

200ASBS DIGITAL PANEL METER

03104

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SECTION 1
DESCRIPTION

1.1 GENERAL

The Newport Series 200 digital panel meters are single range instruments designed to digitally indicate a DC input voltage or current. These panel meters provide readings up to +1999 counts on any of four DC voltage and five DC current ranges. For applications compatible with .05% resolution and .1% basic accuracy the Series 200A/S and 200B/S offers a low-cost reliable approach to the digital display of analog voltages and currents. Utilizing highly stable integrating techniques they can complete from 4 to 60 full readings per second and on command will hold a reading indefinitely. A flashing display or blanking of the display automatically indicates when the input voltage exceeds full scale. Zero offset and full scale adjustments are available through the rear panel.

The Series 200A/S bipolar instrument has true differential inputs to reduce ground-loop effects. Polarity of the input voltage is automatically selected and displayed as either "+" or "-".

Series 200 meters allow the decimal point to be set externally to any one of three positions. The BCD outputs and the external control inputs and outputs are compatible with TTL and DTL for ease in interfacing with other instruments.

The meter consists of two printed-circuit boards enclosed in an aluminum case to minimize the effects of external noise. Both circuit boards can be slid out thru the rear of the case once the rear panel is removed. The lower board contains the digital circuitry and the upper board contains the analog circuitry. The two boards are interconnected by a flexible cable.

Outputs and Control Inputs are available on the digital connector at the lower rear of the meter. The Power and the Voltage to be measured are applied to the upper connector. The standard instrument operates on 115v 50-60Hz power.

Other Newport panel instruments such as the Model 810 Printer may be interconnected to the 200 Series without modification or external logic.

1.2 SPECIFICATIONS

DC VOLTAGE METERS					
Model	200A/S-2	200A/S-3	200A/S-4	200A/S-5	200B/S'
Full Scale	+199.2mv	+1.999v	+19.99v	+199.9v	+1.999v
Resolution	100uv	1mv	10mv	100mv	1mv
Impedance, ohms	1G (min)		10M		10M min
Input Bias Current	2na typ; 10na max.		None		.5uA max
Maximum Overdrive	200v		500v		200v
Maximum Error 15 to 35°C	0.1%R+ 0.1%FS	0.1%R+ 0.05%FS	0.15%R+0.1%FS		0.1%R+ 0.1%FS
Temperature Stability 0 to 15°C and 35 to 55°C	.005%FS ±.01%R/°C				

DC CURRENT METERS						
Model	210A/S-2	210A/S-3	210A/S-4	210A/S-5	210A/S-6	210A/S-7
Full Scale	+19.99ua	+199.9ua	+1.999ma	+19.99ma	+199.9ma	+1.999A
Resolution	10na	100na	1ua	10ua	100ua	1ma
Voltage Drop	200mv, full scale					
Maximum Overdrive	3ma	10ma	30ma	100ma	500ma	2.200A
Maximum Error 15 to 35°C, 30 days	10na ±.15%R ±0.1%FS					
Temperature Stability 0 to 15°C and 35 to 55°C	(.01% FS ±.01%R)/°C					

Reading Rate	Synchronized to the line, 4/sec to 60/sec programmable by external resistance
Settling Time	After full scale step input, to within one digit, 140ms standard, from 2 to 1000ms on special order (see Option SF)
Normal Mode Rejection	20db (60Hz) with standard filter
Polarity	Automatic (200A/S)
Common Mode Rejection, DC to 60 Hz	
To power line, case	100db
To BCD common (200A/S)	80db
Common Mode Voltage to meet CMR Specification	
To power line, case	300 volts
To BCD common (200A/S)	3 volts
Remote Controls	Reading hold and display blanking
Calibration	Full scale and zero adjustment accessible from rear panel
Operating temperature range	0 to 55°C
Storage temperature range	-40 to 80°C
Display	0.55 inch, 7 segment, planar, gas discharge numerals with + and - indication.
Power	115 VAC +10%; 50/60 Hz; 6 watts max; for 230 VAC see option C1
Enclosures	2.2" high x 4.35" wide x 4.1" deep extruded aluminum case and bezel (option A3) Removable name plates for replacement by customer nomenclature
Weight	Less than 2 pounds, net; 4 pounds, shipping

Analog (Top) Connector

Keyed between pins 10 & 11.
Manufacturers type:

SAE	SAC15S/1-2
Viking	2VH15/1AB5
Cinch	250-15-30-170

Digital (Lower) Connector

Keyed between pins 3 & 4.
Manufacturers type:

SAE	SAC15D/1-2
Viking	2VH15/1AN5
Cinch	251-15-30-160

Connector Key

SAE	007900
Viking	091-0024-000
Cinch	456-99-99-193

SECTION 2

RECEIVING AND INSTALLATION

2.1 UNPACKING AND INSPECTION

Your Series 200A/S (B/S) digital panel meter has been carefully inspected and tested before shipment. Unpack the meter and perform a visual inspection to assure that no damage has occurred during shipment or handling. These meters are factory sealed units. The only controls that may require periodic adjustment are accessible through the rear panel. Because extensive damage could result from attempts to measure circuit parameters or to trouble-shoot the meter by non-factory personnel, the warranty is voided if the unit has been removed from its case.

2.2 INSTALLATION-MECHANICAL

Drawing 04119 illustrates the detailed method of mounting the panel meters for each of the three mounting options. All critical dimensions are shown including those for the panel cutout.

MOUNTING STYLE

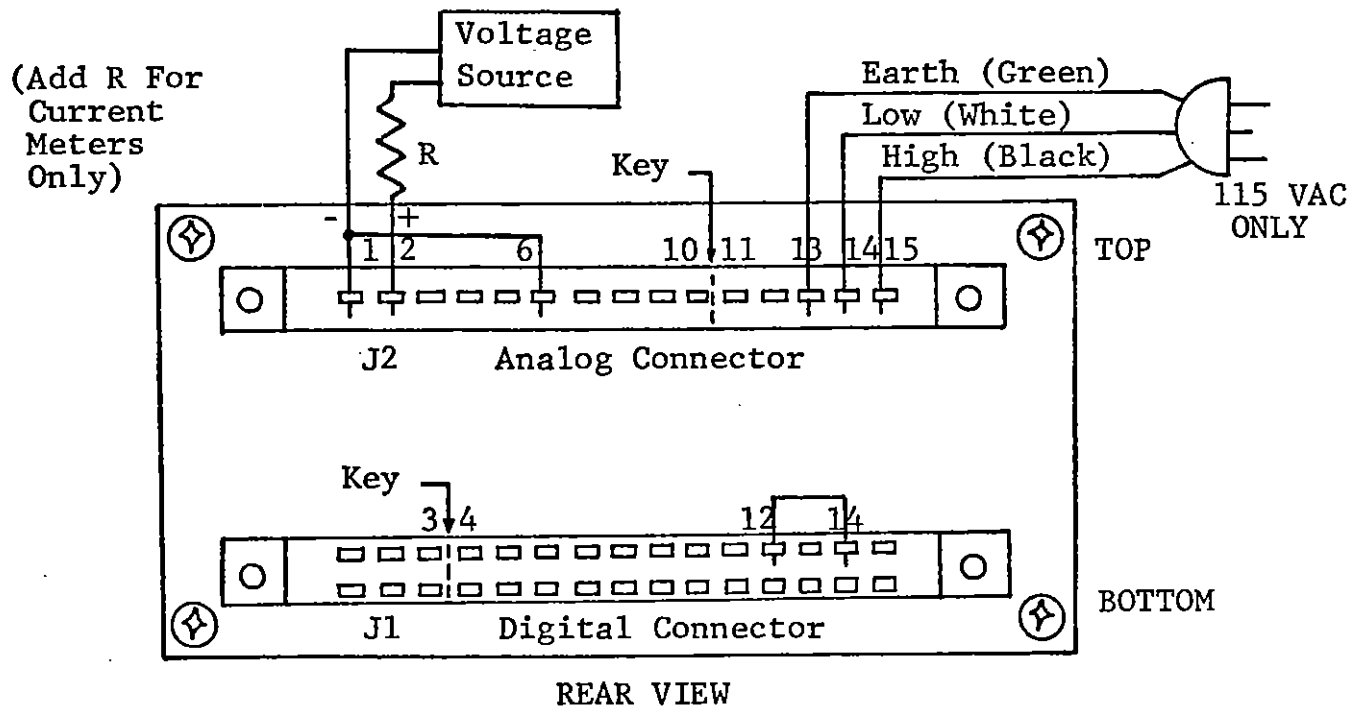
DESCRIPTION

- | | |
|----|---|
| A1 | Unit is mounted flush on studs behind a rack panel. |
| A2 | Unit is mounted behind a rack panel by inserting the furnished 6-32 screws through the rack panel and into threaded holes in the case. |
| A3 | Unit is mounted through the rack panel from the back and held in place from the rear by a "U" bracket. The mounting cutout is hidden by the instrument bezel. |

2.3 INITIAL CHECKOUT PROCEDURE

1. Connect a voltage source (eg. power supply) between pins 1 and 2 on the upper (Analog) connector J2.
2. Connect a jumper between pins 1 and 6 on the same connector.
3. Connect a power cord to the upper (Analog) connector as follows:
 - A. To pin 15 connect the high or "hot" lead.
 - B. To pin 14 connect the low or "cold" lead.
 - C. To pin 13 connect the earth ground or "third wire".
4. Connect a jumper between pins 12 and 14 on the lower (Digital) connector.
5. Apply 115 VAC, $\pm 10\%$, 50-60Hz to the power cord.
6. Adjust the input voltage source to be within the measurement range of the meter and varify that the meter is reading correctly.

CAUTION
Accidental connection of power to the
Digital Board will result in catastrophic failure



SECTION 3

OPERATING INSTRUCTIONS

3.1

POWER

Description

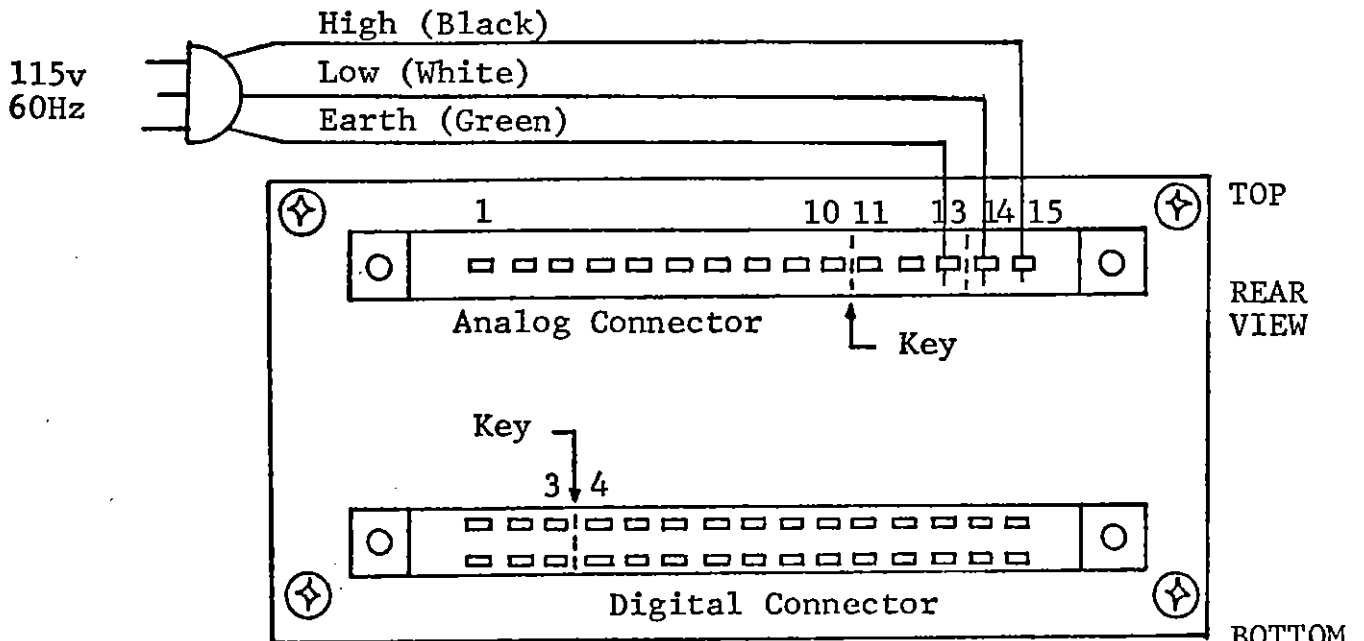
The standard meter operates from a 115v +10%, 50-60 Hertz power source. It dissipates approximately 4.5 watts. It should be connected to the power source by a three conductor cable. Two conductors provide the power to the meter and the third provides for safe grounding of the case. The third conductor should connect to earth ground at the power end of the cable and to the Analog Connector at the meter end of the cable. A wire from the Analog board to a locking terminal lug completes the connection to the case when the lug is secured by the rear panel screw.

Wiring Detail

The power cable is connected as follows to the top or Analog board.

- (a) To pin 15 connect the high or "hot" side of the 115v power line.
- (b) To Pin 14 connect the low or "cold" side of the 115v power line.
- (c) To Pin 13 connect the earth ground or "third wire".

CAUTION
Accidental connection of power to the Digital Board
will result in catastrophic failure



POWER CONNECTIONS

SIGNAL INPUTSIntroduction

The 200A/S series of panel meters employs a differential bipolar input circuit capable of operating with 3 volts of common mode between the low input lead and circuit ground. The 200B/S series is a single-ended unipolar version with the low side of the input tied to circuit ground.

The input impedance for the 199.9mv and 1.999v meters is 1000 megohms minimum. An input attenuator is added to produce the 19.99v and 199.9v meters. The input impedance of the attenuator is 10 megohms.

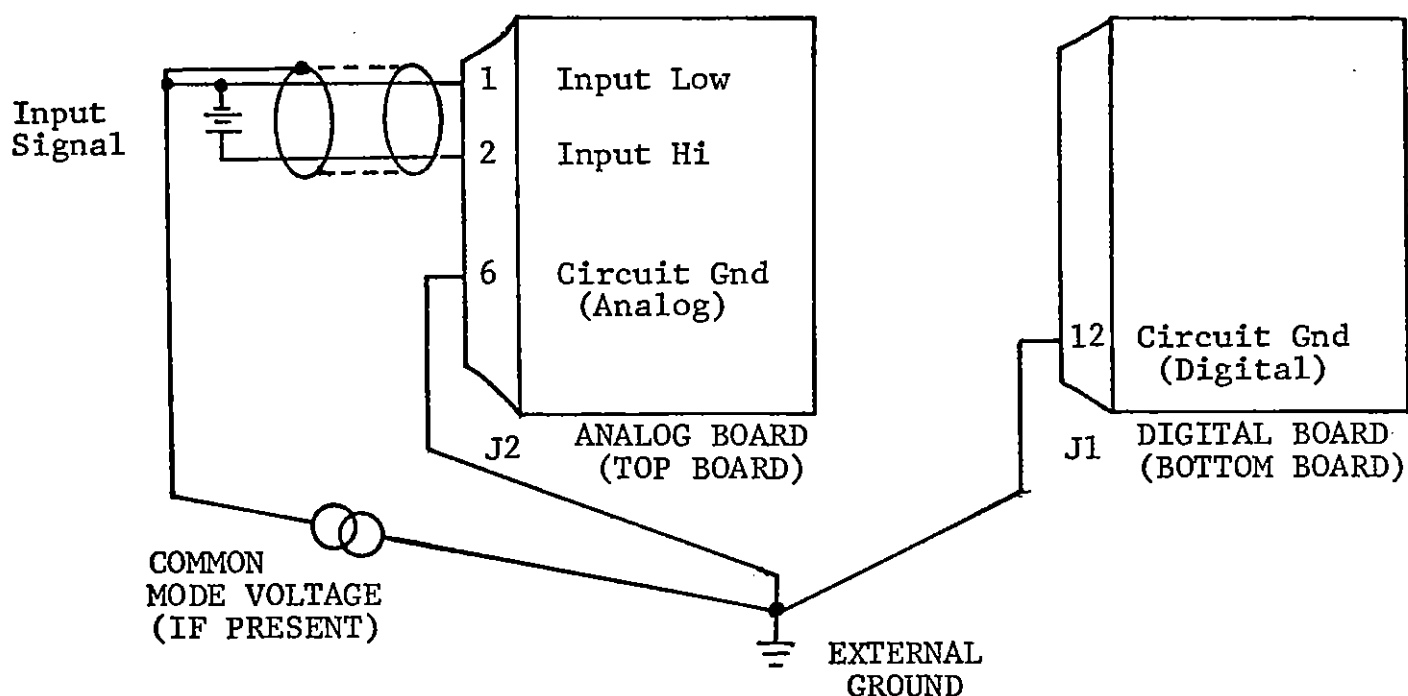
BIPOLAR INPUT - MODEL 200A/SDescription

The basic bipolar input is a differential input circuit with common mode isolation up to +3v between the low input lead and meter circuit ground. Meter circuit ground is the reference ground for the external control and BCD output circuits. Floating inputs require the addition of an external common mode path between the input leads and circuit ground. For this reason two wiring details are presented, one for grounded inputs and one for floating inputs. The input should be considered floating only if the meter circuit ground is in no way connected to the circuit being measured. If the input is floating but can be connected to meter circuit ground, the Grounded Input wiring detail should be used. Circuit ground is isolated with respect to the case or earth ground up to a potential difference of +300v.

3.2.1 Wiring Detail - Grounded Input

For best results the input signal to the Model 200A/S bipolar meter should be connected to the top (Analog) board by a twisted, shielded cable.

- (a) To Pin 2 connect the high side of the input signal.
- (b) To Pin 1 connect the low side of the input signal.
- (c) Connect the shield to the low side of the input signal. Leave the opposite end of the shield unterminated.

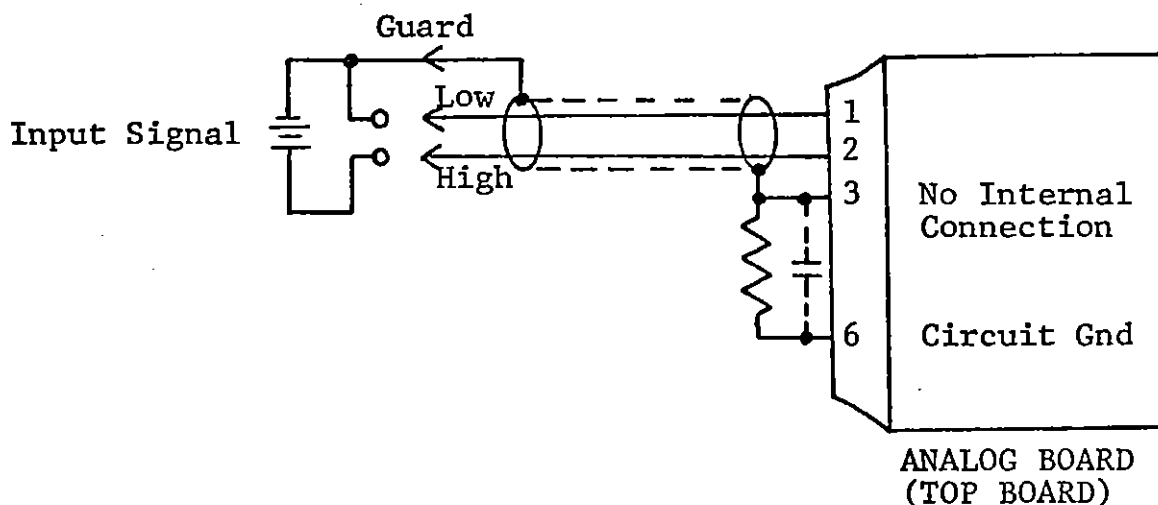


INPUT SIGNAL CONNECTIONS - BIPOLAR INPUT - INPUT GROUNDED

3.2.2 Wiring Detail - Floating Input

When the input voltage source is floating (eg. a battery), the common mode voltage will exceed the 3v limitation due to the lack of a low impedance path for the input bias current between the input leads and circuit ground. The effect is for the readings to bounce erratically. To reduce the common mode voltage to less than 3v, pin 1 should be returned to circuit ground, pin 6, through the smallest tolerable resistance. The value of this resistance should not be greater than 1 megohm. In addition, a .1uF capacitor should be connected in parallel with this resistance to create a low AC impedance path.

- (a) To pin 2 connect a high side of the input signal.
- (b) To pin 1 connect the low side of the input signal.
- (c) To pin 3 (tie point) connect the meter end of the shield. Connect the other end of the shield to the low side of the source.
- (d) Between pins 3 and 6 connect a resistance of 1 megohm or less as described above. In parallel connect a .1uF mylar capacitor with a voltage rating of 50v or higher.
- (e) If the meter is used for visual readout only (eg. no external control) connect a jumper from pin 3 to pin 6 instead of the parallel resistor, capacitor.



INPUT SIGNAL CONNECTIONS - BIPOLAR INPUT - INPUT FLOATING

3.2.3 UNIPOLAR INPUT - MODEL 200B/S

Description

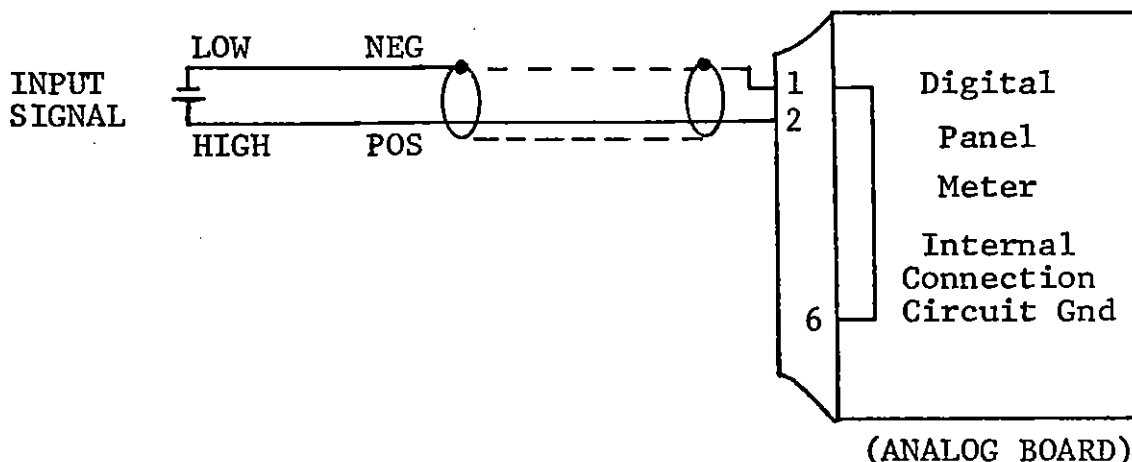
The basic unipolar input is single-ended with the low side of the input signal connected internally to circuit ground. The input is isolated with respect to the case or earth ground up to a potential difference of $\pm 300v$.

There is no common mode isolation between the low side of the input signal and circuit ground. For this reason the Bipolar meter (Model 200A/S) with an inherent $\pm 3v$ common mode isolation is recommended for applications where circuit ground is connected to other external locations (eg. when the BCD outputs and/or external control functions are used).

Wiring Detail

The input signal to the Model 200B/S unipolar meter should be connected to the top (Analog) board by a shielded cable.

- (a) To Pin 2 connect the high side of the input signal by means of the shielded wire. This must be the more positive side.
- (b) To Pin 1 connect the low side of the input signal by means of the shield. This must be the more negative side.



INPUT SIGNAL CONNECTIONS - UNIPOLAR INPUT

3.3 INPUT CHARACTERISTICS

3.3.1 Input Source Resistance - Bipolar Model 200A/S

Maximum bias current for 199.9mv and 1.999v meters is 10na. Up to one digit of error will be generated by input source resistances of 10K and 100K respectively. The error due to source resistance may be eliminated with the zero offset control of the meter provided the source resistance remains constant. Specified accuracy is assured by limiting the input source resistance to 1K for the 199.9mv meter and 10K for the 1.999v meter.

3.3.2 Input Source Resistance - Unipolar Model 200B/S

Due to higher bias currents for the Model 200B/S meter the source resistance should be limited to 5K.

3.3.3 Input Filter

The standard input filter is a single section low pass filter having a cutoff frequency (-3db) of 8 Hz. The settling time to .1% is 140ms.

The filter cutoff frequency may be altered by changing the value of a capacitor to provide either a shorter settling time for faster response or a lower cutoff frequency for better noise rejection.

Since the filter is connected directly to the input, any equivalent source impedance will act to lower the cutoff frequency and increase the noise rejection and settling time. By putting resistance in series with the high input, input filter characteristics may be easily changed.

3.4

DIGITAL INPUTS/OUTPUTS

The logic levels present at the digital connector are DTL and T²L compatible.

(a) Input Requirements:

Low level 0 to +.5v, sink 1.6ma
High level +2.4 to +5.5v, source .1ma

(b) Output Specifications:

Low level 0 to +.6, sink 5ma
High level +2.4 to +5.5v, source .2ma

3.4.1

EXTERNAL CONTROL

The digital panel meter provides a choice of several external control modes. This choice of modes allows the meter to satisfy a wide variety of interface requirements when used as a systems component.

The meter has a basic read rate of 4 conversions per second, but is capable of making measurements at a maximum rate of 60 conversions per second when the 60 Hz Read Rate input is grounded. Each conversion is synchronized to the 60 Hertz power line and always starts at the same point on the power line cycle. By means of external control any number of these cycles may be skipped with the meter retaining the reading corresponding to the last conversion. When the external command is given for a new reading the meter waits until the next synchronization point is reached on the power line cycle before starting the conversion.

The basic external control functions are labeled Hold and Data Ready. After the Hold signal goes false (low) the meter starts a new conversion process at the next synchronization point on the cycle. At the conclusion of the conversion process and before the next synchronization point occurs, the Data Ready signal goes true (high). This indicates that the conversion process is complete and the information present on the data outputs is ready for use.

SIMPLIFIED EXTERNAL CONTROL INSTRUCTIONS

(See Text for Complete Description)

<u>FUNCTION</u>	<u>BOTTOM CONNECTOR PIN NUMBERS</u>	<u>DESCRIPTION</u>
BCD Outputs	A-S	High (+2.4v) for true outputs
Hold	14	Connect to Pin 12 (Gnd) for readings, open (or +4v) to Hold.
Data Ready	1	Is low during conversion time, +4v when BCD data is ready.
Decimal Pt. at XX.X	7	Connect desired decimal point pin to pin 12 (Gnd)
X.XX	8	
.XXX	9	
60 Hz Read Rate	6	Connect to Pin 12 (Gnd) for 60 Hz read rate, open for 4 Hz read rate
Blanking	15	Supply +2.4 to 5.5v @1ma to blank display
+5v Pullup	4	Internal 4.7K pullup resistor
Spare DTL Nand Gate:		
Input 1	2	Spare 2 input DTL Gate
Input 2	11	
Output	10	
Meter Circuit Gnd	12	Ground Reference for inputs and outputs.

3.4.1

HOLD

The Hold input controls the start of each conversion process. A low level enables and a high level (or open) disables the conversion process.

An internal storage element allows one more reading to occur after the Hold input goes high. When this is undesirable an internal jumper on the digital board may be cut to disable the storage feature.

Operation with Storage

The meter is normally furnished with storage. The application of a low Hold input sets the storage element which then remains set after the Hold input goes high. The storage element is reset by the start of the next conversion cycle. The effect is to provide one more measurement after the Hold input goes high. The following three modes of operation exist with the storage element jumper installed.

Level Mode

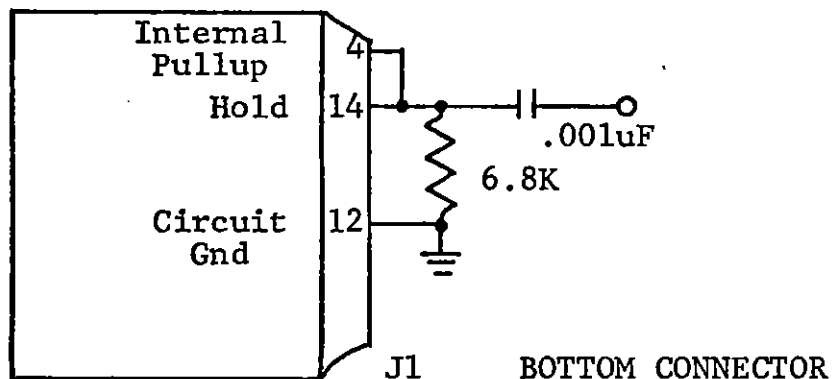
While the Hold input is maintained false (low), measurements occur at the selected reading rate. While it is true (high), the last measurement made is held in memory. One more measurement is made after the Hold input goes high. It is this measurement that is held in memory as long as the Hold input remains true.

Pulse Mode

A pulse that goes low at the Hold input for a minimum of two microsecond and terminates before the next synchronization point on the power line cycle will set the storage element and initiate a conversion cycle starting at the next synchronization point. If the pulse extends beyond the synchronization point, an additional conversion will occur. To insure that only one conversion is made, the pulse width must be less than 300 microseconds.

Transistion Mode

This mode requires an external .001 microfarad capacitor and a biasing network to be connected to the Hold input as shown.



A negative-going transition of the Hold signal will set the storage element and provide one conversion starting at the next synchronization point. The amplitude of the transition must be 3 to 5 volts with a fall time of less than 1 microsecond. The Hold Signal must be low for 1us minimum and high for 100us minimum.

Operation Without Storage

There are applications (eg. when the BCD outputs are connected to a printer) for which it is desirable to disable the storage function. This is accomplished by cutting or removing jumper W21 on the digital board. This insures that when the Hold input goes high, no more conversions take place and the BCD outputs remain static for use by an external device.

Wiring Detail

The Hold input signal is connected to the bottom (Digital) board.

- (a) To Pin 14 connect the high side of the input.
- (b) To Pin 12 connect the low side or ground return of the Hold input.
- (c) When operating the hold line from a switch or open collector driver connect a jumper from Pin 4 to 14.

3.4.2

DATA READY

Two modes of operation exist for the Data Ready output signal, the Conventional Mode and the Reset Mode. The Conventional Mode is operational when the meter is shipped. The Reset Mode requires that the storage circuit be operational and that the two control lines labeled Ready and Data Ready Enable be shorted together.

Conventional Mode

The Data Ready signal goes true (high) to indicate the completion of a conversion process and remains true until the next conversion process is started. During this time the BCD outputs represent the value of the measurement and are available for use by an external device. The Data Ready signal normally remains true for at least 6 milliseconds but this time may be extended indefinitely with a high level on the Hold input.

Reset Mode

With the Data Ready Enable input connected to the Ready output, the Data Ready signal goes true to indicate the completion of the conversion process AND reset condition of the storage element (ie. another reading will not occur). The Data Ready signal goes false to indicate that EITHER the conversion is in progress OR the Hold signal has been made false (low) to set the storage element since the last conversion started. This mode is useful when interfacing with an external device that requires the Data Ready signal to go false immediately when the Hold input goes false.

Wiring Detail

The Data Ready, Ready, and Data Ready Enable connections are available on the bottom (Digital) board.

- (a) Pin 1 - Data Ready output signal.
- (b) Pin 12 - Ground reference for the Data Ready output signal.
- (c) Connect Pin 3 (Data Ready Enable) to Pin 13 (Ready) only if the Reset Mode of operation described above is desired.

3.4.3

DECIMAL POINTS

The three least significant digits contain a left-hand decimal point which may be lighted to provide the proper decimal point representation of the quantity being measured. All three decimal points are available at the connector and may be individually selected by external circuitry.

Wiring Detail

The decimal point locations are designated by representing the three full decimal digits by X's and placing the decimal point in the position corresponding to its display location. The decimal point connections are available on the bottom (Digital) board.

- (a) Pin 7 - Decimal Point XX.X
- (b) Pin 8 - Decimal Point X.XX
- (c) Pin 9 - Decimal Point .XXX
- (d) Pin 12 - Ground reference

Any decimal point may be lighted by connecting the designated pin to ground, Pin 12, either with a jumper or through relay contacts. A solid state switch could also be used if it is rated for 3ma in the ON state and is capable of blocking 70 volts with a leakage of less than 1 microampere in the OFF state.

3.4.4

BLANKING

To blank the display connect a high signal (+2.4 to +5.5, source 1ma) to Blanking Pin 15 on the bottom (Digital) board. This will cause the display to extinguish. One possible application of this is to connect the overload and blanking pins together so that the readout will blank in overload. The readout normally flashes the most significant digit in overload when operating at 4 readings per second and blanks the MSD at 60 readings per second.

3.4.5 CONVERSION RATE

When shipped, the meter will make readings at a rate of 4/sec. To increase this rate to 60/sec the 60 Hz Read Rate input must be grounded. By connecting a resistor between the 60 Hz Read Rate input and ground, conversion rates between 4/sec and 60/sec may be selected. See chart below for approximate values.

Wiring Detail

Connect a short jumper or fixed resistor between Pin 6 and Pin 12 to obtain read rates above 4/sec.

Conversion Rate	Resistance
60/sec.	Short
30/sec.	220K
15/sec.	820K
8/sec.	2.2 Meg
4/sec.	Open

3.4.6 BCD OUTPUTS

Positive true BCD outputs representing each digit of the readout as well as overload and polarity are standard. The Overload output goes true when the input voltage exceeds the full scale rating of the meter. The Positive Polarity output goes true when the polarity of the input signal is positive.

The BCD, polarity, and Overload outputs are settled and ready for acceptance by an external device when the Data Ready signal goes true. The data may be held indefinitely by maintaining a true level at the Hold input.

Wiring Detail

This data occupies the 15 pins on the lower half of the bottom connector. The pin designations are listed on the pin assignment list. Circuit ground, pin 12, should be used as the common reference for these signals.

3.4.7 DISPLAY TEST

A display test mode may be energized by grounding the Display Test input to assure that all readout segments will light.

Wiring Detail

To light all segments on the display connect a jumper between J1 Pins 5 & 12.

3.5 200A/S (B/S) PIN ASSIGNMENTS

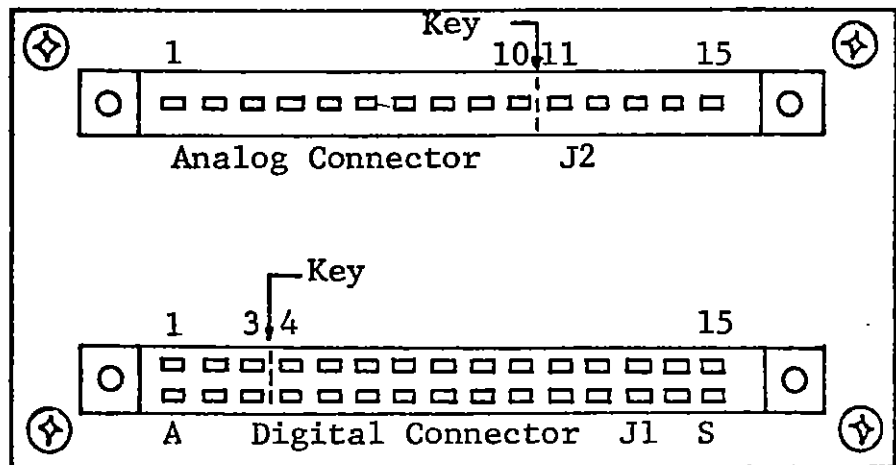
DIGITAL CONNECTOR (LOWER) P1

<u>FUNCTION</u>	<u>PIN NO.</u>
BCD Output: 1 bit	A
2	B
4	C
8	D
10	E
20	F
40	H
80	J
100	K
200	L
400	M
800	N
1000	P
Pos. Polarity	R
Overload	S
Circuit Gnd (Dgt1)	12
Hold	14
Data Ready	1
Decimal Pt at: XX.X	7
X.XX	8
.XXX	9
60/sec Read Rate	6
Ready	13
Data Ready Enable	3
Blanking	15
Spare DTL Nand Gate:	
Input 1	2
Input 2	11
Output	10
+5v Pullup (4.7K)	4
Display Test	5

ANALOG CONNECTOR (UPPER) P2

<u>FUNCTION</u>	<u>PIN NO.</u>
Input: Low	1
High	2
Tie Point	3
Circuit Gnd (Anlg)	6
Power: Neutral	13
Lo 120 VAC	14
High 60 Hz	15

NOTE: To enable continuous reading connect pin 14 to pin 12 on the digital connector.



REAR VIEW

SECTION 4
THEORY OF OPERATION

4.1 GENERAL

The Series 200A/S and 200B/S digital panel meters basically accept DC analog voltages at their input and display the value digitally with cold-cathode glow tubes. The value is also available electrically in BCD form at the digital connector. The inputs to the 200mv and 2v full scale meters are connected directly to the input amplifier. The 20v and 200v full scale meters are basic 2v meters with a 10:1 and a 100:1 attenuator respectively. The current meters are basic 200mv full scale meters with a shunt dropping resistor across the input.

4.2 TIMING

The conversion process is synchronized to the 60 Hz power line as shown in the timing diagram below. Conversion takes place during the negative portion of the cycle. During the positive half cycle the reading is held and the half-wave rectified high voltage is applied to the display tubes.

The reference current is integrated for a period of time proportional to the reading. It is zero for a reading of zero, 4ms for a reading of full scale and greater than 4ms for an overload input.

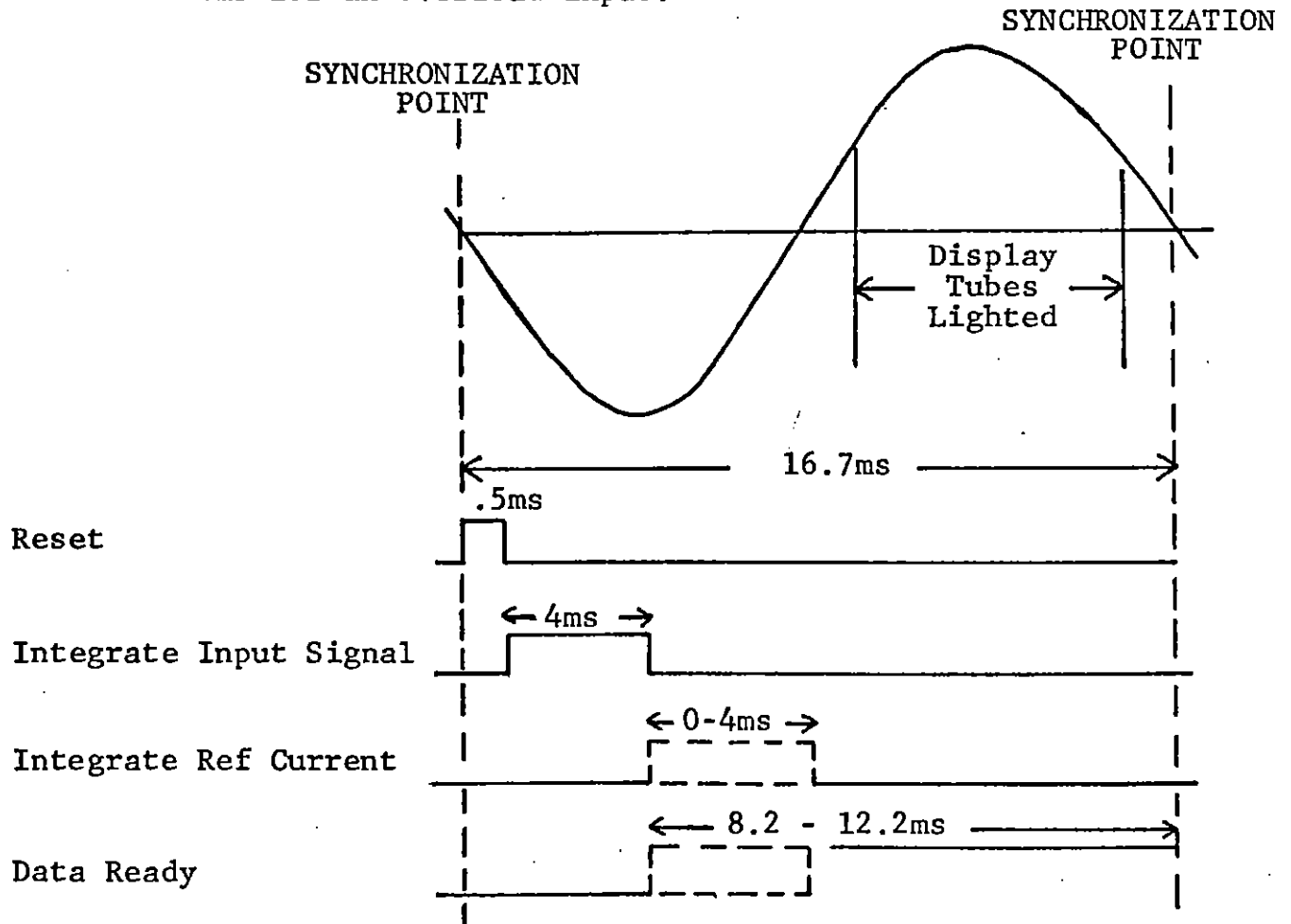


Fig. 4-1 Basic Timing Diagram

4.3

OVERALL FUNCTIONAL OPERATION

Refer to the simplified block diagram (figure 4-2) and basic timing diagram (figure 4-1).

The measurement cycle begins when the reset circuit detects the zero crossing of the falling edge of the AC line and generates a reset pulse. This reset pulse sets the BCD counter to a count of 2000 and sets the I-SW flip flop to the Signal Integrate state. The I-SW flip flop output causes the current switch to switch the signal current sink to the integrating capacitor and turns the gated oscillator on. When the integrating capacitor begins to charge down, the clamping comparator output goes high.

When the BCD counter reaches another 2000 counts and overflows, the I-SW flip flop is set to the Reference Integrate state, causing the current switch to select the reference current source. At this time the BCD counter has overflowed and is at 0000 counts. The integrating capacitor discharges at a constant rate back to its initial charge at which time the clamping comparator goes low, turning the gated oscillator off. The number of counts now in the BCD counter is equal to the input voltage and the data ready signal goes true. The data remains stable until the beginning of the next measurement cycle.

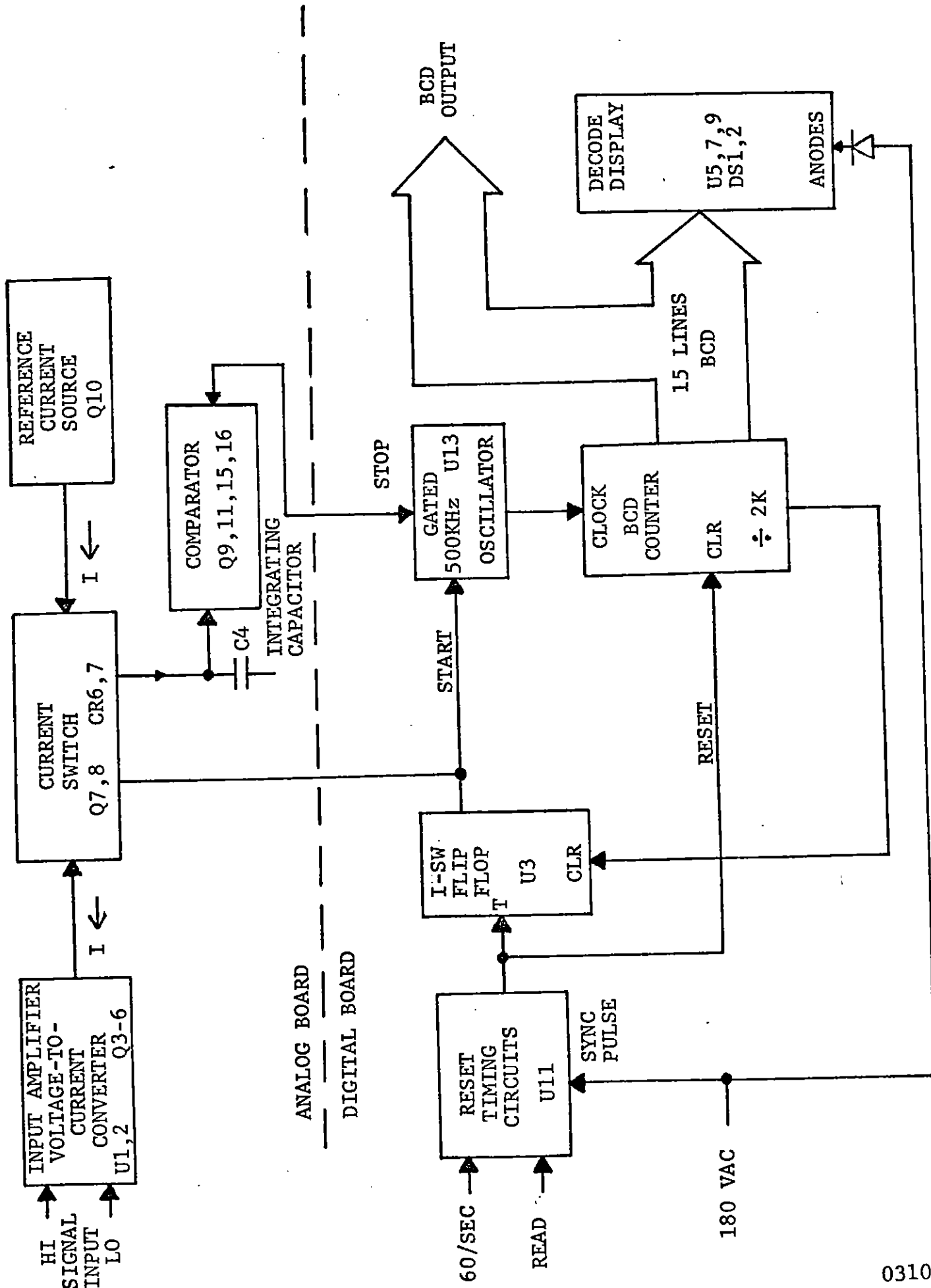


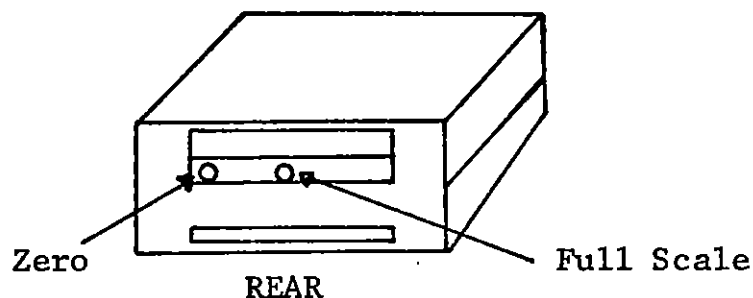
FIGURE 4-2 SIMPLIFIED BLOCK DIAGRAM

SECTION 5
CALIBRATION

5.1 INTRODUCTION

There are two standard adjustments available on the basic digital panel meter. These are the Zero or Balance adjustment and the Full Scale adjustment. These controls are located at the rear of the meter.

All controls should be adjusted with an insulated screwdriver according to the following instructions. Always allow at least 30 minutes warm-up time before making the adjustments.



LOCATION OF
CALIBRATION ADJUSTMENTS

5.2 CALIBRATION

5.2.1 ZERO (BALANCE)

This control is located at the rear of the meter in the upper left hand corner. It adjusts the zero offset of the input amplifier which affects the zero setting of the unipolar meter (Model 200B/S) or the balance between the plus and minus ranges of the bipolar meter (Model 200A/S).

Unipolar Meter (Model 200B/S)

Apply an input voltage equivalent to $10\frac{1}{2}$ counts (eg. 10.5mv for a 1.999v meter) and adjust the balance control for a reading that bounces between 010 and 011. If no adjustable input voltage source is available, follow the bipolar adjustment procedure.

Bipolar Meter (Model 200A/S)

With the input signal leads shorted and a negative reading on the meter, slowly rotate the Zero adjustment in the positive direction. Stop at the instant the polarity indicator switches from minus to plus.

To check the adjustment, apply an input signal equivalent to 10 counts. If the zero adjustment is correct, the meter will display the same reading (except for polarity indication) when the signal polarity is reversed.

5.2.2

FULL SCALE

This control is located at the rear of the meter in the upper middle of the back panel. It adjusts the full scale reading of the meter. For best results this adjustment should be made with an accurately known input set between $1/2$ and $3/4$ of full scale. It is most accurately set by applying to the input a voltage or current known to .01% which has a value half way between two consecutive readings on the meter. The control is then adjusted until the reading bounces between these values.

This adjustment should not be attempted until the previous Zero adjustment has been performed.

5.3

MAINTENANCE & REPAIR

Due to the complex operation of this instrument and special laboratory test equipment needed to repair it, no attempt should be made to troubleshoot the circuit cards in the field by untrained personnel.

Before returning the instrument to the factory, every attempt should be made to insure that the instrument is actually at fault and that the trouble is not in the set up. The best way to insure this is by substituting a known working instrument. Alternately the meter should be removed from the set up and tested by using a battery or power supply as an input source.

If the instrument is found to be at fault, please fill out the Returned Material Authorization and return with the unit. The best way to insure that the defect will be quickly found and repaired is to include a diagram of your actual test conditions, so that the factory will be able to duplicate the failure easily.

If customer repair is to be undertaken, the following guide will assist in the tracing of a fault to a functional area of the meter.

Test 1

After determining that the power supplies are furnishing the correct voltages, hook up the meter per the initial checkout procedure at the front of this manual. Apply a positive and then a negative voltage to the input terminals. If the + and - indicators do not follow the input signal polarity, look at the logic level on U3 Pin 7 (digital). If this signal does not follow the polarity of the input signal, the trouble is likely in the input amplifier circuitry.

Test 2

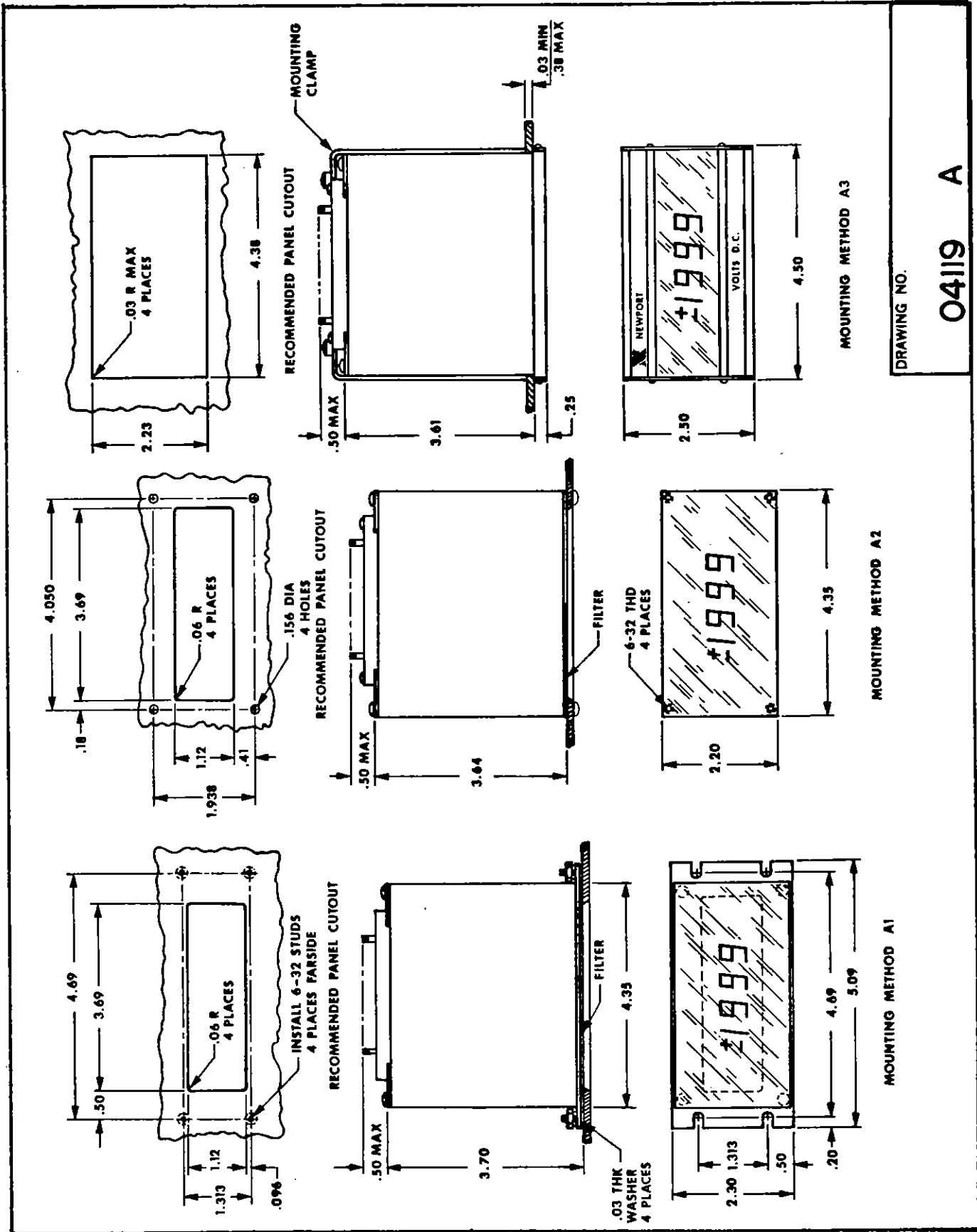
If the signal at U3 Pin 7 (digital) is correct, ground U13 Pin 9 (digital). The readout should indicate 000.

Test 3

Remove the ground from U13 Pin 9 and ground P2 Pin 10 (analog). The readout should be 1XXX (overload). If this test or test 2 produces incorrect results, the trouble is on the digital board.

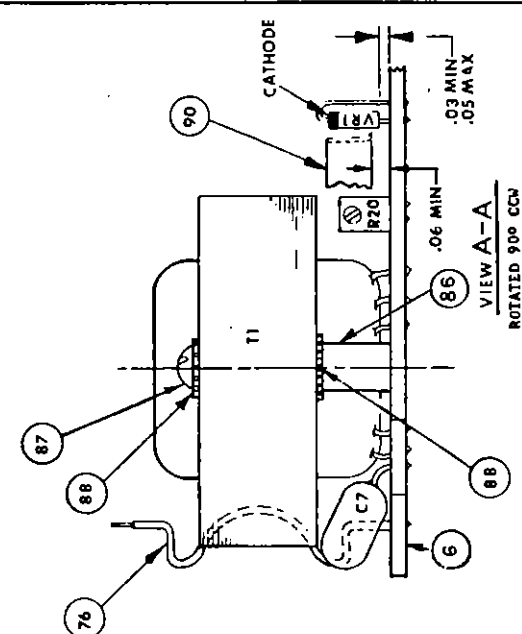
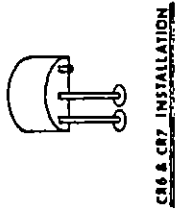
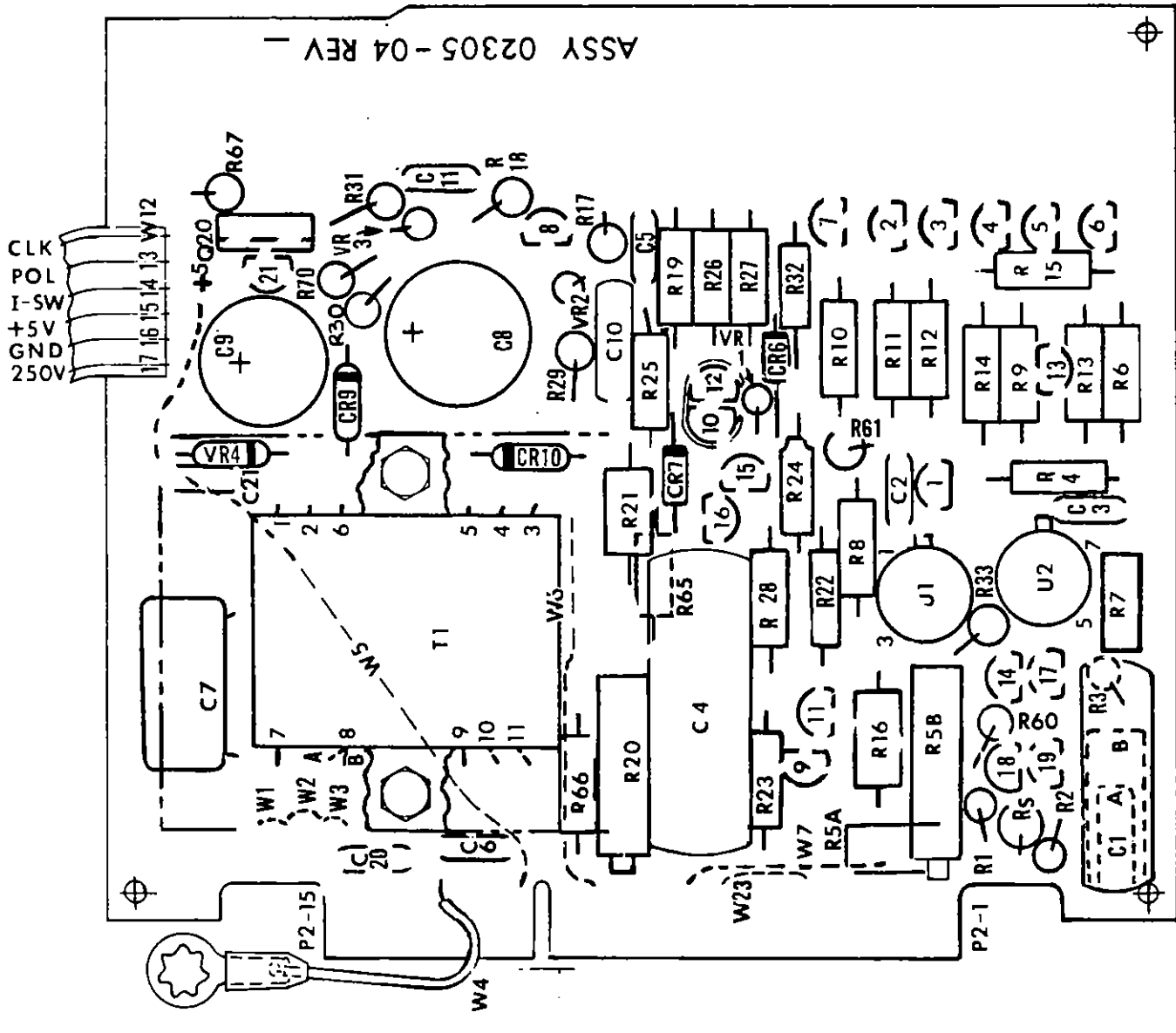
Using the results of these tests, the simplified block diagram, Figure 4-2, will assist in tracing the malfunction to a functional block of the meter.

Test 1 indicates if the input amplifier is following the input signal polarity. Test 2 simulates a comparator input to the digital circuitry as if the analog board was working with zero input. Test 3 simulates no comparator input as if the analog board was working with an overloaded input. If all three tests give correct results, look for the trouble in the reference current source or the current switch circuits. Use a scope to look at Q11 collector using a 10 MOhm probe for a full scale input signal. A waveform should be observed ramping from approximately +9V to a point several volts lower during the time the signal at U3 Pin 12 (digital) is at a positive level (signal integration time) and then ramping back up when the signal at U3 Pin 12 is at a lower level (reference integration time).

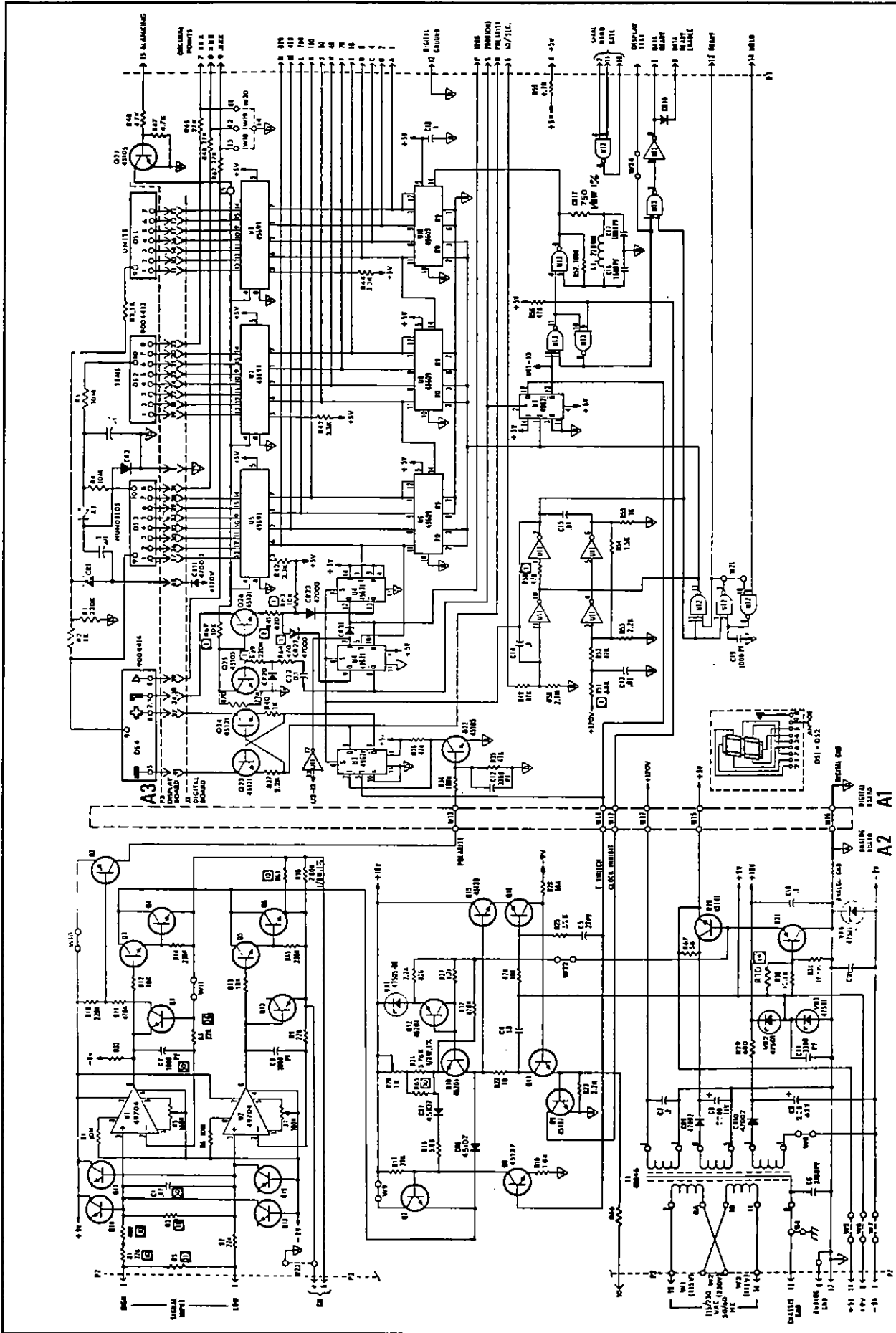


DRAWING NO.

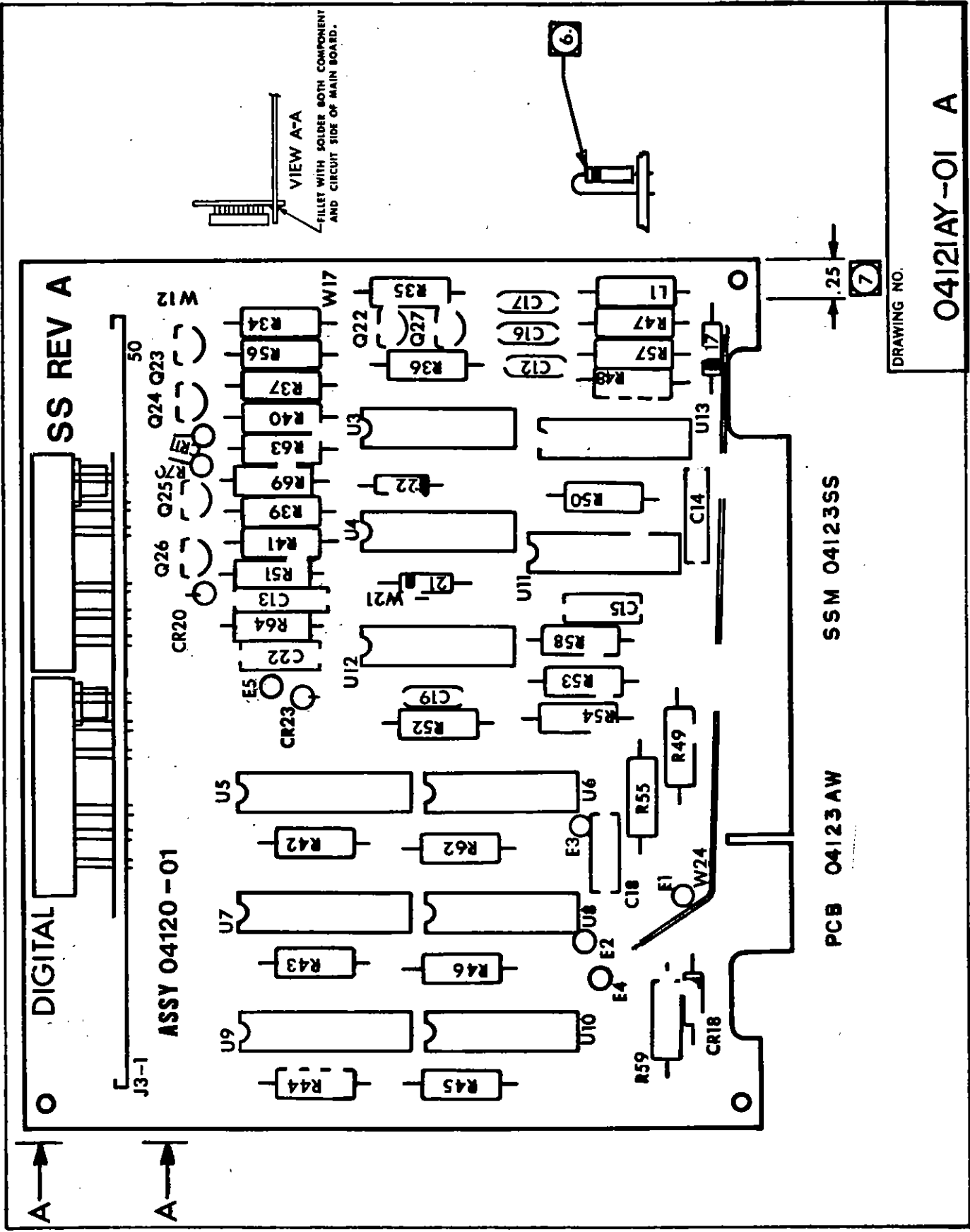
0419 A



DWG. NO.
02306AY-01 B

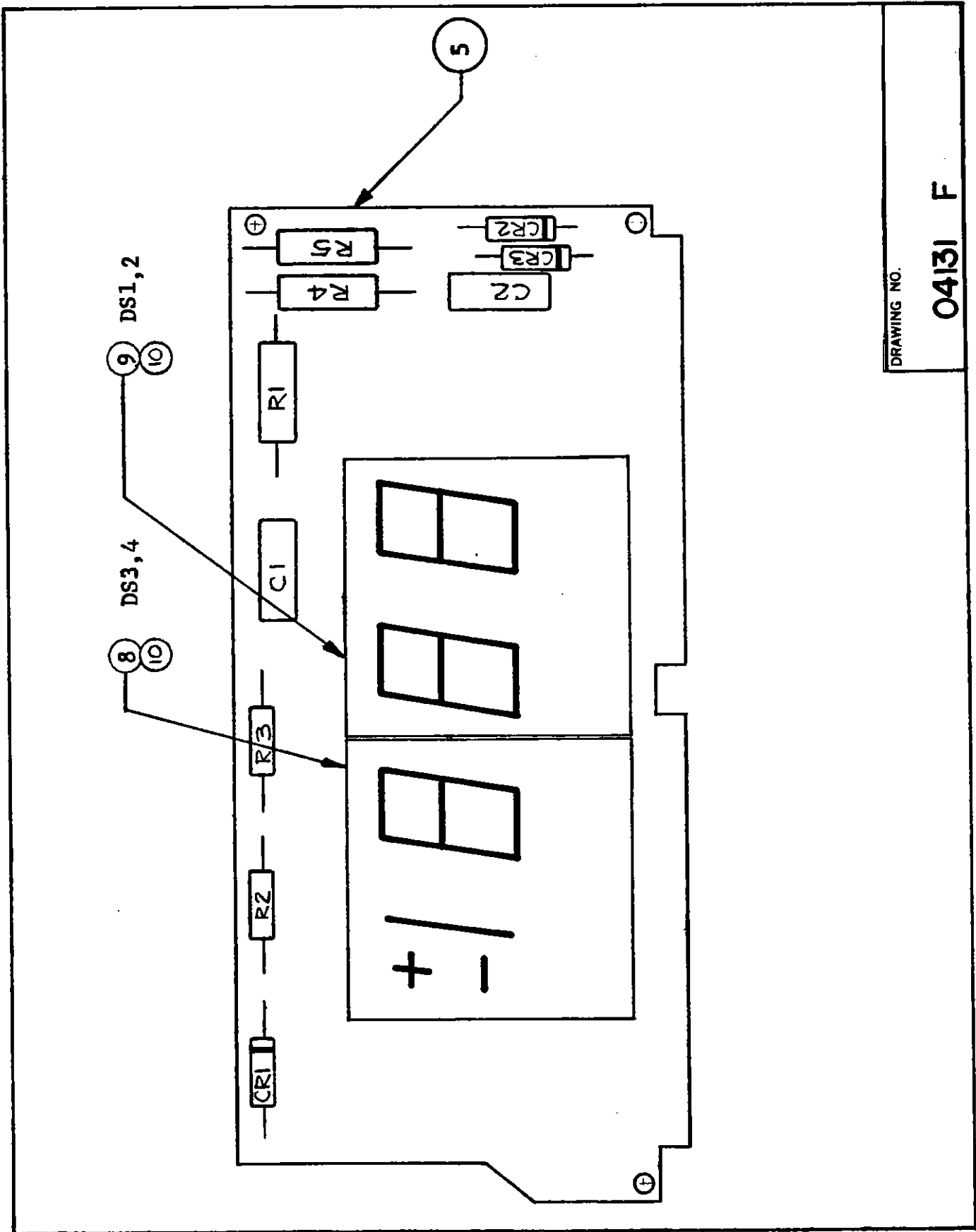


DWG. NO. 02307-03 V



DRAWING NO.

04121AY-01 A



DRAWING NO.

04131 F