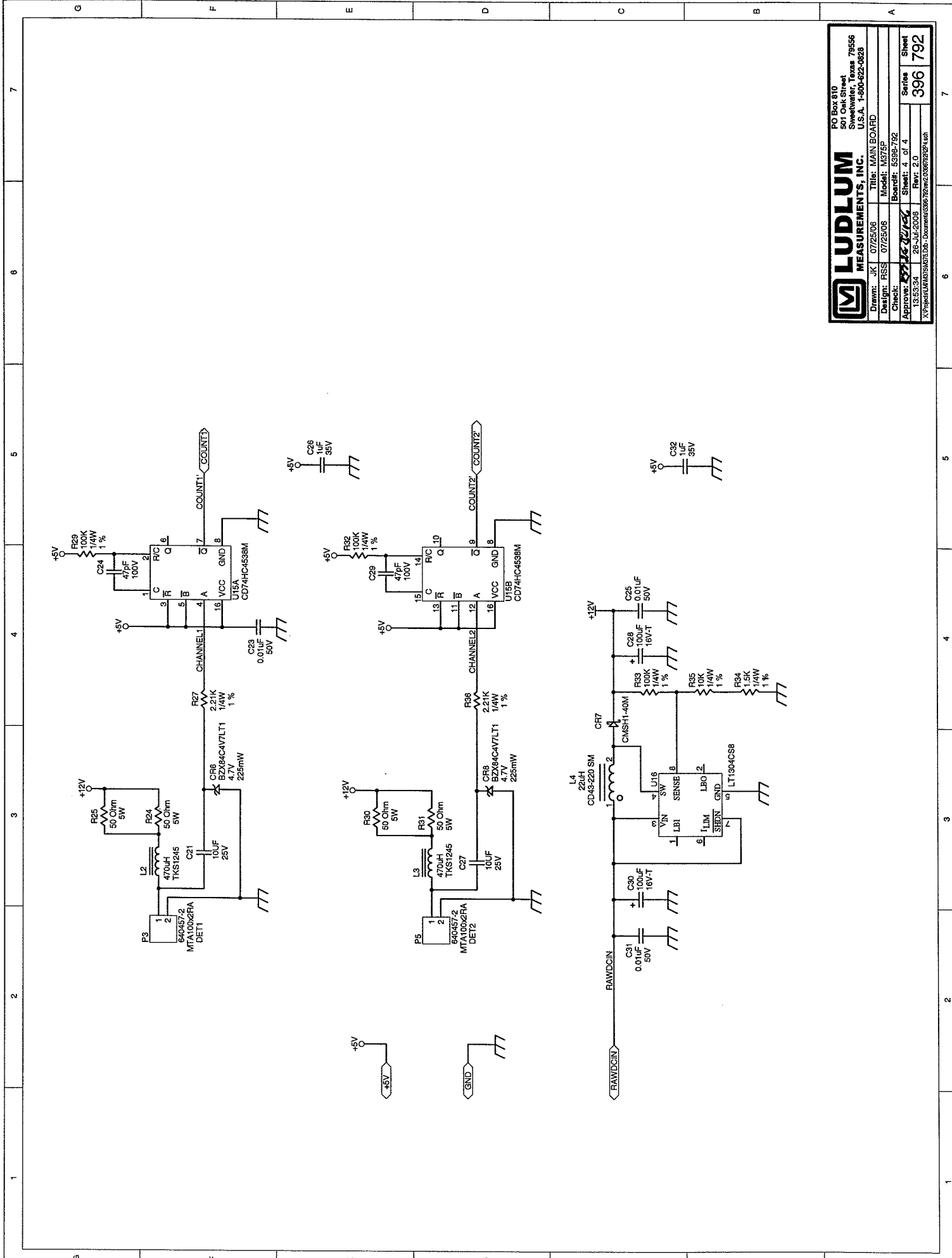
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Design: RSS	07/25/06	Model: M375P
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Approve: <i>[Signature]</i>	26-Jul-2005	Sheet: 3 of 4
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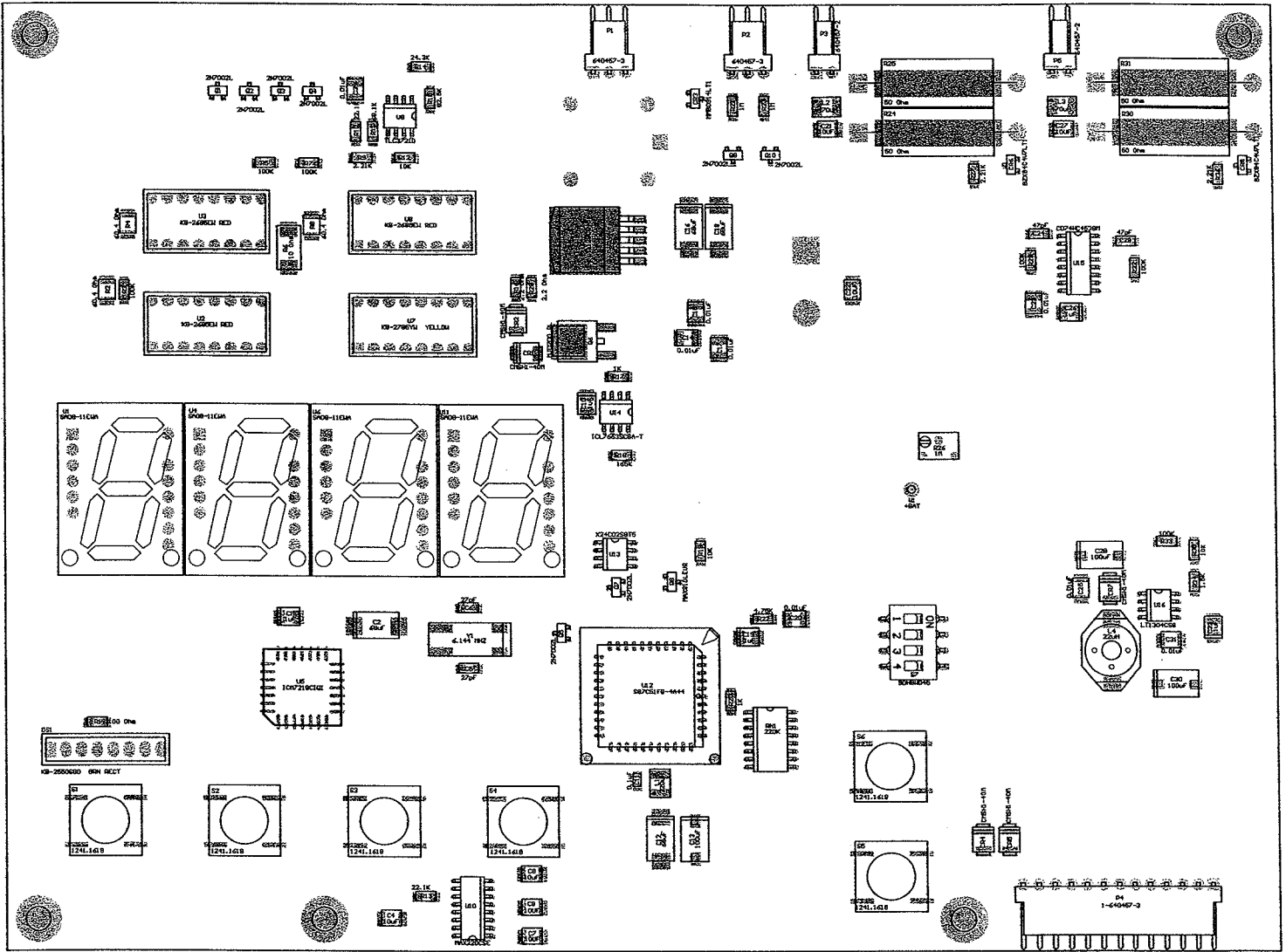
Series **396** Sheet **792**

LUDLUM MEASUREMENTS, INC.
 PO Box 810
 501 Oak Street
 Westborough, Mass. 01581
 U.S.A. 1-800-622-0828

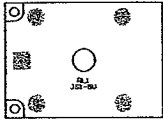
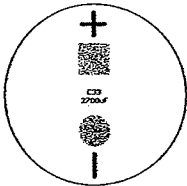
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Design: RSS	07/25/08	Model: M375P
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Approve: <i>[Signature]</i>		Sheet: 4 of 4
13.53.34	28-JUL-2008	Rev: 2.0
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Series **396** Sheet **792**

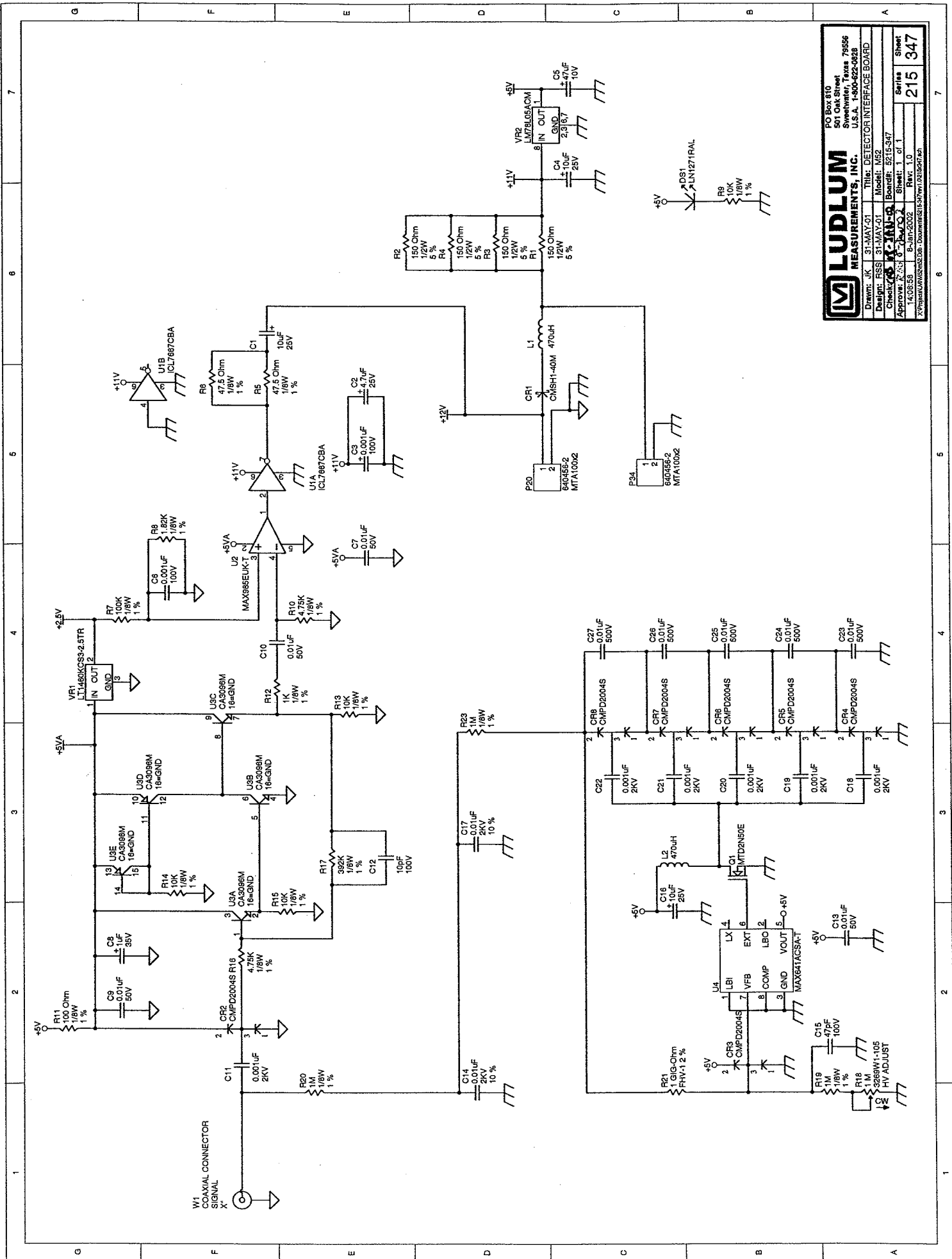




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Design:	RSS	07/25/06	MAIN BOARD		
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Approve:	<i>RSS</i>	<i>26 Jul 2006</i>	Board#: 5396--792		
Layer:			Rev. 2.0	Series	Sheet
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			SCALE: 1.00		



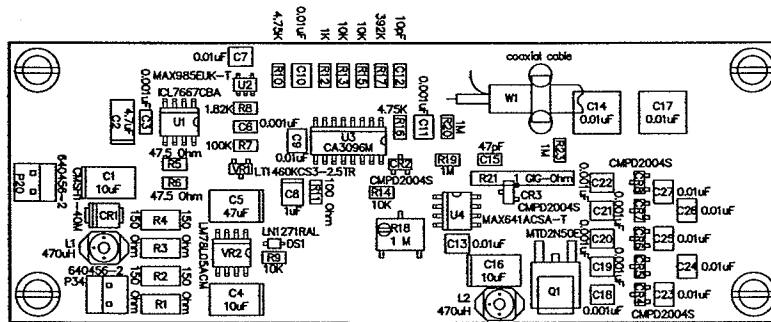
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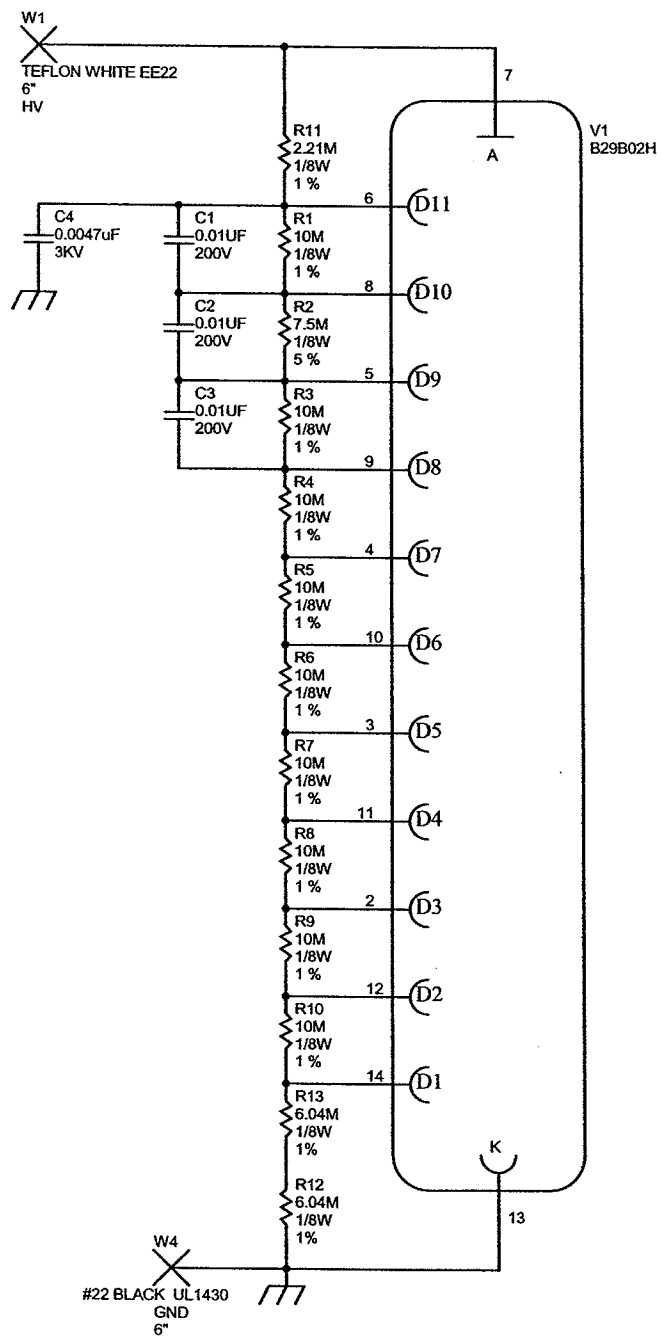
LUDLUM MEASUREMENTS, INC.
 PO Box 810
 501 Oak Street
 Greenville, S.C. 29666
 U.S.A. F50A-524-928

Drawn: JK 31-MAY-01 Title: DETECTOR INTERFACE BOARD
 Design: RSS 31-MAY-01 Model: M2
 Checked: RJS 07-JUN-01 Board: 5215-347
 Approved: RJS 07-JUN-01 Sheet: 1 of 1
 14-06-05 8-Jan-2002 Rev: 1.0
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Series 215 Sheet 347

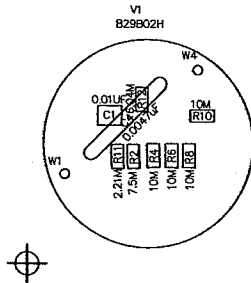


Drawn:	JK	01-JUN-01	Title:	
Design:	RSS	01-JUN-01	DETECTOR INTERFACE BRD.	
Check:	CKD	09-JAN-02	Model: 52	
Approve:	RSS	08-Jan-02	Board#: 5215-347	
Layer:	Top Overlay		Rev. 2.0	Series
Mech.1	MD:		SCALE: 1.00	215
Mech.2	13:07:26			
Mech.4	8-Jan-2002			
bs215347				

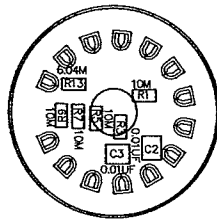


ADIT PO Box 870
300 Crane Street
Sweetwater, Texas 79556
U.S.A. 1-800-399-4557

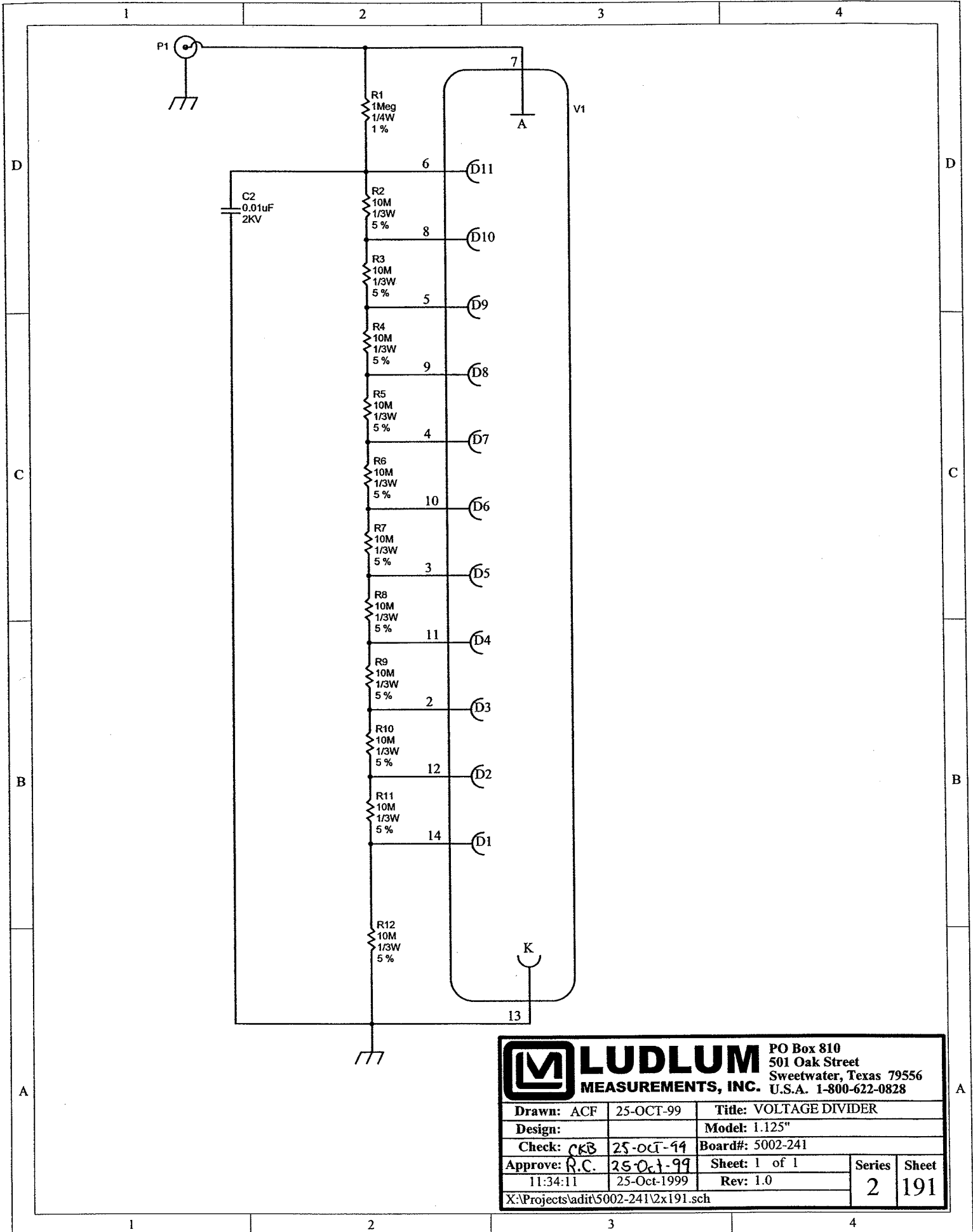
Drawn: KKH	08-JAN-03	Title: 1 1/8" Voltage Divider	
Design: LL	08-JAN-03	Company: Alpha Spectra	
Check:		Tube: B29B10	
Approve: <i>RSS</i>	<i>5 Jun 03</i>	Board#: 5435-182	Sheet: 1 of 1
08:15:47	5-Jun-2003	Rev: 1.0	Series 435 Sheet 435



Drawn: KKH	24-MAR-03	Title: 1 1/8" VOLTAGE DIVIDER		
Design: LL	08-JAN-03	Company: LMI		
		Tube: B29B10H		
Approve: <i>BS</i>	<i>5 JUN 03</i>	Board#: 5435-182		
Layer:	Top Overlay	Rev: 1.0	Series	Sheet
Mech.1		BS435182	435	436
Mech.2				
Mech.3				
Mech.4	MD:			

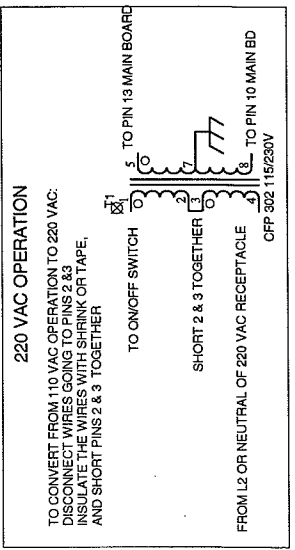
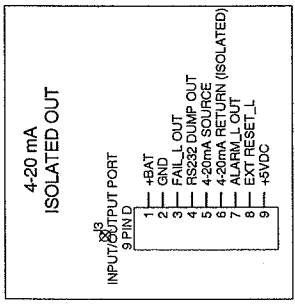
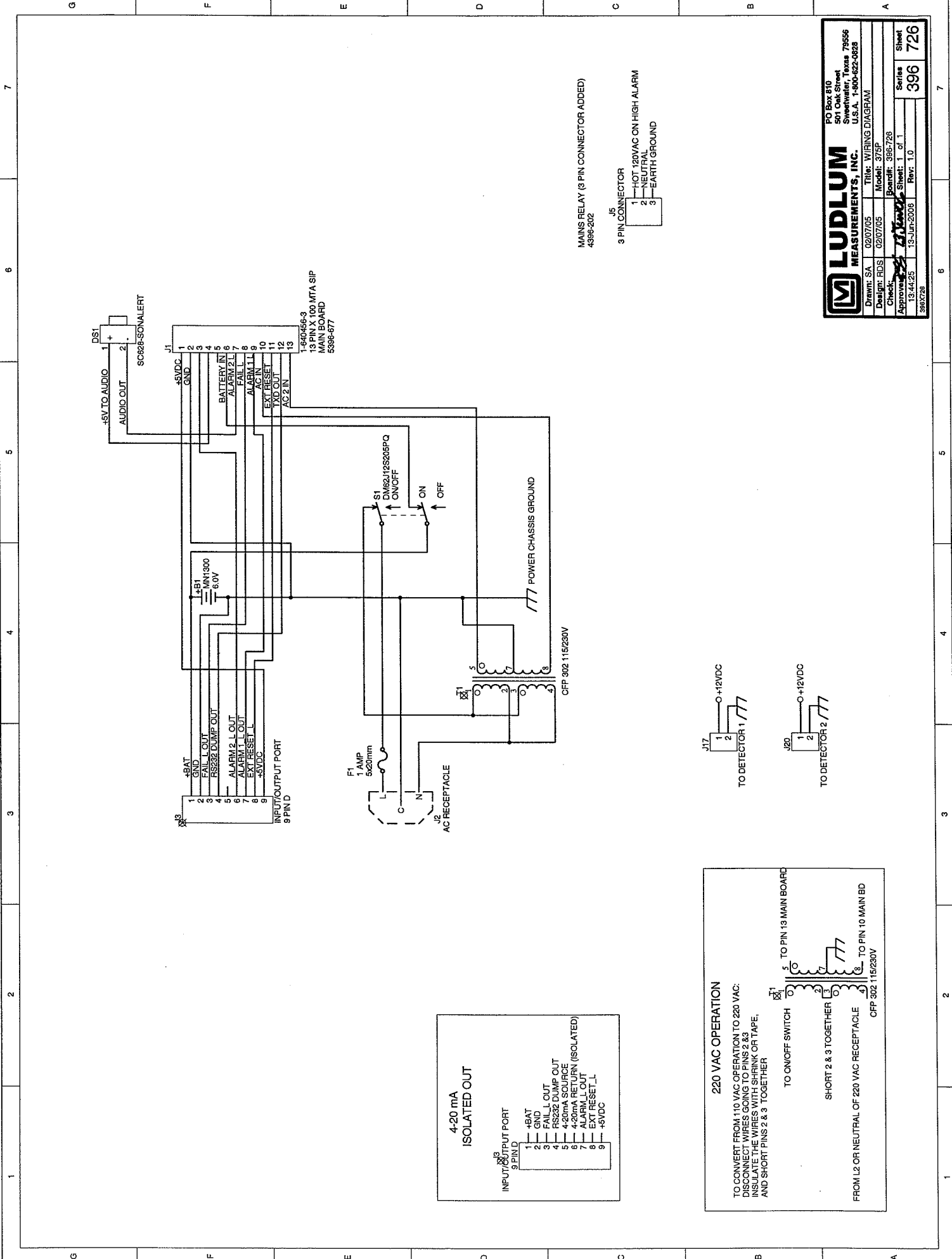


Drawn: KKH	24-MAR-03	Title: 1 1/8" VOLTAGE DIVIDER			
Design: LL	08-JAN-03	Company: LMI			
		Tube: B29B10H			
Approve: <i>RSS</i>	<i>5 Jun 03</i>	Board#: 5435-182			
Layer:	Top		Rev. 1.0	Series	Sheet
Mech.1	Bottom	Bottom Overlay	BS435182	435	436
Mech.2					
Mech.3	MD:				
Mech.4					

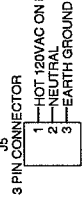


LUDLUM MEASUREMENTS, INC. PO Box 810
501 Oak Street
Sweetwater, Texas 79556
U.S.A. 1-800-622-0828

Drawn: ACF	25-OCT-99	Title: VOLTAGE DIVIDER	
Design:		Model: 1.125"	
Check: CKB	25-OCT-99	Board#: 5002-241	
Approve: R.C.	25-OCT-99	Sheet: 1 of 1	Series
11:34:11	25-Oct-1999	Rev: 1.0	Sheet
X:\Projects\adit\5002-241\2x191.sch			2 191



MAINS RELAY (8 PIN CONNECTOR ADDED)
4396-202



LUDLUM MEASUREMENTS, INC.
PO Box 810
501 Oak Street
Piquette, Michigan 49656
U.S.A. 1-800-622-0829

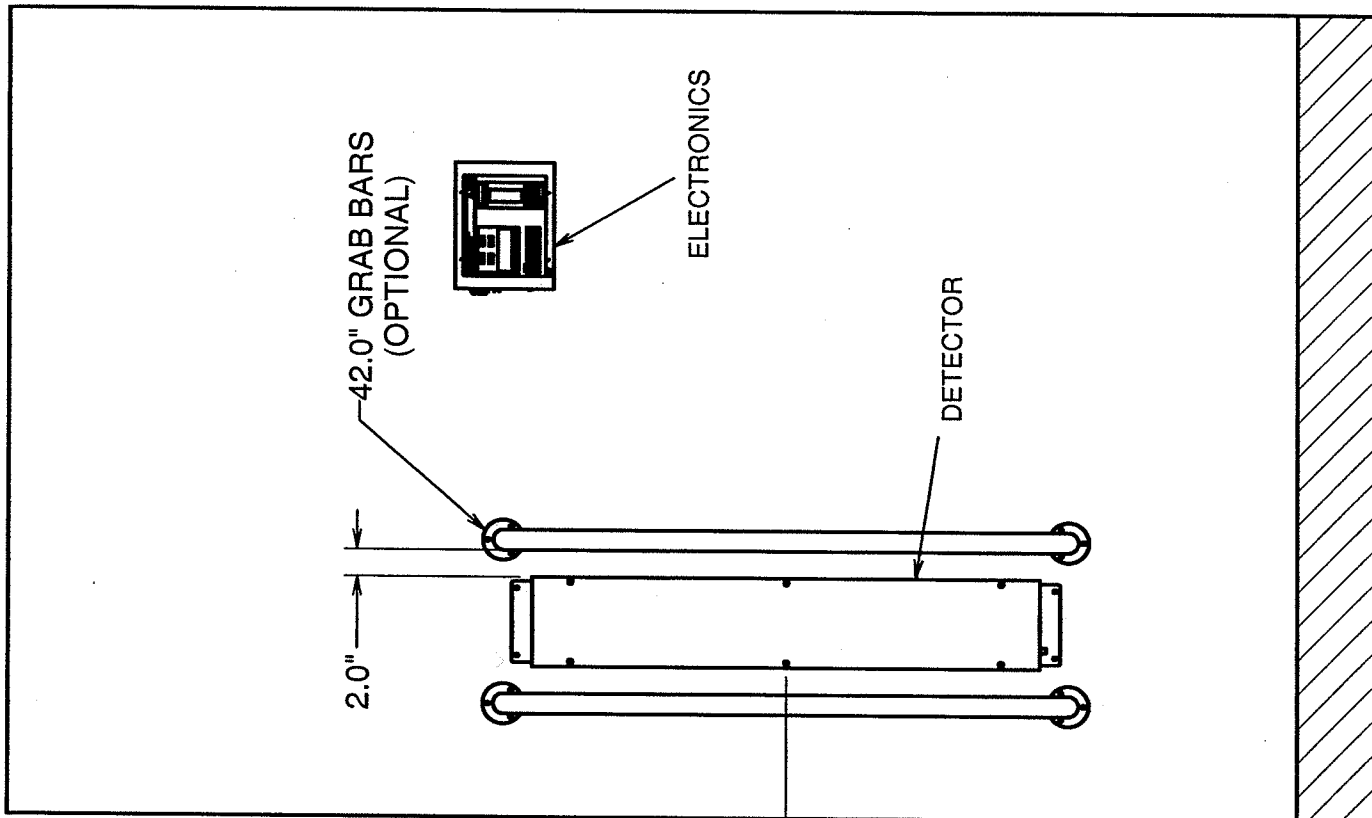
Drawn: SA	02/07/05	Title: WIRING DIAGRAM
Design: RDS	02/07/05	Model: 375P
Check: [Signature]		Board#: 395726
Approved: [Signature]		Sheet: 1 of 1
13/44/25	13-Jun-2008	Rev: 1.0
390X726		Series
		396
		726

REVISION HISTORY

REV	DESCRIPTION	DATE	BY
1	VALID	6/1/2006	JSM

NOTE: ELECTRONICS CAN BE MOUNTED UP TO 1000 FT AWAY

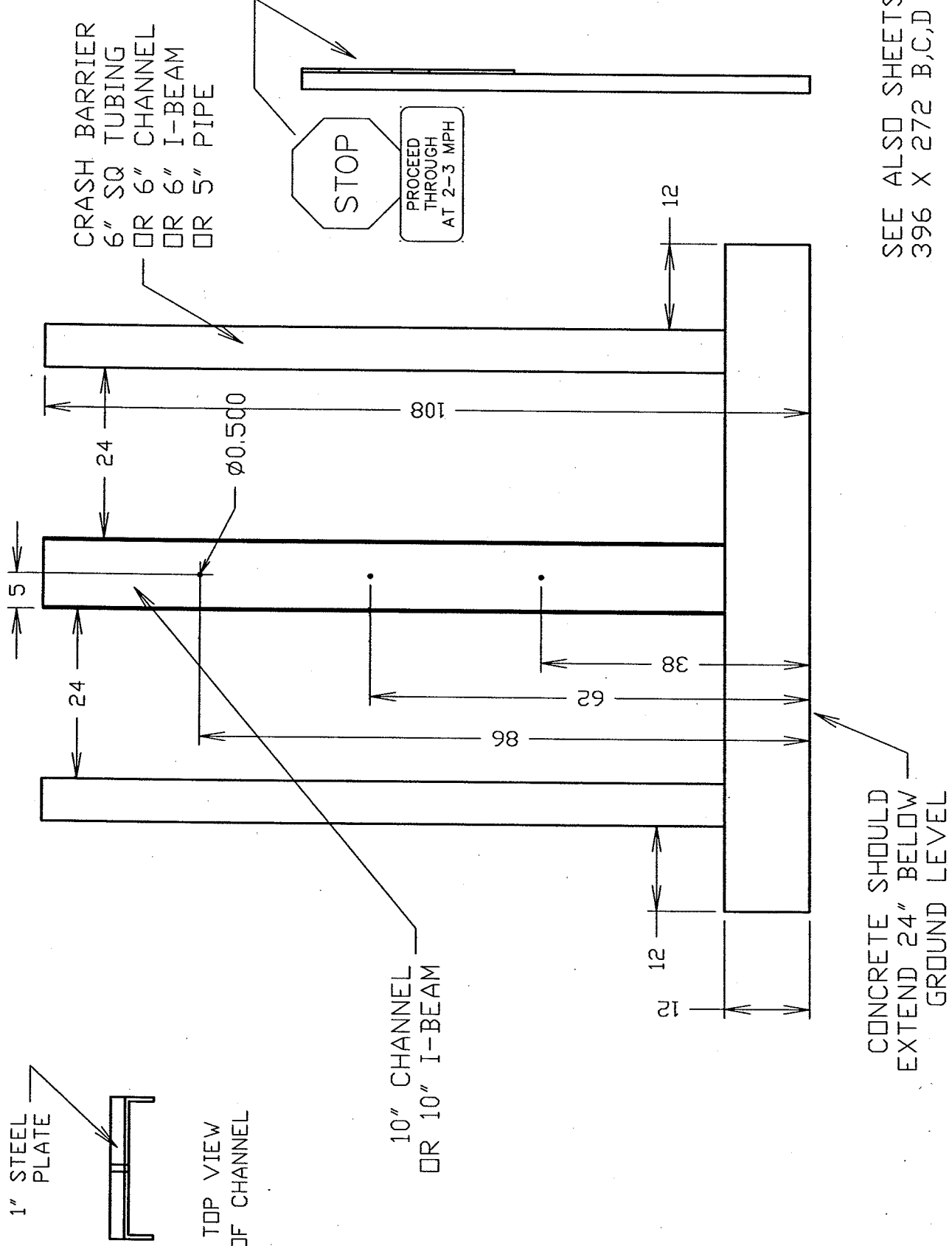
MAX RECOMMENDED DISTANCE BETWEEN DETECTORS = 120". THEY CAN BE SPACED FARTHER APART, BUT SENSITIVITY GOES DOWN AS DISTANCE INCREASES.



38.0" NOMINAL
CENTER OF DETECTOR
SHOULD BE CENTERED
ON TARGET LOAD.

DWN DATE JSM 6-31-06	CHK	DATE	APP DATE New 9-11-06
DWG NUM: 4396-864		SCALE: FULL OTHER	
TITLE: M 375P-336 INSTALLATION			
LUDLUM MEASUREMENTS, INC. 3000 W. WILSON SWEETWATER, TEXAS 75566			SHEET 864
SERIES 396			

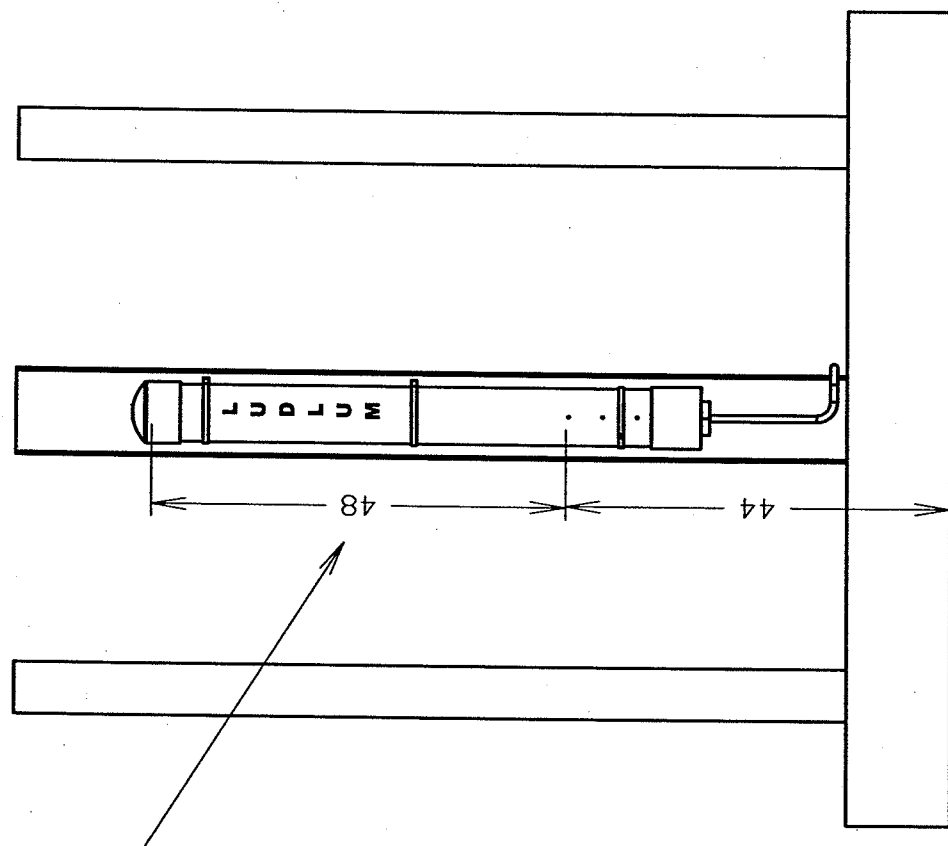
REV #	ALTERATIONS	DATE	BY
1	VALID	4-23-02	JGW



SEE ALSO SHEETS
396 X 272 B,C,D

DRAWN DATE	CHECKED	APPROVED	SHEET
JGW 9-12-06		V6W 9-12-06	272A
TITLE M 375P-1K LOOKING AT DETECTOR			SERIES 396
LUDLUM MEASUREMENTS, INC. 500 ONE STREET SPRINGWATER, TEXAS 75558			272A

REV #	ALTERATIONS	DATE	BY
	VALID	4-23-02	JGV

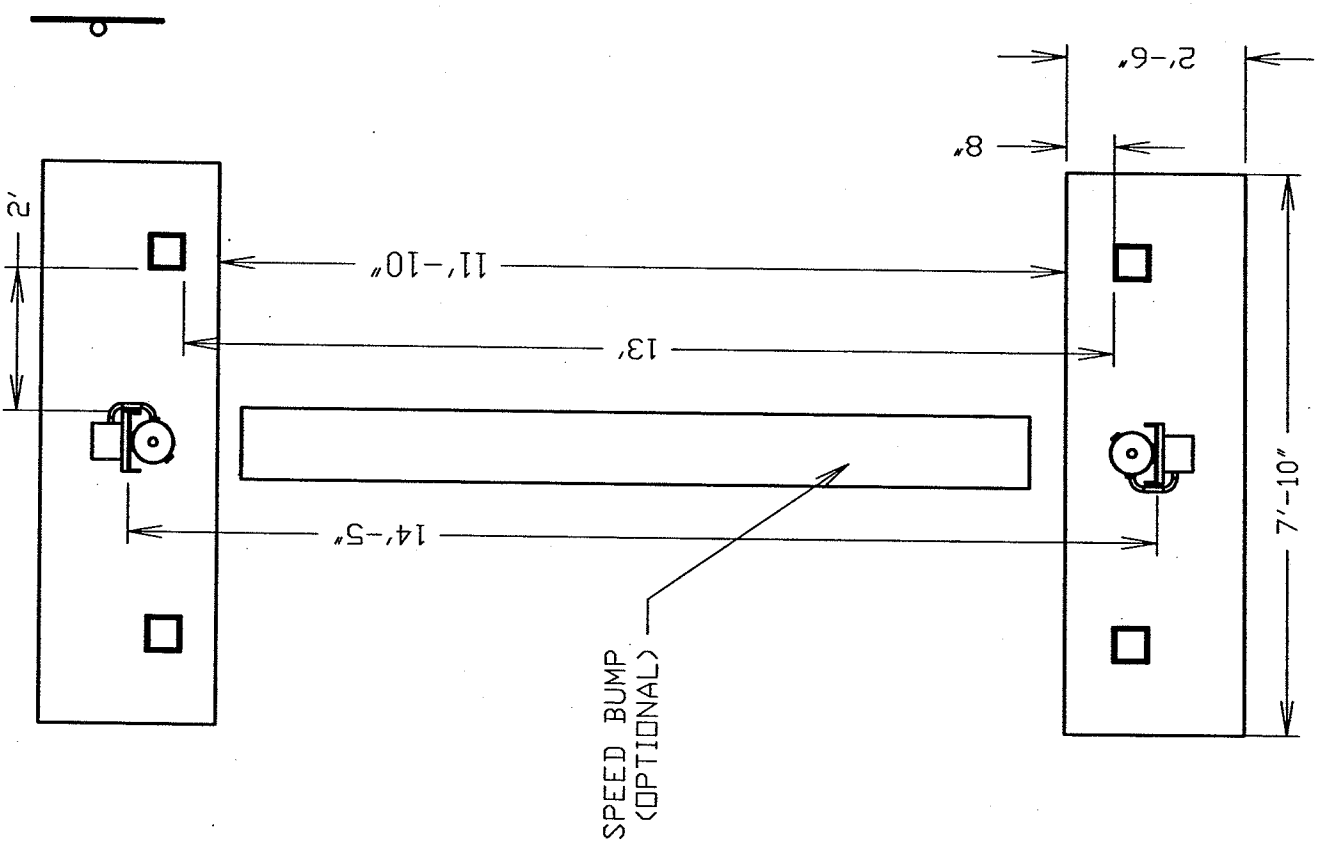


ACTIVE AREA
OF DETECTOR

SEE ALSO SHEETS
396 X 272 A,C,D

DRAWN JGV	DATE 9-12-06	CHECKED	APPROVED JGV	DATE 9-12-06
TITLE: M 375P-1K LOOKING AT DETECTOR				
LUDLUM MEASUREMENTS, INC. 500 OAK STREET SPOKANE, IDAHO 83402				SERIES 396 SHEET 272B

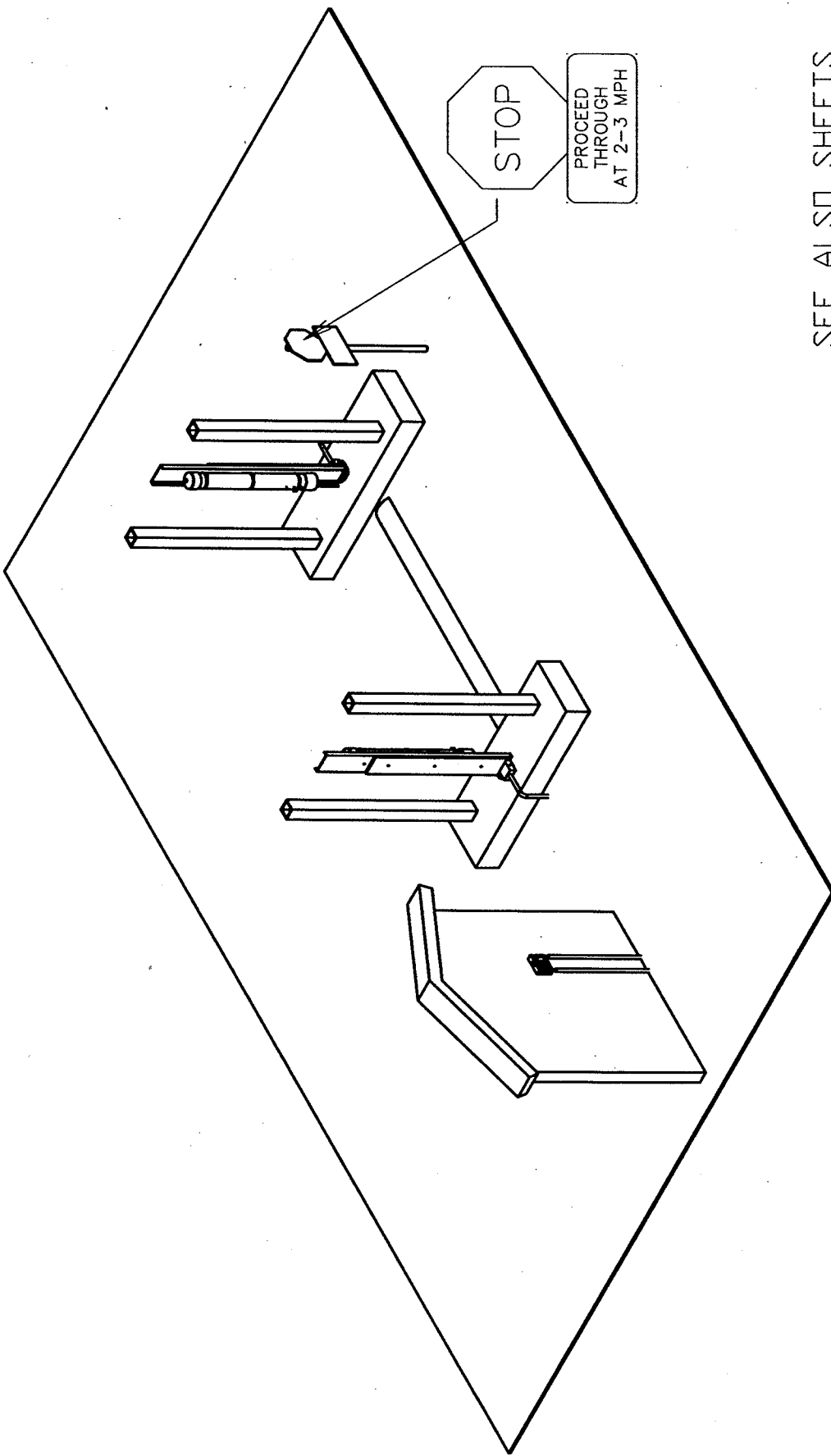
REV #	ALTERATIONS	DATE	BY
	VALID	4-23-02	JGV



SEE ALSO SHEETS
396 X 272 A,B,D

JGV DATE	CHECKED	APPROVED
JGV 9-12-06		JGV 9-12-06
TITLE: M. 375P-1K AERIAL VIEW		
LUDLUM REPAIRMENTS, INC. 300 01K STREET SPRINGWATER, TEXAS 75558		SHEET
		396
		272C

REV #	ALTERATIONS	DATE	BY
	VALID	4-23-02	JGV



SEE ALSO SHEETS
396 X 272 A,B,C

DATE	CHECKED	APPROVED
9-12-06		JGV 4-18-06
TITLE: M 375P-1K ISD VIEW		
LUDLUM MEASUREMENTS, INC. 3000 W. MARKET ST. SPRINGTOWN, TEXAS 75081		
SHEET	SERIES	272D
	396	