

MODEL 630

PLC LINE SIMULATOR

Instruction Manual



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Introduction

The Model 630 line simulation test box is used to simulate coupling a Power Line Carrier (PLC) to a transmission line. This simulation allows the technician to preset new installations or test the line tuner to determine if it is working correctly. The line simulation test box may also be used to troubleshoot line tuner problems.

The line simulation test box is made of resistors and capacitors. The resistors are used to simulate the characteristic (surge) impedance of the line at RF frequencies. The capacitors are used to simulate the Capacitive Voltage Transformer (CVT). This allows the technician to isolate the line tuner from the line and Test it.

Functions

Line Z

The resistive part of the test box consists of a set of fixed resistors and a 12-position switch. The switch allows you to vary the resistance from 200 ohms to 600 ohms. The following is a list of the resistance values available. All resistance values are + 5%.

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

The resistive values allow you to duplicate the line characteristic (surge) impedance of the line. The phase-to-ground line characteristic impedance is normally between 200 to 600 ohms for most high voltage transmission lines.

Coupling Capacitance

The capacitive part of the test box consists of a set of fixed capacitors, a 10-position switch and three toggles switches. The 12-position switch allows you to vary the capacitance from 0.001 μf to 0.01 μf in 0.001 μf steps. The three toggle switches allow you to add either 0.00015 μf (150 pF), 0.00025 μf (250 pF) or 0.0005 μf (500 pF) or any combination of the three for numerous additional capacitance values.

Dummy Load

The 50 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	$\pm 5\%$
Max Input	40 V
Capacitance	
Accuracy	$\pm 5\%$
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%.

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

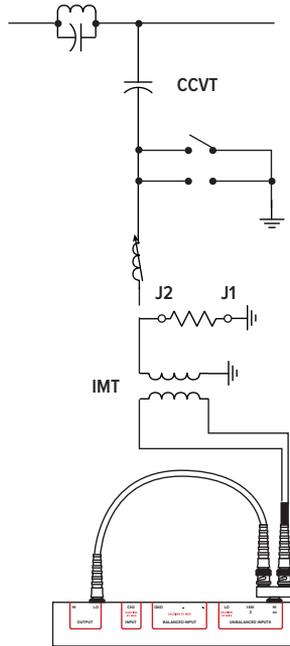


FIG 1 - IMT TEST CONNECTIONS

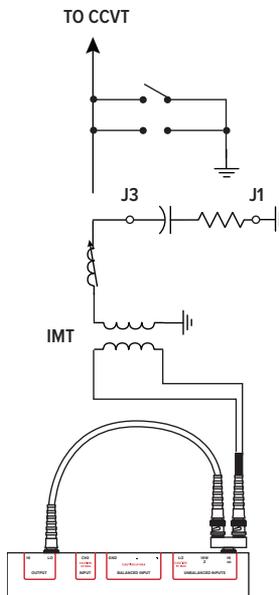


FIG 2 - SERIES INDUCTOR TEST CONNECTIONS

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 630 test box 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 than 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 test box and the SWR reading.
16. Disconnect test box and reconnect series inductor to the protective unit.
17. Open the Grounding Switch.

Test Procedures with Model 70 & 90

The Model 630 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%.

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**CAUTION! HIGH VOLTAGES MAY BE PRESENT IN THE LINE TUNER. ALWAYS  
CLOSE THE GROUND SWITCH BEFORE WORKING ON LINE TUNER.**  
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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 630 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 than 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 test box and reconnect the impedance matching transformer to the series inductor.
13. Open the Grounding Switch.

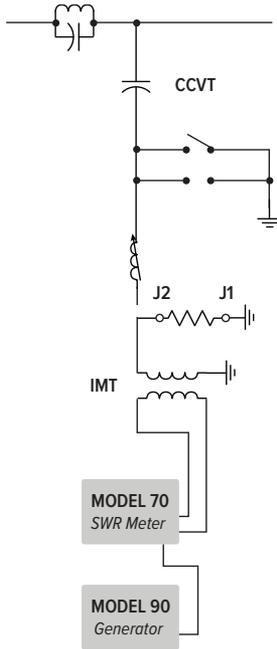


FIG 3 - IMT TEST CONNECTIONS

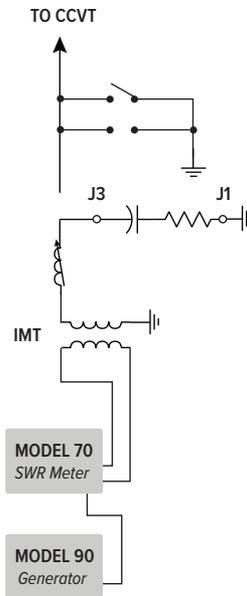


FIG 4 - SERIES INDUCTOR TEST CONNECTIONS

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 630 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 than 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 test box 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 630 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. V_1 is the voltage output of the Model 90. V_2 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 (V_2).

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

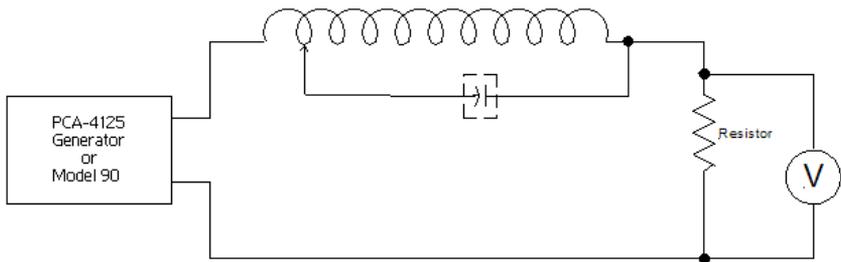
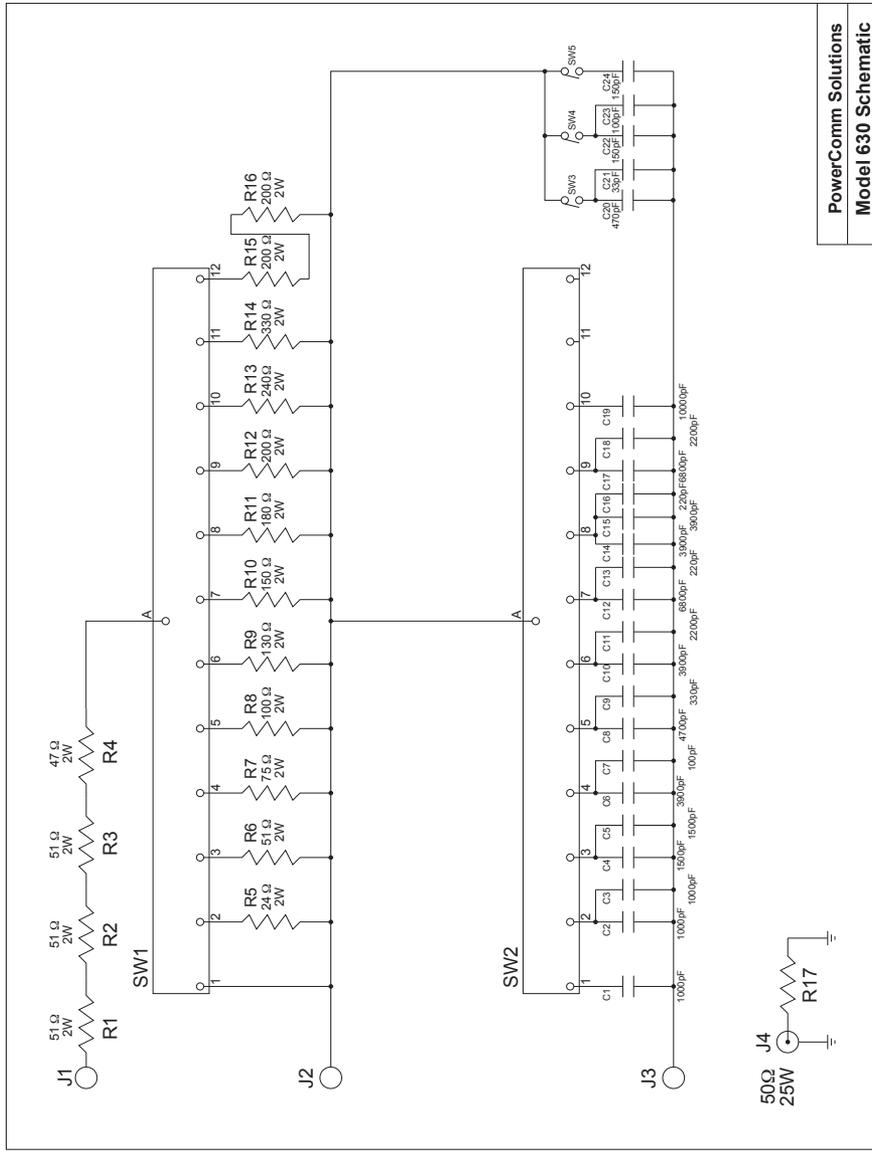


FIG 5 - RESISTOR METHOD DIAGRAM



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Model 630 Schematic

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