

**INSTRUCTION MANUAL FOR: "ULTIMA 200" 207 & 213 03-07-05**  
**INTELLIGENT DPMS FOR ALL YOUR PRESENT AND FUTURE NEEDS**

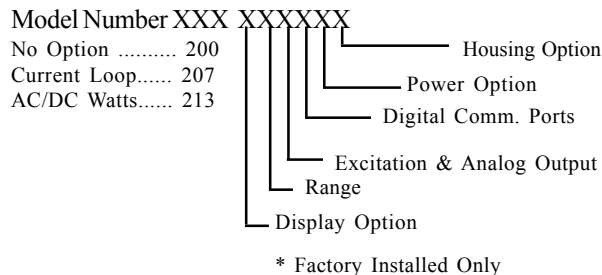


**SECTION I - MAINFRAME**

**I.1 "ULTIMA 200" ARCHITECTURE:**

The "ULTIMA 200" consists of a mainframe (mother board) containing a 4 1/2 digit A/D and all associated components for its operation and to it several display boards can be added. The mainframe has three connectors for factory/field installation of options, they are: a) DC/DC converter for analog out and excitation. b) Digital communication ports. c) Analog input signal conditioners (see note).

**MODEL NUMBERS:** The basic model number is 200 for a unit without an analog input signal conditioner. When an analog option is added, the model number of the instrument changes to the option's part number as follows:



**NUMBERING SYSTEM:** All OTEK's populated boards have an A81-XXX part number. The last four digits indicate the board number and range. For example: A81-2010 is Ohms converter, Range 0; A81-2011 is Ohms Converter, range 1, etc.

**OPTION NUMBERING SYSTEM** (Allocated Blocks)  
 A81-2000 thru A81-2001 are Mainframe with specific range.  
 A81-2010 thru A81-2130 are Analog Input Signal Conditioners  
 A81-2210 is Excitation and Analog Out  
 A81-2310 thru A81-2350 are Display Boards  
 A81-2410 thru A81-2500 are Digital Comm. Ports  
 A81-2510 thru A81-2512 are Power Supply Kits  
 A84-0200 thru A84-0201 are Housing Kits

**I.2 MAIN FRAME DESCRIPTION & MODIFICATIONS**

As stated above, the mainframe consists of a 4 1/2 digit A/D for either a 4 1/2 or 3 1/2 digit instrument.

**I.2.1 RANGE MODIFICATIONS**

<u>Part Number</u>	<u>Description</u>	<u>Comments</u>
200X0XXXX	2VDC	RX=1M5%, Ry N.U.
1	.2VDC*	RX=1M5%, Ry N.U., R4=10K 1%
2	20VDC	RX=10M 1%, Ry=1.1M 1%
3	200VDC	RX=10M1%, Ry=100K 1%
4	500VDC	RX=10M 1%, Ry=10K 1%
5	Radiometric	RX=1M 5%, Ry N.U. (Remove JP9, add JP10)
6	2mA DC	RX=0, Ry=1K1% 1/4W
7	20mA DC	RX=0, Ry=100 1% 1/4W
8	200mA DC	RX=0 Ry=10 1% 1/2W
9	2 Amp DC	RX=0 Ry=1 1% 5W
\$	50mVDC*	RX=1M 5%, Ry N.U. R4=10K 1%

\* 3 1/2 digit models only.

**I.2.2 POWER INPUT MODIFICATION**

<u>Model</u>	<u>Description</u>	<u>Comments</u>
2XXXXXX0X	5VDC Non Isol.	Standard Unit
1	115VAC Isol.	Use Kit A81-2520 JPRS #1 and 2
2	230VAC Isol	A81-2530, JPRS#3
3	10VAC Non Isol.	A81-2540, Jump 1&8 of XFR and 4&5 of XFR pads
4	9-15VDC Non Isol.	A81-2550 JPR #14
5	7-32VDC Non. Isol.	A81-2511 Jump CR3 & CR6 pads and VR1 1&3 pads
6	7-32VDC/5-24VAC Isol.	A81-2512JY Jump CR3 & CR6 pads & VR1&3 pads

\* See A81-2000 Schematic & A82-2000 PLD

Note: This manual consists of Section One for the basic mainframe and the insert (if req'd) of the function(s) you ordered.

## **POWER INPUT KITS CONTENT**

(To Convert from 5VDC Power Input)

A81-2001  
(115/230 VAC)

1 ea. 41-0250, F1  
1 ea. 40-0450, T1  
4 ea. 20-4001, CR3-CR6  
2 ea. 10-0103, C1 & C3  
1 ea. 17-0228, C2  
1 ea. 23-0805, VR1

A83-2003  
(10VAC)

1 ea. 41-0250, F1  
4 ea. 20-4001, CR3-CR6  
2 ea. 10-0103, C1 & C3  
1 ea. 17-0228, C2  
1 ea. 23-0805, VR1

A83-2004  
(9-15 VDC)

2 ea. 20-4001, CR1 & CR2  
2 ea. 10-0103, C1 & C3  
1 ea. 17-0228, C2  
1 ea. 23-0805, VR1

A81-2511  
(7-32 VDC)

1 ea. A81-2511 Assy.

A81-2512  
(Isol. 7-32 VDC/5-24 VAC)

1 ea. A81-2512 Assy.

**CIRCUIT DESCRIPTION** (Power Supply): The 200 series has provisions to input six different power supply configurations. When option zero is selected (5 VDC) all components not required are deleted (refer to schematic power supply notes). Care must be taken to make the appropriate connections to J1 as per the power supply configuration required.

**CLOCK**: The timing signal for U1 is generated by U3. This signal is also available at J5 for synchronization purposes to optional boards. Its nominal frequency is 120KHz.

**-5VDC**: This voltage is generated by U2 to allow U1 to operate in a differential and bipolar mode. Due to its design restriction, no current is available for external use. Its nominal output voltage is 4.5 VDC +/-10%.

**RATIOMETRIC**: When using the ratiometric mode, JP9 must be removed and JP10 added. An external voltage signal of between 1 and 2 VDC must be applied to Pin 1 of J1. If this voltage is greater, a limiting resistor must be placed in series with Pin 1, or R17 must be changed to keep this pin within the operating voltage range. The other leg of the divider is a combination of R4, R5, R6, and R7 (1200 Ohms).

**DECIMAL POINTS**: Q2 is the decimal point driver and interconnects the digit select to the corresponding LED on the display. ± sign, Q1, and Q3 generate the positive or negative signals for the display board and they are driven from U1 Pin 23.

**BCD INTERCEPT**: In the event that the BCD generated by U1 has to be changed by the digital control option, the appropriate links must be broken (on J5) and the new BCD information synchronized with the digit select to display the correct information. This change is called out on the specific option board that plugs into J5.

**FULLSCALE ADJUSTMENT**: VR2 is a 1.2 volt reference and the combination of R4, R5, and R6 allows a 1.000 voltage reference to be adjusted at the wiper of R5. If a wider range of adjustment is required either one of these components can be changed.

**WARNING**: Due to the flexibility and capabilities of this instrument, care must be taken prior to making any connections to J1. Refer to the appropriate connections (governed by options and model number). The following connections are given strictly for the mainframe with no options taken into consideration (Model 200 only).

**Pin 1** is the A/D Reference Output (nominally 1 VDC). It can also be the input when used in the ratiometric mode.

**Pin 2** is Analog Ground. This is the systems analog ground which is internally connected at one point to digital ground. Do not connect this pin to any high current carrying terminal.

**Pin 3 In Low** Only use with analog option

**Pin 4 in High** Only use with analog options

**Pin 5 Negative Input** Connect the less positive signal to this terminal.

**Pin 6 Positive Input** Connect the most positive signal to this terminal.

**Pin 7 Run/Hold** When left open, the A/D will free run, at about 3/s, when the conversion must be held, this pin should be grounded preventing additional conversions from taking place.

**Pin 8, 9, & 10** are only used when the option calls for them.

**Pin 11 +5VDC** This is the output of the internal power supply when specified or the input to the instrument when 5V power operation is selected.

**Pin 12 Digital Ground** This is the return of the 5V power. Do not connect to any other terminal since it might cause ground loop problems. (OK to connect to Pin 7 for Run/hold).

**Pin 13 & 14** are the power supply inputs and will be normally factory connected by means of JP1 through JP4 depending on the option chosen.

**Pin 15 Earth Ground** This is a safety and shielding pin and should be connected through a low impedance line to ground.

## **TROUBLE SHOOTING TIPS**

### **SYMPTOM**

No Display  
Display Flashes  
Display Erratic

Unit Does Not Zero

Non-linearity

### **CAUSE**

1. Check power to unit
1. Open input
1. Input signal with ripple
2. Reference signal defective
3. 5V power with ripple
1. No zero voltage at input pins
2. Ground loop in external equip.
1. Low -5V supply.

**ADJUSTMENTS & CALIBRATION:** Full Scale, Zero, Gain, and Decimal Point Selections are accessible by removing bezel with small screw driver on bottom slot. All adjustments are marked on P.C. board and PLD drawing. Note: Instructions on following pages regarding calibration and/or modifications are for units not factory or distributor supplied.

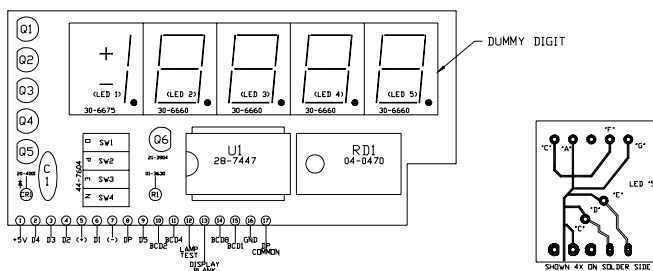
**SECTION II - DISPLAY OPTIONS**

**Note:** The display boards are factory installed to match the A/D. DO NOT change a 3 1/2 with a 4 1/2 digit one. Basic mainframes with 200mV range must not be used with 4 1/2 digit displays (too noisy). Amplification must be done at the signal conditioner level.

**II.1 3 1/2 DIGIT LED W/DUMMY LSD (BOARD A81-2310)**

This board has provisions for programming the LSD. To disable the LSD, completely remove R2. To program it, cut the foils of the segments not wanted per requirements. If a foil must be reconnected, remove the "solder mask" before making a "bridge".

- Note 1: Only one decimal point can be selected at a time. All other switch jumpers must be off
- Note 2: Automatic range option requires that all D.P. switch jumpers be on the off position.
- Note 3: All logic signals are Positive True Logic.
- Note 4: When used for AC measurement or when the polarity is unwanted, cut pins 5 and 7 on display board (applies to all display options).



**TROUBLE SHOOTING TIPS**

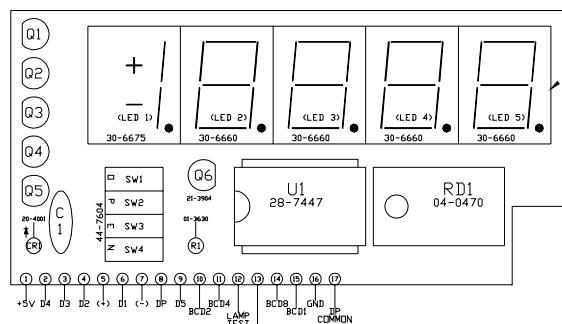
SYMPTOM	CAUSE
No Display	1. No power to unit
Missing segments	1. Defective U1 or RD1
Missing Digits	1. Defective LED or LED driver. 2. Defective Q2 on mainframe.
More Than 1 Decimal Point	1. More than 1 decimal point selected on switch 2. Shorted digit select line.

**II.2. 4 1/2 DIGIT LED (Board No, P/N A81-2320)**

This board contains four full digits. The over-range polarity indication, operation, and troubleshooting is the same as the 3 1/2 except for the dummy digit.

**TROUBLE SHOOTING TIPS**

SYMPTOM	CAUSE
No Display	1. No power to unit
Missing Segments	1. Defective U1 or RD1.
Missing Digits	1. Defective LED or LED Driver 2. Defective Q2 on mainframe.
More Than 1 Decimal Point	1. More than 1 decimal point selected on switch 2. Shorted digit select line.

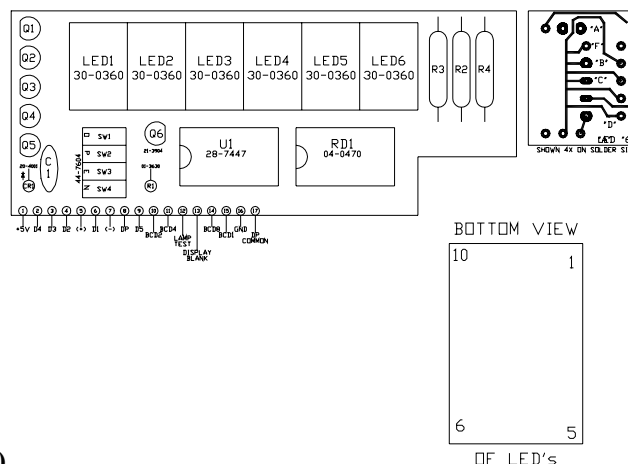


**II.3. 4 1/2 Digit LED with Dummy LSD (Board No. 233, P/N A81-2330)**

When this option is selected the LED displays are smaller than the previously ones explained in order to physically accommodate six LED's. Due to unavailability in the market of a "+/-" display, seven segment is used and the G segment is used to denote a negative sign, The absence of a negative sign is an indication of a positive signal, other than that, its operation and dummy digit selection is the same as the 3 1/2 and 4 1/2 digit displays.

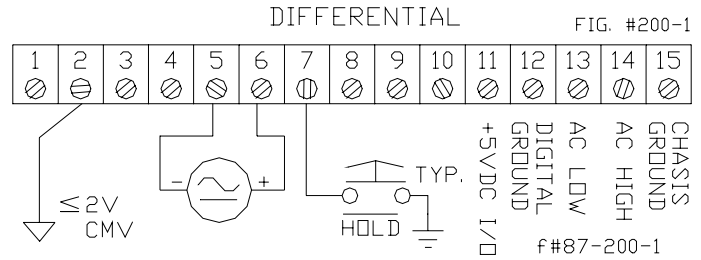
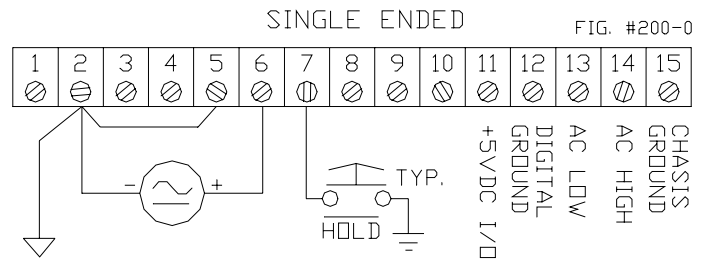
**TROUBLE SHOOTING TIPS**

SYMPTOM	CAUSE
No Display	1. No power to unit.
Missing Segments	1. Defective U1 or RD1.
Missing Digits	1. Defective LED or LED driver. 2. Defective Q2 on mainframe
More Than 1 Decimal Point	1. More than 1 decimal point selected on switch 2. Shorted digit select line

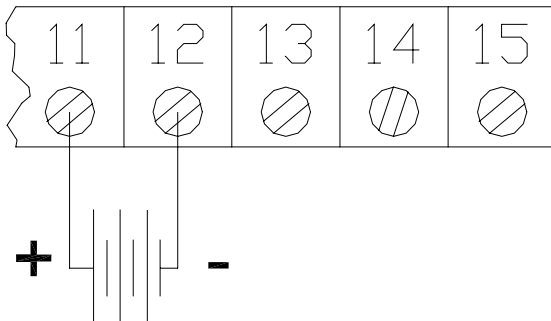


## TYPICAL "ULTIMA 200" CONNECTIONS VDC

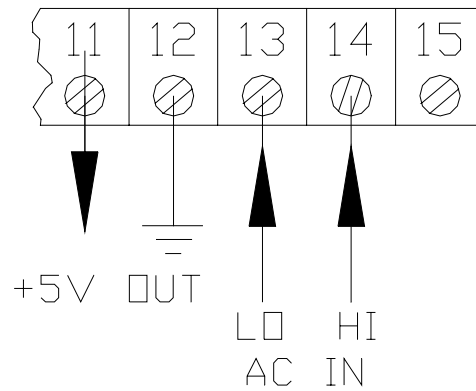
1	-VE / IE / REF I/O
2	ANALOG GROUND
3	IN LO
4	IN HI
5	- AN. SIGNAL I/O
6	+ AN. SIGNAL I/O
7	<u>RUN</u> <u>HOLD</u>
8	+ AN. CONTROL OUT
9	CAL. SHUNT
10	+E COMPLIANCE OUT
11	+5VDC I/O
12	DIGITAL GROUND
13	POWER INPUT
14	POWER INPUT
15	DO NOT CONNECT



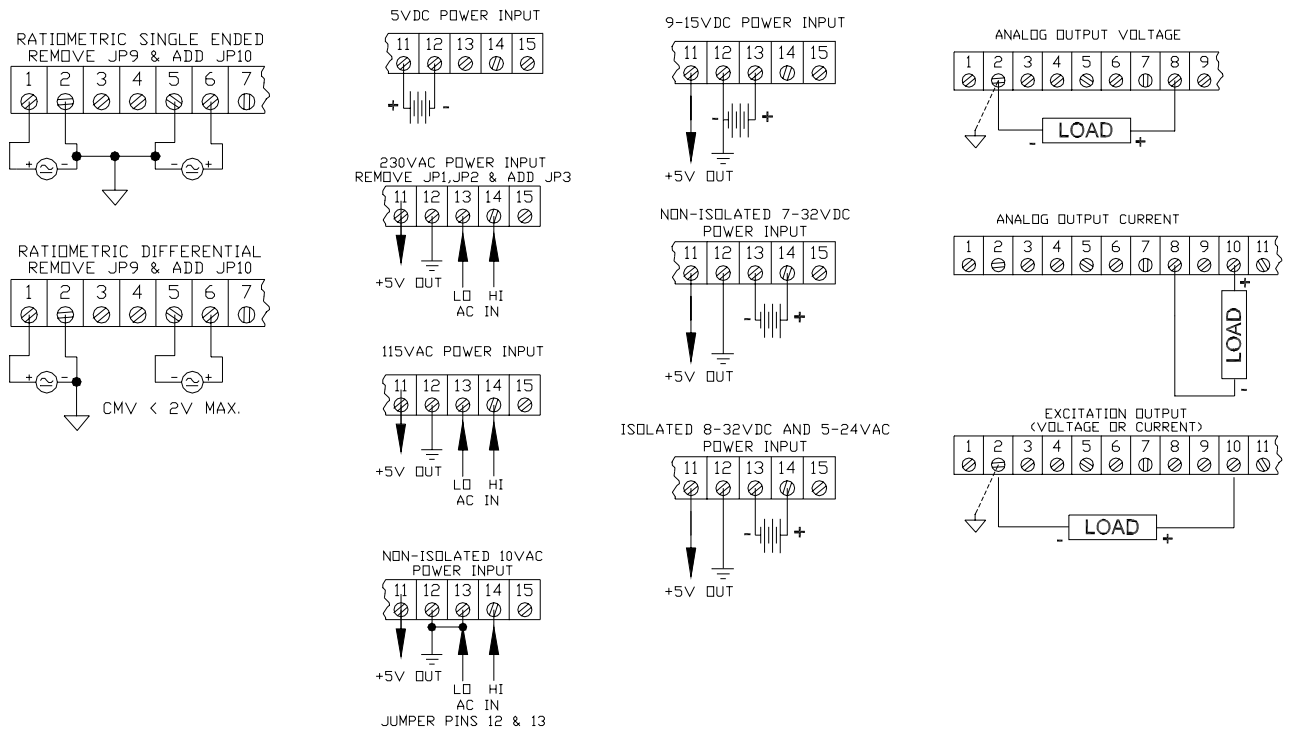
5VDC POWER INPUT



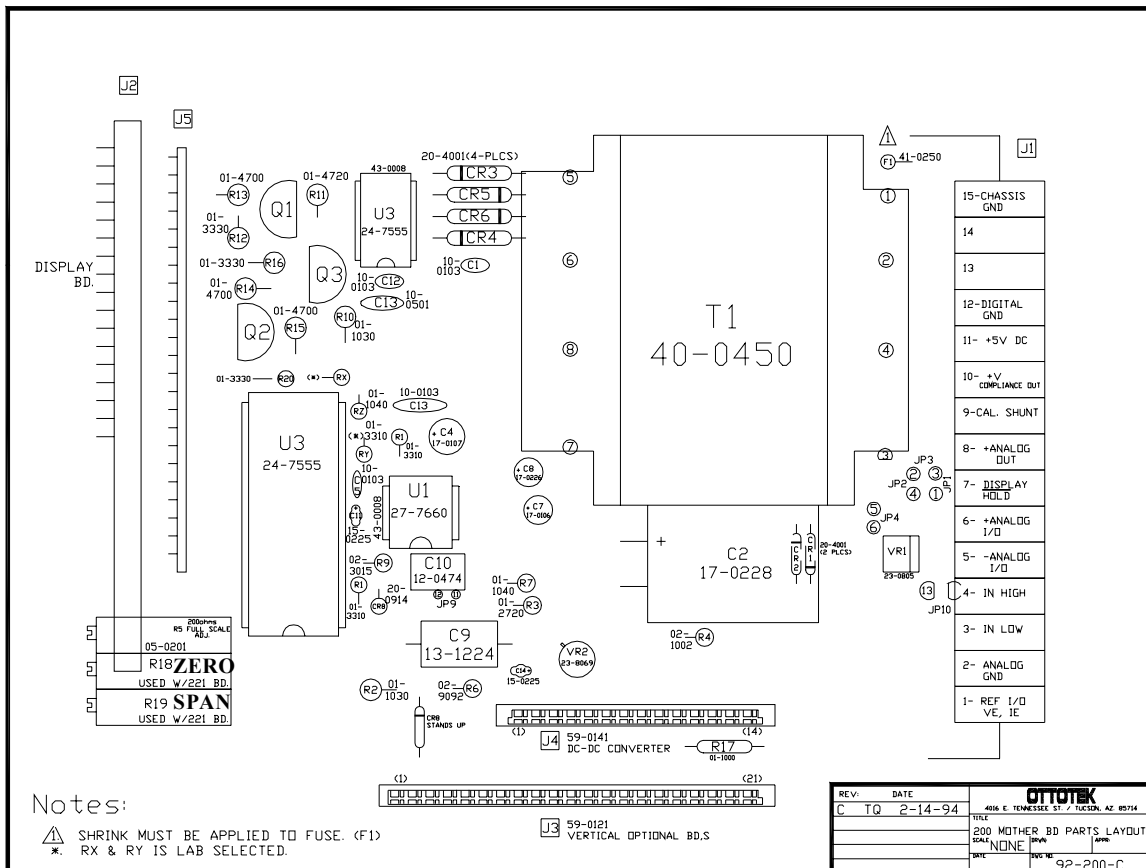
115VAC POWER INPUT  
REMOVE JP3 & ADD JP1,JP2



# TYPICAL "ULTIMA 200" CONNECTIONS VDC



## A81-200 MOTHER BOARD PARTS LAYOUT

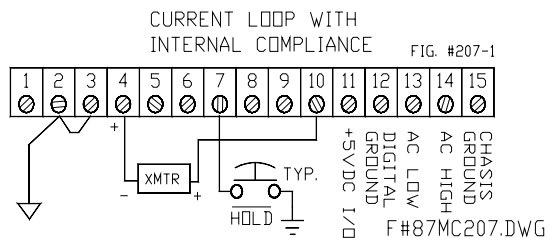
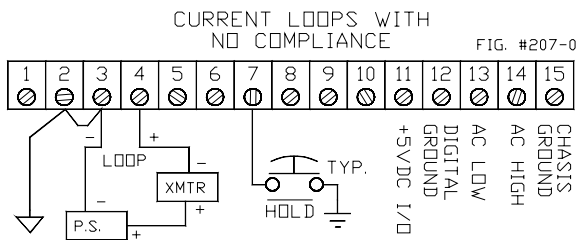


## ORDERING INFORMATION (03-07-05)

<b>MODEL</b> <span style="border: 1px solid black; padding: 2px;">2</span> <span style="border: 1px solid black; padding: 2px;">0</span> <span style="border: 1px solid black; padding: 2px;">0</span> <span style="border: 1px solid black; padding: 2px;">□</span> <span style="border: 1px solid black; padding: 2px;">□</span> <span style="border: 1px solid black; padding: 2px;">□</span> <span style="border: 1px solid black; padding: 2px;">□</span> <span style="border: 1px solid black; padding: 2px;">□</span> <span style="border: 1px solid black; padding: 2px;">0</span>		<b>200</b>
<p><b>DISPLAY TYPE</b></p> <p>0 ..... 3½ LED w/Dummy Zero</p> <p>1 ..... 4½ LED</p> <p>2 ..... 4½ LED w/Dummy Zero</p> <p>5 ..... 3½ LED</p>	<p><b>POWER INPUT</b></p> <p>0 ..... 5VDC</p> <p>1 ..... 120VAC</p> <p>2 ..... 240VAC</p> <p>3 ..... 10VAC</p> <p>4 ..... 12VDC</p> <p>5 ..... 7-32VDC</p> <p>6 ..... Isolated 7-32VDC</p>	
<p><b>INPUT RANGE</b></p> <p>0 ..... 2VDC</p> <p>1* ..... 200mVDC</p> <p>2 ..... 20VDC</p> <p>3 ..... 200VDC</p> <p>4 ..... 500VDC</p> <p>5 ..... 2VDC Ratiometric</p> <p>6 ..... 2mADC</p> <p>7 ..... 20mADC</p> <p>8 ..... 200mADC</p> <p>9 ..... 2Amp DC</p> <p>\$* ..... 50mVDC</p> <p style="text-align: center; font-size: small;">(50mV=1000 Counts)</p> <p style="text-align: center; font-size: x-small;">* 3½ Digit Models Only</p>	<p><b>DIGITAL CONTROL OUTPUTS (1)</b></p> <p>0 ..... None</p> <p>1 ..... BCD Parallel</p> <p>2 ..... BCD Parallel Opto-Isolated</p> <p>3 ..... Peak &amp; Hold</p> <p>4 ..... Digital Limit</p> <p>5 ..... RS232C</p> <p>6 ..... RS422</p> <p>7 ..... Parallel BCD with Peak &amp; Hold</p> <p>8 ..... BCD Encoded</p> <p>9 ..... BCD Encoded Optoisolated</p>	
<p><b>EXCITATION &amp; ANALOG OUTPUTS</b></p> <p>0 ..... None</p> <p>1 ..... 10VDC &amp; 0-5VDC</p> <p>3 ..... 24VDC &amp; 0-5VDC</p> <p>4 ..... None &amp; 4-20mADC</p> <p>5 ..... None &amp; 20-4mADC</p> <p>7 ..... 1.8mADC &amp; 0-5VDC</p>		<p>(1) Thumbwheel Switches are available for the Digital Limit Option, Order P/N 89-0213 (±3½) or 89-0215 (±4½)</p>

<b>MODEL</b> <span style="border: 1px solid black; padding: 2px;">2</span> <span style="border: 1px solid black; padding: 2px;">0</span> <span style="border: 1px solid black; padding: 2px;">7</span> <span style="border: 1px solid black; padding: 2px;">□</span> <span style="border: 1px solid black; padding: 2px;">□</span> <span style="border: 1px solid black; padding: 2px;">□</span> <span style="border: 1px solid black; padding: 2px;">□</span> <span style="border: 1px solid black; padding: 2px;">□</span> <span style="border: 1px solid black; padding: 2px;">0</span>		<b>207</b>
<p><b>DISPLAY TYPE</b></p> <p>0 ..... 3½ LED w/Dummy Zero</p> <p>1 ..... 4½ LED</p> <p>2 ..... 4½ LED w/Dummy Zero</p> <p>5 ..... 3½ LED</p>	<p><b>POWER INPUT</b></p> <p>0 ..... 5VDC</p> <p>1 ..... 120VAC</p> <p>2 ..... 240VAC</p> <p>3 ..... 10VAC</p> <p>4 ..... 12VDC</p> <p>5 ..... 7-32VDC</p> <p>6 ..... Isolated 7-32VDC</p>	
<p><b>INPUT RANGE</b></p> <p>0 ..... 4-20mADC</p> <p>1 ..... 1-5mADC</p> <p>2 ..... 10-50mADC</p> <p>3 ..... 1-5VDC</p> <p>4 ..... -10 to +10VDC</p>	<p><b>DIGITAL CONTROL OUTPUTS (1)</b></p> <p>0 ..... None</p> <p>1 ..... BCD Parallel</p> <p>2 ..... BCD Parallel Opto-Isolated</p> <p>3 ..... Peak &amp; Hold</p> <p>4 ..... Digital Limit</p> <p>5 ..... RS232C</p> <p>6 ..... RS422</p> <p>7 ..... Parallel BCD with Peak &amp; Hold</p> <p>8 ..... BCD Encoded</p> <p>9 ..... BCD Encoded Optoisolated</p>	
<p><b>EXCITATION &amp; ANALOG OUTPUTS</b></p> <p>0 ..... None</p> <p>1 ..... 10VDC &amp; 0-5VDC</p> <p>3 ..... 24VDC &amp; 0-5VDC</p> <p>4 ..... None &amp; 4-20mADC</p> <p>5 ..... None &amp; 20-4mADC</p> <p>7 ..... 1.8mADC &amp; 0-5VDC</p>		<p>(1) Thumbwheel Switches are available for the Digital Limit Option, Order P/N 89-0213 (±3½) or 89-0215 (±4½)</p>

### TYPICAL CONNECTIONS MODEL 207



## ORDERING INFORMATION (03-07-05)

213

MODEL 2 1 3             0

### DISPLAY TYPE (7)

- 0 ..... 3½ LED w/Dummy Zero
- 5 ..... 3½ LED

### INPUT RANGE F.S.

- 0 ..... Customer Selected (1)
- 1 .. 50mV for I<sub>x</sub>: 120VAC For V<sub>x</sub> (Line Power) (2)
- 2 .. 50mV for I<sub>x</sub>: 240VAC For V<sub>x</sub> (Line Power) (2)
- 3 .. 50mV for I<sub>x</sub>: 480VAC For V<sub>x</sub> (Line Power) (2)
- 4 ..... 100mV for I<sub>x</sub>: 120VAC (3)
- 5 ..... 100mV for I<sub>x</sub>: 240VAC (3)
- 6 ..... 100mV for I<sub>x</sub>: 480VAC (3)

### EXCITATION & ANALOG OUTPUTS

- 0 ..... None
- 1 ..... 10VDC & 0-5VDC
- 3 ..... 24VDC & 0-5VDC
- 4 ..... None & 4-20mADC
- 5 ..... None & 20-4mADC
- 7 ..... 1.8mADC & 0-5VDC

### POWER INPUT

- 0 ..... 5VDC
- 1 ..... 120VAC
- 2 ..... 240VAC
- 3 ..... 10VAC
- 4 ..... 12VDC
- 5 ..... 7-32VDC
- 6 ..... Isolated 7-32VDC

### DIGITAL CONTROL OUTPUTS (6)

- 0 ..... None
- 1 ..... BCD Parallel
- 2 ..... BCD Parallel Opto-Isolated
- 3 ..... Peak & Hold
- 4 ..... Digital Limit
- 5 ..... RS232C
- 6 ..... RS422
- 7 ..... Parallel BCD with Peak & Hold
- 8 ..... BCD Encoded
- 9 ..... BCD Encoded Optoisolated

### NOTES:

- (1) Customer to select and mount externally R<sub>1</sub>, R<sub>2</sub> & R<sub>3</sub> per Diagram #1 and Formula #1
- (2) 50mV at either 10, 100 or 1000 Amps full load
- (3) 100mV at either 10, 100 or 1000 Amps full load.
- (4) Select Decimal Point as required, by removing Bezel & Filter
- (5) Absolute maximum input signals: I<sub>x</sub>: 1VRMS; V<sub>x</sub>: 2VRMS for Option 0, 550 VRMS for Options 1 thru 6
- (6) Thumbwheel Switches are available for the Digital Limit Option, Order P/N 89-0213 (±3½).
- (7) 4 1/2 digit on request.

## TYPICAL CONNECTIONS MODEL 213

FOR OPTIONS 1 THRU 6 COM I<sub>x</sub> V<sub>x</sub> FIG. #213-0

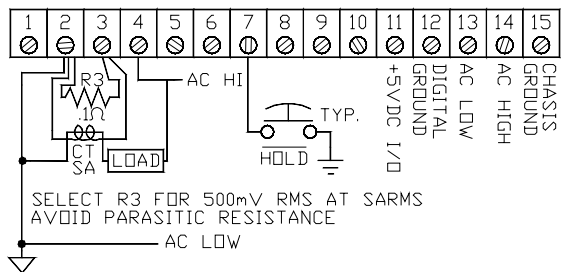
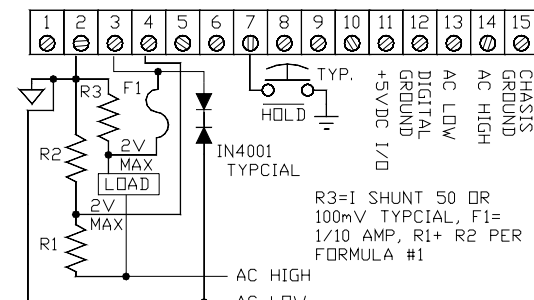


DIAGRAM #1 FOR OPTION "0" COM I<sub>x</sub> V<sub>x</sub>



$$V_{rms} \times I_{rms} \leq 2000 \text{ COUNTS}$$

$$\text{FORMULA \#1: } \frac{R2}{R1 + R2} = \frac{\sqrt{10} V_{rms}}{W / I_{rms}}$$

$$IE: \frac{3.333}{20KW/100A} = 0.1666 = \frac{R2}{R1 + R2}$$

$$R2 \frac{(1-0.1666)}{0.1666} = R1 = 50R2 \quad R2 = 1K \bullet R1 = 50K \Omega$$

(7)