MODEL 730
PLC LINE SIMULATOR

Instruction Manual

Introduction

The Model 730 Power Line Carrier Line Simulator simulates coupling capacitor values and characteristic line impedances in a Power Line Carrier System to allow for pre-tuning and troubleshooting of line tuners. Also included is a 50 or 75 Ohm dummy load that can be used for setting transmitters and checking the integrity of BNC cable.

The Model 730 replaces the now discontinued Model 630 Power Line Carrier Line Simulator. The updated design was needed to accomodate CCVT's with higher capacitive values than the Model 630 was capable of supporting. The only change from the Model 630 is the ADD 150 pF toggle switch value was replaced with an ADD 0.01 uF (10,000 pF). Using the 0.01 uF (10,000 pF) toggle switch in conjunction with the rotary switch now permits capacitive values of up to 0.02075 uF (20,750 pF). All other values and functionality remain the same as the Model 630.

Functions

Line Impedance Simulation

A set of fixed resistors and a 12-position rotary switch are used to vary resistance values which act as the simulated line characteristic impedance in the circuit. The phase-to-ground line characteristic impedance is normally between 200 to 600 ohms for most high voltage transmission lines. All resistance values have an accuracy of ±5%. The following is a list of the selectable switch positions and their resistance values:

SWITCH POSITION	RESISTANCE VALUE
1	200
2	225
3	250
4	275
5	300
6	330
7	350
8	380
9	400
10	470
11	530
12	600

Coupling Capacitance Simulation

Simulating the coupling capacitance is acheived through a set of fixed capacitors, a 10-position rotary switch, and three toggles switches. The rotary switch allows you to vary the capacitance from 0.001 to 0.01 µf in 0.001 µf steps. The three toggle switches allow you to add either 0.01 µf (10000 pf), 0.0005 µf (500 pf), or 0.00025 µf (250 pf) or any combination of the three for numerous additional capacitance values.

Dummy Load

The 50 or 75 Ohm, 25 Watt non-inductive dummy load provides the technician another necessary tool in the alignment of the PLC system. This dummy load can be accessed via a standard BNC female connector on the front panel of the decade box.

Specifications

Resistance	
Accuracy	±5%
Max Input	40 V
Capacitance	
Accuracy	±5%
Max Input	100 V
Dummy Load	
	50 or 75 Ohm, 25W, Non-Inductive
Dimensions	
Case	6.75”L x 5.5” W x 3.75” H
Overall	6.75”L x 5.5” W x 4.75” H

Test Procedures with PCA-4125

Impedance Matching Transformer Test

The following procedure will test the impedance matching transformer to determine if it is good or bad. If the transformer is bad, the SWR reading should be very high, 50% or more and usually 90 to 100%.

CAUTION! HIGH VOLTAGES MAY BE PRESENT IN THE LINE TUNER. ALWAYS CLOSE THE GROUND SWITCH BEFORE WORKING ON LINE TUNER.

PROCEDURE

1. Verify that the pilot relay is out of service before testing the line tuner.
2. Close the grounding switch on the protective unit of the line tuner.
3. Disconnect the coaxial cable from the line tuner.
4. Connect a BNC "Y" adapter to the High Level input of the PCA-4125.
5. Connect the PCA-4125 low level generator output to one side of the "Y" connector at the High Level Input.
6. Connect the other side of the "Y" connector to the coaxial cable input on the impedance matching transformer.
7. Disconnect the impedance matching transformer from the series inductor.
8. Connect the Model 730 test box white terminal (J2) to the output of the impedance matching transformer & the black terminal (J1) to ground (See Figure 1). This connects the test box for resistance only.
9. Adjust the test box to the resistive value that the impedance matching transformer is set at.
10. Turn on the PCA-4125 and press the VSWR button on the lower right side of the instrument.
11. Then press the "output" button and set the generator to the transmitter's frequency. The VSWR Screen should read less that 5% SWR.
12. If the SWR is higher than 5%, try adjusting the resistance of the test box to get a lower SWR reading.
13. Disconnect the test box and reconnect the impedance matching transformer to the series inductor.
14. Open the grounding switch.

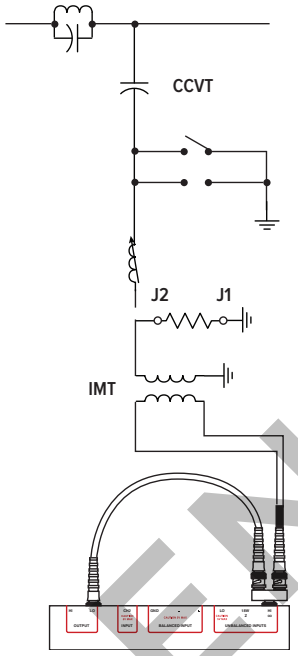


FIG 1 - IMT TEST CONNECTIONS

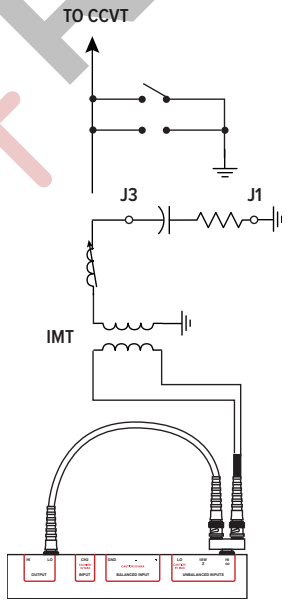


FIG 2 - SERIES INDUCTOR TEST CONNECTIONS

Series Inductor Test

The following procedure will test the series inductor to determine if it is good or bad. If the series inductor is bad the SWR reading should be very high, 50% or more and usually 90 to 100%.

PROCEDURE

1. Verify the pilot relay is out of service before testing the line tuner.
2. Close the grounding switch on the protective unit of the line tuner.
3. Disconnect the coaxial cable from the line tuner.
4. Connect the BNC "Y" adapter to High Level input of the PCA-4125.
5. Connect the PCA-4125 low level generator output to one side of the "Y" connector at the High Level Input.
6. Connect the other side of the "Y" connector to the coaxial cable input on the impedance matching transformer.
7. Disconnect the series inductor from the protective unit.
8. Connect the Model 730 red terminal (J3) to the output of the series inductor and the black terminal (J1) to ground (See Fig. 2). This connects the test box for resistance and capacitance.
9. Adjust the test box resistance to the resistive value that the impedance matching transformer is set at.
10. Adjust the test box to the capacitive value of the coupling capacitor or CVT.
11. Turn on the PCA-4125 and press the VSWR button on the lower right side of the instrument.
12. Then press the "output" button and set the generator to the transmitter's frequency. The VSWR Screen should read less that 5% SWR.
13. If the SWR is higher than 5%, adjust the resistance of the test box to get the lowest SWR reading.
14. If the SWR is higher than 5%, adjust the capacitance of the test box to get the lowest SWR reading.
15. Record the values of capacitance and resistance of the Model 730 and the SWR reading.
16. Disconnect Model 730 and reconnect series inductor to the protective unit.
17. Open the Grounding Switch.

Test Procedures with Model 70 & 90

The Model 730 PLC Line Simulator may be used to test either the impedance matching transformer only or the impedance matching transformer and the series inductor as a unit. The technician must follow all applicable safety procedures while testing the tuner.

Impedance Matching Transformer Test

The following procedure will test the impedance matching transformer to determine if it is good or bad. If the transformer is bad the SWR reading should be very high, 50% or more and usually 90 to 100%.

CAUTION! HIGH VOLTAGES MAY BE PRESENT IN THE LINE TUNER. ALWAYS CLOSE THE GROUND SWITCH BEFORE WORKING ON LINE TUNER.

PROCEDURE

1. Verify that the pilot relay is out of service before testing the line tuner.
2. Close the grounding switch on the protective unit of the line tuner
3. Disconnect the coaxial cable from the line tuner.
4. Connect the Signalcrafters Model 90 signal generator output to the Model 70 SWR meter's input.
5. Connect the Model 70 SWR meter's output to the coaxial cable input on the impedance matching transformer.
6. Disconnect the impedance matching transformer from the series inductor.
7. Connect the Model 730 test box white terminal (J2) to the output of the impedance matching transformer & the black terminal (J1) to ground (See Figure 3). This connects the test box for resistance only
8. Adjust the test box to the resistive value that the impedance matching transformer is set at.
9. Turn on the Model 90 signal generator and set it to the transmitter's frequency.
10. Adjust the Model 90 signal generator voltage output to approximately 10 volts. The Model 70 SWR meter should read less that 5% SWR.
11. If the SWR is higher than 5%, try adjusting the resistance of the test box to get a lower SWR reading.
12. Disconnect the Model 730 and reconnect the impedance matching transformer to the series inductor.
13. Open the Grounding Switch.

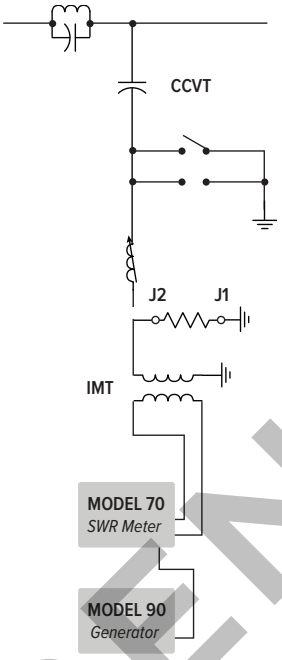


FIG 3 - IMT TEST CONNECTIONS

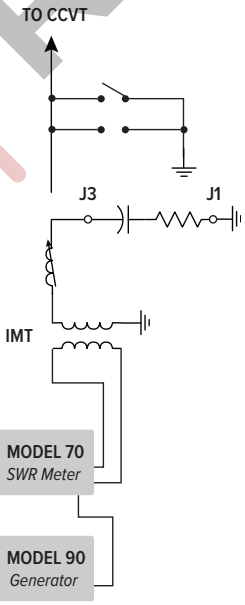


FIG 4 - SERIES INDUCTOR TEST CONNECTIONS

Series Inductor Test

The following procedure will test the series inductor to determine if it is good or bad. If the series inductor is bad the SWR reading should be very high, 50% or more and usually 90 to 100%.

PROCEDURE

1. Verify the pilot relay is out of service before testing the line tuner.
2. Close the grounding switch on the protective unit of the line tuner.
3. Disconnect the coaxial cable from the line tuner.
4. Connect the Signalcrafters Model 90 signal generator output to the Model 70 SWR meter's input.
5. Connect the Model 70 SWR meter's output to the coaxial cable input on the impedance matching transformer.
6. Disconnect the series inductor from the protective unit.
7. Connect the Model 730 test box red terminal (J3) to the output of the series inductor and the black terminal (J1) to ground (See Fig. 4). This connects the test box for resistance and capacitance.
8. Adjust the test box resistance to the resistive value that the impedance matching transformer is set at.
9. Adjust the test box to the capacitive value of the coupling capacitor or CVT.
10. Turn on the Model 90 signal generator and set it to the transmitter's frequency.
11. Adjust the Model 90 signal generator voltage output to approximately 10 volts. The Model 70 SWR meter should read less that 5% SWR.
12. If the SWR is higher than 5%, adjust the resistance of the test box to get the lowest SWR reading.
13. If the SWR is higher than 5%, adjust the capacitance of the test box to get the lowest SWR reading.
14. Record the values of capacitance and resistance of the test box and the SWR reading.
15. Disconnect the Model 730 and reconnect series inductor to the protective unit.
16. Open the grounding switch.

Line Trap Test Using Resistor Method

If you do not own a Signalcrafters Model 60 Impedance Magnitude Meter or if one is not available, here is another method of testing a line trap. Use the PCA-4125 Generator or Signalcrafters Model 90 frequency generator along with a resistor and a voltmeter as shown in Figure 5. The voltmeter must be able to read RF frequencies. Most handheld DMM are not capable of reading voltages at RF frequencies. The resistor must be non-inductive.

It is recommended to use a 50 Ohm resistance or less. The 50 ohm dummy load of the Model 730 Line Simulator works fine for this application. The voltage output of the Model 90 must be held constant for accurate readings. Sweep the line trap across its frequency bandwidth and record the voltage at each frequency step. Use the formula below to calculate the impedance of the line trap. V1 is the voltage output of the Model 90. V2 is the voltage drop across the resistor.

You can also determine the frequency that the trap is tuned (Single Frequency Trap) by sweeping the Model 90 and recording the frequency at which the lowest voltage drop across the resistor occurs (V2).

Line Trap Impedance = $\left(\frac{V_1}{V_2} \times R_1\right) - R_1$

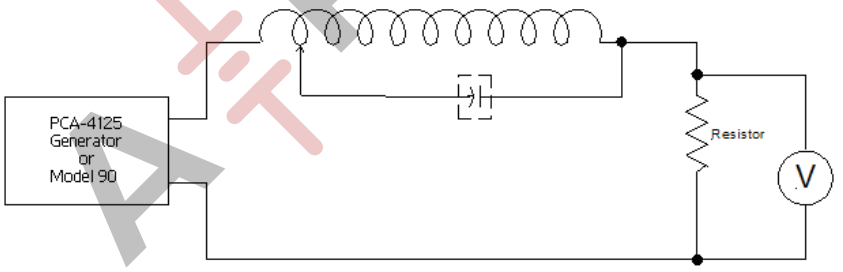
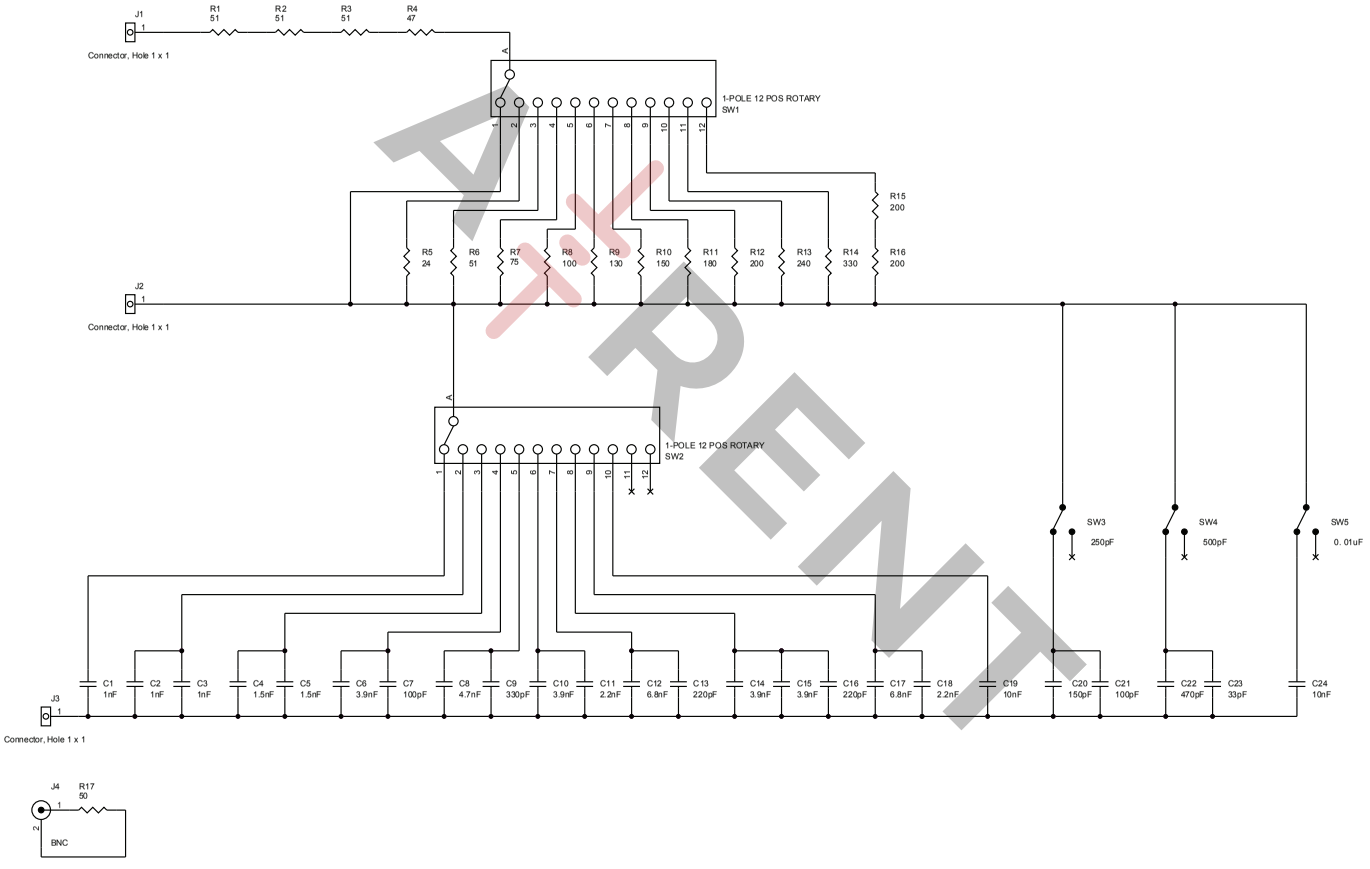


FIG 5 - RESISTOR METHOD DIAGRAM


J1
1
Connector, Hole 1 x 1
R1
51
R2
51
R3
51
R4
47
A
1-POLE 12 POS ROTARY
SW1
1
2
3
4
5
6
7
8
9
10
11
12
R15
200
R5
24
R6
51
R7
75
R8
100
R9
130
R10
150
R11
180
R12
200
R13
240
R14
330
R16
200
J2
1
Connector, Hole 1 x 1
A
1-POLE 12 POS ROTARY
SW2
1
2
3
4
5
6
7
8
9
10
11
12
SW3
250pF
SW4
500pF
SW5
0. 01uF
C1
1nF
C2
1nF
C3
1nF
C4
1.5nF
C5
1.5nF
C6
3.9nF
C7
100pF
C8
4.7nF
C9
330pF
C10
3.9nF
C11
2.2nF
C12
6.8nF
C13
220pF
C14
3.9nF
C15
3.9nF
C16
220pF
C17
6.8nF
C18
2.2nF
C19
10nF
C20
150pF
C21
100pF
C22
470pF
C23
33pF
C24
10nF
J3
1
Connector, Hole 1 x 1
J4
1
2
BNC
R17
50

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