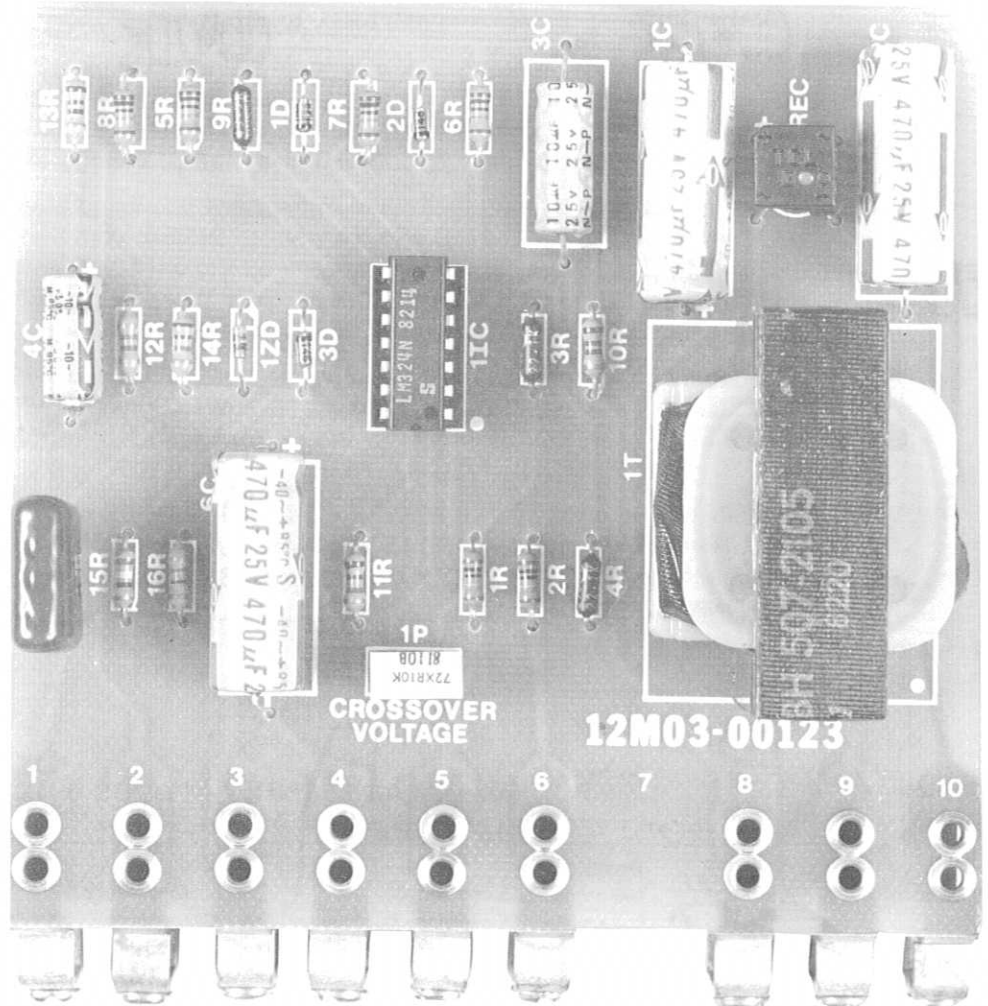


BENCH TEST

1. Set the "CROSSOVER VOLTAGE" pot to full CCW. Jumper terminal 9 to terminal 5 and terminal 10 to terminal 6.
2. Apply 120 VAC to terminals 9 and 10.
3. With an oscilloscope and a digital voltmeter (DVM) monitor terminals 2 (HI) and 8 (LO). The scope should display a sine wave pattern of about 2 volts peak-to-peak and the DVM should read -1.0 to -2.0 VDC.
4. Turn the "CROSSOVER VOLTAGE" pot to its 50% position. The DVM should now read 0.0 to 1.0 VDC, and in its AC mode, the DVM should read a ripple voltage of less than 0.5 VAC.
5. Turn the "CROSSOVER VOLTAGE" pot to its full CW position. The AC reading on the DVM should now be less than 0.05 VRMS and the DC reading should be 0.5 to 2.0 VDC.
6. Turn the "CROSSOVER VOLTAGE" pot to its full CCW position. Jumper terminal 4 to terminal 8 and using the DVM on terminal 3 (HI) and 8 (LO), the readings should be -1.0 to -2.0 VDC and less than 0.05 VAC.



TEST MATERIAL REQUIRED:

- 1 - 120 VAC cord with plug and spade lugs
- 3 - Clip leads
- 1 - Oscilloscope (Tektronix 2213 or equal)
- 1 - Digital Voltmeter (Beckman HD-110 or equal)

VOLTAGE CHECKS

1. The primary voltage of 1T, leads 1 and 2 (terminals 10 and 9) should be 120V AC.
2. The secondary voltage of 1T, leads 3 to 4 and leads 5 to 6 should be 10V AC. These can be measured between circuit common, terminal 8 (leads 4 and 5), and each AC input to the bridge rectifier 1 REC (leads 3 and 6). Voltage at the AC input to the bridge rectifier 1 REC (leads 3 to 6) should be 20V AC.
3. +15V DC nominal between the positive end of capacitor 1C and terminal 8 (common).
4. -15V DC nominal between the negative end of capacitor 2C and terminal 8 (common).

REFLEX[®] MODEL 221 CROSSOVER ASSEMBLY

PART NUMBER 12M03-00123-01
SCHEMATIC DIAGRAM 12M03-00123-01

I. SPECIFICATIONS

SUPPLY

- 120 Volts AC, $\pm 10\%$
- 50/60 Hz, single phase

AMBIENT TEMPERATURE

- 0° to 40°C (32° to 104°F)
- 50°C in cabinet

INPUT

- 0 to 250 volts DC from motor armature circuit

OUTPUT

- Connects to Model 216 Power Converter (Positive 0.6 to negative 6 VDC nominal at terminal 2)

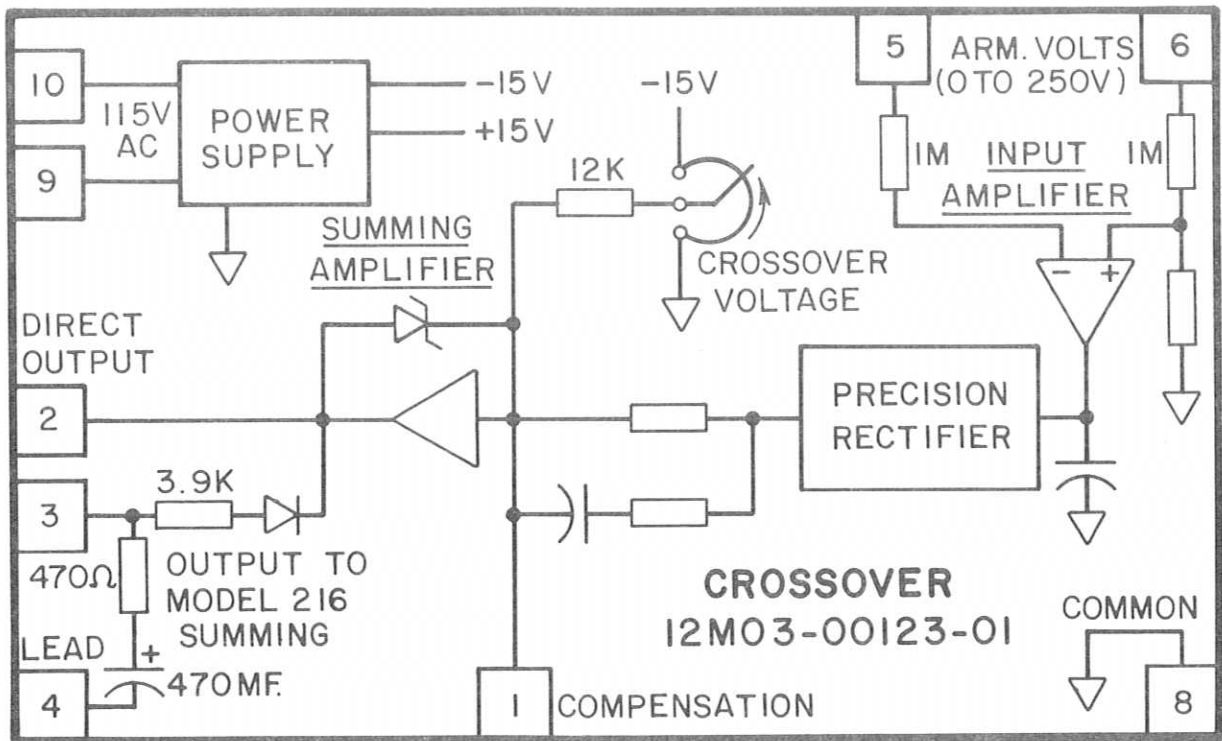


FIGURE 1 SIMPLIFIED SCHEMATIC

II. THEORY OF OPERATION

The Model 221 Crossover Assembly is designed to provide extended speed range of a DC Motor Drive when used with the Model 216 Power Converter.

It consists of several elements as shown in the Simplified Schematic Diagram (Figure 1).

1. Power Supply
2. Input Amplifier
3. Precision Rectifier
4. Summing Amplifier

1. **Power Supply** – The power supply uses a center-tapped transformer with 10 volts on each side of center together with a bridge rectifier and two 470 MF capacitors to provide a nominal positive and negative unregulated 15 volts DC with respect to the transformer center-tap which is connected to circuit common.

2. **Input Amplifier** – Differential amplifier, 11C(A), is impedance isolated from the armature power loop by 1 megohm input resistors, 1R and 2R. Its nominal 5 volt output at 250 volts input is filtered and applied to the input of a Precision Rectifier.

To maintain clearance requirements dictated by national codes, the input voltage on terminals 5 and 6 must be limited to 250 volts.

3. **Precision Rectifier** – An absolute value amplifier consisting of 11C(B) and 11C(C) and associated components provides a nominal output of 1 mA positive to the summing junction at pin 13 of the Summing Amplifier, 11C(D), when the armature voltage is 250 volts, regardless of polarity.

4. **Summing Amplifier** – The "Crossover Voltage" potentiometer, 1P, provides a reference current of approximately zero to 1 mA negative to the summing junction at pin 13 of 11C(D). When the output of the Precision Rectifier exceeds this input reference, the output of the Summing Amplifier swings negative. There is no change in output until the armature voltage reaches a value determined by the setting of the "Crossover Voltage" potentiometer, usually rated armature voltage of the DC motor.

The maximum output at terminal 2 is limited to negative 6 volts nominal by the clamping action of zener diode 1ZD. The output of terminal 3, with respect to system common terminal 8, is connected to the "Summing" input of the Model 216 Power Converter (terminal 13). The negative signal from the Crossover circuit applied to the summing input, subtracts from the positive reference signal into terminal 15, reducing field current by an amount proportional to the output of the Crossover Assembly.

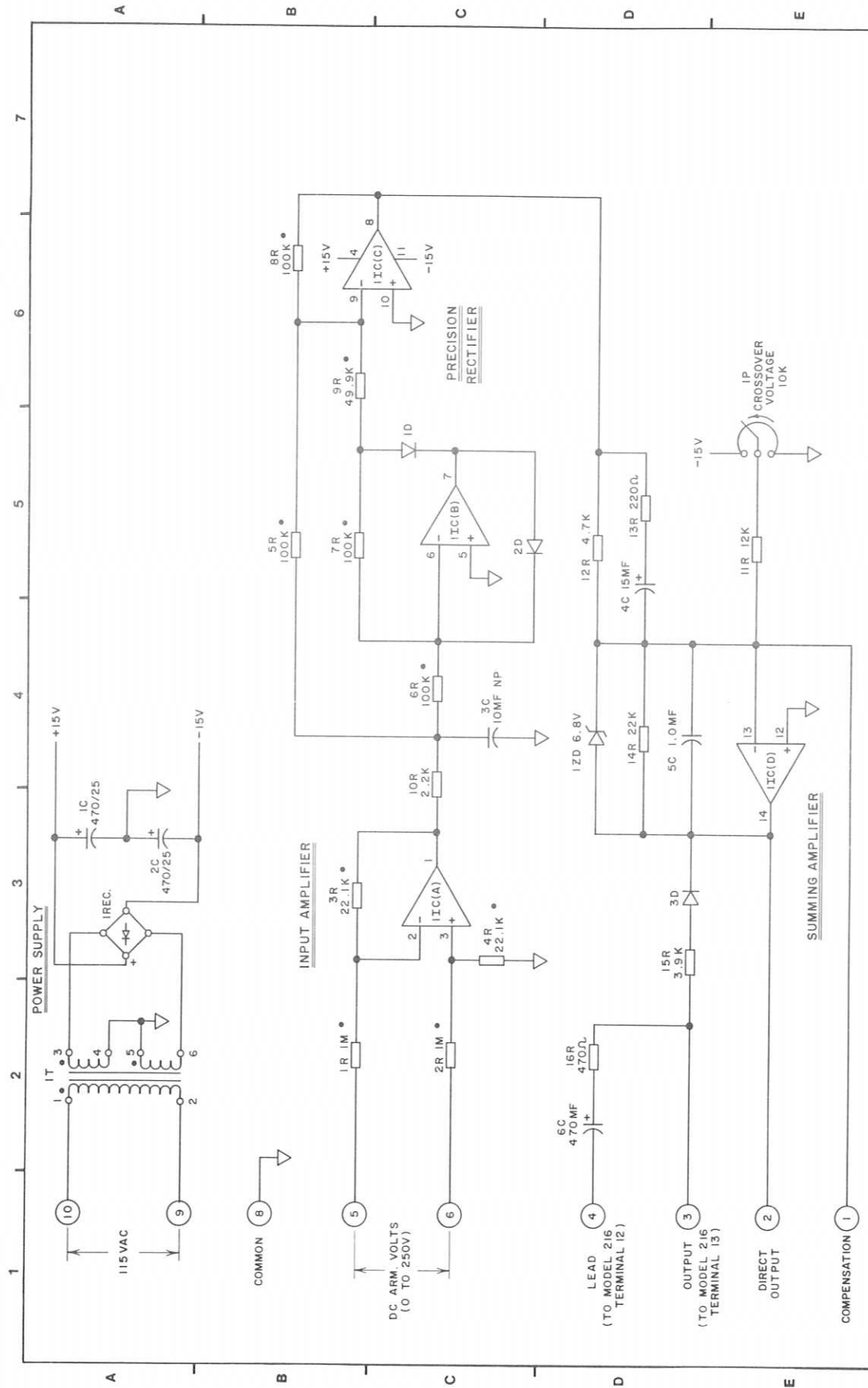
A "Lead" network consisting of capacitor 6C and resistor 16R is used to improve system stability when the current feedback mode is used on the Model 216 Power Converter. The current signal is obtained by connecting terminal 4 on this assembly to the current feedback terminal 12 of the Model 216 Power Converter.

CAUTION: SINCE THE MODEL 216 POWER CONVERTER DOES NOT HAVE LINE ISOLATION, NO PART OF ITS CIRCUITRY OTHER THAN THE 115 VOLT AC SUPPLY POWER SHOULD BE CONNECTED TO ANY PART OF THE MAIN DRIVE CIRCUITRY UNLESS AN ISOLATION TRANSFORMER IS USED ON THE AC INPUT (TERMINALS 3 AND 7).

COMPONENT LIST - ASSEMBLY #12MO3-00123-01

Symbol	Part #	Description (Acceptable Substitute)*	Symbol	Part #	Description (Acceptable Substitute)*
1T	04P01-00001	Transformer - 120V AC PRI, two 10V SEC. @ 220 mA (Signal-PC 20-220)	1R, 2R	01P02-10041-01	Resistor - 1.0M, 1/2W, 1%
1REC	05P01-00003	Rectifier Bridge - 50V, 1A (EDI-PF50)	3R, 4R	01P02-22121-01	Resistor - 22.1K, 1/2W, 1%
1D-3D	05P02-00001	Diode, Signal-50mA, 200 PIV (1N4148)	5R-8R	01P02-10031-01	Resistor - 100K, 1/2W, 1%
1ZD	05P03-00005	Zener Diode - 6.8V, 500mW, 10% (1N5235B)	9R	01P02-49921-01	Resistor - 49.9K, 1/2W, 1%
11C	05P08-00001	Quad Op-Amp (National-LM324)	10R	01P01-22200-02	Resistor - 2.2K, 1/4W, 5%
1P	02P04-10301-00	Potentiometer - 10K, 1/2W (Beckman 72XR10K)	11R	01P01-12300-02	Resistor - 12K, 1/4W, 5%
1, 2, 6C	03P01-47102-01	Capacitor - 470MF, 25V, Electrolytic	12R	01P01-47200-02	Resistor - 4.7K, 1/4W, 5%
3C	03P02-10002-00	Capacitor - 10MF, 25V, NP, Electrolytic	13R	01P01-22100-02	Resistor - 220 Ohm, 1/4W, 5%
4C	03P01-15001-00	Capacitor - 15MF, 16V, Electrolytic	14R	01P01-22300-02	Resistor - 22K, 1/4W, 5%
5C	03P07-10510-00	Capacitor - 1.0MF, 100V, Film	15R	01P01-39200-02	Resistor - 3.9K, 1/4W, 5%
			16R	01P01-47100-02	Resistor - 470 Ohm, 1/4W, 5%

*OR EQUAL



PCB NO. 13S01-00123
LAYOUT NO. 12M03-00123

REV	DATE	DESCRIPTION	INT.	DATE	DESCRIPTION	INT.

DESIGN	DATE	SCALE	SHEET	OF

REV	DATE	DESCRIPTION	INT.	DATE	DESCRIPTION	INT.

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"CONFIDENTIAL"

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REFLEX INC.
CEDARBURG, WI
PRODUCT: CROSSOVER CIRCUIT FOR USE WITH MODEL 216 POWER CONVERTER
REFLEX No. EX-221
JOB No.

SCHEMATIC DIAGRAM
12M03-00123

1 2 3 4 5 6 7

A B C D E F