

**LUDLUM MODEL 500-1  
PULSER**

**June 2019**

**Serial Number 206262 and Succeeding  
Serial Numbers**

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PULSER**

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

## **STATEMENT OF WARRANTY**

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

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

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

## **RETURN OF GOODS TO MANUFACTURER**

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

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

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

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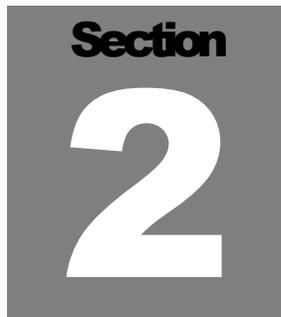
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**Section**  
**1****Introduction**

The Ludlum Model 500-1 Pulse Generator (Pulser) provides the functions necessary for use in calibrating Ludlum instruments, as well as many other scaler/ratemeter instruments. The adjustable output pulse rate is displayed on a three-digit LED readout. Potentiometers (both coarse and fine controls) and a multiplier switch provide rates from 10 to  $9.9 \times 10^6$  counts per minute (cpm). Pulse amplitude is controlled by a multiplier switch and a LO/HI potentiometer, while pulse polarity is chosen by a selector switch. Amplitude may be varied between 0 and  $\pm 5$  volts, displayed on an analog meter. The high voltage of the instrument under test is displayed on a four-digit LED display.

*Model 500-1 Pulser*

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## Specifications and Controls

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**Power:** 115 Vac, 50/60Hz at less than 20 volt-amperes.

**Pulse Output:** Standard connector “C” type (“C” cable is provided).

**High Voltage Readout:** measured by a high-impedance voltmeter up to 1999 volts on the PULSE OUT connector. Voltmeter impedance is 1000 megohms  $\pm 10\%$ . Voltmeter linearity is  $\pm 5\%$  of the reading.

**Pulse Rate:** six multiplying ranges provide pulse rate settings of X0.1 through X10K, displayed on a three-digit LED readout. Minimum pulse rate is 1 cpm, while the maximum pulse rate is 9,900,000 cpm, with accuracy better than  $\pm 2\%$  of the reading.

**Pulse Amplitude:** read on an analog meter labeled 0-5. Four scales are provided: 0-5 mV, 0-50 mV, 0-500 mV and 0-5 V. The desired range is selected using the four position switch. Actual pulse amplitude is within 10% of the reading.

### Note

If the pulse rate is above 500 cpm with the range multiplier switch set to X10K, a slight decrease in overall pulse amplitude may occur.

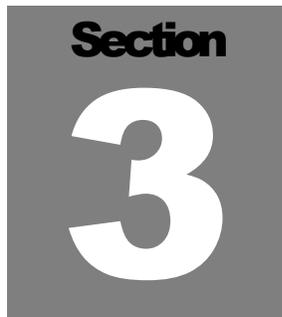
**Pulse Polarity:** The output pulse polarity may be selected by a switch located on the front panel. Total pulse width is typically 7.0 microseconds, comprised of a leading edge of 0.3 microseconds, a pulse flat top of 1.7 microseconds, and a pulse trailing edge of 5 microseconds. The positive pulse width is less than 2.25 microseconds.

**Accessories:** Series “C” to “BNC” and “C” to “MHV adapters are provided.

**Note**

If the pulse amplitude from the pulser exceeds 10 times the input sensitivity of the test instrument, double-pulsing may occur in the instrument under test.

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## Getting Started

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**T**he Ludlum Model 500-1 Pulser (Pulser) is commonly used to calibrate a variety of radiation detection (survey) equipment to a certain count rate (CPS-counts per second, CPM-counts per minute, KCPM-kilo counts per minute, etc.). This is accomplished by measuring high voltage, determining pulse height threshold, and feeding simulated pulses to an instrument. The basic methods associated with calibrating such equipment will be covered in this section, giving the first-time user some valuable principles to build upon as he/she becomes more proficient in the task of electronic calibration.

Before calibrating any piece of survey equipment, some information about that piece of equipment would be of much value and can often be found in respective instrument manuals:

1. You should know the polarity of the detector to be used with the instrument. Most radiation detection instruments used with GM (Geiger Muller), proportional, or scintillation detectors produce a negative pulse.
2. You must know the type of detector used with that particular instrument. This is important because the pulser actually emulates the detector.
3. It is helpful to know the voltage requirements of the detector that will be used with the instrument (often 900 Vdc is required for GM detectors). High-voltage requirements for scintillation detectors are determined by the detectors' plateau.
4. Does the instrument you want to calibrate utilize an intermediate preamp or "smart" electronics at the detector? Be aware that the pulser cannot simulate a detector in these cases.

If you are calibrating an instrument with an analog display, you will first want to ensure that the meter movement has proper mechanical zero. Adjustments are typically on the front of the meter bezel and must be made with the instrument power OFF and the instrument in its normal handheld (or “resting”) position.

## **Measuring Instrument High Voltage**

Use a detector cable of identical length of that which is used in normal operation of the instrument to connect the instrument to the pulser. Turn the pulser power switch to the ON position.

Ensure that the instrument power is ON and then adjust the high-voltage output (consult instrument manual) for a proper high-voltage reading on the pulser high-voltage LED display. Remember, high-voltage requirements are based on the detector that will be used with the instrument.

## **Determining Pulse Height Threshold**

On the pulser, adjust the AMPLITUDE, and –NEG/+POS pulse polarity to that which is specified in the particular instruments’ instruction manual (and/or plateau graph) and calibrate if necessary/applicable.

If an instrument manual is not available, the following procedure can be used to determine pulse height threshold.

With the instrument being calibrated set to the highest range, adjust the pulser count rate until the meter reads full scale. Then, adjust the pulser AMPLITUDE down until a 25% loss of counts is read on the meter face. Record the pulse height threshold from the pulser amplitude readout/meter.

Test above and below the threshold by adjusting the pulser AMPLITUDE while observing a rapid increase or decrease (corresponding to increase or decrease in amplitude) in meter counts.

The pulser can also be used to set the pulse height threshold on instruments with an adjustable threshold. The procedure is basically the same as the preceding procedure. If the desired threshold has not been achieved, adjust the threshold control and repeat this procedure until the desired results are met.

## Electronic Count Rate Calibration

Once the high voltage is set and the pulse height threshold has been determined, use the following procedure to electronically calibrate the instruments' ranges.

First, make certain that the pulser AMPLITUDE is set to at least 1.5 times the pulse height threshold of the instrument being calibrated. With the instrument in the highest range, adjust the pulser's pulse frequency (MULTIPLIER, FINE, and COARSE controls) to provide a meter deflection (on the instrument being calibrated) of approximately 80% of full scale. Make instrument adjustments to obtain the proper reading (range potentiometers are commonly used). Check the 20% scale indication by reducing the pulser count rate by a factor of 4. The instrument being calibrated should read within 10% of the actual pulse rate.

Decrease the pulse rate of the pulser by a decade and adjust the range on the instrument being calibrated to the next lower range. Calibrate as described above, working your way down through the remaining ranges and making adjustments as needed.

For more detailed information on electronic calibration of Ludlum Measurements instruments utilizing the Ludlum Model 500-1 Pulser, contact Ludlum Measurements, Inc. Training Department, and/or consult Ludlum Measurements, Inc. specific instrumentation manuals for the instruments being calibrated.

### **CAUTION!**

At Ludlum Measurements Inc., instrument calibration also involves the detector to be used and a source of radiation of similar energy to that which would be seen in normal use. The preceding steps detail only the electronics side of an instrument calibration, and do not take into account the effects of dead time, or the efficiency of the detector(s) to be used.

## Determining Dose Rate Conversion

The pulser is also frequently used to determine a conversion constant between count rate and dose rate after an instrument has been calibrated to dose rate (on a range). This conversion constant can then later be used for “Bottom Range” calibration (see next section).

The following is an example of how a conversion constant is determined in a Model 12SA MicroR Survey Meter, assuming the instrument has already been calibrated to dose rate:

With the pulser delivering 350,000 cpm and with the instrument in the X1000 range, calibrated to 2 on the meter face, the conversion constant would be calculated:  $350,000 / (2 \times 1000) = 175$  cpm per  $\mu\text{R/hr}$ .

Furthermore, with the pulser delivering 175,000 cpm and with the instrument in the X1000 range, calibrated to 1 on the meter face, the conversion constant would be calculated:  $175,000 / (1 \times 1000) = 175$  cpm per  $\mu\text{R/hr}$ .

This conversion (or “calibration”) constant should remain linear throughout the ranges of the instrument and should be checked by following the preceding equation.

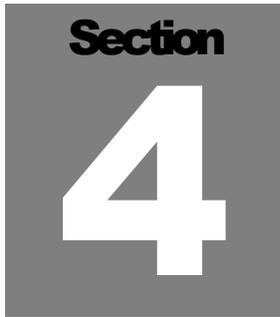
## “Bottom Range” Calibration

The pulser is also frequently used (in accordance with ANSI N323-1997, section 4.2) to calibrate the lowest range of a scintillation detector/instrument, where background radiation levels introduce significant errors.

For instance, with the conversion constant above of 175 cpm per  $\mu\text{R/hr}$  (for the Model 12SA) the bottom range (X1) would be electronically calibrated as follows:

Apply 350 cpm and calibrate the X1 range to a meter reading of 2.

Apply 175 cpm and calibrate the X1 range to a meter reading of 1

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## **Safety Considerations**

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

Indoor use 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 of 95-135 Vac (178-240 Vac available),  
50/60 Hz single phase (less than 100 mA)

Maximum transient voltage of 1500 Vac

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

Pollution Degree 2 (as defined by IEC 664)

### **Cleaning Instructions and Precautions**

The Model 500-1 Pulser 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.

## 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 500 Pulser 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 back 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 back panel. **Note the following precautions:**

### Warning!

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

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

**Caution!**

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



The “**crossed-out wheellie 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 5, “**Recycling**” for further information.

**Replacement of Main Fuse (Back Panel)****Warning!**

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

**Electrical Safety Precautions**

When installing the unit:

- 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, or 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 on a rickety table or a slanted surface. Doing so may result in the unit falling down and causing personal injury and/or property damage.

**Section**  
**5**

## Maintenance and Recalibration

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### Maintenance

Instrument maintenance consists of keeping the instrument clean and periodically checking the calibration. The Model 500 Pulser 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.

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

Every returned instrument must be accompanied by an **Instrument Return Form**, which can be downloaded from the Ludlum website at [www.ludlums.com](http://www.ludlums.com). Find the form by clicking the “Support” tab and selecting “Repair and Calibration” from the drop-down menu. Then choose the appropriate Repair and Calibration division where you will find a link to the form.

# 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.

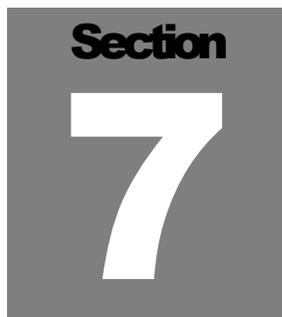
The following types of recyclable materials are present in Ludlum Measurements, Inc. electronics products, and should be recycled separately. The list is not all-inclusive, nor does it suggest that all materials are present in each piece of equipment:

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 wheelie bin.” This notifies the consumer that the product is not to be mixed with unsorted municipal waste when discarding; each material must be separated. The symbol will be placed near the AC receptacle, except for portable equipment where it will be placed on the battery lid.

The symbol appears as such:




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## Parts List

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	<u>Reference</u>	<u>Description</u>	<u>Part Number</u>
<b>Model 500-1 Pulser</b>	UNIT	Completely Assembled Model 500-1 Pulser	48-1166
<b>PULSER BOARD W/ TEMP. STABLE OSC. (Main Board), Drawing 208 X 61</b>	BOARD	Completely Assembled Circuit Board	5208-084
CAPACITORS	C1	10pF, 100V	04-5573
	C2	0.1 $\mu$ F, 100V	04-5521
	C3	0.001 $\mu$ F, 100V	04-5519
	C4	100 $\mu$ F, 10V	04-5576
	C8-C10	22pF, 100V	04-5552
	C11	0.01 $\mu$ F, 100V	04-5523
	C12	1 $\mu$ F, 250V	04-5515
	C15	470pF, 100V	04-5555
	C17	0.1 $\mu$ F, 100V	04-5521
	C18	100pF, 100V	04-5527
	C20	0.001 $\mu$ F, 100V	04-5519
	C21	220pF, 100V	04-5530
	C22-C23	100 $\mu$ F, 10V	04-5576
	C24	1 $\mu$ F, 35V	04-5575
	C25	0.1 $\mu$ F, 35V	04-5574
	C26*	220pF, 100V	04-5530
	C27	47pF, 100V	04-5533
TRANSISTORS	Q1	2N3904	05-5755
	Q2	MPSW51	05-5765
	Q3	2N7000	05-5820
	Q4-Q5	2N3904	05-5755

	<u>Reference</u>	<u>Description</u>	<u>Part Number</u>
	Q6	MPS6534	05-5763
	Q7	2N7000	05-5820
	Q8	VPO300M SILICONIX	05-5834
	Q9	2N3904	05-5755
	Q10	MPS6534	05-5763
VOLTAGE REGULATOR	VR1	LM320LZ-05	05-5771
INTEGRATED CIRCUITS	U1	AD654JN	06-6317
	U2-U6	CD4017BE	06-6001
	U7	LM555CN (M500 ONLY)	06-6017
	U9	CD4098BE	06-6066
	U11	CD4001BE	06-6064
	U12	LM358N	06-6024
	U13	CD4098BE	06-6066
	U16	CA3140E	06-6033
DIODE	CR1	1N4001	07-6268
POTENTIOMETERS / TRIMMERS	R2	10K, MULTIPLIER – REFERENCE	09-6824
	R5	100K, PULSE WIDTH SET	09-6829
	R11	2K, AMPLITUDE	09-6919
	R19	2K, HV METER	09-6919
	R21	100K, TRIGGER SET	09-6829
	R38	ADJUSTABLE TRIMMER	09-6748
RESISTORS	R1	470 Ohm, 1/4W, 5%	10-7008
	R3	560K, 1/4W, 5%	10-7027
	R4	4.7K, 1/4W, 5%	10-7014
	R6	15K, 1/4W, 5%	10-7017
	R7	1K, 1/4W, 5%	10-7009
	R8	3.3K, 1/4W, 5%	10-7013
	R10	3.9K, 1/4W, 5%	10-7084
	R20	100 Ohm, 1/4W, 5%	10-7004

	<u>Reference</u>	<u>Description</u>	<u>Part Number</u>
	R22	1K, 1/4W, 5%	10-7009
	R23	10K, 1/4W, 5%	10-7016
	R24	100K, 1/4W, 5%	10-7023
	R25-R26*	56K, 1/4W, 5%	10-7021
	R28-R29	100K, 1/4W, 5%	10-7023
	R30	10K, 1/4W, 5%	10-7016
	R31	220 Ohm, 1/4W, 5%	10-7041
	R32	100 Ohm, 1/4W, 5%	10-7004
	R33	33 Ohm, 1/4W, 5%	10-7001
	R34	10K, 1/4W, 5%	10-7016
	R36	68 Ohm, 1/4W, 5%	10-7078
	R37	150 Ohm, 1/4W, 5%	10-7005
	R38	10K, 1/4W, 5%	10-7016
	R39-R41	1K, 1/4W, 5%	10-7009
	R42	100K, 1/4W, 5%	10-7023
	R43	2.2K, 1/4W, 5%	10-7012
	R44	10K, 1/4W, 5%	10-7016
<b>M500 READOUT BOARD, Drawing 208 X 176</b>	BOARD	Completely Assembled Readout Circuit Board	5208-172
CAPACITORS			
	C1	1 $\mu$ F, 16V	04-5701
	C2	10 $\mu$ F, 25V	04-5655
TRANSISTORS			
	Q1-Q3	2N7002L	05-5840
INTEGRATED CIRCUITS			
	U1	CD74HC4511E	06-6525
MISCELLANEOUS			
	DS1-DS3	LED-HDSP-E103	07-6342
RESISTORS			
	R1-R7	681 Ohm, 1/8W, 1%	12-7852
CONNECTOR			
	P1	HEADER-TSS-108-16PIN	13-857

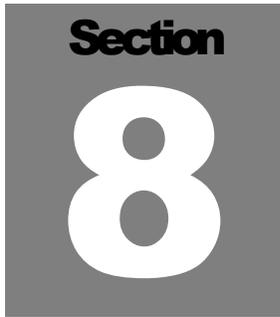
	<u>Reference</u>	<u>Description</u>	<u>Part Number</u>
<b>HV READOUT BOARD, Drawing 208 X 145</b>	BOARD	Completely Assembled HV Readout Board	5208-018
CAPACITORS			
	C1	0.01 $\mu$ F, 100V	04-5523
	C2	0.047 $\mu$ F, 100V	04-5565
	C3	0.22 $\mu$ F, 100V	04-5566
	C4	0.1 $\mu$ F, 100V	04-5521
	C5	100pF, 100V	04-5527
TRANSISTORS			
	CR1	LM385Z-1.2	05-5808
INTEGRATED CIRCUITS			
	U1	ICL7117CPL	06-6161
	U2-U5	HP5082-7650	07-6282
POTENTIOMETER / TRIMMER			
	R3	10K, 3266X1-103	09-6822
RESISTORS			
	R1	10K, 1/4W, 5%	10-7016
	R2	1Meg, 1/4W, 5%	10-7028
	R4	100K, 1/4W, 5%	10-7023
	R5	470K, 1/4W, 5%	10-7026
<b>M500 READOUT CONTROLLER, Drawing 208 X 173</b>	BOARD	Completely Assembled Readout Controller Circuit Board	5208-171
CAPACITORS			
	C1	100pF, 100V	04-5661
	C2-C3	0.01 $\mu$ F, 50V	04-5664
	C4-C6	1 $\mu$ F, 16V	04-5701
	C7	4.7 $\mu$ F, 25V	04-5653
	C8	1 $\mu$ F, 16V	04-5701

	<u>Reference</u>	<u>Description</u>	<u>Part Number</u>
VOLTAGE REGULATOR	VR1	ADP3308ART-3.3- SOT-23-5	05-5880
INTEGRATED CIRCUITS	U1	SN74AHC14D SO-14	06-6474
	U2	MSP430F1101DW SOW-20	06-6529
	U3	SN74AHCT541D SOW-20	06-6527
	U4	TPS3825-33SOT-23-5	06-6558
RESISTORS	R1-R2	10K, 1/8W, 1%	12-7839
	R3-R6	2.21K, 1/8W, 1%	12-7835
	R7	33.2K, 1/8W, 1%	12-7842
	R8	10K, 1/8W, 1%	12-7839
CONNECTORS	P1	SOCKET-SSQ-108-16PIN	13-8574
	P2	640456-5 MTA 100X5	13-8057
	P3	CON-EDGE/MIN- 10-39.37 PITCH	*
<b>Chassis Wiring Diagram, Drawing 208 X 179</b>			
CAPACITORS	C1	1600 $\mu$ F, 50V	04-5535
	C2	1 $\mu$ F, 35V	04-5502
	C3	1600 $\mu$ F, 50V	04-5535
	C4	2.2 $\mu$ F, 20V	04-5508
	C5	0.0056 $\mu$ F, 3KV	04-5522
	C6	2.2 $\mu$ F, 20V	04-5508
	C9	1 $\mu$ F, 35V	04-5502
VOLTAGE REGULATORS	VR1	3N164	05-5757
	VR2	LM320K-12; NTE 1915	05-5797
	VR3	LM320K-5; NTE 1913	05-5787
	VR4	NTE1914; ECG 933	05-5784
DIODES	CR1-CR8	1N4001	07-6268

	<u>Reference</u>	<u>Description</u>	<u>Part Number</u>
SWITCHES			
	S1	PA-1001, AMPLITUDE	08-6502
	S2	SWITCHCRAFT, 46206-LR, POWER	08-6523
	S3	PA-1001, RANGE	08-6502
	S4	PA-2021/D4C0605N, PULSE POLARITY	08-6505
POTENTIOMETERS / TRIMMERS			
	R8	1K, RV4NAYSD102A, PULSE HEIGHT	09-6759
	R9	100K, RV4NAYSD104A3, MIN/MAX	09-6795
	R19	20K, 10T 534-1-1-203, PULSE HEIGHT	09-6909
RESISTORS			
	R1	909 Ohm, 1/8W, 1%	12-7553
	R2	90.9 Ohm, 1/4(1/8)W, 1%	12-7552
	R3	10 Ohm, 1/8 W, 1%	12-7554
	R4	1 Ohm, 3W, 1%	12-7555M2
	R7	1K, 2W, 5%	12-7605
	R10	100 Ohm, 1/4W, 5%	10-7004
	R17	1G, FHV-1, 2%	12-7686
	R18	1M, 1/4W, 1%	12-7609
	R20-R21	1.15K, 1/3W, 1%	12-7807
CONNECTORS			
	J2	MTA 100 X 5	13-8041
	J3	CJ50-44A-30	13-7866
	P	HARDWIRED, HV READOUT	13-8041
	P4	EAC-309	13-7982
	P5	UG709B/U C	13-7777
TRANSFORMER			
	T1	M500 110/220VAC	4275-146

---

	<u>Reference</u>	<u>Description</u>	<u>Part Number</u>
MISCELLANEOUS	M1	BEEDE 0-1 MA 2-04	15-8016
	F1	1 Amp, 250V, AGC-1	21-9277
	*	FUSE-HOLDER 348-8-7-73	21-9403
DS1	DS1	NEON, IDI 2110A1, PILOT	21-9296
	*	ADAPTER-C TO MHV	4208-089
	*	Power Cord-Belden	21-9394
	*	CBL-C	40-1004
	*	ADAPTER-C TO BNC	13-7759

A dark gray square containing the word "Section" in a bold, black, sans-serif font at the top, and a large, white, bold, sans-serif number "8" in the center.

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## Drawings

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PULSER BRD W/ TEMP STABLE OSC, Drawing 208 X 61

MODEL 500 MAIN BOARD, COMPONENT OUTLINES,  
Drawings 208 X 61A (2 sheets)

MODEL 500 READOUT BOARD, Drawing 208 X 176

MODEL 500 READOUT BOARD, Component Outlines, Drawings  
208 X 177 (2 sheets)

HV READOUT BOARD, Drawing 208 X 145

HV READOUT BOARD, Component Outlines, Drawings 208 X  
148A (2 sheets)

MODEL 500 READOUT CONTROLLER, Drawing 208 X 173

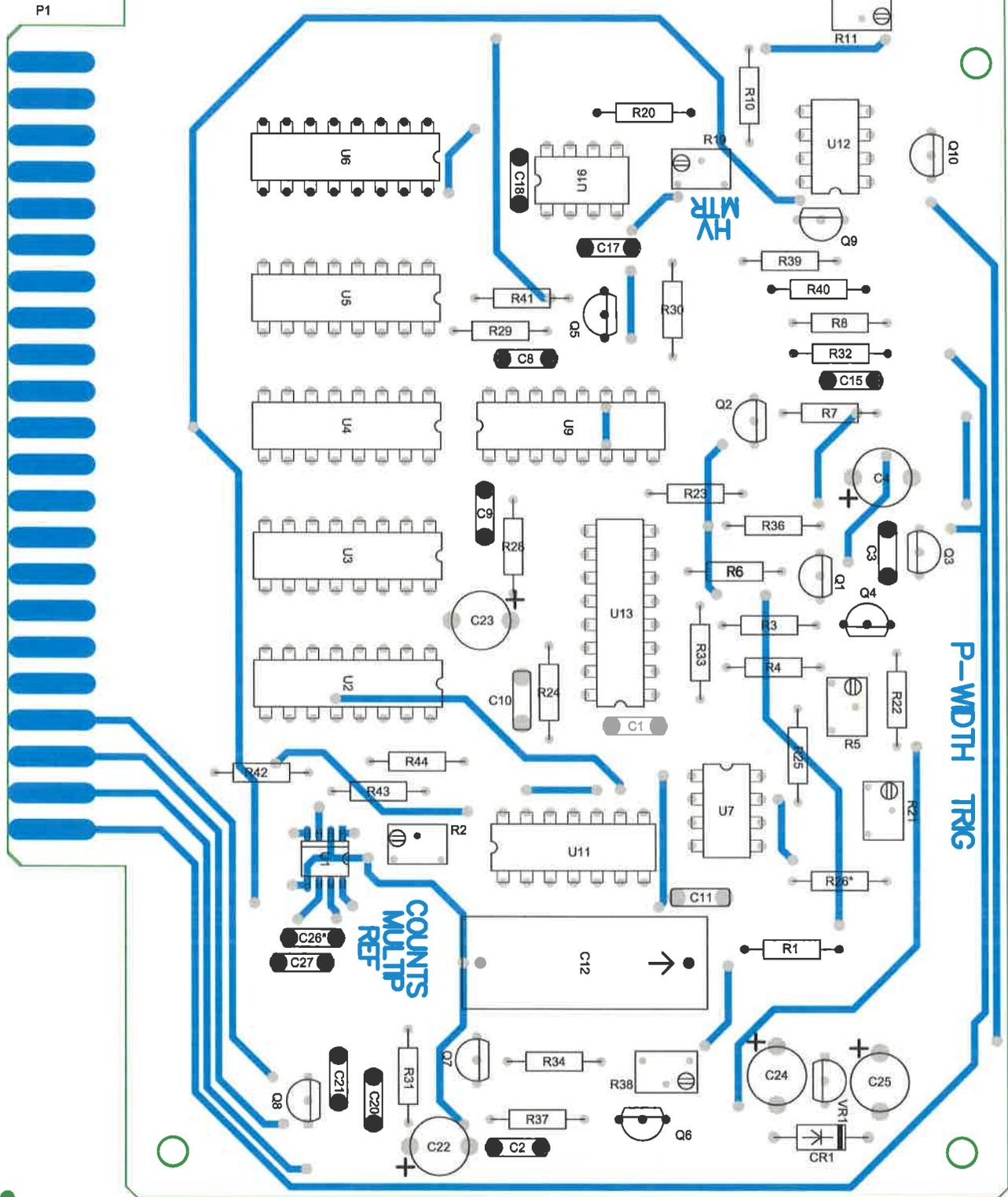
MODEL 500 READOUT CONTROLLER, Component Outlines,  
Drawings 208 X 174 (2 sheets)

WIRING DIAGRAM, Drawing 208 X 179



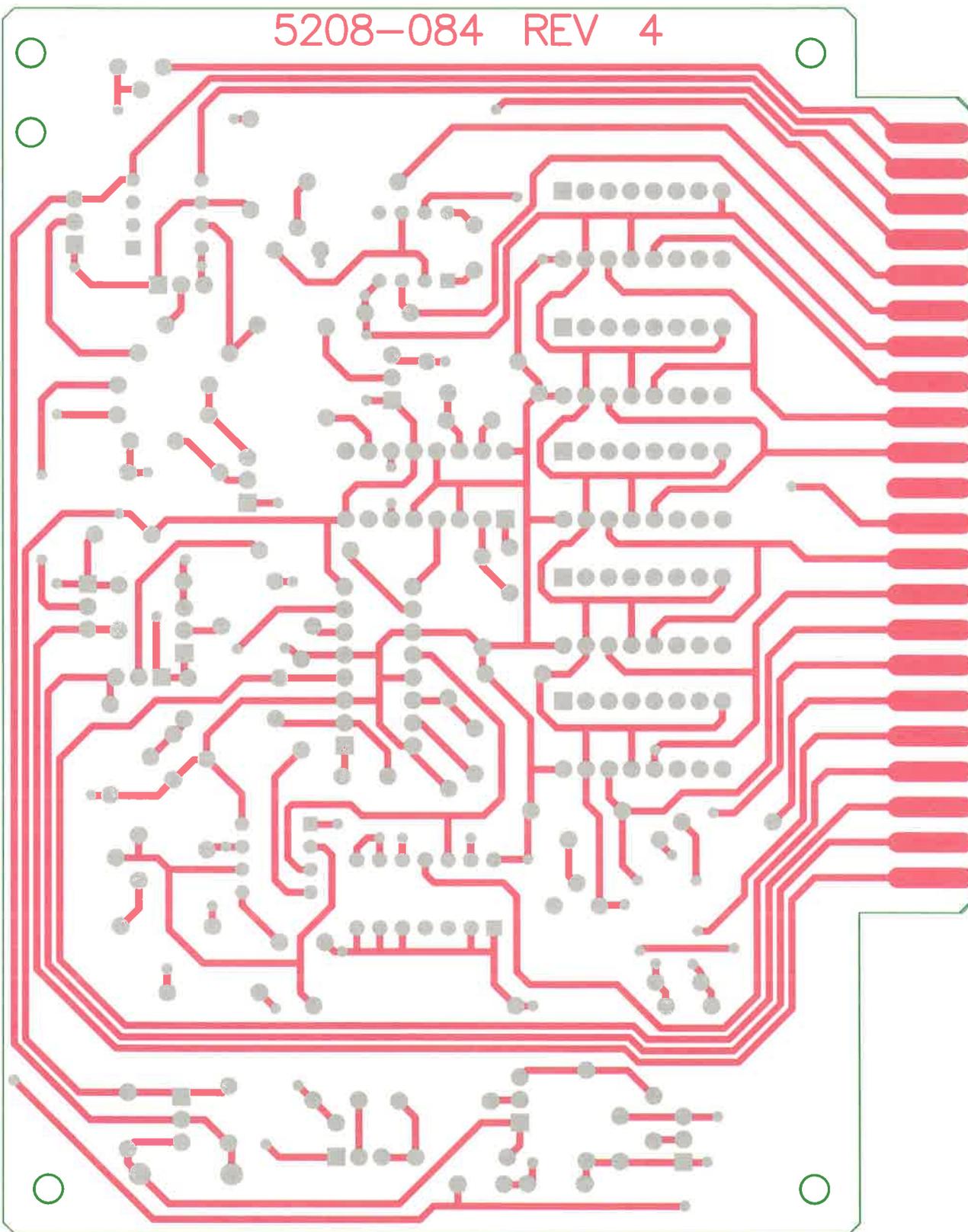
# 5208-084 REV 4

AMPLT

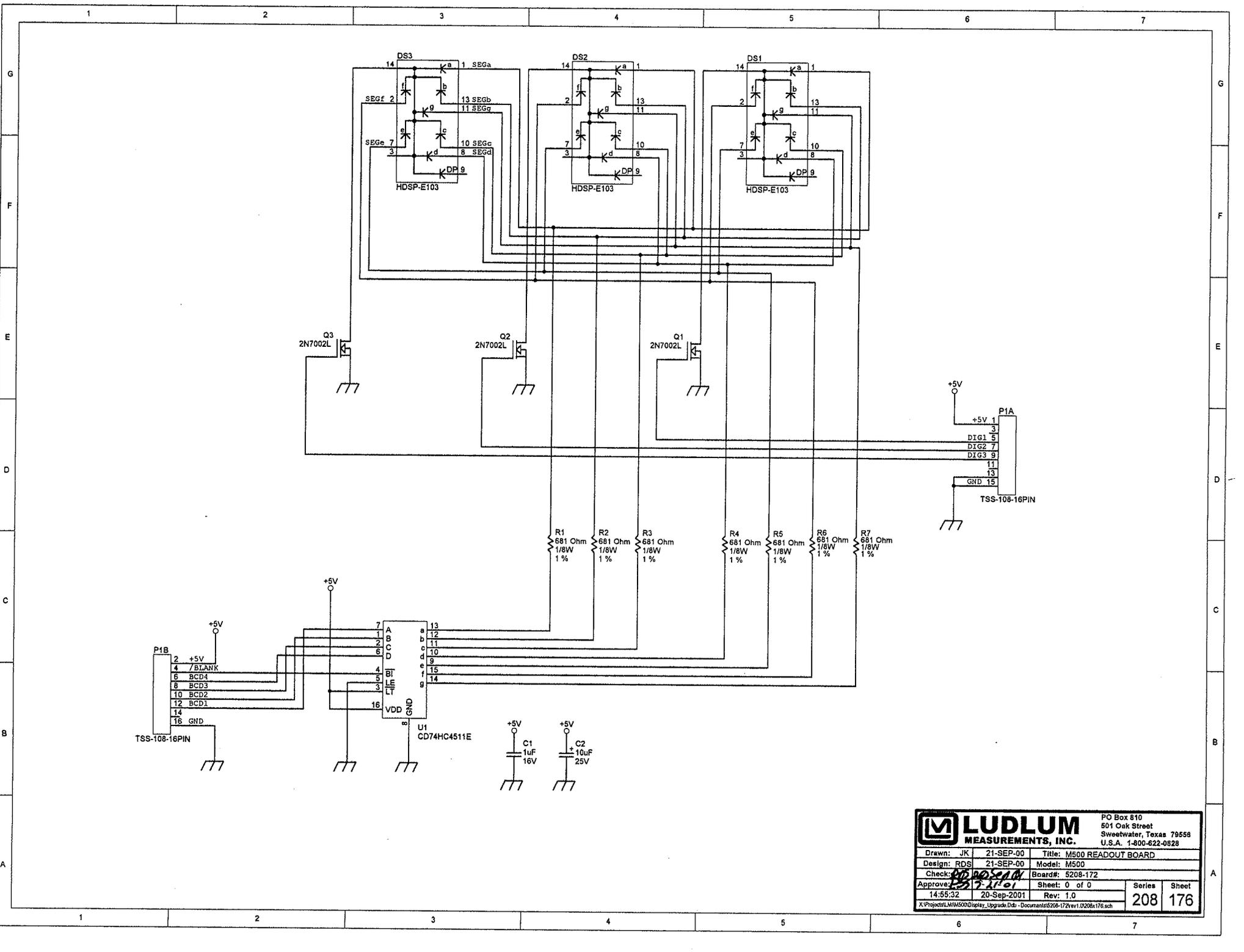


<b>LUDLUM MEASUREMENTS, INC.</b>		PO Box 810 501 Oak Street Sweetwater, TX 79556 U.S.A. 1-800-622-0828	
Title: PULSER BRD W/ TEMP STABLE OSC			
Drawn: PAB	6/12/2019	Model: 500 & 500-7	
Design: DL	10-20-00	Board#: 5208-084	
Approve: <i>JMC</i>	<i>13 Jun 19</i>	Rev: 4	
PCBA Drawing		SCALE: 1.05	Series Sheet
Print Date: 6/13/2019	4:15:40 PM	Top Overlay	208 61A
W:\Project\MM 500\5208-084\Rev4\208084R4_Assy_PcbDoc			

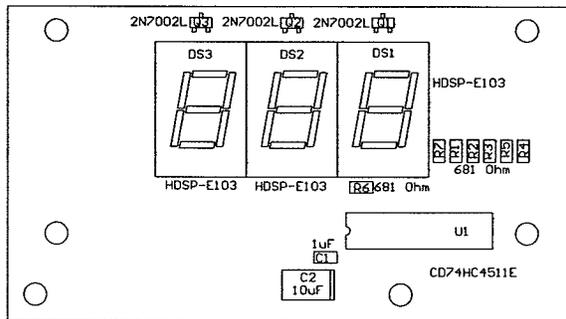
5208-084 REV 4



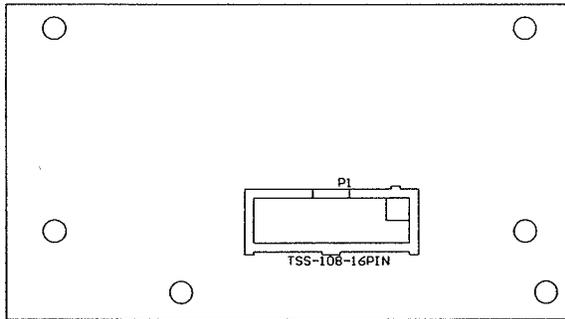
		PO Box 810 501 Oak Street Sweetwater, TX 79556 U.S.A. 1-800-622-0828	
<b>Title:</b> PULSER BRD W/ TEMP STABLE OSC			
<b>Drawn:</b> PAB	6/12/2019	<b>Model:</b> 500 & 500-7	
<b>Design:</b> DL	10-20-00	<b>Board#:</b> 5208-084	
<b>Approve:</b> JMC	13 JUN 19	<b>Rev:</b> 4	
<b>PCBA Drawing</b>		<b>SCALE:</b> 1.05	<b>Series</b> <b>Sheet</b>
<b>Print Date:</b> 6/13/2019	4:15:44 PM	Bottom Overlay	208 61A
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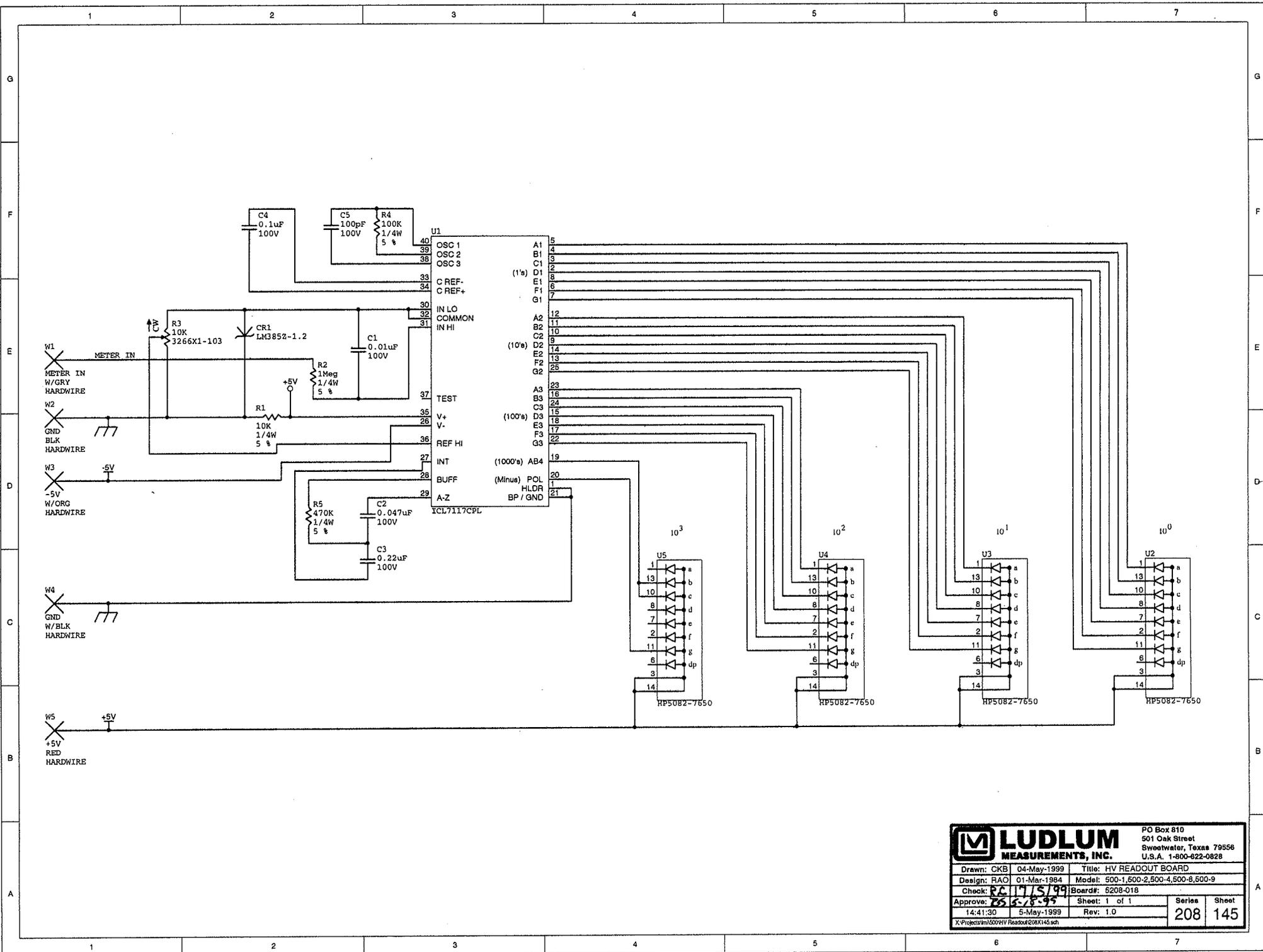
		PO Box 810 501 Oak Street Sweetwater, Texas 79558 U.S.A. 1-800-622-0828	
		Drawn: JK Design: RDS Check: <i>[Signature]</i> Approved: <i>[Signature]</i>	Title: M500 READOUT BOARD Model: M500 Board#: 5208-172 Sheet: 0 of 0 Rev: 1.0



Drawn: JK	21-SEP-00	Title: M500 READOUT BOARD	
Design: RDS	21-SEP-00	Model: M500	
Check: <i>RDS</i>	<i>20SEP01</i>	Board#: 5208-172	
Approve: <i>BS</i>	<i>9-21-01</i>		
Layer:		Rev: 1.0	Series
		SCALE: 0.95	Sheet
14:54:46	20-Sep-2001		208   177



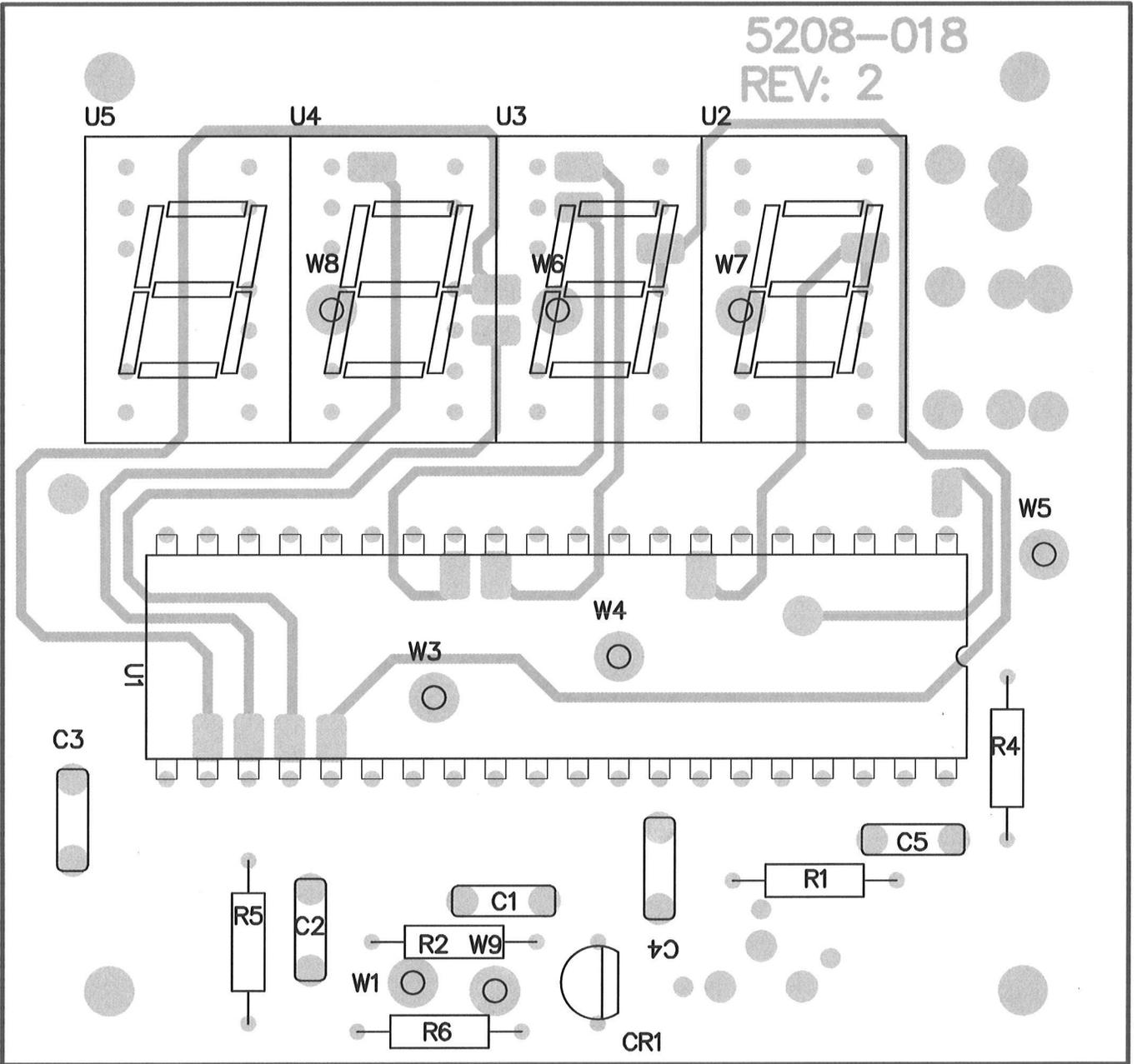
Drawn:	JK	21-SEP-00	Title:		M500 READOUT BOARD
Design:	RDS	21-SEP-00	Model:		M500
Check:	<i>RDS</i>	<i>20 Sep 01</i>	Board#:		5208-172
Approve:	<i>RDS</i>	<i>9-21-01</i>	Rev:	1.0	Series
Layer:			SCALE:	0.95	208
	14:54:47	20-Sep-2001			177



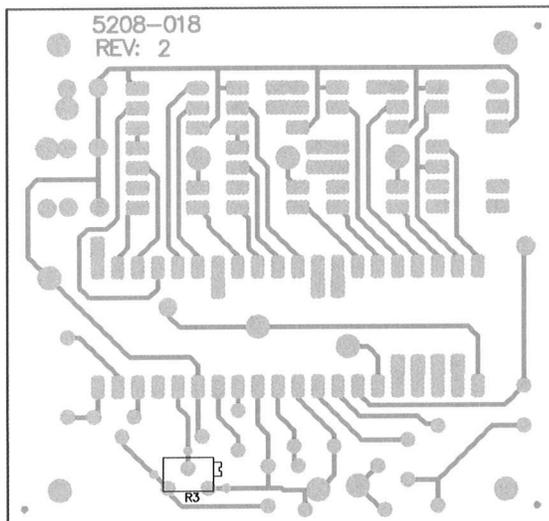
**LUDLUM MEASUREMENTS, INC.**  
 PO Box 810  
 501 Oak Street  
 Sweetwater, Texas 79556  
 U.S.A. 1-800-622-0828

Drawn: CKB	04-May-1999	Title: HV READOUT BOARD
Design: RAO	01-Mar-1984	Model: 500-1,600-2,500-4,500-8,500-9
Check: PC	17/5/99	Board: 5208-018
Approve: <i>PC</i>	6-18-99	Sheet: 1 of 1
14:41:30	5-May-1999	Rev: 1.0
X:\Projects\m\500HV Readout\08X145.sch		Series: 208
		Sheet: 145

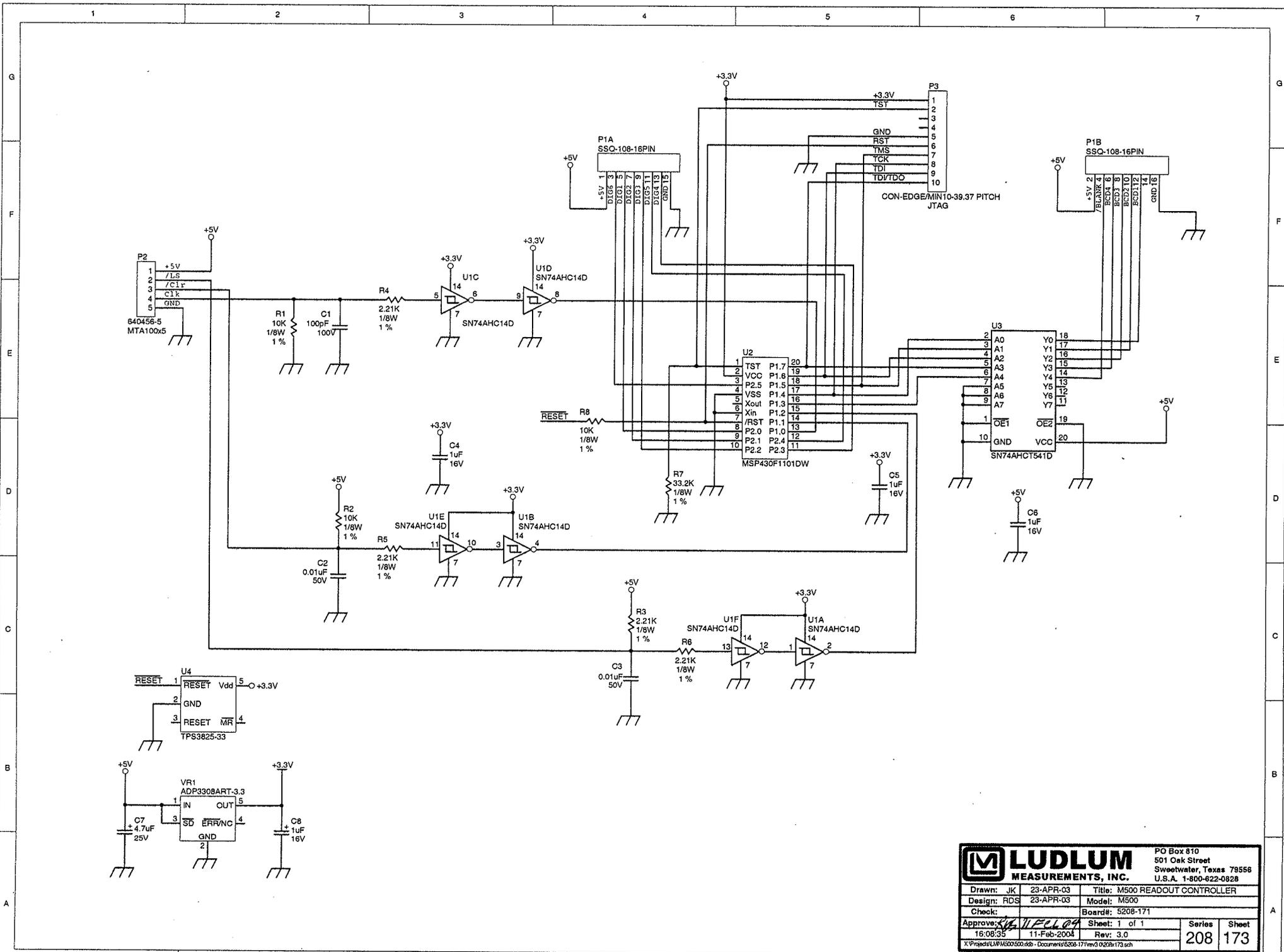
5208-018  
REV: 2



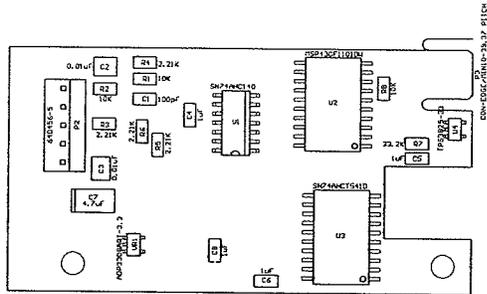
		PO Box 810 501 Oak Street Sweetwater, TX 79556 U.S.A. 1-800-622-0828	
<b>Title:</b> HV READOUT BOARD			
<b>Drawn:</b> CKB	5/5/99	<b>Model:</b> 500	
<b>Design:</b> RAO	7/8/83	<b>Board#:</b> 5208-018	
<b>Approve:</b> <i>RJS</i>	<i>25JAN15</i>	<b>Rev:</b> 2	
PCBA Drawing		<b>SCALE:</b> 1.05	<b>Series</b> Sheet
<b>Print Date:</b> 1/28/2015	9:03:31 AM	Top Overlay	208 148A
<small>W:\Projects\LMM\500\5208-018\rev2.0\208018R2_Assy.PcbDoc</small>			



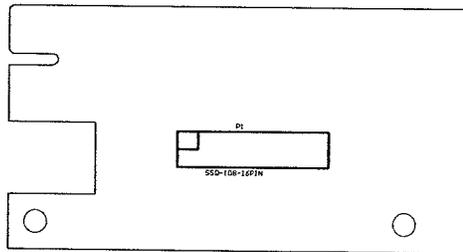
 <b>LUDLUM</b> MEASUREMENTS, INC.		PO Box 810 501 Oak Street Sweetwater, TX 79556 U.S.A. 1-800-622-0828	
		<b>Title:</b> HV READOUT BOARD	
<b>Drawn:</b> CKB	5/5/99	<b>Model:</b> 500	
<b>Design:</b> RAO	7/8/83	<b>Board#:</b> 5208-018	
<b>Approve:</b> <i>RJS</i>	<i>20 Aug 14</i>	<b>Rev:</b> 2	
<b>PCBA Drawing</b>		<b>SCALE:</b> 1.00	<b>Series</b> Sheet
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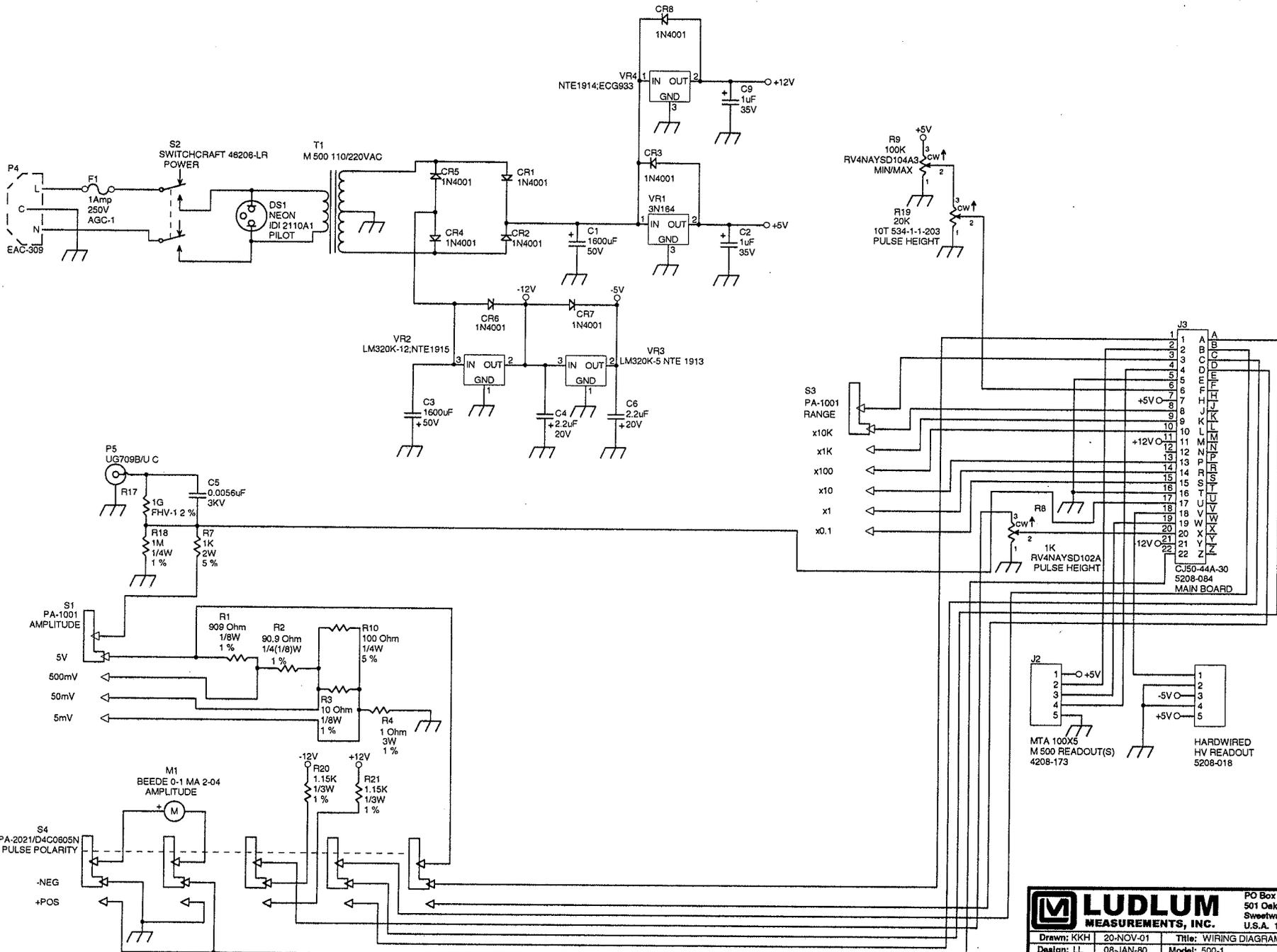
<b>LUDLUM</b>		MEASUREMENTS, INC.		PO Box 810 501 Oak Street Sweetwater, Texas 79556 U.S.A. 1-800-822-0828	
Drawn: JK	23-APR-03	Title: M500 READOUT CONTROLLER			
Design: RDS	23-APR-03	Model: M500			
Check:		Board#: 5208-171			
Approve: <i>[Signature]</i>	11-Feb-2004	Sheet: 1 of 1	Series	Sheet	
16:08:35			208	173	
X:\Projects\LMW\M500\500.dwg - Document\5208-171\rev3 02/26/173.sch					



Drawn:	JK	23-APR-03	Title:	
Design:	RDS	23-APR-03	M500 READOUT CONTROLLER	
Check:			Model: M500	
Approve:	<i>RIS</i>	<i>17 Feb 04</i>	Board#: 5208-171	
Layer:			Rev: 3.0	Series
	16.06.58	17-Feb-2004	SCALE: 0.95	Sheet
			208	174



Drawn:	JK	23-APR-03	Title:	
Design:	RDS	23-APR-03	M500 READOUT CONTROLLER	
Check:			Model: M500	
Approve:	<i>RIS</i>	<i>17Feb04</i>	Board#: 5208-171	
			Rev. 3.0	Series
	16:06:58	17-Feb-2004	SCALE: 0.95	Sheet
				208 174



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

Drawn: KKH	20-NOV-01	Title: WIRING DIAGRAM
Design: LL	08-JAN-80	Model: 500-1
Check: <i>LL</i>	<i>26-NOV-01</i>	Board#: 208-174
Approve: <i>LL</i>	<i>26-NOV-01</i>	Sheet: 1 of 1
14:09:32	26-Nov-2001	Rev: 1.0
208X178		208 179