Telecenter® IV Troubleshooting

Table of Contents   Page

DISPLAY PHONE DIAGNOSTICS

#73 Hardware I/O Diagnostic

Summary: This is the primary diagnostic of the TC4 system. The #73 I/O Diagnostic is a powerful method for exercising all of the features and functions of any physical number in the system from one point, using a display phone. It provides direct access to TCIV hardware thru the flat cable buses by reference to physical numbers, link numbers, and desired actions (relay on, phone line connect, etc.). It can be used to verify physical number associations with hardware and physical number addressing. Keep the following in mind when using the #73 I/O Diagnostic.

> Special characteristics enable dealing with in-use lines and when troubleshooting in interconnect situations.

> It bypasses all attributes, location codes and other software details.

> A system halt feature permits direct measurements of d.c. voltages on flat cables which control expansion modules.

> Individual LLM lines and relays can be tested.

Caution: Perform the #73 diagnostic when the system is not busy: It will tie up a DTMF receiver and may interfere with other system functions, or *vice versa* It can also leave the system in a state unknown to the processor (e.g., by leaving a speaker relay on or leaving a phone connected to a link). To avoid this problem, reset the system after performing this diagnostic.

GENERAL PROCEDURES

Step 1. **Dial #73 on a display** phone. The display will ask for a Physical Number. When the number is entered, the display phone will be connected via a link to a DTMF register. The display field will appear as follows.

> ### NNNN LL V HT AA

NNNN = The Subject physical number. This value can be incremented or decremented using the telephone touch-key pad. The remaining displays fields provide a status report from the main program on the hardware associated with the displayed Subject physical number. Any commands entered through the touch pad will apply to the displayed Subject physical number.

A special null procedure can be invoked for the Subject physical number. The null procedure keeps the main program from interfering with tests on the associated hardware (e.g.: taking a phone off-hook or grounding a call switch will not produce dial tone or a call-in).

The null procedure is normally deleted when the number is changed or when you hang up. However, if the last keystroke before changing the Subject physical number or hanging-up was a connect or relay on command (key 1, 2, or 3), version 102 software allows the procedure to remain invoked. This allows conducting tests involving several lines and/or permits hanging-up to release the receiver for traffic handling.

Always clear connections and procedures established by the diagnostic by resetting the system or issuing the appropriate disconnect commands.

LL = Link Number (00 to 15). Upon #73 initiation, this is the link used by the test phone and its receiver. They will remain in this link. If the displayed link number is changed, all future connect commands use the new link number. This allows connecting two phones to a link which is not the test phone link and enables communication which is Inaudible to the test phone or its receiver.

This display field also changes while checking in-use lines for audio and so forth. The link number of the in-use line will be displayed when the test phone is connected to it, using the connect command key [1]. The test phone link number will reappear upon return to the test link.

V= Activate VCM Intercom. This display indicates that there is a minimum speaker load across the VCMs terminals, making it active. The V field information was not available prior to version 102 software. To see the V displayed, select an SC25 line with a speaker and send the relay on command (press key [2]). Then, send the relay off command (press key [5]) and the V will disappear.

HT = Hook switch (H) and Call-in switch (T) status for the Subject line. This field will display some combination of two characters from the following lists (e.g.: +R).

> H = Hook switch status character will be either +, -, or N:
>
> > **+** = An off-hook is detected for the Subject line.
> >
> > – = An on-hook is detected for the Subject line.
> >
> > **N =** No LLM or no line hybrid is detected on for the subject line.
>
> T = Call-in Switch status character will be either G, R, or N:
>
> > G = A ground is detected on the SC25 T (call-In) terminal.
> >
> > R = A resistor ground is detected on the T terminal
> >
> > N = No connection is detected on the T terminal

The HT display field status indicators represent external inputs to the TCIV. They do not indicate whether the associated line is in use. In some cases service requests are ignored by the system (e.g.: NNNN > 5 11) and in some cases service is provided without a service request (e.g. most in-use C.O. trunks will not show +).

A two-digit hexadecimal figure will appear in the HT field in software versions prior to version 102. A table for Interpreting these hexadecimal values is provided with the procedures for performing Line Type Tests. This information can be derived from Drawing KC1461.

AA = Number of Active Lines in the system (0 - 64). The probability that using the diagnostic will interfere with traffic increases directly with the number of lines in use.

Step 2. **Refer to the following explanations of key functions and the** keypad **illustration on the following page and perform keystrokes as required.**

Key   Function:

[1]   Connect the line associated with the Subject physical number (NNNN) to the LLM link (LL). If the subject line is on-hook, the LLM will send a single ring burst to the phone.

[1]   Connect the Test Phone and its receiver to the link being used by the display line. This will enable monitoring of ongoing voice and audio for test purposes. If a conversation is interrupted, announce testing and press [4] immediatly to return to the test link.

[2]   Turn on a speaker relay associated with the displayed physical number. If a speaker is attached, this will connect the VCM (intercom amplifier) to the speaker's terminals on the SC25 and a **V** will appear in the display.

To hear the VCM, connect the telephone end of the VCM to the same link as the talk/listen phone. Typically, the VCM is connected to line 2.

[3]   **Connect** the single link staff phone relay. This will connect the specified single link **staff** phone to the LLM line which is shared by all single link staff phones.

[4]   If the LLM line is not in-use, it will be disconnected from a connection ma& with the #73 diagnostic.

[4]   If the displayed LLM line is in-use, the test phone and its receiver will be disconnected from it and reconnected to the test link.

[5]   Turn off the speaker relay.

[6]   Disconnect the single link staff phone relay. This will disconnect the specified single link staff phone from the LLM line which is shared by all single link staff phones.

[7]   Increment the NNNN display field to the next higher physical number.

If the last keystroke before doing this was 1, 2, or 3, a null active list record is invoked to block the main programs normal scanning function for this line. This will prevent the system from producing dial tone or call-ins and so forth, allowing lines to be connected and exercised without disturbance from main system functions.

[8]   Increment the LL display field to the next higher link number. This will change the default link used when an LLM connection is made. The new link becomes the default link

[9]   Start a 941 Hz tone signal which is on for 5 seconds and off for 5 seconds. This tone may be used for crosstalk, signal to noise ratio, and loss measurements.

[0]   Decrement the LL display field to the next lower link number. This will change the default link used when an LLM connection is made. The new link becomes the default link.

[*]   Decrement the NNNN display field to the next lower physical number.

Comments under [7] apply here also.

[#]   Stop the 941 Hz tone.

[#]   If the 941 Hz tone is off, the # DTMF tone will be produced and can be used for making measurements.

Notes:

1. An on-hook LLM phone will ring each time a connect signal is sent to it. The ring burst is hardware controlled by a logic hybrid and plug-in LLM line hybrid.

2. If you connect two LLM lines to the same link, they can communicate until one is disconnected or the system is reset.

3. Sending a speaker connect signal will cause an audible click on the SC25 as the relay energizes. A V will appear in the display if a speaker is connected to the designated circuit.

Caution: If you disconnect or change links on either your own (the display phone's) physical number or that of the line used for the DTMF register, use of the display phone for communication and testing will be terminated and the system will have to be RESET.

Test Tone A 941 Hz. test tone (5 seconds on and 5 seconds off) can be obtained for performing audio measurements or listening tests. The tone is available to the test phone or any phone in the link with it. Little display interaction is required, so any phone can be used which has its B:78 attributes set to on. Tone levels are affected by the phone's impedance, the test phone line hybrid, the number of phones in the test link, and component tolerance in the MI0 generator circuits. Typically, tone levels are as follows:

.25 vrms, -10 dbm at the receiver connection to an LLM (0 or 1)

.10 vrms, -17 dbm across a phone line.

Note:
The telephone keys operate as a two by three matrix: Each vertical pair (e.g.: 1 and 4, 8 and 0, etc.,) addresses a common function (i.e.: LLM, Speaker Relay, etc.). The uppermost key makes a connection or increments a numerical value and the lower key of a pair ends a connection or decrements a numerical value.

1 LLM Connect/Ring	2 Speaker Relay On	3 Staff Phone Relay On
4 LLM Disconnect	5 Speaker Relay Off	6 Staff Phone Relay Off
7 Increment Physical No.	8 Increment Line Link No.	9 941 Hz. Tone On
* Decrement Physical No.	0 Decrement Line Link No.	# 941 Hz. Tone Off

System Halting and Voltage Measurements (#73)

Summary: Voltage reading on flat-cable buses can be performed using the #73 diagnostic or the diag-nostic disk program, which is simpler and does not require access to the MIO. Either method requires halting the system, during which time no calls can be made or features accessed. However, this test will not disturb calls in progress. These measurements are important trou-bleshooting aids when the TCIV is operating intermittently or is unable to access certain physical numbers.

Step 1.   Dial #73 and enter the physical number of the line to be tested, then ground pin 66 of the A connector on the back of the MI0 (refer to Drawing KC1461). This ground halts the system and produces a static condition on the flat-cable buses.

Step 2.   Using a one-megohm (or higher) digital meter, measure the voltages on the flat-cable pins. For TC4150 LLM's, access may be gained at the end of the flat-cable. For TC4110 SC25's or TC4120 SCC25's, access may be gained by unplugging the flat-cable from any board not under test. For ease of testing, a flat cable connector (e.g.: 3M NO3399) can be crimped to the flat-cable to provide test access.

Step 3.   Refer to the MI0 schematic (KC1461) to identify each pin/conductor number and verify the voltage reading obtained represents the appropriate binary number.

If Physical Line 7 were entered in the display, the binary number 7 (0000000111) may be verified by measuring 12 volts on LLM flat-cable conductors 18, 20, and 2 1 and 0 volts on conductors 12, 13, 14, 15, 16, 17, and 19. The least significant four bits, measured on con-ductors 19, 20, 18, 21 (Pin 18 is at binary position 2), represent the LLM circuit number (0 to 15). The remaining bits represent the DIP switch setting of the LLM.

For speakers, the flat cable is divided into two sections. Section one is a five-bit relay select number (0 to 24), respectively representing relays 1 through 25. Section two is a six-bit binary module select number which represents the DIP switch setting for the module under test.

Step 4.   Using a one-megohm (or higher) digital meter, measure the multiplex (MPX) voltage from the TC4150 LLM to verify the following for the specified line. This will require taking the phone on and off-hook at the remote station associated with the physical number under test:

On-hook	Less than 5 volts
Off-hook	Greater than 7 volts
Open circuit	6 volts (+/- 0.5 volts)

Note: An open circuit condition may indicate that there is no LLM or no line-hybrid for the specified circuit. If the open circuit voltage is outside the range shown, an LLM is loading the MPX line and needs to be repaired or replaced.

Step 5.   Using a one-megohm (or higher) digital meter, measure the voltage between wires A and B on the SC25 bus and verify the following by using the call-in switches at the target remote location associated with the physical number under test:

No Call-in	Less than 100 mvolts	
Normal Call-in	Over 600 mvolts	
Emergency Call-in	200 mvolts	(Note: This is from a switch with a resistor.)

Note: Use appropriate troubleshooting techniques and schematics to progressively define any problems in individual expansion modules, circuits, and components.

Step 6.   Remove the jumper from pin A:66.

Line Type Tests (#73)

Summary: The I/O hardware diagnostic requires different procedures on different line types for checking out various hardware, including remotes and wiring. These procedures bypass all programming by directly operating relays and circuits based upon physical numbers. Therefore, after connecting a relay or phone line, disconnect it before proceeding to the next physical number. Reset the system after using this function or ensure no connections remain which will interfere with service.

Note: Practice these procedure on a demo or known good system before using it in an actual troubleshooting situation.

C.O. & PBX Trunks

Step 1. Dial #73, then enter the lowest or highest physical number of the type of trunk to be tested.

Step 2. Press [1] and verily one of the following conditions exist:

Trunk busy: The system connects the test phone and its receiver to the link in use. The LL field of the display will reflect the change. and a conference-call will exist between the trunk users and test phone.

Say, "Testing" to announce your presence and immediately press [4] to disconnect from the link and return to the test phone link. Caution: Do not press [4] again, it will disconnect the specified line from the trunk and the call in progress will be cut-off.

Trunk idle: Dial tone is received at the test phone.

Press [4] to restore the trunk to idle.

Step 3. Press [7] or [*] to go to the next physical number and return to **Step 2** until all trunks have been tested.

Special Notes on Central Office Trunks:

Pressing [1] to connect a trunk establishes loop current to the C.O. and lights the CO LED on the associated COA module. However, if the C.O. trunk is held too long due to a defect in the TCIV (software or other), the C.O. may cut-off or sharply reduce its d.c. feed to the trunk line. If this happens, pressing [1] will not get dial tone or turn on the CO LED. The trunk will appear dead, even with a linemans test set.

Correct the condition by opening the loop for a few seconds and then closing it. Do this by pressing [4] twice . . . waiting a few seconds . . . and then pressing [1].

When a trunk line is ringing-in, there will be a + in the HT display field. When the ringing stops, and after a several second delay, the + will change to a -. If a special provision has been made for an external service request, the + will remain as long as the external service request is asserted.

Speakers

This test will identify open or grounded speaker lines via the **VCM** Speaker Sense current (refer to Drawing KC1472). An alternative to the following test would be to place a meter or meters across the D and E terminals of a target speaker to monitor dc resistance and/or resistance to ground.

Step 1.   Dial #73, then enter the lowest or highest physical number of the group of speakers to be tested. **Test** Option: After entering #73, enter the physical number of the VCM, press **[1]** and then increment or decrement to the desired physical number with [7 or *] . This will allow talk/listen audio from each speaker when tested.

Step 2.   Press [2] to turn on the speaker relay and note the following if a speaker is present:

A supervisory beep occurs at the remote location.
A V appears in the display if there is an SC25 relay and speaker and the speaker station does not have an activated privacy switch.
If the test option was selected in **Step 1, room sounds will be audible at the test phone. If there is no audio, a ground or activated privacy switch may be present.**

Step 3.   **Press [5] and verify the V goes off and the supervisory beep discontinues. If this doesn't happen, another relay and speaker may be on.**

Step 4.   Press [7] and verily the physical number in the display increments by one.

Step 5.   Return to Step 3 and repeat the above steps until all speakers have been tested.

Note: **Some tests** require monitoring the **HT** display field. If the software in use is prior to version 102, a two-digit hexadecimal value will be displayed instead of the characters noted in the procedures. If a hexadecimal value appears, use the following #73 Hexadecimal Equivalents Table to interpret the display.

Find the displayed hexadecimal **value under HEX and then locate the equivalent character set under HT. Note** that each character set may be represented by either one of two different two-digit hexadecimal values. The **H** character represents the hook-switch status and the T character is the Call-in Switch status.

#73 Hexadecimal Equivalents Table

HEX		HT		HEX	**HT**		**HEX**		**HT**
00	**80**	**--G**	**10**	**90**	**NG**		18	98	+G
02	82	--R	12	92	NR		lA	9A	+R
03	83	--N	13	93	NN		1B	9B	+N

Phone Lines
Method 1

This procedure can be used to test a series of lines very quickly. It is especially useful for determining which keys of a key system are associated with which lines, as well as verifying that lamp and audible ringing functions operate as wired or programmed. This test is not intended to test all LLM functions of all lines in all links: Use the #75 LLM Line Link Test for that.

Step 1.   Dial #73, then enter the lowest or highest physical number of the type of phone line to be tested.

Step 2.   Verify the HT display field hook switch status is correct:

      +   if the subject phone is off-hook.

      if the subject phone is on-hook.

Step 3.   Press [1] and verify one of the following conditions exist:

Line in use: The system connects the test phone and its receiver to the link in use. A conference-call situation exists between the line users and test phone. The LL field of the display reflects the change.

Say, "Testing" to announce yourself and immediately press [4] to disconnect from the link and return to the test phone link.

Press [7] or [*] to go to the next physical number and return to Step 1 to continue testing

Caution: Do not press [4] again: the specified line will be disconnected, cutting-off the call in progress.

Line idle: One ring burst occurs each time the [l] is pressed. If a key system, one or more ring bursts starting immediately or after several seconds delay.

Take the phone under test off-hook and verify that the – changes to +, indicating the line hybrid detected the off-hook status of the line and transmitted it to the CPU.

Verify two way communication between the test phone and the phone line under test. If a key system, place the line on hold and verify the + remains on the display. Also verify that the correct visual and audible indications occur.

Press [4] to disconnect.

Note: If a problem occurs in Step 3, do the following:

Check and correct any errors in the key system wiring and/or programming.

Try replacing the line hybrid in the suspect LLM (TC4150).

Step 4.   Press [7] or [*] to go to the next physical number and return to Step 2 to continue testing.

**Phone Lines
Method 2**

Two phones can be connected to a link other than the test phone link to allow them to talk or send tones without affecting test phone commands. This will allow the advanced troubleshooter to perform additional tests (e.g.: voltage measurements, functional checks, etc.).

Step 1. Dial #73, note the display phone's test LL Display Field; then, enter the physical number of a phone line (phone A) to be tested.

Step 2. Press [0] or [8] to change the LL Display Field to a value different than that being used by the test phone.

Step 3. Press [1] to connect phone A to the selected link.

Step 4. Press [7] or [*] to display the physical number of another phone line to be tested (phone B)

Step 5. Press [1] to connect phone B to the selected link and verify an audio connection between phones A and B.

Step 6. Using phones A and B, perform whatever tests are desired. During this time, the test phone may be hung-up and phones A and B will remain out of service.

Step 7. Upon completion of testing, either disconnect phones A and B by pressing [4] on the test phone or reset the system.

**Call-in
Switches**

The main program detects the status of each call-in switch as a function of its relationship to ground. This enables the system to distinguish different types of call-ins. In case of problems perform the #74 RP2 Adjustment Procedure.

step 1. Dial #73, then enter the lowest or highest physical number of the call-in switch lines to lx tested

Step 2. Note the character displayed in the HT display field

G = ground on the T terminal, indicating an active normal call-in.
R = resistive ground on the T terminal, indicating an active emergency call-in.
N = no connection is detected on the T terminal, indicating the switch is passive.

Step 3 Place a normal or emergency call-in, or simulate one as follows.

Normal Ground the call-in line.
Emergency Place a 1.5k resistor to ground on the call-in line.

Step 4. Verify the LIT display field changes and provides the correct indication (as defined in Step 2).

Step 5. Repeat steps 3 and 4 for any untested switch positions, ending with the N displayed. Then, press [7] or [*] to go to the next physical number and return to Step 2 to continue testing.

Call-in Sensitivity (RP2) Adjustment (#74)

Summary: This test will prevent any new system activity from being initiated but will not interfere with calls and functions already in progress.

Step 1. Dial #74 from the display phone, then enter the physical number of the Speaker Control board line to be tested and keep the phone off-hook.

Step 2. Place a 1.5K ohm resistor across the T and G terminals of the line under test.

Step 3. Ground pin 66 of the A Connector on the back of the MIO.

Step 4. Monitor the test phone receiver for a clear tone while adjusting RP2 (located at the front of the MI0 near the CPU flat-cable) in the following manner:

Slowly turn RP2 counter-clockwise until the tone becomes scratchy.
Slowly turn RP2 clockwise until the tone just becomes clear again.

Step 5. Mark the position of RP2 and repeat Step 4 from the clockwise end of the adjustment range and, again, mark the position of RP2.

Step 6. Center RP2 between the two marks.

Step 7. While monitoring the test phone receiver, remove the resistor installed in Step 2 and verily the tone goes away. If it doesn't, the resistor may be on the wrong terminal. If so, repeat the entire procedure, starting at Step 2.

LLM Line Link Test (#75)

Summary: This procedure is used to check out all the LLM functions for each line. These include: off-hook sense, audio to each link, DC, and ringing. This test will interfere with anyone using the system. Hang up the test phone to halt the test at any time.

Step 1. Dial #75 from the display phone, then enter the physical number of the first line to be tested.

Step 2. Note that the following prompt, CONNECTION TIME? , appears on the test phone display. Enter a value (in 60ths of a second increments) and press # (e.g.: 30# **for** 1/2 second).

Step 3. Verily a single ring occurs at the phone associated with the specified physical number.

Note: Step 4 is complex. Before beginning it, prepare to note the time (in seconds) at which the target phone is taken off-hook and be ready to send a DTMF tone from the target phone to the test phone.

Step 4. Take the target phone off-hook and verify a clear communication path exists between it and the test phone for a period of time equal to 16 times the time period specified in Step 2. (i.e.: if Step 2 value is 120, this period is 32 seconds).

   Note: During this time period, the system is making and breaking the connection between the two phones via each link in the system, starting at 0 and proceeding sequentially to 15. The length of each connection is determined by the value entered in Step 2. The tone should be clearly audible and subdued clicks may be heard as each link is made and broken. If the value in Step 2 is high enough the click will be slow enough to count.

Step 5. Verily a dead line exists for a few seconds after the time period identified in Step 4 and that this is followed by another sequence as specified in Step 4.

   If a link is faulty, the tone will be interrupted during the connection. To determine which link is faulty, count the clicks, starting at 0. Use the Bus I/0 diagnostic to verify your finding or to check the links individually.

Step 6. If an on-hook phone is available on the line at the next physical number, hang up the first phone and verify the next one rings; then, take it off hook and verify the results obtained in Steps 4 and 5. This process can be quickly advanced down the line to test a complete LLM module.

COMPUTER AIDED DIAGNOSTICS

Computer Monitor Set-up

Summary: With its serial port connected to the TCIV CPU, directly or through a modem, a computer provides a powerful system analysis and troubleshooting tool. A dumb computer terminal or one that can act dumb is required for these procedures. (See Drawing KM0873 for modem connections.)

Caution: The TCIV does not supply the negative voltage required by RS232 standards; however, most serial ports will still work with the TCN CPU. Ensure compatibility before procuring a system for performing these procedures.

Step 1. Build a cable to go between the computer serial port and the TCIV 4 pin connector on the CPU Note: This cable is similar to the one required for connecting a modem to the TCIV. See Drawing KM0873; if using a laptop, use 9 pin connector pins 3, 2, and 5 instead of RS232 25 pin connector pins 2, 3, and 7, respectively.

Step 2. Install a communication program in the computer and set it up in accordance with the following checklist.

Baud rate = Jumper setting on TCIV CPU.
Com Port = Serial Port (COMl, COM2, etc.).
8 bit, no parity.
Full Duplex (Input characters are displayed when returned from the TCIV.)

Step 3. Test the program by connecting the serial port cable connector Out jack to its In jack, start the program, and type some characters. If it is operational, they will appear on the screen. Remove the jack and type some characters; they should not appear on the screen if operating in full duplex mode. (Out and In refer to the direction of signal flow and are always conncctcd out to in; otherwise, the two outputs wilt compete for control of the voltage on the terminal and the two inputs wilt wait for drive signals.)

Step 4. Install the modem or serial port connector onto the CPU, ensuring Out goes to In and vice versa .

step 5. Press the Reset button on the CPU and verify that T5 appears on the terminal screen. This indicates the CPU self test of memory, clock, and UART was successful. If it is not received, check and correct any problem with the following:

5 volts power at the CPU
Baud rate and other settings as described in Step 2.
Serial port connection between the TCIV and the computer or modem.

Serial Port Monitor Commands

Summary: The TClV's built in monitor program responds to one-letter commands and hexadecimal numbers. The principal commands are shown below in bold and quotes (i.e.: "X") variable values which can be input with commands are not in bold and are outside quotation marks. The quotation marks are never part of the command or variable. An example of each command is given along with an explanation of its use.

These commands are available to any terminal or computer with a communication program. They are used by the TCIV diagnostic program for the personal computer to accomplish more extensive diagnostic functions.

aaaa"="	Set the reference address to the value defined by the hexadecimal input aaaa. Use to establish communication with a port (e.g.: 5= or **FOOO=**)
bb'."cc"."	Store bytes bb and cc in memory, starting at the reference address. Use to change a value in RAM or EEPROM (e.g.: 5.E5.) CPU must be switched to ENable to change EEPROM. Example: To set the Monitor Lock (Location Code 64100 which is FA64 in hexidecimal notation) to zero, enter **"FA64=0.0."**
"Space"	Display the byte from the reference address and increment the address.
"H"	Halt the TCIV program (Location Code **64100** must have been set to 0).
"X"	Restart the TCIV program.
dddd"S"	Send the data block (aaaa to dddd) to the serial port in the INTEL hexadecimal format (Use to save an EEPROM Image.) Data block includes all data from the reference address (aaaa) to the ending address **(dddd)** .
"R"	Receive a file in the INTEL hexadecimal format and store it until the End of File command is received. (Use to load an EEPROM image.)
ee"0"	Output byte (ee) to the port defined in the reference address.
"I"	Input the byte from the port defined in the reference address.
pppp ^ G	Call a function at the reference address. Parameter pppp is an optional hexadecimal value for use by the function located at the reference address. ^ G means hold down the control key and press G. (e.g.: 0000= ^ G will reset the TCIV; reference address 0000 contains the reset function and no parameters were required. 00005 = ^ G will call a TCIV function that computes and reports the TCIV checksum value.)
"return"	Move the display cursor to the left margin of the next line and print the current reference address.

Other Serial Port Output

Data Entry   **Usc to identify the architectural number and** DTMF mcssagc of any administrative phone line. **Note:** The Telecenter **Diagnostic** Program will time and date stamp input data and print or save to disk. See detailed description in the manual for the Diagnostic Disk Program.

Step 1.   Dial #23: Upon hearing a long beep, hang up, or dial some additional digits (note the digits and their scqucnce) and then hang up.

Step 2.   Verify that a message appears on the screen identifying the architectural number of the tested line and the dialed digits.

Call in &   This function logs the identity of any staff phone which places a call-in, as well as the type of
Answer   call-in made. Various administrative functions such as paging and answering call-ins may also
Logging   be reported.

step 1.   Turn on the function at Location Code 64206 (See Programming Section).

step 2.   Place several call-ins and verify that the correct architectural numbers and call-in type data is displayed on the screen.

Keystroke   This function indicates which administrative phones are connected/disconnected with which
Monitoring   receiver and, if tones are produced, what they are. It also reports Call Control Console keystrokes.

step 1.   Turn on the function by adding 8 192 to the Receiver Time Limit at Location Code 64012 (See the Programming Section).

step 2.   Perform phone line tests while monitoring screen for keystroke monitoring data. Refer to the following for valid codes and their meanings. Codes are shown in bold and variable data is not. Variable data is for illustration **only and may be any valid value.**

CODE	EXPLANATION
Ap123	Phys **line 123 is connected to Rec 1.**
A 9	Rec 1 detected a DTMF digit 9.
a	Rec 1 is disconnected.
Bp201	Physical line **201 is connected to Rec 2.**
B8	**Rcc 2 detected a DTMF digit 8.**
b	**Rec** 2 is disconnected.
K 2	Console Numeric pad key 2 was pressed (space after K **is required).**
k2	**Console Direct select key 2 was pressed.**
kt	**Console Transfer key was pressed.**
kh	**Console Hold key was pressed.**
kr	**Console Release key was pressed.**
kx	**Console page key was pressed.**

Additional Codes in Version 102 and Later

$p23_15	**Physical line 23 started ringing due to action from line 15.**
-pl4	**Physical line 14 hung-up.**
+p13	**Physical line 13 went from ringing to off-hook.**
!p12	**Physical** line **12** is AAI or DIL and has detected an incoming call.

TCIV TROUBLESHOOTING AND REPAIR

TCIV Find-It Fix-It

Summary: The following quick reference provides symptoms and procedures for troubleshooting them. Just find your symptom and refer to the following procedure to *fix* your problem. These are tried and true find-it and fix-it methods based on a detailed list provided by Art Bickle of Central California Electronics, Fresno Cal. Thanks *from all of us, Art!*

Time Saving Hints and Suggestions

After making any program changes, use #71 to obtain the EEPROM checksum and record it. Whenever a problem is reported, check this before doing any troubleshooting. If a user program change has occurred, whether intentional *or* not, the checksum will change and may point out the problem. This can save lots of time, and headaches.

Use the Statistics Locations for information on how the system is performing. Be sure to zero out any statistics after servicing the system.

System Won't Run / Locks Up   Isolate the MI0 and LLM-0 and try again (disconnect the flat cables to any other LLMs and speaker control boards).

Step 1.   Check outlet voltage and TCIV MI0 voltages +12 Vdc and +5 Vdc. A short from +5 volts to ground can be caused by a shorted over voltage protection diode (Dl) on the CPU. This diode protects 5 volt components on the CPU from damage by 12 volts in case of failure in the 5 volt regulator, or a short.

Step 2.   Determine if the computer will talk to the TCIV. Reset the TCIV with the computer serial port connected to the CPU connector and the communications program operating. A proper reply is T5. If any other reply or none, suspect the CPU.

Step 3.   If TCN talks to computer, verify all connectors to expansion boards are secure and in proper polarity.

Step 4.   Ensure all boards are properly installed and that no connector contacts are bent back.

Step 5.   Ensure that Location Codes and architectural number programming is per your work sheet.

Step 6.   A severely misadjusted RP2 pot will cause the system to lock up. Perform the adjustment procedure as described in the manual.

Step 7.   Use #70 and verily the PROM version number and checksum are correct (refer to the latest software revision sheet for proper values).

System Will Not Program

Step 1.   Phone must have B:78 attributes on (7 for a display and 8 to allow programming).

Note: Line 5 is best for a test phone because it is set-up as a display phone with each system reset.

Step 2.   Use #20 to clear display and insure display integrity.

Step 3.   Make sure the EEPROM jumper on the CPU is set to the ENable position.

Phone Won't Ring

Step 1.   **Check the A: and B: attributes and the architectural number for the line and verify they are correct (refer to the Programming Section).**

Step 2.   **Make sure pin 3 of the line hybrid is intact and the line hybrid is properly inserted.**

Note: **For trunk lines, always cut pin 3 of the LLM serving a COA. Failure to do so will cause damage to the COA.**

Step 3.   **The Direct Seizure Modification may be installed in Key systems with 4OOE cards. Check wiring and ensure a common ground exists between the key system and the TCIV. Contact Sales Engineering for more information on this modification. For new designs, consider using the TCIV King Trip Adapter.**

Step 4.   **A faulty hybrid may be the problem, remove and replace it and then retest.**

Step 5.   **Another port may have the same architectural number, use the #72 function to see if another number appears (refer to the Programming Section).**

Time Tones Do Not Work

Step 1.   **Connect jumpers from the Z terminal to the zone inputs on MIO. If no time tone go to Step 3.**

Step 2.   **If the tone activates, check the master clock and ensure it activates input by going lower than .6 vdc for .5 sec. If more than one zone, make sure the master clock activates all necessary zones at the same time.**

Step 3.   **Insure programming of locations Codes for length of Time Tones (64082 through 64096) is correct for each zone .**

Step 4.   **Check amplifier input level to ensure it is not turned off. Check circuit breaker on amplifier.**

Step 5.   **If MTG is installed, try manual activation with #11 thru #14.**

All-Page Problem

Amplifier audio in/out can be traced through MI0 relays (refer to detail on Drawing KC 1461). Relays can be operated using the computer and monitor functions explained earlier in this section.

Step 1.   **Check for output from the LLM Port #2 and ensure the Fire Alarm Control Panel is reset, if a USR2126 is installed.**

Step 2.   **Ensure the MI0 is properly seated into its rear connector and that no connector pins are bent.**

Step 3.   **Check the amplifier input level control and circuit breaker.**

Step 4.   **If using an electronic key phone, make sure it allows # as a first digit.**

Step 5.   **Use the computer aided diagnostics program to check receivers for proper decoding.**

Phone Rings-Back Upon Hanging Up

Step 1.   User may have hook-flashed phone sometime during use and still had a trunk on soft hold upon hanging-up.

Step 2.   If more than four beeps are heard when lifting receiver, an unanswered transfer call is returning because the allowed timeout has expired.

System Misdials or Won't Allow Access (Intermittent)

Step 1.   There are 2 receivers in the TCIV each one decodes the tones and sends them to the CPU for processing. If one receiver improperly decodes a digit a problem will occur only when that receiver is used. The first phone to pick up always gets the first receiver. Use the diagnostics in the laptop computer to check the receivers. If one is defective, replace the MIO.

Alternate Method: Temporarily turn off the Receiver Time Limit (Location Code 64012). Leave a phone off hook to tie up one receiver and verify the remaining receiver operates by picking up and using each key in turn to break the dial tone.

Interim solution: Lock out a receiver with software until repairs can be ma&.

Talk Path Noisy or Dead (Intermittent)

Step 1.   Use #75 diagnostic and test all 16 links in system, using a touch key to send a tone. Defects with particular links can be further categorized as follows:

Defect on one line only: Suspect U2 or U3 on the affected LLM line.

Defect on **all lines of 1 LLM:**   Suspect U7 or Connector 2 on the affected LLM.

Defect on multiple LLM's: Try another source phone and check the LLM cable from the MIO.

Step 2.   Perform the **Loop Check Procedure** or tty replacing the LLM line hybrid **Ul .**

Crosstalk On Lines

Step 1.   Check wiring and ensure it is correct. All phone wiring must consist of twisted pairs to LLM **T** and R terminals.

Step **2.**   If line amps are in use, verily the negative of the power supply is connected to TCIV common as shown in Drawing KM0716.

Step 3.   If repeater amps arc installed, verify the 28vdc power supply is grounded (negative side to **MI0** pin Z on the B strip).

Step **4.**   **Go** to the **Supplementary Procedures** and perform the Line **Rebalancing Procedure** to improve the balance of TCIV lines from the typical 10% to 30% unbalance to 2% or less if the crosstalk is associated with key phones and cables.

Note: Balance is most important where long multi-pair cables are used, such as with key systems.

Phone Rings When Call Should Go To Attendant

If an incoming call is detected while all attendant lines are busy, the TClV searches up through physical numbers from the last Attendant line until an available administrative line takes the call or it arrives at the physical number of a line that is not administrative. Then it will return to the first Attendant line and repeat the search process.

There are not enough Attendant lines to handle incoming call traffic if overflow causes the TCIV to send calls to administration phones other than the Attendant.

If the TCN fails to find an Attendant line or administrative phone to answer an incoming call, it temporarily ignores the call and the caller will continue to hear ringing.

Location Code 64000 is not programmed to the proper physical number or a trunk is programmed with the A: attributes for DIL instead of AAI.

False Call-ins After All-Call or Time Tones

step 1.   Check the amplifier gain adjustment. If too high, the amplifier will clip the signal and cause this symptom.

Step 2.   Check each side of the amplifier to common signal ground. Make an all-call and press the three bottom keys on the phone. Each side of the output must be within 1 volt ac of the other. If not, a short or leakage to ground exists. Check each speaker line individually.

Alternative Method: Use the diagnostic function #73. disconnect the VCM2 and insert meters in its place. Advance 1 physical number at a time and check the readings.

step 3.   Check the amplifier for possible oscillations. Disconnect the amplifier input & repeat Step 2.

Step 4.   Perform RP2 adjustment procedure.

Step 5.   If the preceding steps don't prevent the false call-ins, unplug the SC25 flat cable from the MIO. If this eliminates the false call-ins, plug the SC25's in one at a time to find out which, if any are defective.

Supplementary Procedures

Finding Duplicate Numbers

Summary **Architectural numbers should not be duplicated. If they are, the following symptoms may appear.**

> **Connections occur to speakers or phones which weren't called.**

> **Call-ins appear but cannot be answered or cleared.**

Step 1. **Dial #72 and look-up the physical number associated with the suspect architectural number.**

Step 2. **Dial #99 and change the suspect architectural number (refer to the Programming Section).**

Step 3. **Dial #72 and look-up the physical number associated with the changed architectural number. If the architectural number is duplicated, a new physical number will be displayed, if not the field will remain blank.**

Step 4. **Reconfigure the architectural number to physical number relationships as required.**

Phone Line TAP Functions

The Comdial phones supplied with the TClV have a TAP function to help with transfers. This is accomplished in two phases: First, the TAP function ensures that the person attempting to transfer a call does not lose it by breaking the loop for too long; Second, that hanging-up on one call and immediately picking-up the receiver to make another call does not initiate a transfer. To pass this test, the timing setting of the TClV and the built in timing of the phone must both be correct and compatible.

Transfer Capability Test

Step 1. **Dial a trunk and get C.O. dial tone; then, press TAP and verify TClV dial tone is received. Repeat TAP if necessary to get dial tone.**

Step 2. **Dial another TClV extension and verily double ring. If only single ringing occurs, the TClV interpreted the TAP as a hangup (disconnect) and one of the following actions is indicated:**

> **Phone TAP period is too long (greater than 0.75 seconds). Replace phone.**

> **TClV's hookflash time is too short (refer to Programming Section and check location code 64014=65)**

Step 3. **Hang-up and repeat Step 1 and 2 five times in a row to assure repeatability.**

Cradle Switch Test

Step 1.   Dial a trunk and get outside dial tone.

Step 2.   Attempt to send a hook-flash **using** the cradle switch instead of the TAP button. The TAP circuit in the phone should extend the on-hook time sufficiently to allow disconnect.

Step 3.   Verify TCIV dial tone.

Step 4.   Dial another TCIV extension and verify that only a single ring occurs. If a double ring occurs, the TAP phone did not force a disconnect, allowing the possibility that a rapid hang-up and answer sequence will initiate a transfer.

Step 5.   If a double ring occurred in Step 4, one of the following actions is indicated.

   Phone disconnect is less than 1.5 seconds. Replace phone.

   TClV hookflash time is set too long (refer to Programming Section and ensure that the value in location Code 64014 is 65).

Step 6.   Repeat Steps 1 through 4 five times in a row to assure repeatability.

Ground Resistance Measurement

A good ground is important for reliable and safe operation of a TCIV system. The ground should also bc common to any associated systems such as Key systems or PBXs. The resistance of the ground connection can be measured as follows by referring to **Drawing KC1461.**

Step 1.   Connect one end of a **100 ohm,** 2 watt resistor to one of the + 12 Vdc (M) terminals on the MIO.

Step 2.   Connect an 18-AWG wire between the other end of the resistor and a good ground, such as a cold water pipe or conduit main. Do not use the same ground connection used by the rack.

Step 3.   With TCIV power on, measure the d.c. voltage between the resistor and any MI0 Z terminal, or switch panel Z, or the cabinet itself. The voltage should be **less than 120 mvdc** which corresponds to a resistance of 1 ohm.

Loss Measurement

If excessive loss is suspected in a TCIV line, measure it with the following procedure. If necessary, refer to the Programming Section and temporarily reprogram the lines to be tested as administrative phone lines and/or equip them with line hybrids.

Step 1.   Connect commercial quality phones to two LLM lines and place them in communication with one another.

Step 2.   Hold down the bottom row of tone buttons on one phone, the **Originator,** to send a pure 941 Hz tone to the other phone, the Listener.

Step 3.   Using a digital meter of sufficient bandwidth for audio frequencies, measure the millivolt level on the two respective T **and R terminals** and verify that the Originator to Listener difference is less than 9db. Typical reading arc shown below.

   Originator   **300 mvrms**   **0 db (ref)**

   Listener   **130 mvrms**   **-7 db**

Lockout (Line, Link, or Receiver)

Summary: Sometimes it may be necessary to temporarily lock out a bad line, link, or receiver for testing purposes, or until replacement modules or parts can be installed. To do this in TCIV proceed as follows:

Line Lockout

Step 1.   Set the line's A: attributes 1 thru 7 off. This signals the TCIV CPU to minimize its response to inputs from these lines. Inputs include call-in, or off-hook service requests. This lockout is never 100% since the CPU must keep scanning these lines and intrepreting the blank attributes.

Step 2.   Attempt to use the line and verify it is locked-out. Note: This lockout will not work if the line has a defect that allows it to respond to incorrect physical number addressing.

Link Lockout

Step 1.   Refer to the Programming Section and program Location Code 64196 to lockout any one or more of the 16 links.

Note: If all 16 links are locked out, a computer will be needed to restore service to the system.

Step 2.   Press the Reset button on the CPU. The lockout only takes effect after resetting.

Receiver Lockout   Refer to the Programming Section and program Location Code 64012 (DTMF time) to lockout a defective receiver temporarily. The system can function with only one receiver until repairs are made.

Statistics

Summary: **TCIV Activity Statistics aid in analyzing traffic and in troubleshooting. Statistics are kept in RAM at the following Location Codes which may be read and/or reset using the #98 function described in the Programming Section. Statistics may also be accessed by the Statistics Function of the Architectural and Diagnostic Program. When the system is powered-up, the Statistics Location Codes contain large "garbage" numbers which must be set to zero using the #98 function before any signifigance can be assigned to their values. The available statistics arc:**

57344   **Number of resets by the reset pushbutton, serial port, and watchdog timer.**

57346   **Number of lines becoming active because of pressing a call button, going off-hook without being called, or incoming call on a trunk.**

57348   **Number of completed Administrative calls.**

57350   **Number of DIA/DISA incoming calls.**

57352   **Number of AAI/DIL incoming calls reccivcd.**

57354   **Number of call-ins.**

57356   **Number of outgoing interconnect calls.**

57358   **Maximum number of links in use at any one time since the last initialization. This number changes whenever the number of links in use exceeds the number already stored.**

57360   **Maximum number of active lines or physical numbers at any given time (64 is the maximum allowed). A line or physical number is active when providing an audio path to another line or speaker. It is also active while a ground or resistor load is connected to the call-in terminal. There is a serious fault when the number stored here reaches 64. One such fault may be an improperly set call-in sensitivity pot, RP2 on the MIO. If RP2 is not properly set, it may appear to the CPU that all 5 12 stations are attempting to place simultaneous call-ins.**

57362   **Number of Receiver faults: Number of times administrative phones have picked up, waited for dial tone, and hung up without receiving it. A single phone can generate several counts here by cycling the hook switch several times at a time when both receivers are busy elsewhere.**

57364   **Number of Console Interface Adapter resets.   The console interface adapter can be reset by a special command from the main program when a communication or response problem is dctectcd. A large number in this statistic may indicate: intermittent or noisy wiring; or faulty components in either the Console or the interface module.**

57366   **Number of Console Data Faults. The console sends a mixture of numerical data and commands to the TCIV which recognizes non-numeric characters as commands. This counter increments any time characters are received which are unknown to the TCIV. These unknown characters are discarded along with the preceding numeric data and considered data faults.**

57368   **Number of Lost Console Commands: In case the TCIV main program happens to be slow in responding to a connect request from the console (the line may be busy) the console support program may discard new console input for a brief period, causing the operator to have to repeat a keystroke. This is a count of the number of characters discarded.**

Loop Sense Measurement

Summary: This test verifies that a line hybrid (U 1) in an LLM (TC4 150) can supply enough current for a phone to operate properly and detect an off-hook condition; that is, when a minimum amount of current is flowing. It can be accomplished without milli-amp meters or breaking connections These measurements are especially important in key systems since the line card introduces a small extra voltage drop in the loop due to a series current detector.

Step 1. Refer to the Programming Section and program the line to be tested as an administration phone by giving it the A: 1 attribute.

Step 2. Refer to the Programming Section and record the value stored in Location Code 64012, then set it to 0.

Step 3. Connect a 470 ohm resistor across the T and R terminals of the line under test and verify a measurement of at least 7.2 volts across the resistor. This represents a current of 15 ma and should be sufficient for detection by the line hybrid, causing the TCIV to connect the line to a link for dial tone sending and receiving.

Step 4. If Step 3 was successful, verify a digital low on the LLM C terminal, indicating the connection discussed in Step 3 was completed.

Step 5. If Step 3 or 4 failed, replace the line hybrid.

Step 6. Remove the 470 ohm resistor installed in Step 3.

Step 7. Take the phone on the line under test off-hook and verify a DC voltage reading of 1 to 3 volts less than the voltage observed in Step 3. This indicates the phone is drawing substantially more current than the 470 ohm resistor. If not, the phone may not be drawing enough current to be reliably detected by the line hybrid.

> **Note:** The DC current in a phone varies with handset orientation, motion, and when a tone sending button is pressed.
>
> Step 7 can also be used to determine the actual loop current in the phone by performing the following steps:
>
> 1. Hang up the phone and connect a decade box across the T and R terminals.
>
> 2. Adjust the resistance to obtain the same voltage as read when off-hook.
>
> 3. Compute the current as: $I_{Loop} = V_{Off\text{-}hook} / R_{Decade} = 25$ to 50 ma.

Line Rebalancing Procedure

Summary: Cross talk sometimes occurs between pairs in a long multiple pair cable, such as those used to connect key phones located several hundred feet from the equipment rack. This may indicate the need to obtain better than average balance on these lines. The following procedure can be used to accomplish this and should eliminate the problem.

Equipment Required: High impedance (1 mcgohm min.) AC meter with minimum 10 mv resolution.
Two 100k resistors, matched within 1%. Capacitor, .005 uf., 47k resistor.
Resistance decade box, or substitution box covering the range 1 k to 15 k ohms.
Resistors to install for rebalancing.

Step 1.   Refer to **Drawing KM 0899,** build the circuit shown from the parts listed above, and use it on each line to be tested. Do not connect the Decade Box until instructed. If only measuring % Unbalance, go to Step 3.

Step 2.   If rebalancing lines, turn TCIV **Power Off** and remove the resistors, marked R2 from the LLM line circuits of all lines to be rebalanced. Then turn the **Power On.**

Step 3.   Using a test phone, call the first line to be rebalanced, establish communication, and leave both phones off hook.

Step 4.   Hold clown the three bottom buttons on the test phone to send a 941 **Hz** tone to the line under test.

    Note: Do not press any tone buttons on the line being rebalanced, as this would result in abnormal d.c. and damage the accuracy of the rebalancing.

Step 5.   Measure the tone level from terminal **T** to ground (Vt) and the voltage from terminal **R** to ground (Vr). TCIV lines may operate 10 to 30 % unbalanced; however, rebalancing can reduce this to less than 2%. The unbalance is determined using the following formula:

$$U\% = \mathbf{100 \times (Vt\text{-}Vr)/(Vt + Vr)}$$

Note: If low level noise causes difficulty when measuring near null (0) voltages, release the tone button to see how low the meter dips and use this as the new 0 **level.** If the noise is fluctuating, set it to the lowest average value.

Step 6.   Connect the **Decade Box as** shown in the Line **Balancing Set-up** figure on the following page.

Step 7.   Adjust the Decade Box until the meter reads close to 0 millivolts. Note the setting of the Decade Box for the line being tested; then, remove the test circuit and repeat Steps 3 through 7 for each line to bc rebalanced,

Step 8.   Turn the **TCN** Power Off; then, using the Decade Box setting noted for each line, install a standard resistor of the value noted in place of the removed R2 using one of the following methods: When finished, turn the TCIV Power On.

        Internally in place of R2; This requires careful soldering and de-soldering on the LLM and the resistor will have to be changed again if the line hybrid (Ul) is changed.

        Externally by wrapping one lead to the **T** pin and soldering or wire-nutting the other end to pin 71 (+ 12vdc).

Line Balancing Set-up

**Part of
LLM Circuit**

71(=12vDC)

V

R3
47K

Decade
Box

T

R1
100K (1%)

Listening
Telephone

C1

.005uf

R2
100K (1%)

R
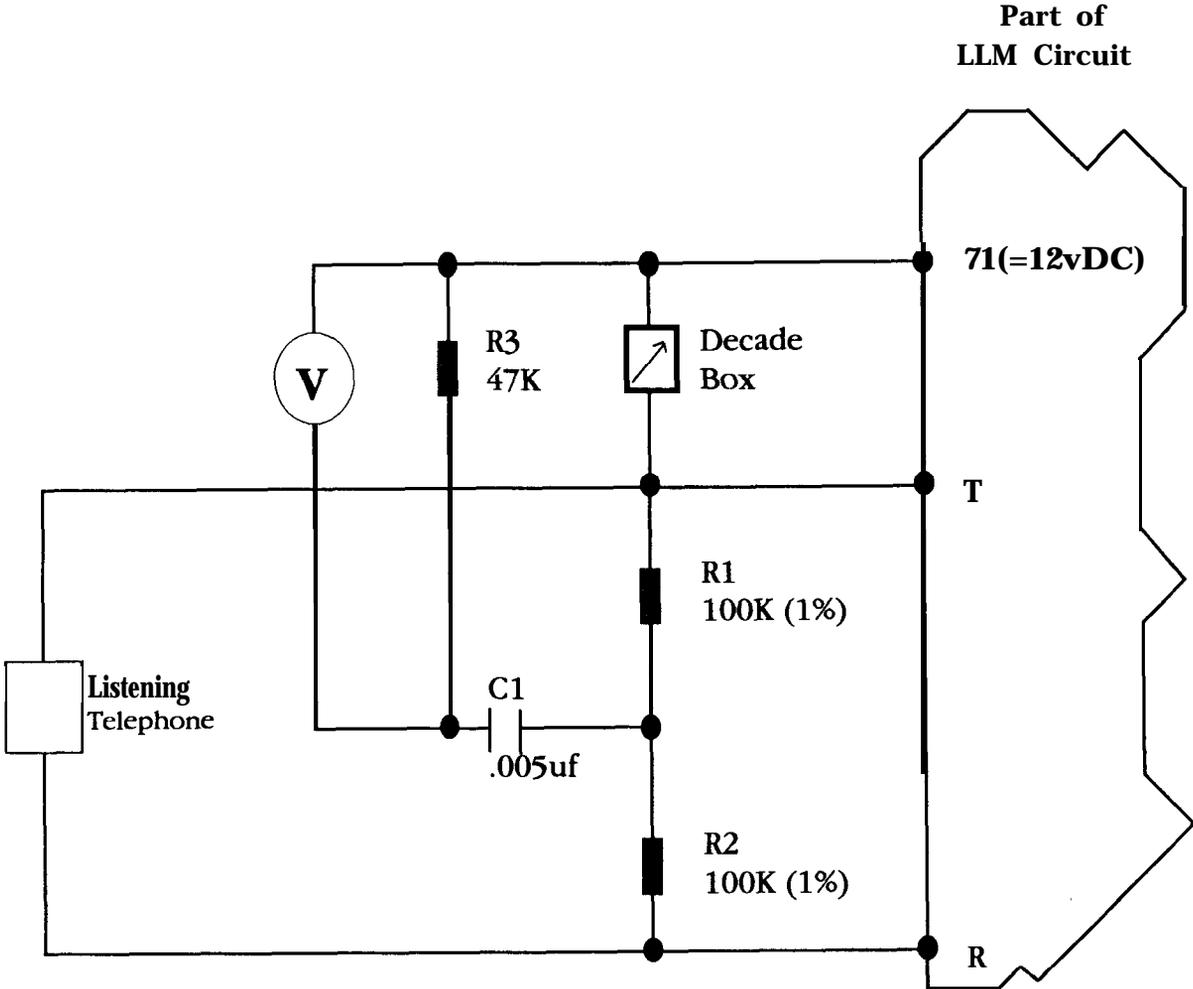
Rl, R2 = 100K Matched within 1%

Console Interface Adapter (TC4420)

Summary: Test the interlace board communication function without the TC4400 Call Control Console connected using this procedure. The main program sends an ASCII M to the console every 15 to 20 seconds: This procedure determines if the Console receives and echoes this signal back through the Interface Adapter to the TClV. If the echo is not received, an error count is incremented at Location Code 57364.

Step 1.   Turn TCIV **Power Off.**

Step 2.   Move the TC4420 jumper **J3, located** next to the edge terminals **M** and Z, from NORMAL to TEST. Remove the Console Interface Adapater Board if necessary to access the jumper.

Step 3.   Remove the field wiring from pins CS and TS and jumper these two pins together.

Step **4.**   Turn TCIV **Power On.**

Step 5.   Refer to the Programming Section and set location Code 57364 to 0; wait for one minute and then read the value in Location Code 57364 again. If Location Code 57364 is still set at 0, the interface board is working.

Step 6.   Turn TCIV **Power Off.**

Step 7   Place the **J3** jumper back to the NORMAL position, remove the jumper from pins CS and TS and reinstall the field wiring to those pins; then, set the TCIV **Power On.**

LCD Display Problems

Step 1.   Dial #20. This will ensure the display has been initialized (required if the display is powered up after the TC4001).

Step 2.   Adjust display phone viewing angle control for an image on the display.

Step 3.   If there is still no display, take the phone to the rack and connect the **black** and yellow wires to one of the **LCD** drives on the **MI0** to obtain 12 Vdc (black is positive). If no display, verify the voltage is present and the display has been properly connected.

Step **4.**   If still no display, connect a small speaker to one of the LCD drivers through a capacitor and place a call which will cause that driver to update the display (refer to the Programming Section). The speaker will provide an audible indication if data is being supplied to update the display.

Single Link Staff Phone Problems

Summary: Single link staff phones are so named because they all connect through relays to a single line of the TCIV. Therefore, all are disabled when anyone is in use, giving rise to the following normal situations which may be considered problems:

> As long as any single link staff phone is in use:
>
> > No other single link staff phone can be used.
> > Picking up a single link staff phone will not make a speaker call private.
> > A call-in exists which cannot be cleared.

Unclearable Call-in

Step 1. Place the single link staff phone on-hook using one of the following methods:

> Go to the remote location.
>
> Dial ## followed by the architectural number of the remote location and request that someone place the phone on hook. (## keeps the call from reverting to the phone before communication can take place.)

Step 2. If Step 1 did not clear the call-in, ground was not removed from the T call-in terminal of the speaker: Check the wiring for a short to ground or other problem.

Step 3. Check the DIP switch setting of the Speaker Control Boards serving the problem speaker and single link staff phone, the rightmost switch lever should be positioned as follows:

> **Down**   Single Link Staff Phone
>
> **Up**   Speakers

Other Problems

Step 1. Verify the A: attribute of the single link staff phone is A:12 (A:7 is off).

Step 2. Verify Location Code 64008 contains the physical number of the LLM (TC4150) line shared by single link staff phones.

Step 3. Verify Pin 3 is cut on the line hybrid (UI) for the LLM line serving single link staff phones.

Step 4. Verify the T and R terminals of the single link LLM line are properly connected to the Speaker Control Board (SCC25) S1 and S2 terminals (refer to Drawings KM0674 and KMO686).

Speaker Intercom Problems

> Using the #99 function, ensure ail A: attributes for the VCM are off. If B: attributes are on, access to the VCM speakers is restricted via the special page algorithm (refer to the Special Page Line Type Selection Chart in the Programming Section).

Interconnect Problems

Summary: Wiring from the C.O. to the demarcation block, from the block to the TCIV, COA and LLM circuitry within the TCN, programming, and wiring to the remote station may all affect the operation of interconnect lines.

Step 1.   Obtain or make an interconnect planning layout as described in the Interconnect Planning Section.

Step **2.**   Verify interconnect trunk programming is as required.

> If B: attributes specify "external service request", a special connection is required at the COA (refer to Drawing KC1475). If this connection is not made, calls to affected trunks will terminate after answering when the **COA** timer shuts-off.

Step 3.   Use the #73 Diagnostic for trunks (part one of this section) and check for the following:

> Idle: 48 Vdc on **COA** terminals CT and CR.
>
> Busy: **6-8 Vdc on COA terminals CT and CR.**
>
> Other: Less than 2 Vdc indicates a central office time-out fault. Disconnect for 2 seconds to get 48 Vdc back. (See Special Notes on Central Office Trunks under the Line Type Tests section in this manual.)

Step **4.**   Verify the problem line is idle and there is **12** Vdc on LLM terminals **T** and **R.**

Step 5.   Place a call to the problem line from the outside and check for the following:

> Ringing: **6 Vdc on LLM terminals T and R.**
> **COA** LED TC glows steadily.

Step **6.**   Connect the problem line to the incoming call and verify **COA LED CO glows steadily. This** LED indicates CO or PBX loop current and will not glow if a break exists in the loop.

Step 7.   Check the CO line integrity by connecting a telephone directly to the demarcation block and placing test calls from and to the remote CO or PBX. If this test is unsuccessful, the problem is the phone company's responsibility to repair.

Note: If a "ground start" trunk, a 2 second ground on the ring lead is required to acquire dial tone.

Telecenter IV Quick Reference Chart

Location Codes (#98)

64000	Attendant or TC4400
64002	Select Time-Zone tone
64004	#40 - 49 Authorimtion
64006	Extra Character ASCII Code
64008	Physical number for l-Link Staff Phones
64010	3 or 4 Digit dialing (3=3)
64012	Dial Tone Timeout (600=10 sec) (Add 8192 turns on key stroke monitoring.)
64014	Hook Flash time limit (60= 1 sec)
64016-34	Physical number of line dialed using O-9
64036	Keep-Alive time limit (600=10 sec)
64038	Keep-Alive response time (600= 10 sec)
64040	VCM line for Speaker Control board 48
6404280	VCM lines for Speaker Control boards 00-19
64082-96	Time tone duration, Zones 1-8
64098	Disconnect Delay time (180=3 sec)
64100	Monitor Lock (Lock=O, Normal=255)
64102	Priority beep interval (60=1 sec)
64104	Normal beep interval (600= 10 sec)
64106	Repeat single-buttondialing time limit (O=Disable, <6O=No limit, 300=5 sec)
64108	Set internally by TClV
64110	Remote hook-flash time (30= .5 sec)

64112-74	Phy. # for Special Page or VCM **access** (NO-N31)
64176-90	Same as above for MO-M7
64192	Attendant ring-back time (1200=2 sec)
64194	System number
641%	Link block, each bit = a link (1=block)
64198	Trap Vector (0 or address)
64202	Signal via B20 when all Grp 1 trunks busy
64204	Signal via B22 when all Grp 2 trunks busy
64206	Log control or activity signal via B20 or B22 (1=Call logging; 2=Page logging; 16=Normal via B20; 32=Priorityvia B20; 64=Normal via B22; l28=Priority via B22
64208	Call-in Graphic Display (Driver 1)
64210	PBX access digit
6421620	Graphic display of activities for specified Adm. phones Driver 2-4 [1024 x total lines-l] + Phys. #]
64222	Physical number of line to ring after DIL/AAI timeout
64224	TC44OO Audio (physical number of hardware TCIV line
64226	TC4400 Trunk Lines (physical numbers)
64228	TC4400 Attendant (software TCIV lines)
64230	TC4400 Monitored extension lines
64232	TC4400 Additional monitored extensions
65280-84	3 allowed area codes

Line Attributes and Options (#99)

Line Type	Adm. or TC4400	Staff	Page/VCM	Routing Attributes
A: Speaker Only	B: 1 Intercn	B:l Gnd Prior	B:l N b0	
A:1 Admin Line	B:2 Toll	B:2 Cancel	B:2 N bl	A:7 Spkr First
A:2 Staff (16 link)	B:3 Zone	B:3 Disp 1	B:3 N b2	Spkr Only
A:12 Staff (1 link)	B:4 All Page	B:4 Disp 2	B:4 N b3	Admin Line
A:3 AAI	B:5 Tones	B:5 Res Prior	B:5 N b4	16 Link Staff
A:13 DISA	B:6 Exc Override	B:6 Cancel	B:6 M b0	
A:23 Special Page	B:7 Display 1	B:7 Display 1	B:7 M bl	
A:123 DIL	B:8 Display 2	B:8 Display 2	B:8 M b2	A:8 Hunt
A:14 Console Line				Admin Line
				16 Link Staff
AAI Line	**DISA Line**	**DIL Line**	**TC4400 Audio**	AAI
B:l Access	B:l Access	B:l Access	B: 1 Interconnect	DISA
B:2 Toll	B:2 Toll	B:2 Toll	B: 12 Restrict	DIL
B:3	B:3 Zone	B:3 Private	B:3 Zone Page	TC4400 Opr.
B:4	B:4 All-Page	B:4	B:4 All-Page	
B:5	B:5 Tones	B:5	B:5 Tones	
B:6 PBX Code	B:6 PBXCode	B:6 PBXCode	B:6 Exc Override	
B:7	B:7 SBD	B:7 Wait	B:7 Display 1	
B:8 Ext Service Req	B:8 Ext Service Req	B:8 Ext Service Req	B:8 Pre-screen	

Statistics (#98)

57344	Resets
57346	Scan Output
57348	Admin Calls
57350	DISA Incoming
57352	AAI/DIL Incoming
57354	Call-ins
57356	Outgoing Int.
57358	Maximum Links
57360	Max Active Lines
57362	Receiver Faults
57364	Interface Resets
57366	Console Data Faults
57368	Ignored Characters

Dial Codes

#00	All Page	#71	EEPROM Checksum
#01-08	Zone 1 - Zone 8	#72	Phys. Nmbr Lookup
#ll-14	MTG Tone s	#73	I/O Diagnostic
#20	Initiate Display	#74	RP2 Adjust
#21	Cancel All Call-ins	#75	LLM Diagnostic
#22	Review Call-ins	#76	Trap Execute
#23	Enter Data	#96	Toll Prefix
#30	Night Answer	#97	Zone Change
#31	Night On-Off	#98	Location Edit
#40-49	Call Pick-up (pick-up)	#99	Arch Code Edit
#70	Version Checksum		