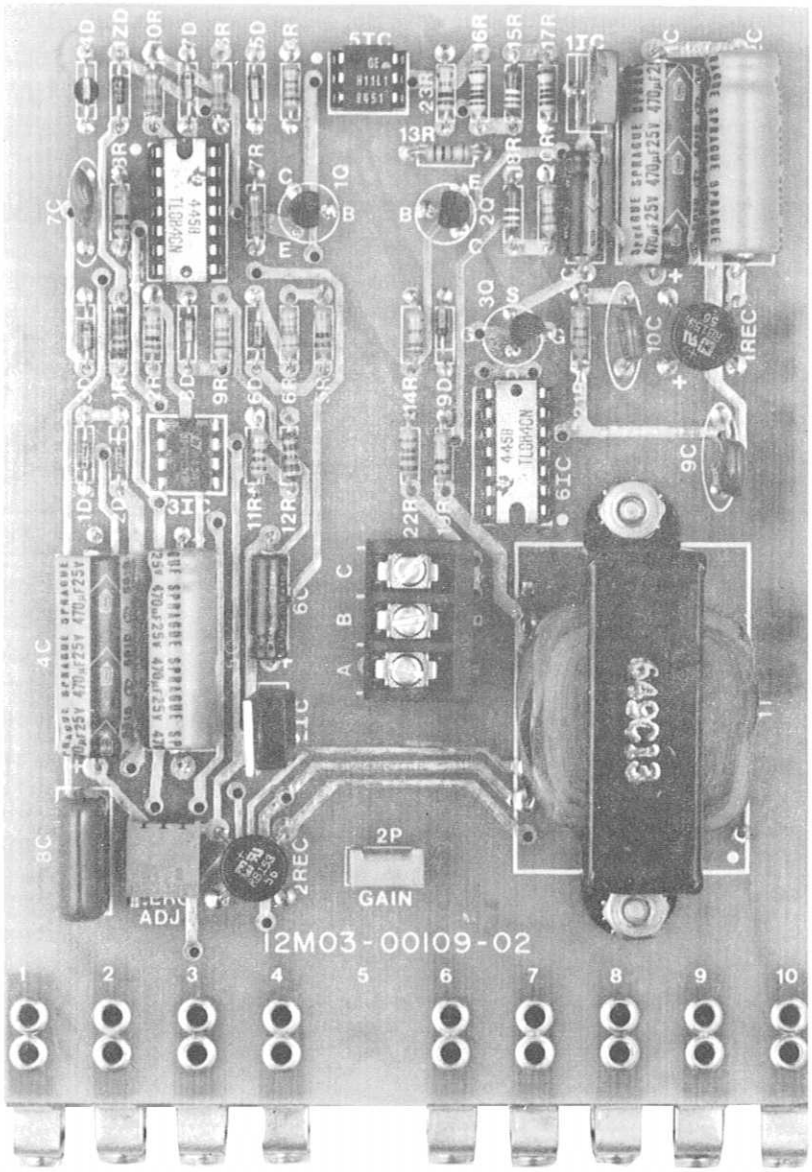
REFLEX®

Trouble-shooting Manual
MODEL 213
SIGNAL ISOLATOR
PART NUMBER 12M03-00109-02

BENCH TEST



1. Connect a jumper from terminal A to terminal B on the board. Connect terminal 8 to 9 and terminal 10 to 4.
2. Connect a 1K resistor from terminal 1 to 2, and a 100K resistor from 2 to 3.
3. Apply 120V AC to terminals 9 and 10. **CAUTION! SHOCK HAZARD!** For this test the circuit is connected to 120 volts and all tests should be conducted without touching the circuitry.
4. Temporarily connect terminal 1 to 4 and apply a digital voltmeter to terminals 7 and 8 (common). Adjust "Zero" potentiometer from end to end. The meter should indicate a minimum swing of 10mV DC on either side of the 0 voltage point and a minimum of 60mV DC total swing.
5. Set "Zero" to read 0mV DC at terminal 7.
6. Disconnect the jumper from terminals 1 and 4.
7. Using a 5K potentiometer, and a 100K and a 1.8K resistor, fashion an input circuit as follows: Connect the CW end of the potentiometer to +6V DC, the CCW end of the potentiometer to -6V DC, the wiper to one end of the 100K resistor. The other end of the 100K resistor should go to terminal 1. Connect the 1.8K between terminals 1 and 4. The ± 6V from the **INPUT POWER SUPPLY** may be used.
8. Adjust the 5K potentiometer from end to end. The voltage at terminal 7 should saturate at plus or minus 2.9 to 3.1V DC.
9. Place the voltmeter lead on terminals 3 and 4 (common) and adjust the 5K potentiometer for +2.0V DC.
10. Return the voltmeter leads to 7 and 8 (common) and read +1.9 to 2.1V DC.
11. Move the meter leads from terminal 7 to point "C" on the circuit board and read +1.9 to 2.1V DC. Return lead to terminal 7.
12. Repeat steps 9 and 10, using -2.0V DC and reading -1.9 to -2.0V DC out.
13. As in step 9, adjust for +3.2V DC between terminals 3 and 4.
14. With the meter leads between point "A" and 8 (common) and starting at the full CCW position, rotate the "Gain" potentiometer fully CW and notice a smooth rise from 0 to a minimum of -10V DC.
15. Repeat steps 13 and 14, using -3.2V DC, and read a minimum of +10V DC.
16. With an ohmmeter read zero ohms between terminal 6 and point "B."

REFLEX® MODEL 213 SIGNAL ISOLATOR

PART NUMBER 12M03-00109
SCHEMATIC DIAGRAM 12M03-00109-02

I. SPECIFICATIONS

SUPPLY:

- 120 volts AC ± 10%
  50/60 Hz, single phase

AMBIENT TEMPERATURE:

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

MAXIMUM ISOLATION VOLTAGE:

- Nominal 480 volts AC or
  700 volts DC between
  Input and Output

GAIN:

- 1.0 ± 10%

LINEARITY:

- ± .5% of full scale

DRIFT:

- 5% maximum, 2% typical (0 to 50°C)

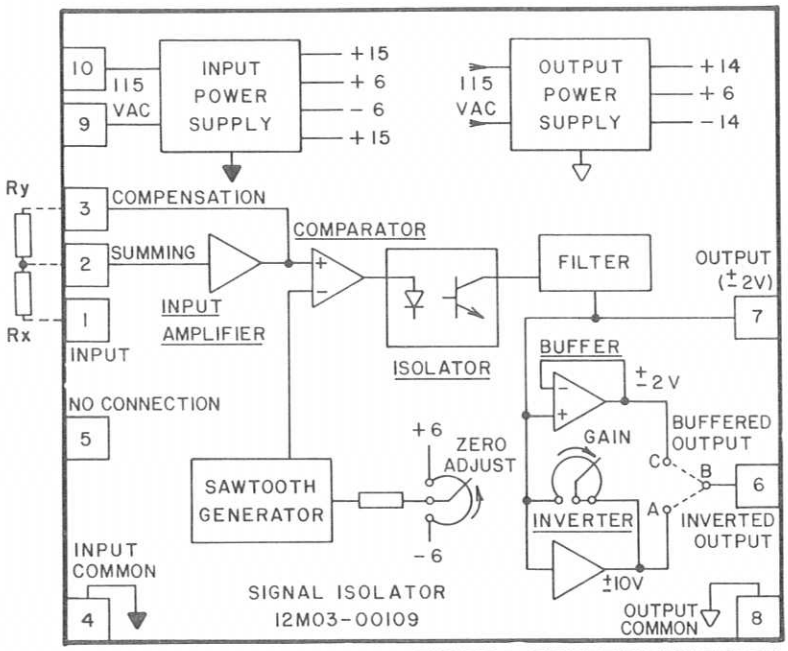


FIGURE 1. SIMPLIFIED SCHEMATIC

OUTPUT VOLTAGE:

- 0 to ± 2 volts (± 10 volts with integral inverting amplifier)

INPUT VOLTAGE:

- Depends on external gain resistors — 50mV to 500V DC

CAUTION: IF INPUT AND OUTPUT CIRCUIT COMMONS ARE CONNECTED TOGETHER, ISOLATION IS LOST AND DAMAGE TO EXTERNAL CIRCUITRY MAY RESULT.

II. THEORY OF OPERATION

The REFLEX® Model 213 Signal Isolator provides isolation between two circuits of up to 480 volts AC potential.

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

1. Power Supplies (Input and Output)
2. Input Amplifier
3. Sawtooth Generator and Comparator
4. Isolator and Switching Circuit
5. Active Filter
6. Output Amplifier

1. **Power Supplies** — The power supply uses a transformer having four identical 12 volt secondary windings. Two pair of windings are connected in a center-tapped configuration. A bridge rectifier on each pair of windings together with two 470 MF filter capacitors provides two electrically isolated power supplies each with a nominal positive and negative unregulated 15 volts with respect to the transformer center-tap which is connected to Input or Output circuit commons. To provide separate identification the Output Power Supply is labeled 14 volts and the Input Power Supply is labeled 15 volts.

   Additionally, two positive 6 volt regulated references are obtained from the positive 15 volt supplies using positive voltage regulators, 1IC and 2IC, each with a 10 MF filter capacitor. A negative 6 volt reference for the input circuit is obtained from the negative 15 volts supply using resistor 1R and zener diode 1ZD.

2. **Input Amplifier** — The input amplifier, 3IC, is a precision op-amp that conditions the input signal for the Comparator 4IC(A), so that a maximum of two volts is applied to pin 12 of 4IC(A). Diode clamps 3D and 4D prevent overloading of the Comparator 4IC(A). Since this is a conventional inverting amplifier, the normal rules for input and feedback apply.

3. **Sawtooth Generator and Comparator** — Operational amplifier 4IC is configured to generate a high accuracy triangular wave of ± 3 volts (6 volts peak to peak), at approximately 4000 Hz. The sawtooth wave is generated by 4IC(D) and 4IC(C) and automatically biased by 4IC(B) to insure a symmetrical wave form. Op-amp 4IC(A) acts as a Comparator, comparing the input signal from 3IC.

   If there is no input from 3IC, the output of the Comparator is an equal-duty square wave and the output of the assembly (terminal 7) is zero. If the input signal is positive or negative, it changes the duty cycle to a rectangular wave with a greater proportion of time at one state or the other.

   The "Zero Adjustment," IP, compensates for difference in input offset voltages of the op-amps and should be adjusted for zero output with zero input.

4. **Isolator and Switching Circuit** — Transistor 1Q switches the opto-coupler 5IC on and off at the same frequency and duty cycle as the rectangular wave out of the Comparator, 4IC(A).

   The output of the opto-coupler 5IC drives the base of common emitter amplifier 2Q. The collector of 2Q is switched between positive and negative 15 volts at the same duty cycle as the input to the opto-coupler, 5IC.

   Op-amp 6IC(C) inverts or non-inverts the signal depending on the state of FET switch, 3Q. The output of 6IC(C) is ± 3 volts, of the same duty cycle as the opto-coupler.

5. **Output Amplifier** — Op-amp 6IC(B) is used as a 2 pole, nominal 300 Hz active filter that attenuates the 4000 Hz carrier leaving relatively pure DC output at terminal 7.

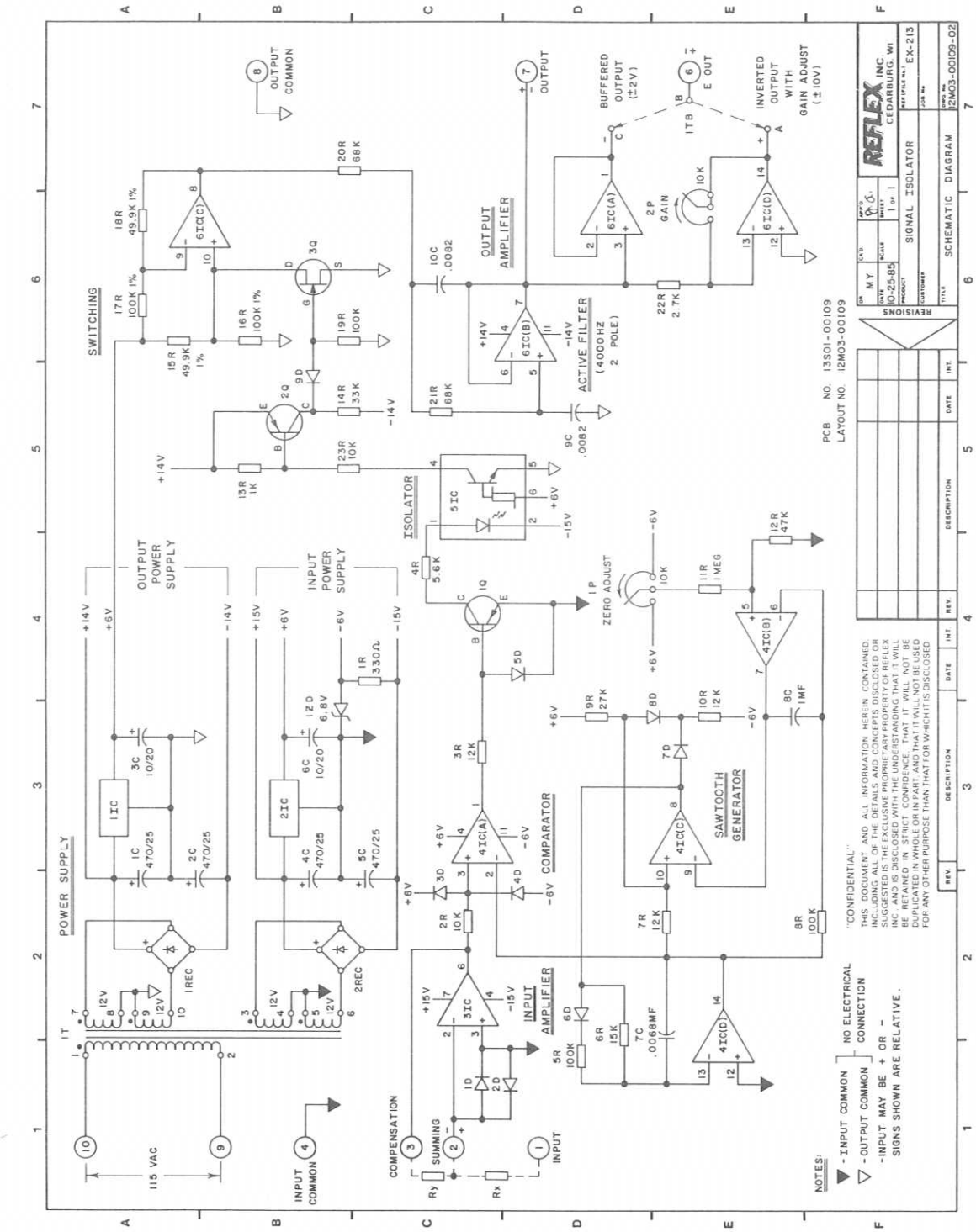
   If required, a buffered output is available from 6IC(A) or an inverted output with gain adjustment from 6IC(D) at terminal 6 depending on the position of the jumper on 1TB.

COMPONENT LIST — ASSEMBLY #12M03-00109

Symbol	Part #	Description (Acceptable Substitute) *
1T	04P01-00004	Transformer - 120V AC PRI, four 12V SEC @ 50mA (Coil Trans. Inc.-649C13)
1, 2REC	05P01-00003	Rectifier Bridge - 50V, 1A (EDI-PF50)
1-9D	05P02-00001	Diode - Signal, 50mA, 200 PIV (1N4148)
1ZD	05P03-00005	Zener Diode - 6.8V, 500 mW, 10% (IN5235B)
1Q, 2Q	05P04-00001	Transistor - PNP, Small Signal (2N3638A)
3Q	05P05-00001	Transistor - N Channel JFET (2N4093)
1, 2IC	05P08-00006	+6 Volt Regulator (7806)
3IC	05P08-00005	Precision Op-Amp (Fairchild 714)
4, 6IC	05P08-00002	Quad Op-Amp (TI-TL084)
5IC	05P10-00004	Opto-Isolator (GE-H11L1)
1P	02P05-10301-02	Potentiometer - 10K, 25 Turn
2P	02P04-10301-00	Potentiometer - 10K, ½W (Beckman 72XR10K)
1, 2, 4, 5C	03P01-47102-01	Capacitor - 470MF, 25V, Electrolytic
3, 6C	03P01-10001-00	Capacitor - 10MF, 16V, Electrolytic
7C	03P07-68210-00	Capacitor - .0068MF, 100V, Film
8C	03P07-10510-00	Capacitor - 1.0MF, 100V, Film
9, 10C	03P07-82210-00	Capacitor - .0082MF, 100V, Film
1R	01P01-33100-02	Resistor 330, ¼W, 5%
2, 23R	01P01-10300-02	Resistor 10K, ¼W, 5%
3, 7, 10R	01P01-12300-02	Resistor 12K, ¼W, 5%
4R	01P01-56200-02	Resistor 5.6K, ¼W, 5%
5, 8, 19R	01P01-10400-02	Resistor 100K, ¼W, 5%
6R	01P01-15300-02	Resistor 15K, ¼W, 5%
9R	01P01-27300-02	Resistor 27K, ¼W, 5%
11R	01P01-10500-02	Resistor 1.0 M, ¼W, 5%
12R	01P01-47300-02	Resistor 47K, ¼W, 5%
13R	01P01-10200-02	Resistor 1K, ¼W, 5%
14R	01P01-33300-02	Resistor 33K, ¼W, 5%
15, 18R	01P02-49921-01	Resistor 49.9K, ½W, 1%
16, 17R	01P02-10031-01	Resistor 100K, ½W, 1%
20, 21R	01P01-68300-02	Resistor 68K, ¼W, 5%
22R	01P01-22200-02	Resistor 2.2K, ¼W, 5%

* OR EQUAL

BULLETIN TM213-1086



VOLTAGE CHECKS

1. The primary voltage of 1T, leads 1 and 2 (terminals 10 and 9), should be 120V AC.
2. One secondary voltage of 1T, leads 3 to 4 and leads 5 to 6 should be 12V AC. These can be measured between circuit common, terminal 4 (leads 4 and 5), and each AC input to the bridge rectifier 2 REC (leads 3 and 6). Voltage at the AC input to the bridge rectifier (leads 3 to 6) should be 24V AC.
3. The other secondary voltage of 1T, leads 7 to 8 and leads 9 to 10 should be 12V AC. These can be measured between circuit common, terminal 8 (leads 8 and 9) and each AC input to the bridge rectifier 1 REC (leads 7 to 10). Voltage at the AC input to the bridge rectifier (leads 7 to 10) should be 24V AC.
4. +15V DC nominal between the positive end of capacitor 1C and terminal 8 (common).
5. –15V DC nominal between the negative end of capacitor 2C and terminal 8 (common).
6. +6V DC nominal between the positive end of capacitor 3C and terminal 8 (common).
7. +15V DC nominal between the positive end of capacitor 4C and terminal 4 (common).
8. –15V DC nominal between the negative end of capacitor 5C and terminal 4 (common).
9. –6V DC nominal between the anode of 1ZD and terminal 4 (common).