



Derived Channel multipleX

Field Trouble Shooting Manual

DCX Systems Inc.
2360 Maryland Road
Willow Grove, PA 19090

215-830-8520



A NUMEREX COMPANY

Table of Contents

Derived Channel multipleX - System Overview	1
STU Troubleshooting Guide	8
2ZSTU Troubleshooting Tips	18
11ZSTU Troubleshooting Tips	19
STU / CPE Compatibility Guide	20
Product Features	23
Glossary	26

DERIVED CHANNEL MULTIPLEX

SYSTEM OVERVIEW

DCX Systems' Derived Channel multipleX Network is designed to reliably transport alarm signals and associated messages between protected premises and participating central monitoring stations. The patented feature that makes this system the most unique is its ability to transport this data across customers' existing telephone lines without interfering with their voice service.

These messages, typically fire or burglary alarms, originate at customers' homes or offices and are routed to an appropriate monitoring center by means of the Derived Channel multipleX Network. The monitoring center personnel then act on this information.

The Derived Channel multipleX Network consists of three principal elements: the customer premise equipment, the message routing equipment, and the central monitoring station equipment.

Customer Premise Equipment

Subscriber Terminal Unit^â

The Subscriber Terminal Unit (STU[®]) is located at the customer's home or office and is connected as a non-ringing extension to the existing telephone line. It's primary function is to interface the alarm panel (or other signaling devices) to the telephone line and therefore, to the Derived Channel multipleX Network. The STU is designed to interface to a variety of commercially available alarm panels and sensors.

Signals originate from alarm sensors at the premises and enter the network through the STU[®]. Each STU can monitor multiple discreet alarm input zones or communicate with the panel via a serial port in addition to monitoring supervisory inputs such as low battery or AC Fail or tamper. The STU connects directly to the

customer's telephone line via a standard RJ11 jack, but its use does not preclude the use of the phone by the customer.

Message Routing Equipment

Once a message is generated by the STU, it must be sent to the proper monitoring station facility. This is accomplished by the message routing equipment which is installed in the telephone company's central offices -- the Scanner, RScanner, and Message Switch.

Scanner

The Scanner, which resides at a local telco central office, communicates with STUs (a maximum of 1024 per Scanner). The Scanner periodically interrogates the STU for messages. Should any STU have an alarm signal to report, it is passed to the Scanner which duplicates the message and passes the duplicate to a redundant part of the Scanner. This pair of messages now travel throughout the network in duplicate to insure reliable delivery to the central station.

In addition, the Scanner is responsible for supervising the STUs and will report a STU malfunction or a problem with the telephone line (such as a disconnected line). Information regarding STU status is sent by the Scanner to the Message Switch.

RScanner

The RScanner is an optional component in the network which is used as an extension to the Scanner. Many telco central offices are small and do not require the STU capacity of a full Scanner. An RScanner is ideal for these locations. It is much smaller and less expensive, with a capability of handling 1 to 96 STUs. However, it is not a stand-alone unit. It must be linked to a Scanner at a remote location (another central office) by means of dual two-wire data lines and a special plug-in card for the Scanner.

The telcos' use of a mix of large Scanners and small RScanners is transparent to the alarm central monitoring station.

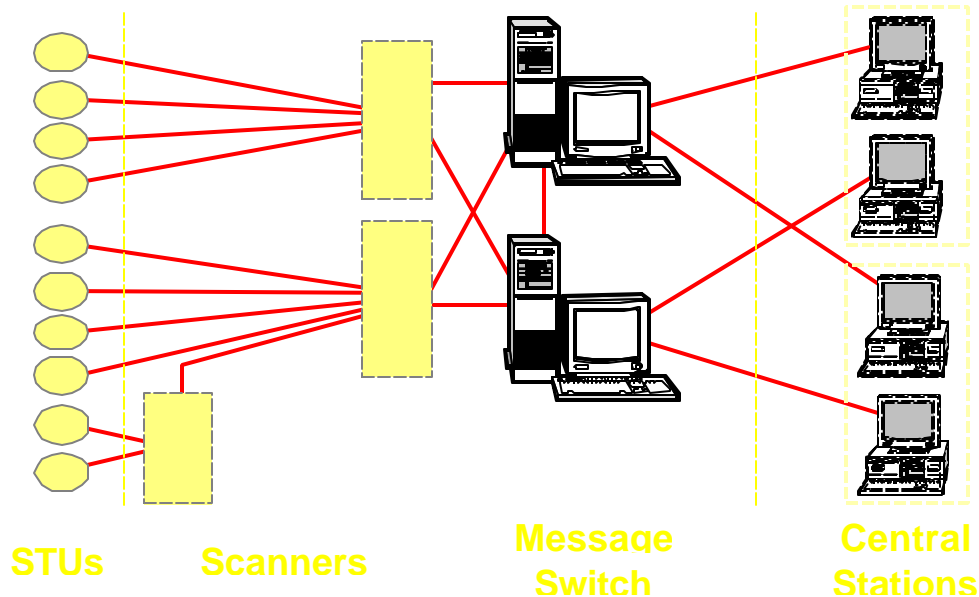


Figure 1

Message Switch

The Message Switch is the hub of the network. It consists of a pair of minicomputers that are cross-linked to provide back-up reliability. The Message Switch is typically installed in a telco minicomputer operations center or central office. It communicates with Scanners (up to 95) at many different central offices, in much the same manner as the Scanner communicates with many STUs. STU messages from the Scanner are logged to magnetic tape by the Message Switch and routed to the proper central monitoring station.

The Message Switch is dedicated to communicating with Scanners and central station equipment. A database is included to keep track of alarm dealers and the STUs assigned to them as well as the operating characteristics of each STU. As messages are received from the Scanners, a database is interrogated for ownership of the STU. Once the owning central station is identified, the message is passed to the central station's equipment for processing in the central station. Similarly, messages from the central station are routed to the proper STU.

Central Monitoring Station Equipment

There is a variety of equipment commercially available to central stations to use as receivers of Message Switch data. This equipment permits personnel to receive

messages and communicate with the Derived Channel multipleX Network to determine the status of the various system components, particularly the STUs.

Derived Channel Receiver

The Derived Channel Receiver consists of a pair of PCs with a software package designed by DCX Systems and listed by Underwriters' Laboratories for monitoring high risk burglary and fire applications. Its primary function is to interface the central monitoring station to the DCX Systems Message Switch.

The Message Switch interrogates (polls) the Derived Channel Receiver every few seconds for data which it may have to send into the network. (At the same time, if the Message Switch has data for the Derived Channel Receiver, it will be sent along to the Derived Channel Receiver with one of the interrogations.) This constant handshake can be seen by the alarm dealer by observing a pair of light emitting diodes (LED's) flashing on the front panel of the modem.

The Derived Channel Receiver converts messages it receives from a machine based language used by the Message Switch into English text which it displays on its terminal. Likewise, any dealer response entered at the keyboard is converted to machine language and sent to the Message Switch.

A printer is attached to the Derived Channel Receiver and provides a paper log all alarm traffic going to and from the central monitoring station. This can be used as an audit trail should one be required by the monitoring station.

Refer to Figure 2 for a diagram of the equipment required in the alarm central monitoring station for a redundant configuration. Connection to the Message Switch is by way of two (2) private data circuits provided by the telephone company. These circuits appear to the alarm dealer as telco 4-wire loops.

Each telco loop is connected to a modem that translates electrical signals compatible with telephone equipment into those compatible with computer equipment.

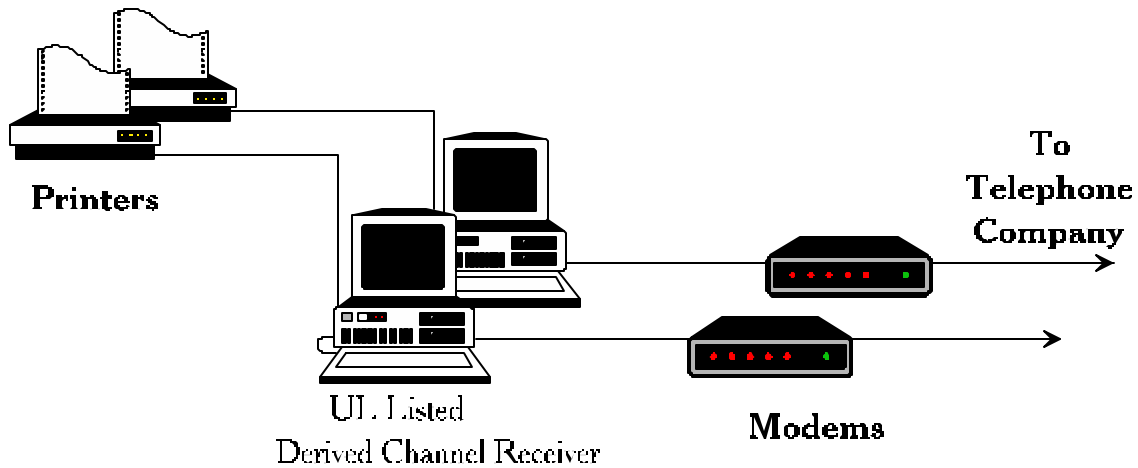


Figure 2

Typical Central Station or Remote Station Monitoring Configuration

Summary of Derived Channel Receiver Features:

A *Local Database* is provided and maintained on the hard drive. Network information, specific to each of the alarm account, is extracted from the database and presented to the user in an easy to view format. Also, the Derived Channel Receiver is capable of comparing some of the information stored within the network to that desired by the dealer and reporting any discrepancies found.

User Friendly Menus provide easy access to network functions. Users are not required to memorize cryptic syntax commands. The user need only select a desired function from a menu of items. The Derived Channel Receiver will automatically prompt the user for any additional parameters required to complete the desired function.

A "*Message Watch*" feature is provided that allows the alarm dealer to program certain messages into the Derived Channel Receiver that will trigger an audible alarm should the message be received from the network. This allows the dealer to be notified of certain network alert messages.

BASIC SYSTEM OPERATION

Scanner-to-STU Communications:

The Scanner is responsible for communications to and from the STUs in the network. STUs, connected to customers' telephone lines, are accessed by the Scanner by means of links to the Main Distribution Frame (MDF) of the telco central office. The three primary Scanner-to-STU communications tasks are:

- determine on-hook/off-hook status,
- monitor supervisory tone status, and
- polling.

On-hook/Off-hook Status: The Scanner constantly monitors the hook status of the customer's telephone. This status is detected by the SIM (Subscriber Interface Module) card located at the central office. The detection used is either by a voltage drop or a drop in low tone, dependent upon the type of SIM card used.

Supervisory Tone Status: Under normal circumstances, any STU connected to a Scanner and on-line will generate a supervisory tone of approximately 36 Hz. This tone is not audible to the customer when using his telephone, but it is detected by the Scanner, its presence indicating that no new alarms have occurred. If an alarm occurs, the STU shuts off the tone which triggers a Scanner poll (see below).

Polling: Alarm status information is passed from the STU to the Scanner during a polling sequence.

Polls are generated by the Scanner and are responded to by the STU. In this response the STU tells the Scanner whether or not an alarm exists and, if so, what the alarm is (for example, self-test failure, tamper, fire, forced entry, etc.).

Two types of polls exist-scheduled polls and commanded polls. During normal Scanner operation, every STU connected and on-line is polled continually, within 40 seconds - a scheduled poll. Polls are audible, so when the customer is using the phone (off-hook condition) scheduled polling is inhibited. However, the service agency may override this by enabling off-hook polling or delayed off-hook polling for that STU. Commanded polls are

generated by the Scanner in response to either of these two conditions: a request for status from the service agency or a loss of supervisory tone from the STU.

Scanner-to Message Switch Communications

The Scanner and Message Switch communicate over dedicated data lines using Bell 202 protocol modems. One Message Switch communicates with as many as 95 Scanners. The Scanner is continually polled by the Message Switch much like the Scanner polls the STU. The Message Switch receives messages from various service agencies and passes them to the appropriate target Scanner. Examples of these messages are: "bring a STU on-line," "acknowledge an alarm," or "get status of STUs".

Redundancy

The DCX network maintained by the telephone company operates in duplex, that is to say most network equipment is duplicated and operating simultaneously. This allows network failures, should they occur, to be detected and repaired without disrupting alarm reporting service to the central monitoring station. By convention, the two identical halves of the network are referred to as Side A and Side B. Two data circuits are provided to the central monitoring station so that the dealer may have access to both sides A and B. The central monitoring station may choose to use either side for routine use of the network. Connection to both sides are maintained so that failures in central station equipment or telephone company circuits will be detected and handled swiftly and appropriately.

Network Control and Monitoring

All central office components of the Derived Channel Network are able to be connected to standard remote diagnostic and alarm networks. Alarm information can be provided to remote data centers for handling and the Host Message Switch provides access pathways for remote Scanner diagnostics. A standard VDT can be connected to a Scanner at a local level for more detailed diagnostics. Every Scanner is equipped with self diagnosing software which will display an alarm message at the local Scanner and can be interfaced into standard central office reporting systems.

STU TROUBLESHOOTING GUIDE

This section will assist in STU troubleshooting. There are two basic types of Derived Channel STU troubles:

Unrequested polling “off-hook” The Derived Channel telemetry poll (chirp) is heard when a customer is using their telephone in a non-UL type of application. The method of troubleshooting will depend on the type of poll (single or double) and how frequently the polling is heard.

Non-Responding STU A STU will not answer telemetry polls (chirps) from the Scanner.

Recommended Test Equipment:

- 1) DCX Portable Test STU (P\N 22013-0001)
- 2) Telephone linesmen Butt-Set
- 3) Fluke 8060A Meter or equivalent true RMS Digital Volt Meter (DVM)

Trouble Shooting Technique

All types of Derived Channel trouble shooting should be approached in a logical manner. Derived Channel problems are no different than any other type of DC electrical trouble. The fundamental philosophy is:

Always split your electrical circuit in half and isolate the trouble to one side of the split circuit. The logical place to do this with a Derived Channel trouble is the telephone company demarcation point. This point separates your trouble into the telco network or the customer’s equipment. Make sure that customer wiring on the CPE side of the telephone demarcation point is inspected as part of the alarm system.

Following this simple premise will give you a logical methodology for isolating and clearing Derived Channel troubles.

UNREQUESTED POLLING “OFF-HOOK” SYMPTOMS:

This lists the most common of the Polling “Off-Hook” (chirp) sequences that may be heard at the customer’s premises. Each method is identified with a corresponding number. Determine the type of polling sequence that is occurring and refer to the number associated with that polling sequence. Follow the listed steps to troubleshoot the particular problem. If you require further assistance, call DCX Systems’ technical service department at 800-761-9070.

- 1) Double poll every 30 seconds
- 2) Double poll every 2 minutes
- 3) Single poll every 30 seconds
- 4) Random double poll
- 5) Motor boating
- 6) Single poll every second
- 7) Single poll every second

1. Double Poll every 30 seconds:

Possible Causes:

- A) OFF-HOOK polling enabled
- B) Customer premise equipment does not provide enough resistance on the line to indicate an “off-hook” condition.

Troubleshooting:

- **Call the owning Central Monitoring Agency and have them perform an ID STU using the ID SU command in the ATU or DCR.**

EX: ID SU 1-1 <CR> - [Central Station Operator Command typed into the Derived Channel Receiver: ATU, ATU 6000]

A Central Station using the new DCR (PC platform) will simply follow the menu command from the main menu screen

- **Response at owning Central Monitoring Agency to ID SU**

STU 1-1 TEL#215-830-8520 RESP OK **OHP=ON** UP OUTPUT ENABLED.

If **OHP=ON**, this is the cause of the chirp. The OHP command tells the systems to poll the STU regardless of hook status. Have the owning Central Monitoring Agency operator verify with a supervisor before they disable OHP. This may be mandatory for the customers' alarm account.

If **OHP=OFF**, proceed to verify whether or not trouble is with the STU or customer's equipment.

- **Disconnect all telephones and CPE from the Derived Channel service line leaving the STU connected.**

Using the telephone lineman's test set, connect to the line at the demarcation point and go "off-hook". If the chirp persists, the problem is **NOT** with the customer's telephone equipment. Proceed to testing the STU AC and DC voltages.

If the chirp goes away using the telephone lineman's test set, reconnect the customer's telephone equipment, one telephone at a time, until the defective telephone is uncovered. **NOTE: A Derived Channel line has a maximum ringer equivalency of 5.0, including the STU. Too many telephones connected to the line could cause a "chirping" problem.**

- **Measure the STU AC and DC voltage outputs to determine proper low tone signature.**

For measurements at the customer's premises, refer to Addendum A, chart number 1 for dB to AC conversions for ON-HOOK & OFF-HOOK readings.

Take AC and DC voltage readings for "on-hook" and "off-hook" telephone line transitions.

Note: It is imperative that the troubleshooting alarm technician identify the type of Subscriber Interface Module (SIM) card before proceeding. This information can be obtained from the telephone company Repair Service Bureau representative. If this information cannot be obtained, contact DCX Systems after all voltage readings are taken.

If the STU low tone and dB drop for “on-hook” and “off-hook” are not normal, replace the STU to correct the polling “off hook” problem.

If the STU low tone and dB level readings appear to be normal, it is likely that the problem is an incompatible phone company facility (Digital Subscriber Loop Carrier) and the local telephone company should be contacted and a trouble reported.

2. Double Poll every 2 Minutes:

Cause: Delayed OFF-HOOK polling is enabled.

Troubleshooting:

- Call the owning Central Monitoring Station and have them ID that STU using the ID SU command.

EX: ID SU 1-1 <CR>

- **Response at the Supervisory Terminal.**

STU 1-1 TEL#215-830-8520 RESP OK **OHP=DLY** UP OUTPUT ENABLED. If **OHP=DLY**, this is the cause of the chirp. Have them verify with a supervisor before they disable OHP. This may be mandatory for this account.

3. Single Poll every 30 seconds:

Reason: The STU is not responding.

Troubleshooting:

- Have the Alarm Monitoring Station UP the STU. If a “**WAS RESET**” message is printed out this indicates the STU has suffered a loss of power. If the STU is powered from the alarm panel’s power supply, it may be prudent to check the alarm panel’s back-up battery.
- If the STU fails to respond to the UP STU command from the Alarm Monitoring Agency, disconnect the CPE equipment and install the Portable Test STU at the telephone company Demarcation Point. Call the monitoring agency for another UP STU command. If the Portable

Test STU works, then the problem is not a telco-related trouble. Check the customer's CPE or Alarm Dealer's STU. See next step.

- If the STU is powered by a common alarm panel power supply, measure the DC voltage and AC ripple voltage. Listed below is a table for the different STU's available and the associated current draw for each. This chart is for DC powered STU's only.

STU POWER TABLE

Type of STU	DC Voltage range	AC Ripple not to exceed	Current Draw
2Z STU	10.5 - 15VDC	50mV or 0.05 V	70m Amp
2Z UL STU	10.5 - 15VDC or 19-28VDC	50mV or 0.05 V	75m Amp
4Z STU	10.5 - 15VDC	50mV or 0.05 V	100m Amp
11Z UL STU	10.5 - 15VDC	50mV or 0.05 V	150m Amp

- If other devices are sharing the same power source (ex: PIR, Smoke Detectors, Glass Break sensors) disconnect the devices. If the problem clears, a separate power supply may be needed.
- If using a 2Z, 2Z-UL or 4Z STU, it is recommended that a continuity check be performed on the modular RJ cord. This can be accomplished by connecting the RJ cord between two RJ31X modular jacks and measuring the continuity between the pins.
- If the Portable Test STU fails to respond to the UP STU command, the problem is probably a telco equipment problem and a trouble should be opened with the serving telephone company.
- If all AC ripple and continuity tests yield negative results, change out the STU.

4. Random Double Poll:

Possible Causes:

- A) Low Tone is not being properly generated by the STU.
- B) Too Many Ringers at the customers locations.

Troubleshooting:

- Disconnect all equipment connected to the Derived Channel service telephone line. If the polling stops, connect back the telephone equipment one piece at a time until polling reappears. This is an indication that the customers equipment has exceeded the maximum allowed ringer equivalency.

- Measure to see if the STU is generating Low Tone. The levels for ON HOOK and OFF HOOK should be in the range of 0 to -30dbm with a phone line attached. The STU with no phone line attached should read between 2VAC and 2.5VAC.

NOTE: In order for a STU to generate low tone the stu must be upped and power cannot be removed.

- If the STU passes all voltage testing, connect the Portable Test STU to the line and adjust the dB level till the chirping stops. If this corrects the problem, record the level and report a trouble to the serving telephone company. There is more than likely a metallic or noise problem with the telco cable facility.
- If increasing the amplitude of Low Tone does not correct the problem, report a trouble to the serving telephone company. There is more than likely a metallic or noise problem with the telco cable facility.

5. Motor Boating:

Cause: The Low Tone generated by the STU may be amplified by some phone sets or some phone systems. (See the attached STU / CPE Compatibility List)

Troubleshooting:

- If the phone sets have a volume switch, lower the volume till the motor boating stops.
- Cut the Low tone jumper on the 2Z STU. This will decrease the amplitude of Low Tone from a -6 to a -10dB.
- If these steps do not stop the motor boating, call DCX systems and request RMA shipping instructions for sending the STU in for a modification to reduce the Low Tone amplitude. **This is not a modification that can be done in the field.**

6. Single Chirp every second:

Cause: The STU is in Wail Tone. The STU will chirp every second for two minutes then stop for 60 seconds. Then it will start chirping again.

Troubleshooting:

- The STU (connected to the alarm panel through one of the STU's zones) has been downed by the Alarm Monitoring Agency without a visit to the premise to power down the STU. A subsequent alarm was tripped by the alarm panel, loading an alarm into the STU through the connected zone. To stop the chirping, the STU must be upped by the Alarm Dealer or power must be removed from the STU.

7. After connecting the STU the customers phones no longer works.

The phone line cuts out after installing the STU to the customers line. The causes could be the RJ cords, or the RJ31 plugs on the STU, or the pair gain telephone network..

Troubleshooting:

- If using a 2Z , 2Z UL STU or 4Z STU check the RJ cord. This can be done by using two (2) RJ31X blocks and connecting the modular cord into both jacks and do a continuity test pin for pin between the two (2) jacks.
- Install two (2) RJ cords into the RJ31 jacks on the STU and due a continuity test between the cords.
- Power the STU off, but leave all the wiring in place. Try making a call. If the phone service comes back, the telephone line may be an incompatible pair gain system. Contact your System Administrator or DCX Systems.

NON-RESPONDING STU SYMPTOMS:

A) Symptom

STU reports in "NOT RESPONDING" but no Chirps are heard at the customers premises.

FIX:

Jumper is not in place at the TELCO Central Office. Call the serving telephone company and generate a trouble report.

B) Symptom:

STU goes "NOT RESPONDING" every time the customer goes ON-HOOK and comes back when customer goes OFF - HOOK.

FIX:

This particular STU is on a line equipped with digital loop carrier (AKA, SLC, pair gain, DLC) and is losing its time slot, not allowing polls to be passed through. Contact the serving telephone company and request the facility be changed to a compatible type.

ADDENDUM A

Listed below is a chart that contains the Low Tone dBm and AC voltage equivalent that can be used in troubleshooting STU chirping problems.

AC Voltage & dB conversion into a 900 Ω load.

Chart 1: Low Tone Conversion Chart

dBm	Vac	dBm	Vac	dBm	Vac	dBm	Vac
0	.949	-11	.267	-22	.075	-33	.021
-1	.846	-12	.238	-23	.067	-34	.019
-2	.754	-13	.212	-24	.060	-35	.017
-3	.672	-14	.189	-25	.053	-36	.015
-4	.599	-15	.169	-26	.048	-37	.013
-5	.533	-16	.150	-27	.042	-38	.012
-6	.475	-17	.134	-28	.038	-39	.011
-7	.424	-18	.119	-29	.034	-40	.009
-8	.378	-19	.106	-30	.030		
-9	.337	-20	.095	-31	.027		
-10	.300	-21	.085	-32	.024		

A typical 900Ω termination is achieved with a standard telephone instrument connected to the telephone line. In order to assure that the low tone output from the STU is being attenuated properly by telephone instruments attached to the customer's telephone line, perform the following:

(Refer to Chart 1 for voltage conversions)

- 1) Verify with a telco representative what type of Subscriber Interface Module is connected to the customer's telephone line.
- 2) A VSIM or ESIM interface card will listen for a -3dB drop in low tone in order to recognize properly an off-hook condition. Using the chart above, measure the AC output and determine the dB output at the telco demarcation point with all telephone instruments on hook.
- 3) Repeat the same steps with one of the telephone instruments off-hook. The difference should be at least -3dB in order for the VSIM interface card to recognize off-hook (i.e.-3dB on-hook, -6dB off-hook).

- 4) Repeat the same steps with each telephone instrument connected to customer's telephone line to ensure that all instruments are functioning properly.
- 5) If any telephone instrument fails to generate the proper dB difference, the customer will hear "chirping " on the line during conversation. This is because the Scanner cannot properly determine the off-hook condition.
- 6) Repeat all the above steps for a DSP interface card. The proper attenuation is -6dB (i.e.: -3dB to -9dB).
- 7) If the Subscriber Interface Card is identified as an "H" or "HF", none of the above tests need to be performed.

2ZSTU - Troubleshooting Tips

SYMPTOM	CAUSE	POSSIBLE CURE
Confidence LED does not blink	No power applied to STU	<ol style="list-style-type: none"> 1. Check power connections 2. Check voltage levels 3. Replace STU
Confidence LED stays on	STU problem	<ol style="list-style-type: none"> 1. Check power 2. Replace STU
Low battery alarm	Low battery	<ol style="list-style-type: none"> 1. Check voltage
Alarm zone does not register	Zone circuit resistance	<ol style="list-style-type: none"> 1. Check loop resistance (0 ohms when contacts are closed)
Constant fault on alarm zone	EOL resistor not installed	<ol style="list-style-type: none"> 1. Install EOL resistor (2.2k)
STU "not responding"	Attempted break-in	<ol style="list-style-type: none"> 1. Verify that phone line has not been cut
	Bad TIP/RING connection	<ol style="list-style-type: none"> 1. Check TIP and RING connections at the STU and at the line tapp-off point
	Noisy phone line or phone line over spec. (1500ohms)	<ol style="list-style-type: none"> 1. Verify and report problem to Telco if necessary
	No power to STU	<ol style="list-style-type: none"> 1. Check power connections 2. Check voltage levels
	STU connected to wrong line	<ol style="list-style-type: none"> 1. Verify that no chirps are heard on current line. Identify line with chirps and connect it to the STU
	STU incompatible with other equipment on line	<ol style="list-style-type: none"> 1. Disconnect all telephones and other equipment from the line. If STU now "responding" a compatibility problem may exist
Chirps on the phone line when in use	Alarm condition	<ol style="list-style-type: none"> 1. Check to see if any alarm devices connected to the STU are active
	No supervisory tone from STU	<ol style="list-style-type: none"> 1. Verify adequate supervisory tone level. With phone on hook, measure AC volts across TIP and RING terminals: $V > 0.3$ VRMS 2. Replace STU
	Noisy phone line	<ol style="list-style-type: none"> 1. Verify and report to Telco if necessary
	Network or Bell Central Office problem	<ol style="list-style-type: none"> 1. Only after completing all of the above tests, call Telco repair. Tell them the Soft ID of the STU and the telephone number.
	Excessive line loading	<ol style="list-style-type: none"> 1. Check the Ringer Equivalence Number (REN) of all devices on the telephone line (on the label).

11ZSTU - Troubleshooting Tips

SYMPTOM	CAUSE	POSSIBLE CURE
Confidence LED does not blink	No power applied to STU	<ol style="list-style-type: none"> 1. Check power connections 2. Check voltage levels 3. Check fuse F1 4. Replace STU
Confidence LED stays on	STU problem	<ol style="list-style-type: none"> 1. Verify that the PROM properly installed 2. Replace STU
Low battery alarm	No battery	<ol style="list-style-type: none"> 1. Check fuse F1 2. Check jumpers JP5, JP6, JP7 3. Check battery leads and connections 4. Check battery voltage
	Battery not charging	<ol style="list-style-type: none"> 1. Check AC voltage at 12VAC terminals
Box alarm	Faulty tamper switch	<ol style="list-style-type: none"> 1. If no tamper switch, verify that TMPR is connected to GND 2. Verify switch closure with STU lid closed 3. Replace STU
Alarm zone does not register	Zone circuit resistance	<ol style="list-style-type: none"> 1. Perform a continuity test of alarm zones. 2. Replace STU
	PROM problem	<ol style="list-style-type: none"> 1. Verify that the PROM has been properly programmed 2. Replace STU
Self test error alarm	Bad STU	<ol style="list-style-type: none"> 1. Replace STU
STU "not responding"	Attempted break-in	<ol style="list-style-type: none"> 1. Verify that phone line has not been cut
	Bad TIP/RING connection	<ol style="list-style-type: none"> 1. Check TIP and RING connections at the STU and at the line tap-off point
	No power to STU	<ol style="list-style-type: none"> 1. Check power connections 2. Check voltage levels 3. Check fuse F1 4. Replace STU
	STU connecting to wrong line	<ol style="list-style-type: none"> 1. Verify that no chirps are heard on current line. 2. Identify line with chirps and connect it to STU.
	STU incompatible with other equipment on line	<ol style="list-style-type: none"> 1. Disconnect all telephones and other equipment from the line. If STU is now "responding" a compatibility problem may exist
Chirps on the phone line when in use	Alarm condition	<ol style="list-style-type: none"> 1. Check to see if any alarm devices connected to the STU are active
	No supervisory tone from STU	<ol style="list-style-type: none"> 1. Verify that there are no active alarms. 2. Verify adequate supervisory tone level. With phone onhook, measure AC volts across TIP and RING terminals: $V > 0.3$ VRMS 3. Disconnect CPE
	Noisy phone line	<ol style="list-style-type: none"> 1. Verify and report to Telco if necessary
	Network or Bell Central Office problem	<ol style="list-style-type: none"> 1. Only after completing all of the above tests, call Telco repair. Tell them the Soft ID of the STU and the telephone number.
	Excessive line loading	<ol style="list-style-type: none"> 1. Check the Ringer Equivalence Number (REN) of all devices on the telephone line (on the label). The REN must be less than

STU / CPE COMPATIBILITY GUIDE

Through research and tracking of customer service calls, we have compiled a list of Customer Premise Equipment (CPE) that is incompatible with Derived Channel multipleX equipment. This information is made available to all Derived Channel suppliers in an effort to make the “Installation and Troubleshooting” of our equipment easier.

The information in the guide is believed to be accurate and reliable. However, we need your input to keep the information up-to-date. If any inconsistencies are found please notify the DCX technical support team at 215-830-8520.

Common situations that may cause compatibility problems between CPE equipment and Derived Channel STUs are:

1. CPE equipment amplifies the STU’s supervisory signal to the point where the harmonics are audible, causing a “motor-boating” sound or a voice modulation.
2. CPE equipment produces signals similar to our DCX signals (i.e. fax machines, credit card machines, modems) causing data corruption at the STU, the CPE, or both, and subsequently causing the STU to send in a “Not Responding” message to the alarm monitoring station.
3. CPE equipment does not sufficiently attenuate the phone line when in an off-hook condition, preventing proper hook status detection at the DCX scanning equipment. The effect of this is constant chirping on the customer’s phone line as a result of the customer line status always appearing as “on-hook”.

STU Incompatibility List

Equipment	Symptom	Remedy
AT&T Digital Answering Machine Model #4810	This answering machine has 2 volume settings. Setting volume control on higher levels cause hum and/or "motorboating".	Cut Low Tone Telephone jumper on STU-2Z. Call DCX for other options
AT&T Partner Plus Key System	AGC circuit of phone systems hum and/or cut low tone jumper "motorboating".	Cut Low Tone Telephone jumper on STU-2Z. Call DCX for other options
Code-a-phone Answering Machine Model #700	STU low-tone may slightly modulate the receive message	None
Dictaphone Answering Machine Model #1400B	STU low-tone will modulate the voice being recorded to tape. Cutting the low-tone jumper will not cure the problem	None
Digital Key Systems	Un-requested polling off hook.	None.
EZ1 Isopro PBX	When used with a VSIM, there is not enough attenuation of low tone to signal an off-hook condition. The line will chirp every 30 seconds	If practical cross connect the STU to an HF SIM in the Central Office
FAX, Modems	It is not recommended to have STUs on the same line as a FAX or modem. FAX corruption, FAX machine locking up and the STU going non responding are possible results. Occasionally they will work together, but it is not guaranteed nor recommended.	Put STU on another line.
NEC Electro Mark II Telephone	AGC circuit of phone systems hum and/or cut low tone jumper "motorboating".	Cut Low Tone jumper on STU-2Z. Call DCX for other options
Northern Telecom Meridian Business Set aka P-Phone	Low-tone interrupts a 8khz tone transmitted from this phone set, causing the business set to lock up.	Move STU to another line
Northern Telecom Meridian Norstar Modular Telephone System	When used with a VSIM or ESIM, the drop of low tone to signal an off-hook condition is right at the threshold. Therefore, the line may chirp every 30 seconds.	If practical cross connect the STU to an HFSIM in the central office
Panasonic Key System Models #412 & #416	Intermittent "chirping" has been reported with this system. Reported chirping varies from every 30 seconds to no chirping at all. Reported was the fact that most customers accept this condition.	None

Panasonic Easy Phone 2-line Phone #208 Model #KTX3130	Data from on-hook STU line can be heard over off-hook conversation. This is inherent with this station.	Cut Low Tone jumper on STU-2Z. Call DCX for other options
Phonemate Answering Machine Model#7650	When a STU is connected to the line, incoming calls get cut off.	None
Tie Model EK6M Telephone	AGC circuit of phone systems hum and/or cut low tone jumper "motorboating".	Cut Low Tone jumper on STU-2Z. Call DCX for other options
Toshiba Strata VI Key System	STU low-tone causes modulation and echo on live system conversation.	Cut Low Tone jumper on STU-2Z. Call DCX for other options
Trillium Talk to Key system Model #308	When used with a VSIM, there is not enough drop of low tone to signal an off-hook condition. The line will chirp every 30 seconds.	If practical cross connect the STU to an HFSIM in the central office

PRODUCT FEATURES

Subscriber Terminal Unit (STU):

- 5 types of STU's
 - 2Z STU
 - 2Z UL STU
 - 11Z UL STU
 - 4Z STU
 - 4Z Fire Communicator
- Connected as a telephone line extension.
- Can be connected in parallel or series with phones.
- Between two and 11 contact closure zones.
- 4 diagnostic inputs.
- On-hook/off-hook operation.
- UL Listed Fire and Burglary.
- 11Z UL will trip with positive voltage (5VDC to 12VDC), loss of voltage, dry contacts or supervised loops, selected by loop.
- 2Z UL will trip with positive voltage (5VDC to 40VDC) or dry contacts.
- 2Z and 4Z STU's are supervised loops that active with dry contacts only.
- 4 Zone Fire Communicator is activated by dry contacts.
- Interfaces with most alarm panels.
- Provides continuous monitoring of standard telephone lines.
- Hard ID stored in non-volatile memory
- Data Encryption & Soft ID stored in volatile RAM. i.e. requires constant power to maintain this data.
- Produces a 36 Hz Supervisory (Low) Tone indicating it has no messages to report. If an alarm condition is detected Supervisory Tone is turned off until the STU is polled by the Scanner.
- Responds only when polled by the Scanner. Responses consist of either all zones normal or by zone(s) in alarm.
- Will retransmit any and all alarms not acknowledged by the alarm Dealer within 3 minutes. DCR acknowledges automatically, as soon as the alarm comes in.

Scanner

- Continuously monitors STUs
- Multiplexes up to 1024 STUs
- Uses existing telephone lines
- Normal telephone use unaffected
- Completely redundant
- Automatic switch over
- Prioritized communication
 - 1) **OHP Disabled**
 - On-Hook Poll every 30 sec. and monitor low tone
 - Off-Hook No polling; monitor low tone - will Poll if low tone is not present.
 - 2) **OHP Enabled**
 - On-Hook Poll every 30 sec. and monitor low tone
 - Off-Hook Poll every 30 sec. and monitor low tone
 - 3) **Delayed OHP**
 - On-Hook Poll every 30 sec. and monitor low tone
 - Off-Hook Poll every 2 min. and monitor low tone

Message Switch

- Redundant Minicomputer
- Maintains a database of subscribers
- "Polls" Scanners and Dealers
- Directs alarms to the appropriate Dealer
- Logs all commands and messages to archive log tape
- Extensive security features restrict Dealers' access to only their subscribers.
Telephone companies have no access to customer information.

Derived Channel Receiver (DCR)

- Locally stored database for STUs provides easy subscriber lookup and increased central station performance.
- Audible and visual trouble alerting.
- Separate connections for Host modem, printer, terminal, and automation/receiver.
- Fail-safe external alarm relay for remote annunciation.
- Computer terminal and printer for network command, software configuration, and hard-copy audit trail.
- Message Watch traps ASCII character strings and triggers alert.
- User-friendly menus.
- Receiver-style outputs allow direct connection to central station automation packages.
- Automatic OFF-HOOK polling enabled with STU closing report.

GLOSSARY: DCX Alarm Transport System Terminology

APR (Audible Poll Response):

Any poll from the Scanner which occurs when the subscriber is off hook. This is heard on the phone as a “chirp-chirp”.

AUTOMATION:

Central station equipment and software that is used to accept alarm traffic from different receivers.

DEDICATED LINE:

An uninterrupted direct phone line used for transmitting data.

CENTRAL OFFICE:

The telephone company exchange building which houses the telco dial tone switching equipment and the Derived Channel Alarm Transport Scanner.

CENTRAL STATION:

The monitoring location for the Alarm Dealer.

DERIVED CHANNEL MULTIPLEX:

The monitoring of a remote device using existing telco networks by deriving a second path for data communications over the existing cable pair which connects the customers premise to central office.

FSK (Frequency Shift Keying):

A technique for modulating an output frequency by shifting it between two predetermined frequencies corresponding to a binary 0 or 1.

HARD ID:

The identification number programmed into every STU **by** the alarm agency. Must be four digits between 0001 and ABCD.

MESSAGE SWITCH:

The dual - redundant computer system that controls the Derived Channel network. (AKA "Host Computer")

MODEM:

(Modulate **D**EModulate) device used to connect the DCR and Host computer over a dedicated circuit. Converts binary computer transmission to a analog data signal which is compatible with a dial tone telephone line.

NOT RESPONDING:

Failure in the communication link between the Central Office Equipment and the STU.

POLL:

A request for information.

POTS:

Plain Old Telephone Service; the standard dial tone loop between a customer's premise and their serving telco Central Office.

PROTOCOL:

Format of the information that is used to transmit and receive data in the Derived Channel Network.

REMOTE SCANNER

Central Office Equipment the provides service in remote locations that can be configured for different capacities. (NScanner - 16 STU's, MicroScanner - 64 STU's, RScanner - 96 STU's)

RESPONSE:

Data sent from one unit to another as a result of a poll.

SCANNER:

Derived Channel equipment responsible for monitoring up to 1024 subscribers.

SOFT ID:

The telco assigned identification number for the premise STU. The subscriber's DCX scan point.(scanner port or network address) Example: 19-0018

STU (Subscriber Terminal Unit):

A communicator located on a subscriber's premises that interfaces the alarm panel to the telephone line and provides a communications path to the Scanner.

SUPERVISORY TONE:

An inaudible low frequency signal generated by the STU that supervises the loop. Loss of this signal indicates that the Scanner cannot communicate with the STU (e.g., could be caused by a cut line) or that the STU has an alarm message to transmit.

WAIL TONE:

Signal generated by the STU to initiate a poll from the Scanner. Heard as a constant repeated chirping. Comes on only when the STU has a message to report, and the Scanner has not polled as expected.