201A DC VOLTMETER
201AN DC VOLTMETER
201AN-AC AC VOLTMETER

Operator's Manual

MADE IN THE U.S.A.

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It is the policy of NEWPORT to comply with all worldwide safety and EMC/EMI regulations that apply. NEWPORT is constantly pursuing certification of its products to the European New Approach Directives. NEWPORT will add the CE mark to every appropriate device upon certification.

The information contained in this document is believed to be correct but NEWPORT Electronics, Inc. accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.

WARNING: These products are not designed for use in, and should not be used for, patient connected applications.

This device is marked with the international caution symbol. It is important to read the Setup Guide before installing or commissioning this device as it contains important information relating to safety and EMC.

SAFETY CONSIDERATIONS

This device is marked with the international Caution symbol. It is important to read this manual before installing or commissioning this device as it contains important information relating to Safety and EMC (Electromagnetic Compatibility).

Unpacking & Inspection

Unpack the instrument and inspect for obvious shipping damage. Do not attempt to operate the unit if damage is found.

This instrument is a panel mount device protected in accordance with Class I of EN61010 (115/230 AC power connections). Installation of this instrument should be done by Qualified personnel. In order to ensure safe operation, the following instructions should be followed.

This instrument has no power-on switch. An external switch or circuit-breaker shall be included in the building installation as a disconnecting device. It shall be marked to indicate this function, and it shall be in close proximity to the equipment within easy reach of the operator. The switch or circuit-breaker shall not interrupt the Protective Conductor (Earth wire), and it shall meet the relevant requirements of IEC 947–1 and IEC 947-3 (International Electrotechnical Commission). The switch shall not be incorporated in the mains supply cord.

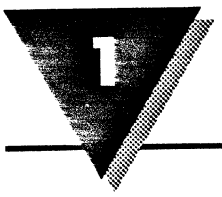
Furthermore, to provide protection against excessive energy being drawn from the mains supply in case of a fault in the equipment, an overcurrent protection device shall be installed.

- The **Protective Conductor** must be connected for safety reasons. Check that the power cable has the proper Earth wire, and it is properly connected. It is not safe to operate this unit without the Protective Conductor Terminal connected.

- Do not exceed voltage rating on the label located on the top of the instrument housing.
- Always disconnect power before changing signal and power connections.
- Do not use this instrument on a work bench without its case for safety reasons.
- Do not operate this instrument in flammable or explosive atmospheres.
- Do not expose this instrument to rain or moisture.
- Unit mounting should allow for adequate ventilation to ensure instrument does not exceed operating temperature rating.
- Use electrical wires with adequate size to handle mechanical strain and power requirements. Install without exposing bare wire outside the connector to minimize electrical shock hazards.

EMC Considerations

- Whenever EMC is an issue, always use shielded cables.
- Never run signal and power wires in the same conduit.
- Use signal wire connections with twisted-pair cables.
- Install Ferrite Bead(s) on signal wires close to the instrument if EMC problems persist.



General Information

The 201A, 201AN and 201AN-AC are different pinout versions of the same 3 1/2 digit panel meter for applications which require a compact, quality dc voltmeter. Standard features include HOLD function, selectable decimal point location and LAMP TEST.

Each model contains the circuitry for all ranges. The range is changed by opening and closing the appropriate switches on the printed circuit board via installation of push-on jumpers.

1.1 MODELS 201A AND 201AN

Model 201AN is pin-compatible with Newport's 202A, 2001 and 2002A series. Models 201A and 201AN have a resolution of 1 part in ±1999 counts, or 0.05% of full scale. By using an external dc voltage reference, any of these ranges can be configured for 3-wire ratio measurement with readout from 0 to 1.999.

1.2 MODEL 201AN-AC

Model 201AN-AC, for AC power-line monitoring, has a screw-terminal barrier strip for signal and power. This model uses a half-wave average converter calibrated to read RMS. It offers input ranges of 199.9 and 650 Vac, with resolution of 100 mV and 1 V, respectively. Maximum rated input in either range is 650 V RMS or 920 Vp.

2 Specifications

2.1 Analog Input

Models 201A and 201AN

Signal ranges	±199.9 mV	±1.999 V	±19.99 V	±199.9 V
Bias current	50 pA	50 pA	5 pA	1 pA
Maximum input	130 Vp	130 Vp	250 Vp	250 Vp
Resolution	100 uV	1 mV	10 mV	100 mV
Input resistance	1 GΩ	1 GΩ	1.1 MΩ	1.0 M^N8,50
Configuration		Differential, bipolar		
Zero		Automatic		
Span adjustment		±5%		

Model 201AN-AC

Signal ranges	199.9 Vac	650 Vac
Bias current	1 pA	1 pA
Overvoltage protection	650 Vac	650 Vac
Resolution	100 mV	1 Vac
Input resistance	1 MΩ	1 MΩ
Configuration	Half-wave average, RMS-calibrated	
Zero	Automatic	
Frequency	47-1000 Hz	

2.2 Accuracy at 25°C

Warmup to rated accuracy	10 minutes

Models 201A and 201AN

Maximum error	±0.05% or reading °1 count
Span to tempco	±0.01% of reading/°C
Step response	1 second

Model 201AN-AC (10% to 100% of full-scale range)

Maximum error (actual reading)

20.0 to 199.9 V range	±0.003%FS (R-110 V) / V ±1.5 counts
20.0 to 650. V range	±0.003%FS (R-220 V) / V ±1.5 counts
Span to tempco	±0.01% of reading / °C
Step response	1 second

2.3 Noise Rejection

NMR	56 dB at 50/60 Hz
CMR, SIG LO to SIG GND	80 dB, DC to 60 Hz
CMV, SIG LO to SIG GND	±1.0 Vp
CMR, AC GND to SIG GND	120 dB, DC to 60 Hz
CMV, AC GND to SIG GND	1500 Vp per HV test; 354 Vp per IEC spacing

2.4 Analog to Digital Conversion

Technique	Dual-slope, average-value
Read rate	2.5/second
Input integration period	100 milliseconds

2.5 3-Wire Ratio Reference

Models 201A and 201AN

Analog input range	±200 mV, ±2 V, ±20 V, ±200 V	
Reference voltage	+0.05 to +0.2 V	+0.5 to 2.0 V
Load on reference	30.6 ohms	65.3 ohms
Accuracy	99.9%R	99.9%R

2.6 Display

Type	7-segment, red LED; 14.2 mm (0.56 in)
Symbols	
201A & 201AN	-1.8.8.8
201AN-AC	1.8.8.8
Decimal points	3 position programmable internally or at connector
Overrange indication	3 least-significant digits blank

2.7 Digital Signals (Referenced to SIG GND)

Logical 0	0 to +1.4 V
Logical 1	+3.7 V to +5.0 V
Display HOLD	1 = latched reading
LAMP TEST	1 = display of -1888
Output voltage	+4.7 Vdc ±5% at 10 mA max -4.6 Vdc ±5% at 10 mA max

2.8 Power

AC input voltage	115 or 230 Vac ±15%
AC frequency range	49 to 440 Hz
DC input voltage	9-32 Vdc, isolated to 300 Vp 26-56 Vdc, isolated to 300 Vp
Power consumption	2.4 W (nominal)

2.9 Environmental

Operating temperature	0 to +60°C
Storage temperature	-40 to +85°C
Relative humidity	95% at +40°C (non-condensing)

2.10 Mechanical

Bezel	96 x 48 x 6.1 mm (3.78 x 1.89 x 0.24 in)
Depth behind bezel, with connector	99 mm (3.90 in)
Panel cutout	92 x 45 mm (3.62 x 1.77 in)
Weight	400 g (14 oz)
Case material	94V-O UL-rated polycarbonate
D1 connector:	18-pin, double-row, 3.96 mm (0.156 in) pin spacing
D4 connector:	Screw-terminal barrier strip for signal and power (removes these inputs from D1)

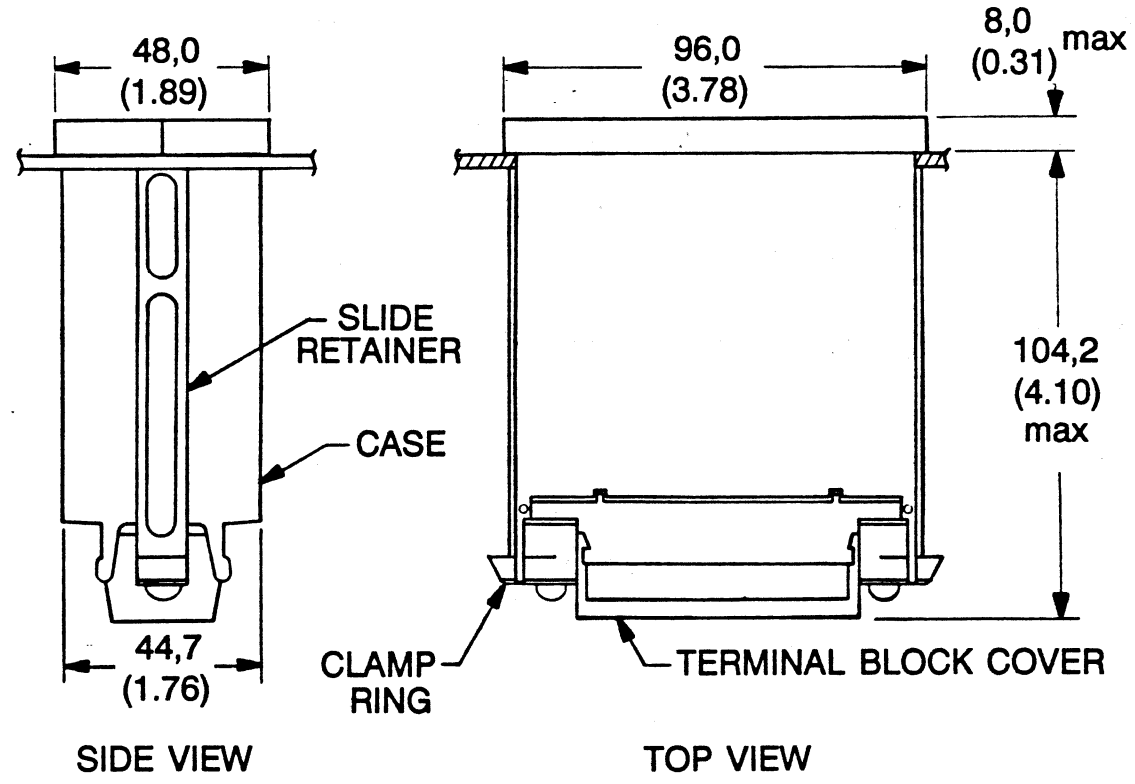
3 Mechanical Assembly and Installation

3.1 SAFETY CONSIDERATIONS

This instrument is protected according to Class I (Protective Earth) of the IEC (International Electrotechnical Commission) 348 and the VDE 0411 regulations. To ensure safe operation, follow the guidelines below:

- VISUAL INSPECTION: Do not attempt to operate the instrument if damage is found.
- POWER VOLTAGE: This instrument is delivered with the AC power input connected for 240 V ac in Europe (C1 option) or 120 V ac in the USA (unless the instrument is provided with the DC power input option). Verify that the instrument is connected for the correct power voltage rating before using. If incorrect, make the required change as described in Section 4, Changing Operating Voltage.
- POWER WIRING: This instrument has no power switch; it will be in operation as soon as the power is connected.
- Verify that the power cable has the proper ground (earth) wire and that this wire is properly connected to an adequate ground (earth) point. The meter must be grounded in accordance with the latest local safety regulations.
- If AC, the power cable must contain a protective ground conductor which is not disconnected (open) either inside or outside the instrument. No extension cables without grounding wires shall be used.
- SIGNAL WIRING: Do not make signal wiring connections or changes while power is on.
- RAIN OR MOISTURE: Do not expose the instrument to condensing moisture.
- FUMES AND GASES: Do not operate the instrument in the presence of flammable gases or fumes.
- EXERCISE CAUTION: As with any electronic instrument, high voltages may be exposed when attempting to install, calibrate, or remove parts of the meter.

3.2 Panel Mounting



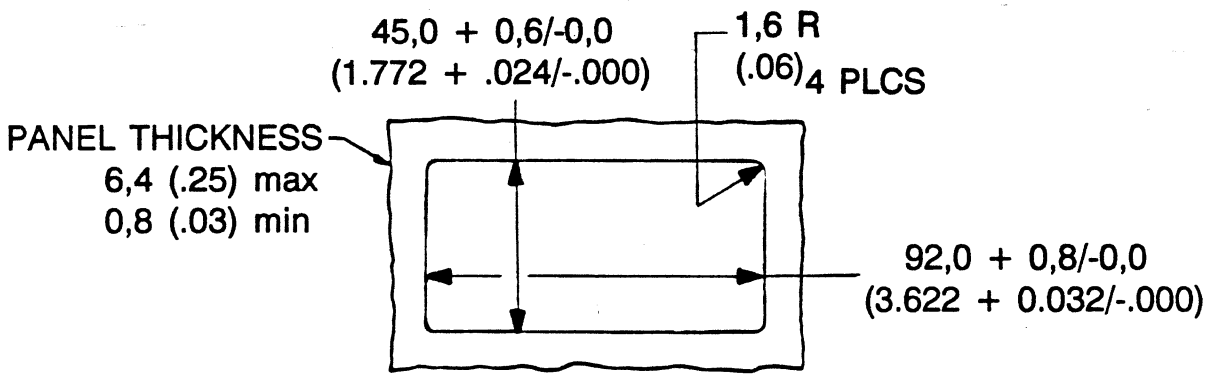


Figure 3-1 DIN Case Dimensions

1. Remove the main board edge connector (J1) if installed.

2. Use a #8 Phillips-head screwdriver to loosen the two screws on the rear of the case until you can rotate the two clamp rings. Loosen the screws enough to allow for the panel thickness.

3. Slide the two slide retainers towards the rear of the unit and remove them.

4. Observe the case dimensions previously shown. From the front of the panel, insert the meter into the panel cutout.

5. Slide the slide retainers back onto the case and push up tightly against the rear of the panel.

6. Rotate the clamp rings back into their original position and tighten until the case is held in place. Do not overtighten.

7. Reinstall any connectors that were removed.

WARNING

High Voltage is present when using Model 201 AN AC with the 650 Vac option

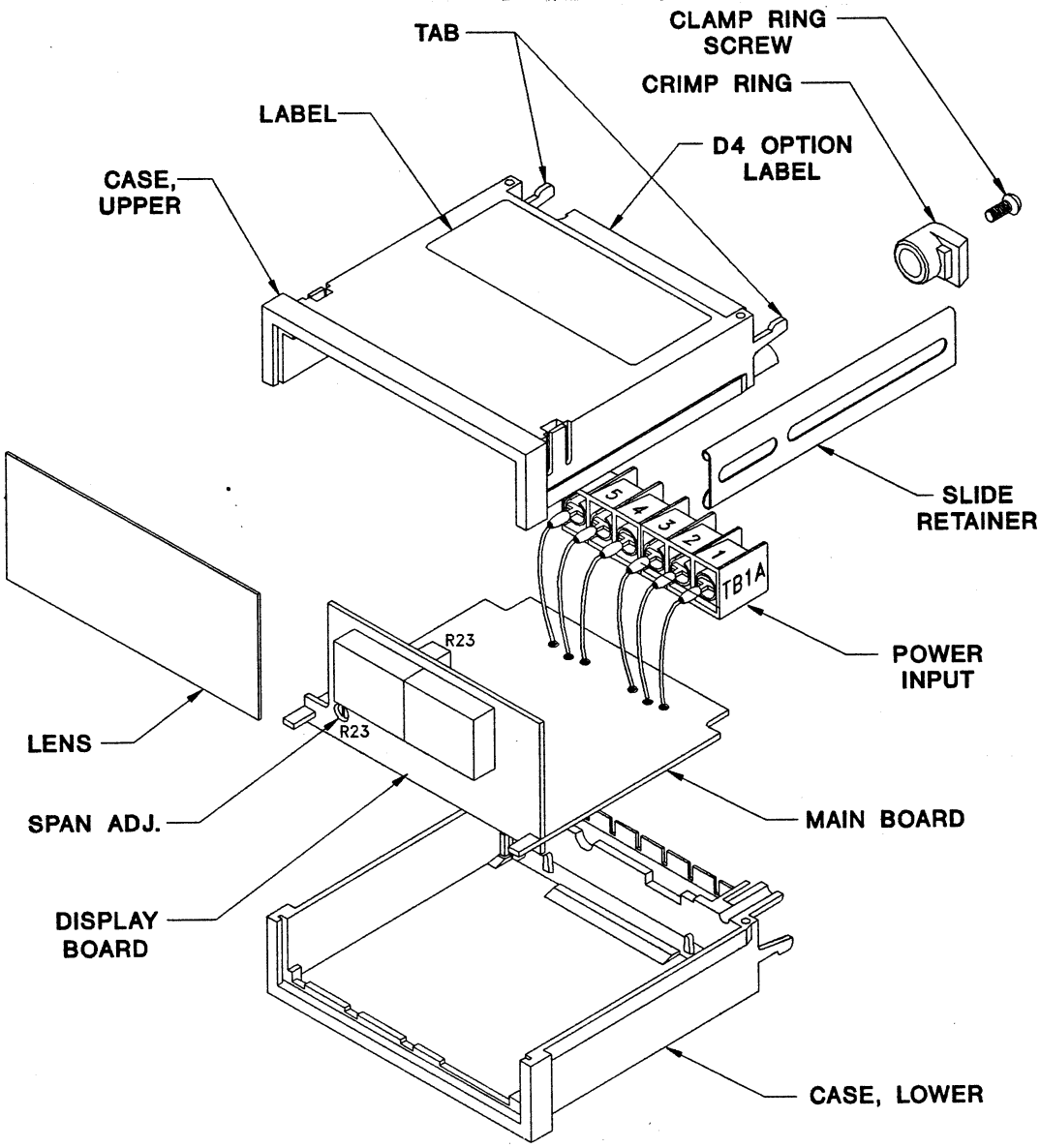


Figure 3-2 Exploded View of Model 201A

4 Power and Signal

4.1 Changing Operating Voltage

Remove power lines from the meter, then remove the meter from the case.

Operating Voltage	Jumper Installation
230 Vac ±15% (Option C1)	Remove W8 and W9 on the transformer Install W4 on the printed circuit board
115 Vac ±15% (Standard)	Install W8 and W9 on the transformer Remove W4 on the printed circuit board

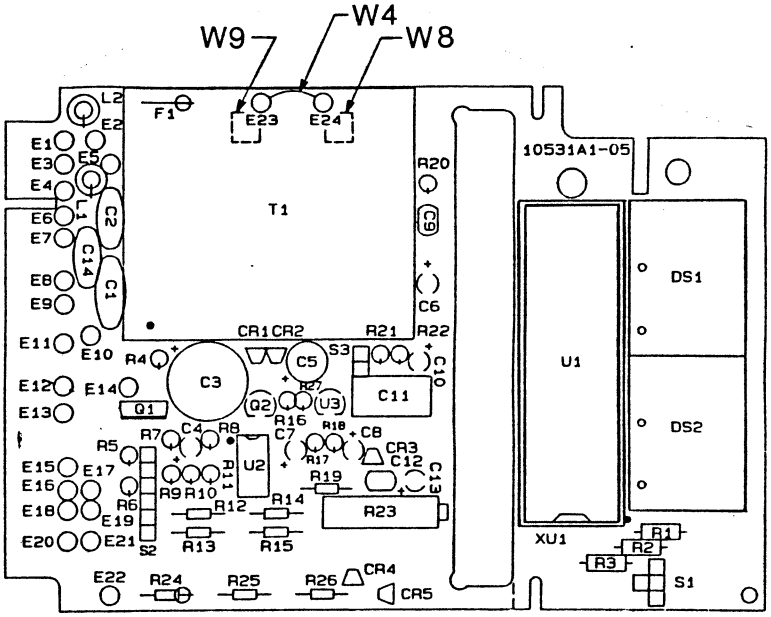
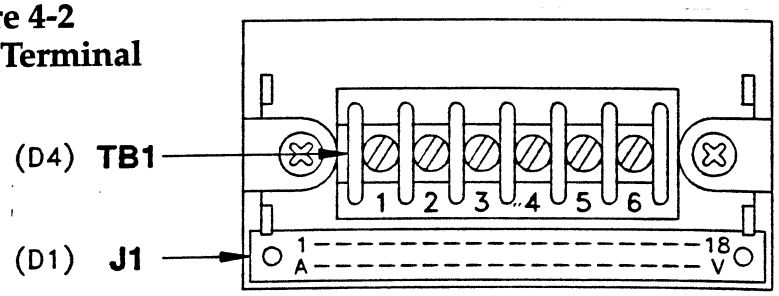


Figure 4-1 Main Board

4.2 Power and Signal Connections

Models 201A, 201AN and 201AN-AC are factory-set for 115 Vac ±15% operation. Power and signal can be connected using the D1 or D4 option.

Figure 4-2
Rear Terminal



Refer to Figure 4-2.

	Connector	Power		Signal	
Model 201A					
ac	D1	A	High	V	High
		C	Low	T	Low
		E	Ground		
	D4	1	High	6	High
		2	Low	5	Low
		3	Ground		Signal Gnd
dc	D1	C	+ DC	V	High
		E	- DC (return)	T	Low
	D4	1	No connection	6	High
		2	+ DC	5	Low
		3	- DC (return)	4	Signal Grnd
Model 201AN					
ac	D1	A	High	17	High
		2	Low	16	Low
		C	Ground		
	D4	1	High	6	High
		2	Low	5	Low
		3	Ground	4	Signal Grnd
dc	D1	2	+ DC	17	High
		C	- DC (return)	16	Low
	D4	1	No connection	6	High
		2	+ DC	5	Low
		3	- DC (return)	4	Signal Grnd

Connector	Power		Signal	
Model 201AN-AC				
D4	1	High	6	High
	2	Low	5	Low
	3	Ground	4	No connection

Wire Color for AC Power	USA	Other
(High)	Black	Brown
(Low)	White	Blue
(Ground)	Green	Green

4.3 Connector Pin Assignments

201A J1 Connector (D1 Option)

AC HI	A	1	N/C
N/C	B	2	N/C
AC LO/+DC PWR	C	3	N/C
N/C	D	4	N/C
AC GND/-DC PWR	E	5	N/C
N/C	F	6	DIG GND
199.9 DP	H	7	199.9 DP
19.99 DP	J	8	19. 99 DP
1.999 DP.	K	9	1.999 DP
LAMP TEST	L	10	LAMP TEST
4 7 V	M	11	+4 7 V
-4 6 V	N	12	-EXC
+REF	P	13	+EXC
HOLD	R	14	HOLD
ANA GND	S	15	Spare
SIG LO	T	16	Spare
N/C	U	17	Spare
SIG HI	V	18	N/C

201AN-AC J1 Connector (D1 Option)

Spare.	A	1	N/C
N/C.	B	2	N/C
Spare.	C	3	N/C
N/C.	D	4	N/C
Spare.	E	5	N/C
N/C.	F	6	N/C
199 9 DP.	H	7	199 9 DP
19 99 DP.	J	8	19 99 DP
1 999 DP.	K	9	1 999 DP
LAMP TEST.	L	10	LAMP TEST
+4 7 V.	M	11	+4 7 V
-4 6 V.	N	12	-EXC
+REF.	P	13	+EXC
HOLD.	R	14	HOLD
ANA GND.	S	15	Spare
Spare.	T	16	Spare
N/C.	U	17	Spare
Spare.	V	18	N/C

201AN J1 Connector (D1 Option)

AC HI.	A	1	N/C
N/C.	B	2	AC LO/+DC PWR
AC GND/-DC PWR.	C	3	N/C
N/C.	D	4	N/C
Spare.	E	5	N/C
N/C.	F	6	DIG GND
199 9 DP.	H	7	199 9 DP
19 99 DP.	J	8	19 99 DP
1 999 DP.	K	9	1 999 DP
LAMP TEST.	L	10	LAMP TEST
+4 7 V.	M	11	+4 7 V
-4 6 V.	N	12	-EXC
+REF.	P	13	+EXC
HOLD.	R	14	HOLD
ANA GND.	S	15	Spare
SIG LO.	T	16	SIG LO
N/C.	U	17	SIG HI
Spare.	V	18	N/C

Connector TB1 (D4 Option)

	AC Power Versions		DC Power Versions
1	AC HI	1	N/C
2	AC LO	2	+DC PWR
3	AC GND	3	DC PWR RET
4	ANA GND*	4	ANA GND*
5	SIG LO	5	SIG LO
6	SIG HI	6	SIG HI

* No connection with 201AN-AC

4.4 Digital Test Signals

Display HOLD instructs the meter to maintain a display of the last reading. To activate HOLD, connect J1-pin 14/R to J1-pin 11/M.

LAMP TEST instructs the meter to light the minus sign and all digits on the display to verify that the display is operating properly. To test the display, connect J1-pin 10/L to J1-pin 11/M. The decimal point does not light when LAMP TEST is activated.

5 Configuration

Select the desired configurations from the following charts. Install jumpers and open/close solder switches as indicated. Remove all push-on jumpers not used.

5.1 Decimal Point Selection

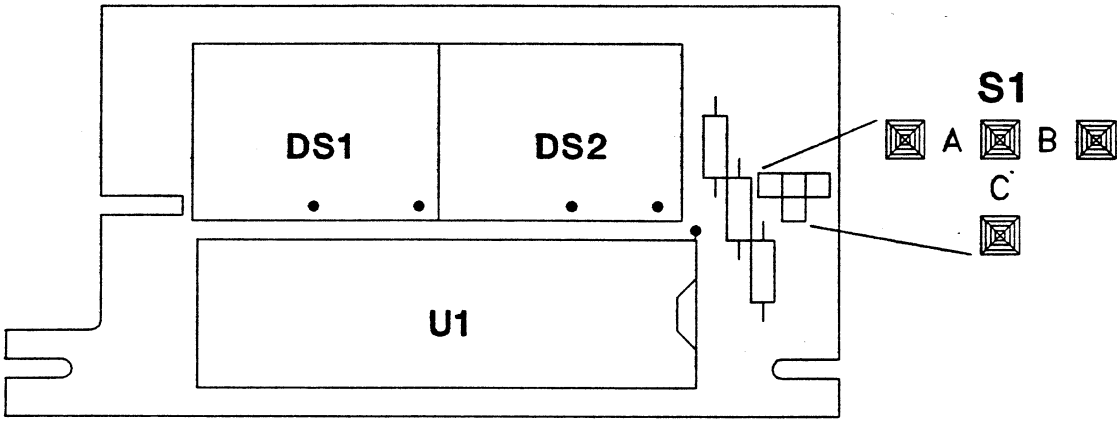


Figure 5-1 Display Board Jumper Locations

Decimal Point	S1	Alternate decimal point configuratio using main board connector J1.
1.999	A	Connect K/9 to 6
19.99	C	Connect J/8 to 6
199.9	B	Connect H/7 to 6

5.2 VOLTAGE RANGE SELECTION

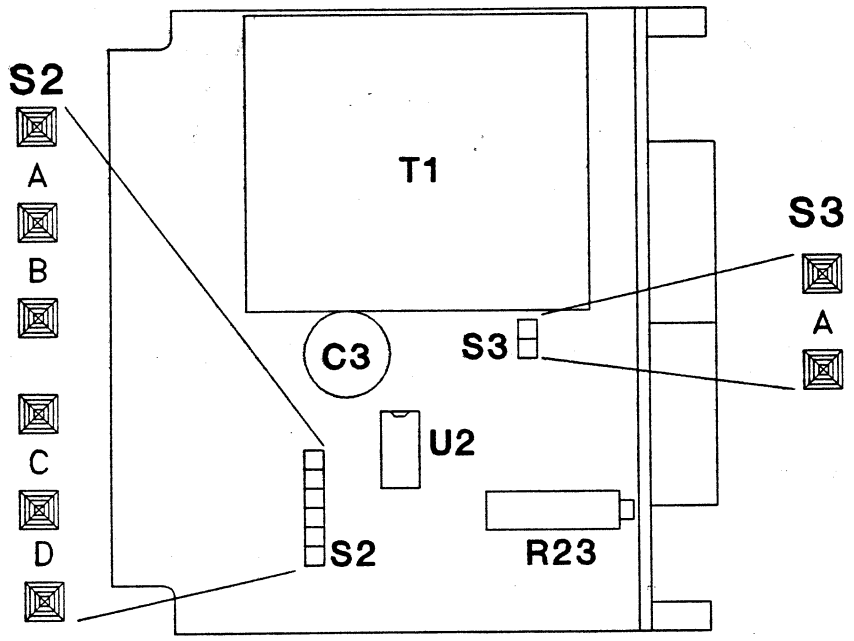


Figure 5-2 Main Board Jumper Locations

Input Configuration	Solder Open	Switches * Close	Push-on Jumpers S2	S3	Remove Jumper Wire
200 mVdc	-	-	A	A	
2 Vdc	-	-	B	-	
20 Vdc	-	-	B, C	-	
200 Vdc	-	-	B, D	-	
200 Vac	I	G, K, J	B	-	E-17 to TB1B-4
650 Vac	I	H, K, J	B	-	E-17 to TB1B-4
True-differential	C	--	-	-	

* Refer to Figure 5-3 on the following page for solder switch locations.

5.3 Blanking the Least-Significant Digit

To blank the least-significant digit, open solder switch 'A' on the circuit side of the display board.

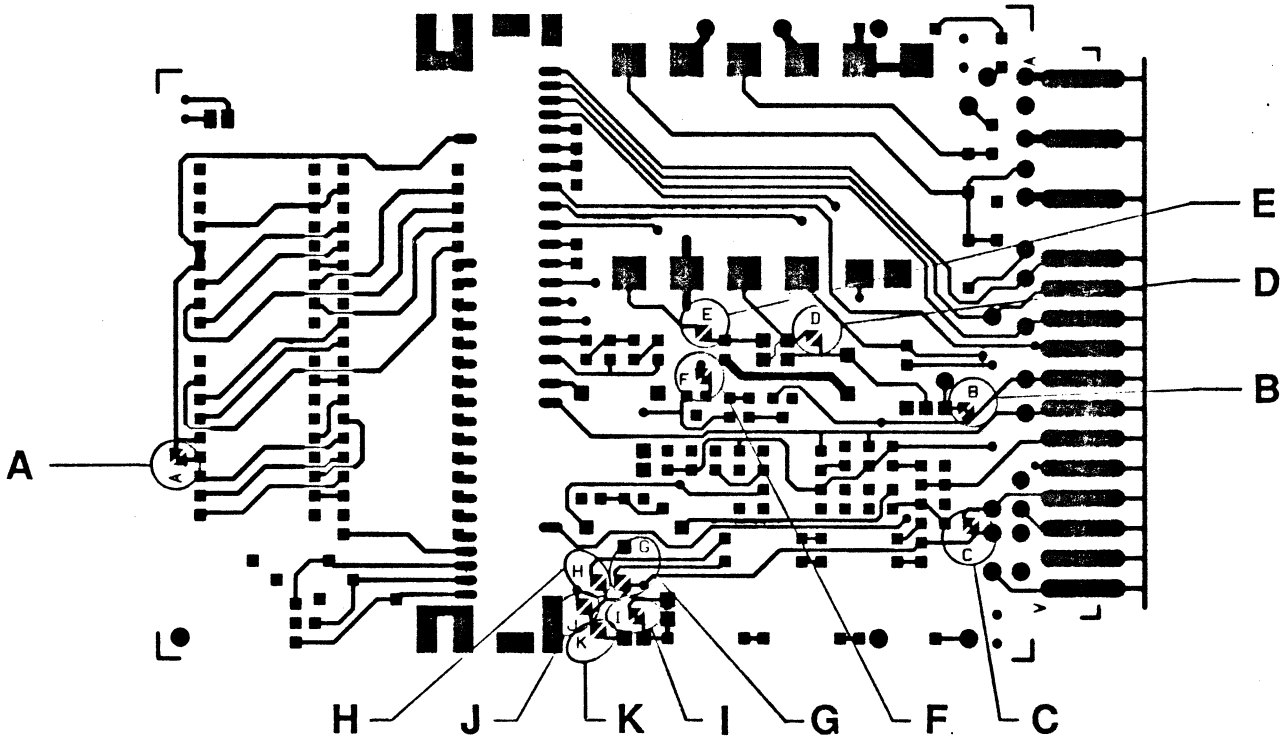


Figure 5-3 Solder Switch Locations

6 Calibration

6.1 Dc Voltage Ranges

1. Remove the front lens. Insert a blade screwdriver under the notch at the bottom of the lens and gently pry it off.

2. Short the input signal connections and verify that the display reads zero.

3. Apply an input voltage equal to 95% of the high end of the range selected.

4. Locate the Span potentiometer (R23) in Figure 3-2. Adjust until the display reads 1900 ±1 count.

6.2 Ac Voltage Ranges

1. Follow steps 1 and 2 from above.

2. Apply an input voltage equal to 110.0 Vac at 50 or 60 Hz on 200 Vac range or 220 Vac at 50 or 60 Hz on 650 Vac range.

3. Locate the Span potentiometer (R23) in Figure 3-2. Adjust until the display reads:

   110.0 on 200 Vac range
   220 on 650 Vac range

7 Drawings

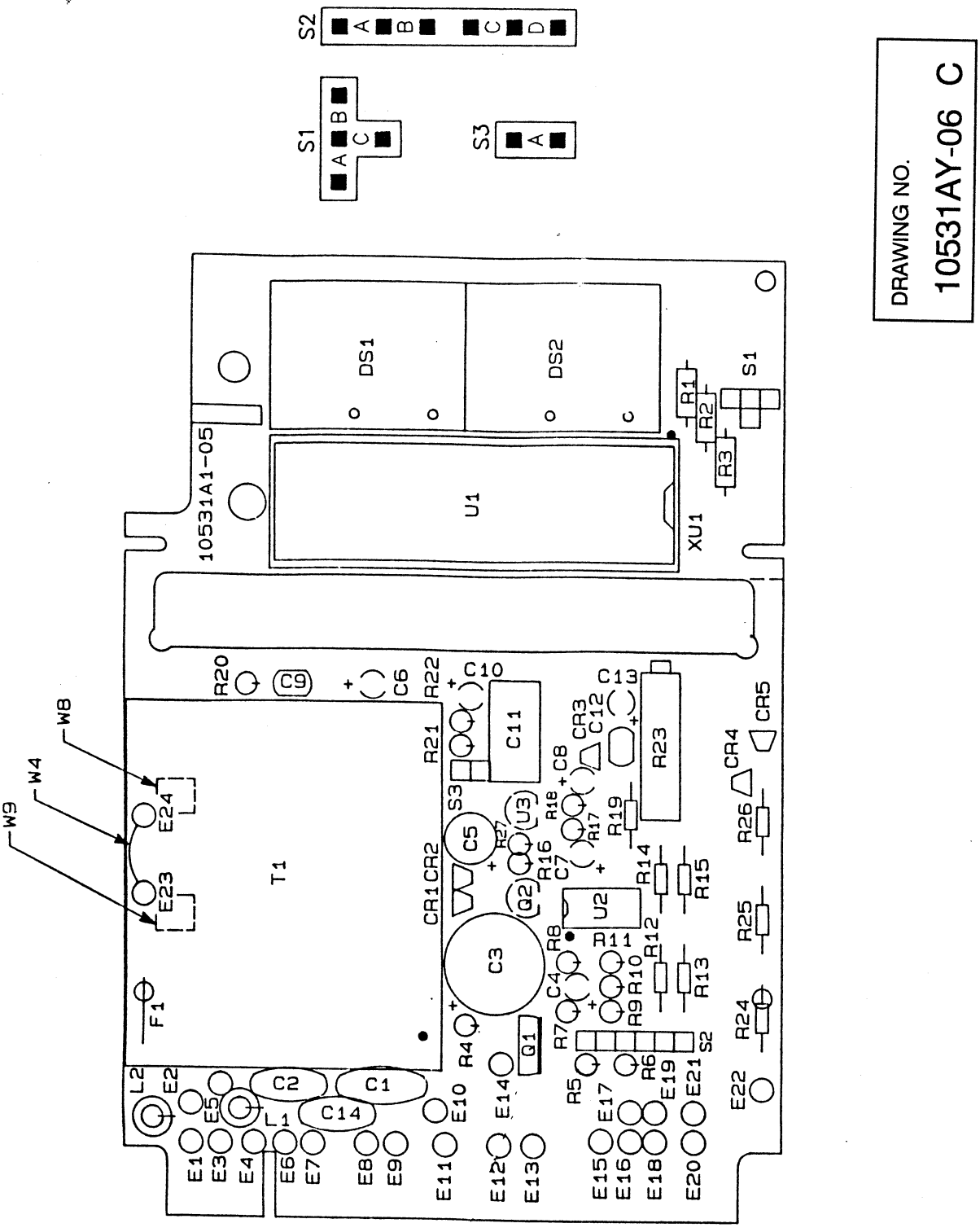


Figure 7-1 Assembly Diagram

Warranty/Disclaimer

NEWPORT ELECTRONICS, INC. warrants this unit to be free of defects in materials and workmanship for a period of one (1) year from date of purchase. In addition to NEWPORT's standard warranty period, NEWPORT ELECTRONICS will extend the warranty period for one (1) additional year if the warranty card enclosed with each instrument is returned to NEWPORT.

If the unit should malfunction, it must be returned to the factory for evaluation. NEWPORT's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by NEWPORT, if the unit is found to be defective it will be repaired or replaced at no charge. NEWPORT's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of NEWPORT's control. Components which wear are not warranted, including but not limited to contact points, fuses, and triacs.

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CONDITIONS: Equipment sold by NEWPORT is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, NEWPORT assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and additionally, purchaser will indemnify NEWPORT and hold NEWPORT harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

Return Requests/Inquiries

Direct all warranty and repair requests/inquiries to the NEWPORT Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO NEWPORT, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM NEWPORT'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting NEWPORT:

1. P.O. number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult NEWPORT for current repair charges. Have the following information available BEFORE contacting NEWPORT:

1. P.O. number to cover the COST of the repair,
2. Model and serial number of product, and
3. Repair instructions and/or specific problems relative to the product.

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