The Telephone Switchhook and Handset

PROCEDURE

Setting Up the Central Office

☐ 1. Make sure that the Reconfigurable Training Module, Model 9431, is connected to the TTS Power Supply, Model 9408.

Make sure that there is a network connection between the Reconfigurable Training Module and the host computer.

Install the Dual Analog Line Interface, Model 9475, into one of the analog/digital (A/D) slots of the Reconfigurable Training Module.

Connect two analog telephone sets to the Dual Analog Line Interface. Make sure that the tone dialing mode is selected on the analog telephone sets.

CAUTION!

High voltages are present on the standard telephone connectors of the Dual Analog Line Interface. Do not connect or disconnect the analog telephone sets when the Reconfigurable Training Module is turned on.

Connect the AC/DC power converter supplied with each analog telephone set to one of the AC power outlets on the TTS Power Supply. Connect the DC power output jack of each AC/DC power converter to the DC power input connector on either one of the analog telephone sets.

> **Note:** *The analog telephone set requires an auxiliary DC power source for the digital display to be operative.*

☐ 2. Turn on the host computer.

Turn on the TTS Power Supply then the Reconfigurable Training Module.

☐ 3. On the host computer, start the Telephony Training System software, then download the CO program to the Reconfigurable Training Module. The CO program configures the Reconfigurable Training Module so that it operates as a central office.

> **Note:** *If the host computer is unable to download the CO program to the Reconfigurable Training Module, it may not be using the proper IP address. Have your instructor or the LAN administrator check if the host computer uses the proper IP address to communicate with the Reconfigurable Training Module.*

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The Switchhook

☐   4. On the host computer, zoom in on ANALOG LINE INTERFACE A, connect Oscilloscope Probe 1 to TP1 (voltage across the telephone line connected to ANALOG LINE INTERFACE A), and start the Oscilloscope.

> **Note:** *Probe 1 is associated with channel 1 of the Oscilloscope.*

☐   5. Make the following settings on the Oscilloscope:

> Channel 1
> > Mode . . . . Normal
> > Sensitivity . . . . 10 V/div
> > Input Coupling . . . . DC
> Time Base . . . . 1 ms/div
> Display Refresh . . . . Manual

☐   6. Make sure the handset of telephone set A is correctly placed on the cradle. Refresh the Oscilloscope display. Observe that a DC voltage is applied to the telephone line. Record the value of this DC voltage in the following blank space.

> DC Voltage Across the Telephone Line: **-49**   V

Where does this DC voltage come from?

Although telephone signals come in AC signals or voltages, there is still DC level to be detected because that is the offset level being fed to the line in order to make the transfer of the weak AC signal.

☐   7. A display in ANALOG LINE INTERFACE A indicates the value of the DC current flowing through the telephone line (DC loop current). Observe that no DC current is flowing through the telephone line. Briefly explain why.

DC current flows through a telephone when it is off hook & no DC current flows through a telephone. The central office senses the current and is ready for the outgoing call and is off hook. When an incoming call comes in, then it is on hook.

☐   8. Lift off the handset of telephone set A and observe that DC current flows through the telephone line. Record this current in the following blank space and replace the handset of telephone set A on the cradle.

> DC Loop Current: **-11.9** mA   (handset off the cradle)

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Briefly explain why DC current flows through the telephone line when the telephone handset is off the cradle.

hook switch gets released when the handset gets removed.

Thus, DC current starts flow & loop current is observed by the central office.

On the host computer, set the sensitivity of channel 1 on the Oscilloscope to 2 V/div.

Lift off the handset of telephone set A and refresh the Oscilloscope display. Observe that the DC voltage across the telephone line has decreased significantly. This will be explained later in the second unit of this manual.

Replace the handset of telephone set A on the cradle.

The Handset and Speech Circuit

☐ 9. On the host computer, disconnect Oscilloscope probe 1 from TP1 of ANALOG LINE INTERFACE A and reconnect this probe to TP3. This test point, which is AC coupled, allows observation of the voice signals on the telephone line.

Make the following settings on the Oscilloscope:

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Channel 1
    Sensitivity  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.5 V/div
    Input Coupling . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . AC
Time Base . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 5 ms/div
Trigger
    Source . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Ch 1
    Level . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 0 V
    Slope . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Positive (+)
Display Refresh . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Continuous
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☐ 10. Lift off the handset of telephone set A and dial the number of telephone set B. Lift off the handset of telephone set B to answer the call and establish a communication.

Talk into the handset of telephone set A while observing the signal at TP3 on the Oscilloscope screen.

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Note: *The rate at which the Oscilloscope display is refreshed depends on the speed of the host computer running the Telephony Training System software. Closing other applications that are running on the host computer releases system resources, and thereby, should improve the Oscilloscope display refresh rate.*

What does the signal at TP3 of ANALOG LINE INTERFACE A represent?

It is the responsibility of the sensing interface to transform the analog voltage output signals from the sensors interfaced to the wireless sensor unit into digital signals.

☐ 11. Talk (or blow softly) into the handset of telephone set A while carefully listening to the earpiece. Observe that your voice is repeated in the handset earpiece. This is the sidetone provided by the speech circuit in telephone set A.

☐ 12. Ask somebody to talk into the handset of telephone set B while your are listening to the handset of telephone set A and observing the signal at TP3 on the Oscilloscope screen.

What does the signal at TP3 of ANALOG LINE INTERFACE A represent?

The interface processes analog speech signal from the handset microphone & turns them into digital packets for VOID protocol transmission across.

Briefly describe the role of the handset and speech circuit of the telephone set.

The handset & speech circuit play important role and functions in telephone A.

When phone is put on the cradle. The phone gets disconnected from the system.

Switches get opened.

Effect of the Telephone Line Resistance (Length) on the Voice Sound Level

☐ 13. On the host computer, increase the resistance of the telephone line connected to ANALOG LINE INTERFACE A by steps until it is equal to 2.0 kΩ. While doing this, have a telephone conversation and observe the signal at TP3 on the Oscilloscope screen.

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Describe what happens. Briefly explain.

The telephone line loss & consequently the low pass filter action increase

with frequency because the resistance of the wire rises with frequency

Replace the handset of each telephone set on the cradle.

On the host computer, set the Oscilloscope display refresh to Manual.

☐ 14. On the host computer, close the Telephony Training System software.

Turn off the TTS Power Supply as well as the host computer (if it is no longer required).

Disconnect the AC/DC power converters from the TTS Power Supply and the analog telephone sets.

Disconnect the analog telephone sets from the Dual Analog Line Interface.

Remove the Dual Analog Line Interface from the Reconfigurable Training Module.

CONCLUSION

In this exercise, you saw that the switchhook is a DPST switch that connects the dialing and speech circuits of a telephone set to the local loop when the handset is lifted off the cradle. You observed that this causes DC current to flow through the telephone line.

You learned that the telephone handset converts the user voice into an electrical signal that is routed to the telephone line. You also learned that it converts the electrical voice signal received from the telephone line into sound waves.

You saw that the main function of the speech circuit is to properly route the electrical voice signals on the two wires of the telephone line to the four wires of the handset. You observed that the speech circuit maintains the voice sound level virtually constant by adjusting the amount of side tone and performing loop length equalization.