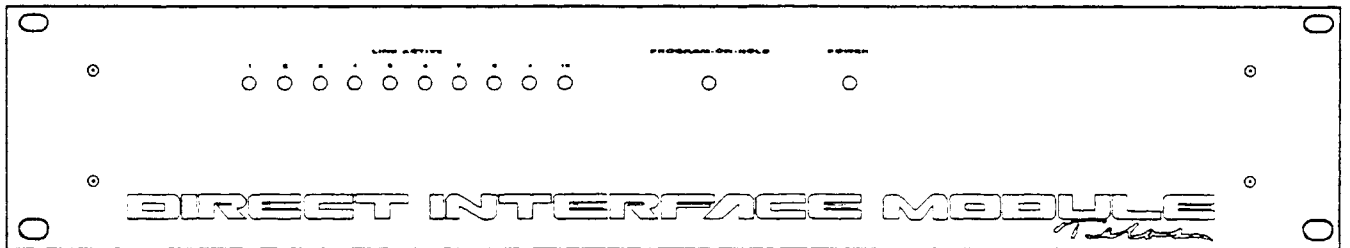


Telos *Direct Interface* *Module*

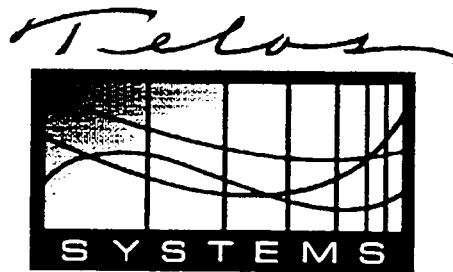
Multi-line Broadcast Telephone System



User's Manual

Revision D2 – April, 1993

For models with Firmware Versions 1.4 and higher



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User's Manual

DIRECT INTERFACE MODULE

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SECTION 1
INTRODUCTION

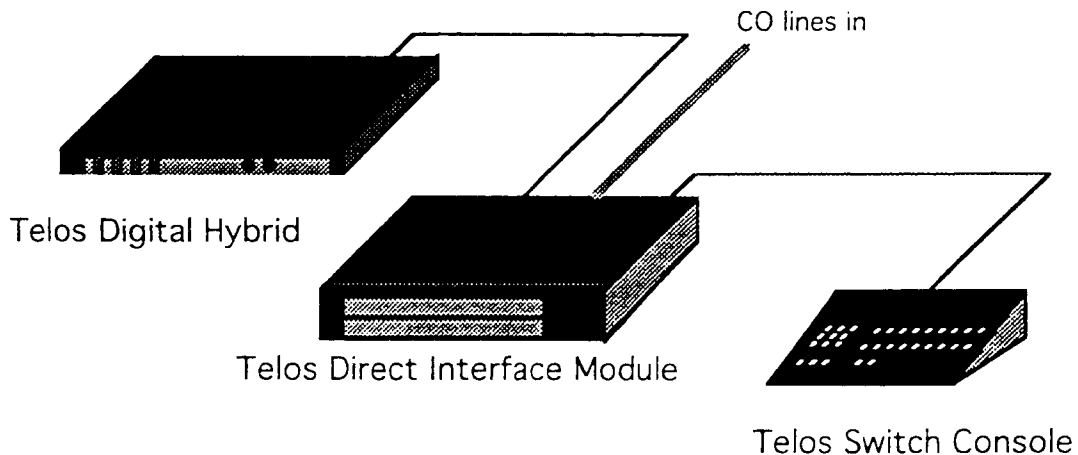
1.1 OVERVIEW

The Telos Direct Interface Module is designed to interface on-air telephone lines to Telos hybrids and control consoles. The Direct Interface Module accomplishes all of the usual telephone system switching functions for broadcast telephone interface.

The Direct Interface Module connects to standard dial-up phone lines from the telco central office using industry standard RJ11C connectors. Each line card connects two lines, with five line cards per unit, allowing access of up to ten phone lines.

The Direct Interface Module communicates with the Telos Switch Console and console control surfaces by sending and receiving serial data over a "skinny wire" data link. This serial link uses a modular phone type cable. Power is also conveyed through the modular cable.

The simplest possible system consists of the Interface module, a hybrid, and a control switch console.



Each Direct Interface Module will switch up to 10 lines into as many as two hybrids and will accommodate directly up to two Switch Consoles (more switch consoles are possible with external power supplies). The Interface routes the main and conference audio to the hybrids and provides extra contact closures for the user-assignable buttons on the Switch Console, a serial connection for controlling other Telos equipment, and an IBM AT-style RS-232 serial port for computer

control with software such as Telos' Call Screen Manager. The Direct Interface Module also has a Program-On-Hold input with AGC and a "page" output.

The excellent and popular full-featured electronic phone, the Mitel® Superset 4, may be used for call screening and other off-air conversation. As many as two of these may be connected.

The Interface has been designed with care to audio performance in order to insure that the Telco audio arrives at the hybrids with negligible degradation.

1.2 NOTE ON FIRMWARE VERSIONS

This manual is for use with Direct Interface Modules with firmware version 1.4 or higher. You can determine the firmware version of your unit by checking the label on the EPROM inside the unit. If you have an earlier version of the firmware, an upgrade is available free from Telos Systems. Call or fax us with the serial number of your unit and the upgrade will be sent to you.

The Switch Console referred to in this manual is the later generation model that first shipped in January, 1993. It has a molded chassis and dual LED indicators above the LINE selection buttons. Older model Switch Consoles, with a metal chassis and a single LED indicator above the LINE buttons, will work with all versions of the Direct Interface Module. If you require an instruction manual for your older model Switch Console, please contact Telos Systems and we will provide one to you at no charge. Both models of Switch Console may be connected to the same Direct Interface Module, but the feature set will vary.

SECTION 2
INSTALLATION

2.1 CONNECTION TO TELCO LINES

2.1.1 THE CENTRAL OFFICE CONNECTION

Telco lines are brought into the Direct Interface with standard RJ11C cables. Plug the Telco lines directly into the appropriate modular receptacles on the Interface rear panel. The red/green (inner) pins of the modular receptacles make the Telco connection, while the yellow/black (outer) pair is used as a loop-through for connection to another phone system or PBX (as described below). Therefore, you should be sure that no unintended connections are made to the yellow/black pair. Also, note that the Interface should be used with loop-start phone lines (the standard, most common sort).

2.1.2 INTEGRATION WITH ELECTRONIC PHONE SYSTEMS

Three approaches are described. Each offers specific advantages and disadvantages.

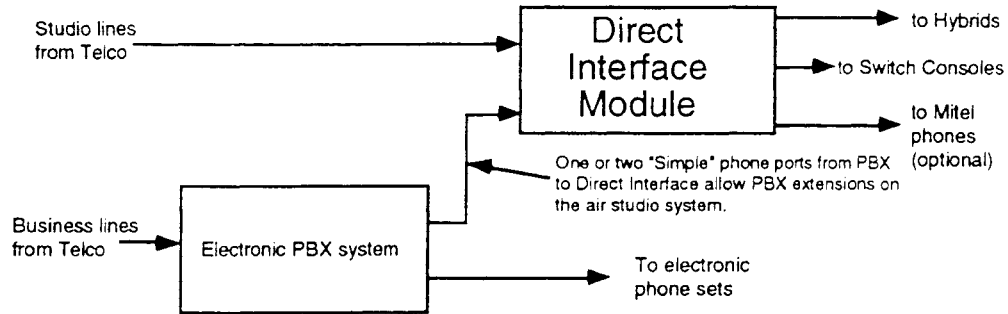
A. Using the Telos "behind the PBX"

In this manual we refer to any phone system other than the Telos on air system as a *PBX* (Private Branch Exchange). This is generally the station office phone system, whatever its configuration.

Most of the electronic PBXs have ports intended for standard single-line phones as well as for the fancy feature phones. Since these ports look like Central Office lines with ring voltage, talk battery and the like, they can be connected as inputs to the Direct Interface, just as a CO line would. For instance, this scheme allows the studio phones to access WATS lines, make in-station calls, and take calls that come in through the switchboard. The phone people refer to this concept as "using the Key (the Telos) behind the PBX."

Within this general concept, there are three approaches to consider:

Behind the PBX Approach #1 is to segregate the studio lines onto the Direct Interface only, bypassing the electronic system altogether. An extension or two off the electronic system would allow airing of calls received on the main station switchboard, local in-station calls, etc. If non-studio answering of calls is desired, such as for a talk show "screener," the Telos-provided Mitel® Superset 4 phone is used, which plugs into the Direct Interface Module.



Behind the PBX Approach #1: Segregate Studio and Business Lines

Behind the PBX Approach #2 is to route all of the lines through the electronic system so they can be answered on any system phone which has been programmed for the studio lines. Generally, the electronic systems can be programmed to send "private lines" to a particular extension, so that the studio lines can be directly used without being answered by the station operator. This approach has the advantage that the lines can be answered on any system phone which has been properly programmed. See the diagram on the next page.

The disadvantages of this approach are:

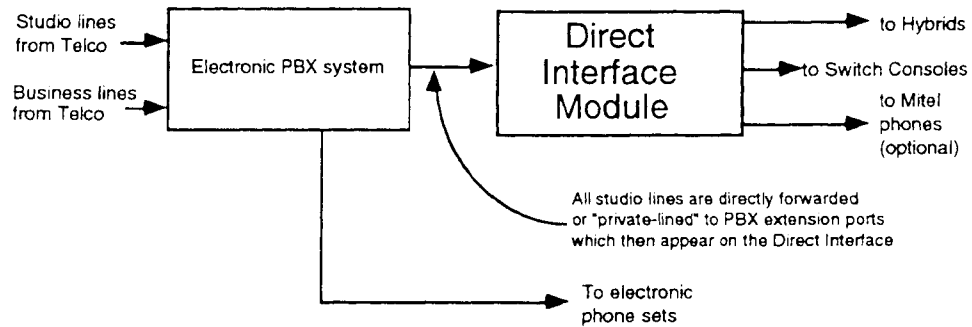
Audio degradation may result. Analog systems are often noisy or frequency response limited. Often, the main problem is that the data signals crosstalk into the audio path. Most digital systems have poor audio quality verging on unacceptability for on air broadcast. See our Telos Telephone Q & A for a discussion of this problem.

Cost. You need both input (Central Office) ports and output (extension) ports for each of the studio lines. This can get very expensive because you'll need one card for each line.

Reliability. You now have two systems which could screw up. Blame and finger pointing could result in the event of a system failure.

Hybrid performance may worsen somewhat since you are throwing another impedance bump into the talk path.

The Direct Interface uses loop drop detection to release lines that have been on hold when the caller gets tired of waiting and hangs up. Your analog ports must generate a loop drop if a held call hangs up. Otherwise, when the talent goes to that line, dial tones or reorder tones will be there, or, worse yet, the "please hang up now " message!



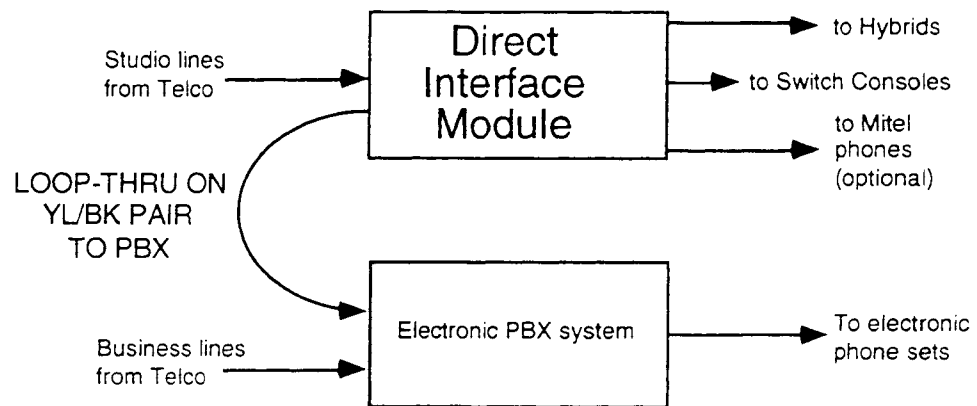
*Behind the PBX Approach #2:
Route all Lines Through Electronic System*

Behind the PBX Approach #3, an easy way for both systems to talk to each other, is to get Centrex® service from your phone company. Centrex® allows you to transfer lines to other Centrex® lines using hook-flash and 2, 3, or 4 digit "extension" numbers. This way you can keep on air lines and business lines separate, but still be able to send call from the air studio to the business PBX and send calls from the PBX to the air studio. Call your local phone representative for more details on Centrex®.

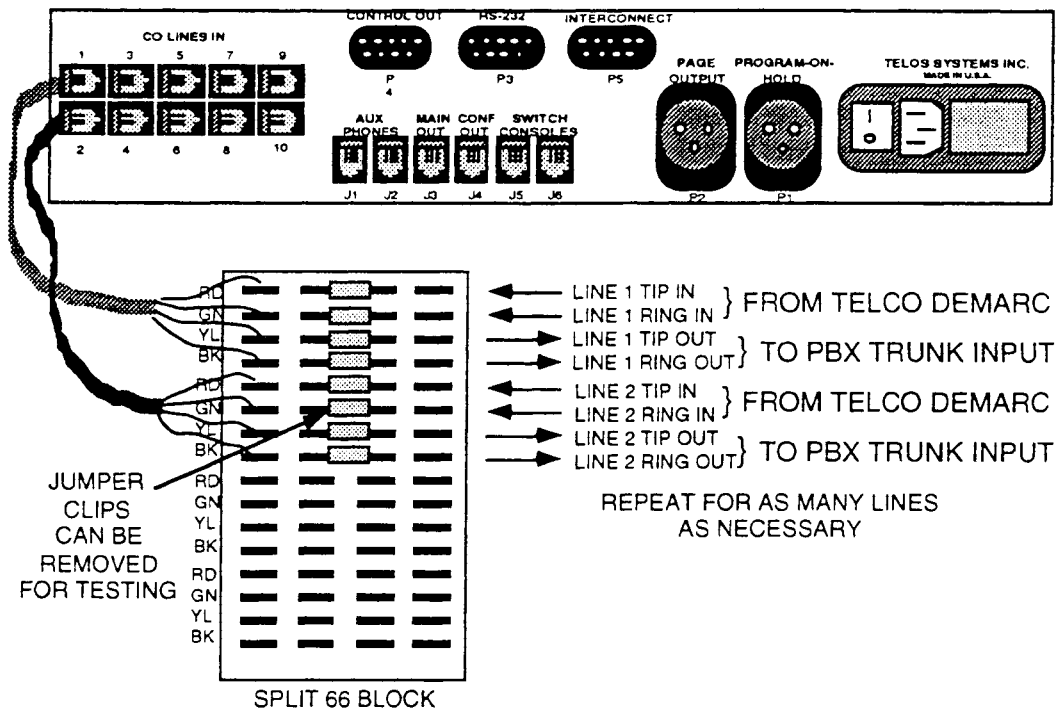
B. Looping through the Telos

This approach uses the Direct Interface's Y1/Bk (outer) pair on the CO line modular connectors to loop through to your PBX. Once connected to the PBX, all lines can be shared between systems. If a line is seized on the PBX the Direct Interface detects loop current and will light the appropriate button on the screener's phone and the Switch Console. *The Telos system cannot access any line that has been seized by the PBX first.* Any line seized by the Direct Interface will pull the tip/ring pair away from the PBX so that on-air calls cannot be disturbed by other phone users.

The Direct Interface knows when a line is off-hook on the PBX because it has current sensing circuitry on the line card. Thus, the Telos LINE buttons will be illuminated solid (indicating a simple off-hook). If the PBX puts a line on hold, the Direct Interface will still keep the LINE button illuminated solid, since it can't differentiate electrically between talking and being "on hold." (The "talk" and "hold" circuits both draw loop current!) Use a 66-block and punch down the Yl/Gn/Rd/Bk wires for each line to make interconnection easy. Refer to the diagrams below and on the next page for details.



Looping CO lines through the Direct Interface to the PBX



Using a split 66-block to wire the Direct Interface's loop through

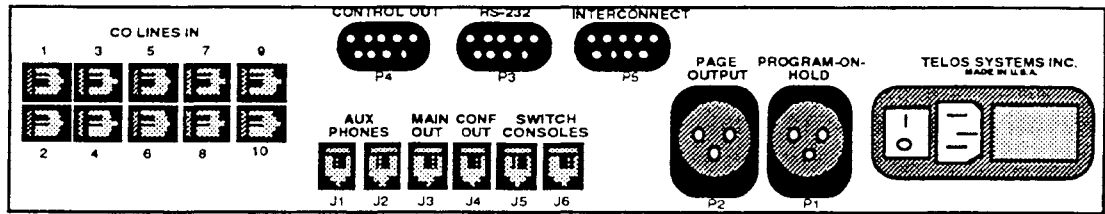
C. Yet another approach - simple paralleling

If supervision is not required, the Telco line may be simply paralleled to the PBX and Telos. Keep in mind that the Telos Direct Interface will NOT know when shared lines are off-hook or on hold from the other PBX. This may cause unintended interruption of calls on the air, calls being screened, and so forth.

2.2 REAR PANEL CONNECTIONS (OTHER THAN TELCO)

On the rear panel of the Direct Interface Module there are 16 six-position/six-contact RJ11C-sized modular plugs, one male DB-9 connector, two female DB-9 connectors and the AC receptacle.

The ten RJ11C modular jacks marked 1-10 under CO LINES IN are for connection of the telco lines as already described.



J1 & J2 - Aux Phones

The two RJ11C jacks labelled *AUX phones* are used for the Mitel[®] Superset 4 phones. Generally, these would be used for call screening or other off-air conversations. Standard two (or four) conductor modular cables are required. For these phones, voice, data, and power are combined on a single pair.

J2 should be used for the Superset inside the air studio as the phone connected to J2 can be made to mute when the studio mics are on. See the description below for remote connections to P4 for details on the muting function. The Superset connected to J2 will not warble for incoming lines ringing when the mute input is active.

A standard single-line desk phone may be used in place of the Mitel phone on J2. Now the Telos Switch Console becomes the line selector. When the phone handset is lifted off its cradle any lines active on the main hybrid will be routed to that phone automatically. The hybrid system will be restored if any lines are still active on the main hybrid when the handset is returned to its cradle.

J1 should be used for the call screener phone that will normally be outside the air studio since it will not be affected by the mute function.

J3 & J4 - Main and Conference Audio Outs

These are for telephone audio which go to the hybrid(s). In single hybrid systems, the MAIN OUT jack will be active for calls which have been selected from either the main or conference banks. In dual hybrid systems, the MAIN OUT contains only the calls which have been selected on the main bank. The CONF OUT jack will have audio from lines selected on the conference bank. A standard two (or four) conductor modular cable is used for the hybrid connection. When using a Telos hybrid, the appropriate jack at the hybrid end is the one labeled LINE.

J5 & J6 - Switch Consoles

The two rightmost modular connectors are for Switch Consoles or console mounted control surfaces. You plug your Telos Switch Consoles or console panel into either of these jacks (they are in parallel) using the six-conductor cord provided. *You must use 6-wire modular cables for the console connection; standard 4 wire cables will not work. The cables that come with the Switch Consoles are labeled indicating which end should be connected to the Switch Console and which is connected to the Direct Interface Module. See the Appendix of this manual for more information on how the modular cables are wired.*

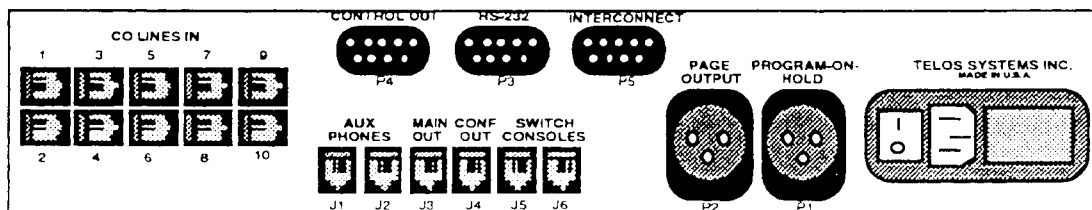
Each Direct Interface module is capable of powering a total of two drop-in console panels or five desktop consoles (the newer, molded plastic style). An external Local Power Supply may be used if more panels and/or consoles are desired.

The maximum cable length from the Direct Interface Module to the desktop control surfaces is 100', using the shielded flat phone-style cable provided by Telos. The Switch Console has local regulation, so cable voltage drop will not affect illumination until the drop-out point is reached.

The drop-in console panels will work at a maximum distance of 25', owing to the greater voltage drop caused by the power consumption of the incandescent lamps used in these panels. If distances of greater than 25' are required, use the Local Power Supply. Installation of the Local Power Supply is detailed in the Appendix of this manual.

A 25' cable to connect the Direct Interface Module to a Switch Console is provided with each Switch Console. Cables of other lengths can be made from components available from telephone suppliers. *If you are making your own cable, be certain the cables' two plug tabs are on the same side of the cable as shown in the diagram in the Appendix. Note that this causes a reversal of the pins from end to end.*

The Section 3.2 has details on operation of the Switch Console.



P1 - Program-On-Hold Input

This is a female XLR connector for your music or program to be fed to callers that are on hold. It is an active, balanced, 10K Ω input that will accept program levels from between -20dBm to +4dBm. An AGC circuit maintains consistent levels to callers on hold for any input level within this range. The front panel Program-On-Hold Level LED indicates the presence of input. There is no gain control since the AGC has a very wide range to accommodate whatever level you might have.

If you prefer, the AGC may be bypassed. There is a jumper (with obvious labelling) inside the Interface unit. Move it to the AGC bypass position for a direct connection.

P2 - Page Output

This is a male XLR which provides an output when the PAGE button on either Mitel Superset phone is pressed. It may be used to feed the building paging system, for announcer cueing, or for any other purpose. This output is transformer balanced and provides a level of approximately -10dBm.

P3 - RS-232

Using a male DB-9, this is the standard RS-232 serial port. Telos' Call Screen Manager software, designed for producer-to-talent communications, utilizes this port. It uses the standard IBM AT style scheme for serial communication. Section 3.4 of this manual covers RS-232 application and has details on the pin-out, data protocol, etc.

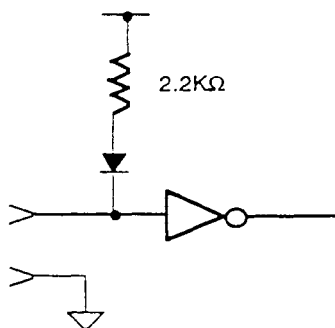
P4 - Control

This is a female DB-9 connector which provides the on-off control information to the hybrids, as well as the user button outputs. All outputs are open-collector closures to ground. The pin-out is detailed below.

This connector also has the "mute" input, which is active low. The mute input pin will accept either a voltage or a closure to ground. Voltage in the range of +5VDC to +24VDC is OK. With either closure or voltage input, a low signifies a mute condition.

P4 - CONTROL Pin-Out

- 5 Main Hybrid OFF
- 9 Main Hybrid ON
- 4 Conference Hybrid OFF
- 3 Conference Hybrid ON
- 2 Mute Input
- 7 Record Start
- 8 Record Stop/User Output
- 1 Delay Dump/User Output
- 6 Ground



Mute Input Circuit accepts either voltage or closure.

P5 - Interconnect

The DB-9 connector provides interconnect between Direct Interface Modules when more than one is being used. These are simply paralleled to each unit using a ribbon cable or shielded pairs. The system interconnect is not supported in the version of firmware current at the time of this writing.

AC Receptacle

The AC receptacle is a combination line filter/fuse holder/on-off switch.

2.3 INTERNAL ROTARY SWITCH

The screwdriver adjusted rotary switch inside the Direct Interface Module box tells the system firmware how many hybrids are being used. The firmware supports up to ten phone lines and one or two hybrids. The default setting is "0."

**USE POSITION "0" FOR ONE-HYBRID SYSTEMS.
USE POSITION "6" FOR TWO-HYBRID SYSTEMS.**

2.4 INTERNAL 4-POSITION DIP SWITCH

The Direct Interface also has a 4-position DIP switch to provide extra options. These switches are shipped from the factory OFF for default operation. The firmware incorporates the following functions:

Dip #1 - "Locked-on" Conferencing

OFF: The factory setting for this DIP Switch is OFF, so that the "locked-on" conferencing feature is active. (See Section 3.2 for details on this feature.) Double-pressing any LINE button on a Switch Console or console mounted control surface will lock the line on, and the LED indicator will stop flashing and remain lit.

ON: This will deactivate the "locked-on" conferencing feature. Double-pressing any LINE button will not lock the line on, nor will the LED indicator stop flashing and remain lit. If any other LINE button is pressed, the previous line will be dropped. HOLD and OFF will function normally.

Dip #2 - FLASH/NEW and AUTO-ANSWER

OFF: This is the factory default setting and will make the button third from the left below the LINE buttons of a Switch Console the FLASH/NEW button. All lines that are seized on the MAIN hybrid will be broken for 500 millisecond (locked-on or not). Used for PBX or Centrex phone lines which require this for feature access. Also useful for dropping a line when a wrong number is dialed or if many calls are to be made on the same line.

ON: Activates the AUTO-ANSWER feature. When lines ring into the Direct Interface Module, they will automatically be answered and placed on hold. Once on hold, the callers will hear your Program-On-Hold source. This feature is useful in some applications where there is no one screening calls, in distance learning, and in teleconferencing. The third button from the left below the LINE buttons of the Switch Console will turn this feature on and off. If you are using a dual 10-line console mounted control surface, refer to the manual for the panel for information on how to toggle this feature.

Dip #3 - Tone or Pulse Dialing

OFF: This is the factory default and causes the phone pads on any Switch Consoles, console mounted control panels, and Mitel® phones connected to the Direct Interface Module to dial out using DTMF Touch Tones®.

ON: This causes the phone pads on any Switch Consoles, console mounted control panels, and Mitel® phones connected to the Direct Interface Module to dial out using "rotary pulses." Please note that the Mitel phones will produce both DTMF and pulse output on the line, so you must ensure that the phone line does not see the DTMF - or there will be a "doubling" of each dialled digit.

Dip #4 - Aux Phone Port Configuration

OFF: Configures system for a Mitel® Superset to be connected to the Aux Phone 2 (J2) port. This is the setting set at the factory.

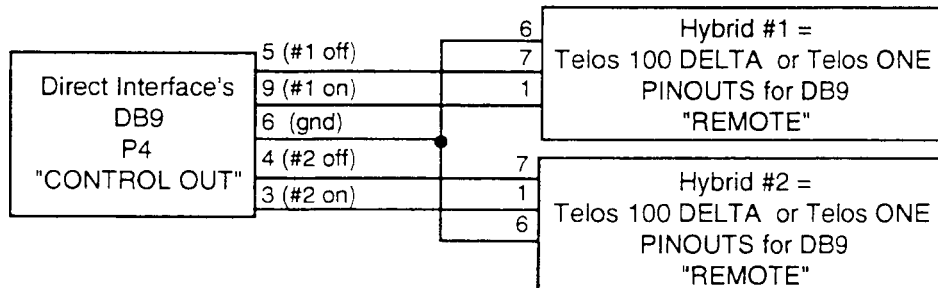
ON: Configures system for a standard single-line desk phone to be connected to the Aux Phone 2 (J2) port rather than a Mitel Superset.

2.5 SYSTEM CONFIGURATION

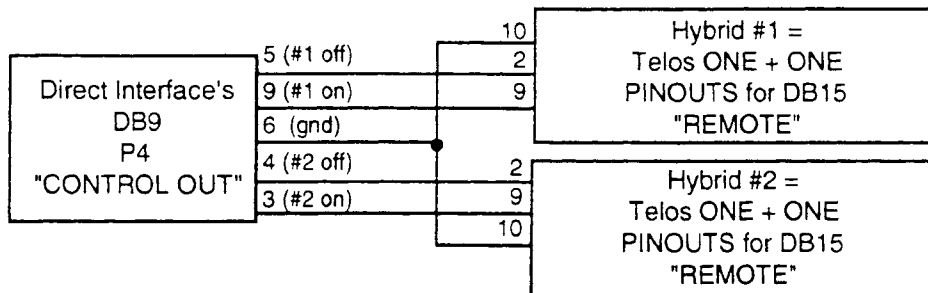
Systems with the Direct Interface module may have up to 10 lines and as many as 2 hybrids. Connection is straightforward. The illustration on page 19 shows one of the many possible configurations.

The steps to implementing a system are as follows:

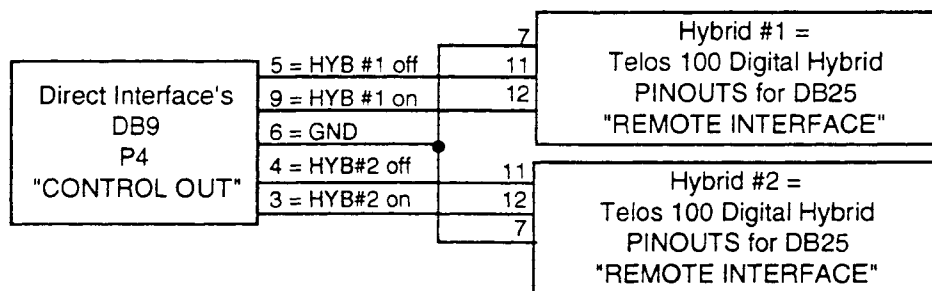
- 1) Connect your phone lines into the RJ11C jacks marked 1-10. These ports have a one-to-one correspondence with the LINE buttons on the Switch Console. Choose carefully which lines you'll want to be #1, #2, etc. If another phone system must share phone lines, refer to Section 2.1 of this manual.
- 2) Plug one or two Switch Consoles or console mounted control surfaces into J5 or J6. Section 2.2 of this manual has more information on this connection.
- 3) Connect the audio to the hybrid(s) using standard modular cables. MAIN OUT (J3) goes to the Main Hybrid's LINE jack. If two hybrids are being used, CONF OUT (J4) goes to the Conference Hybrid's LINE jack. See Section 2.2 of this manual for more information.
- 4) Connect the hybrid on/off control functions from CONTROL OUT (P4) to the hybrid control connector(s) using the charts below. Be sure you know which hybrid(s) you have before making the cable up! Refer to the pin-out chart on page 14 and the manual for your hybrid for information on creating cables for hybrids not listed.



*Connection Scheme for Hybrid Control Functions
Using Telos 100 DELTA or Telos ONE hybrids*



*Connection Scheme for Hybrid Control Functions
using a Telos ONE plus ONE hybrid*



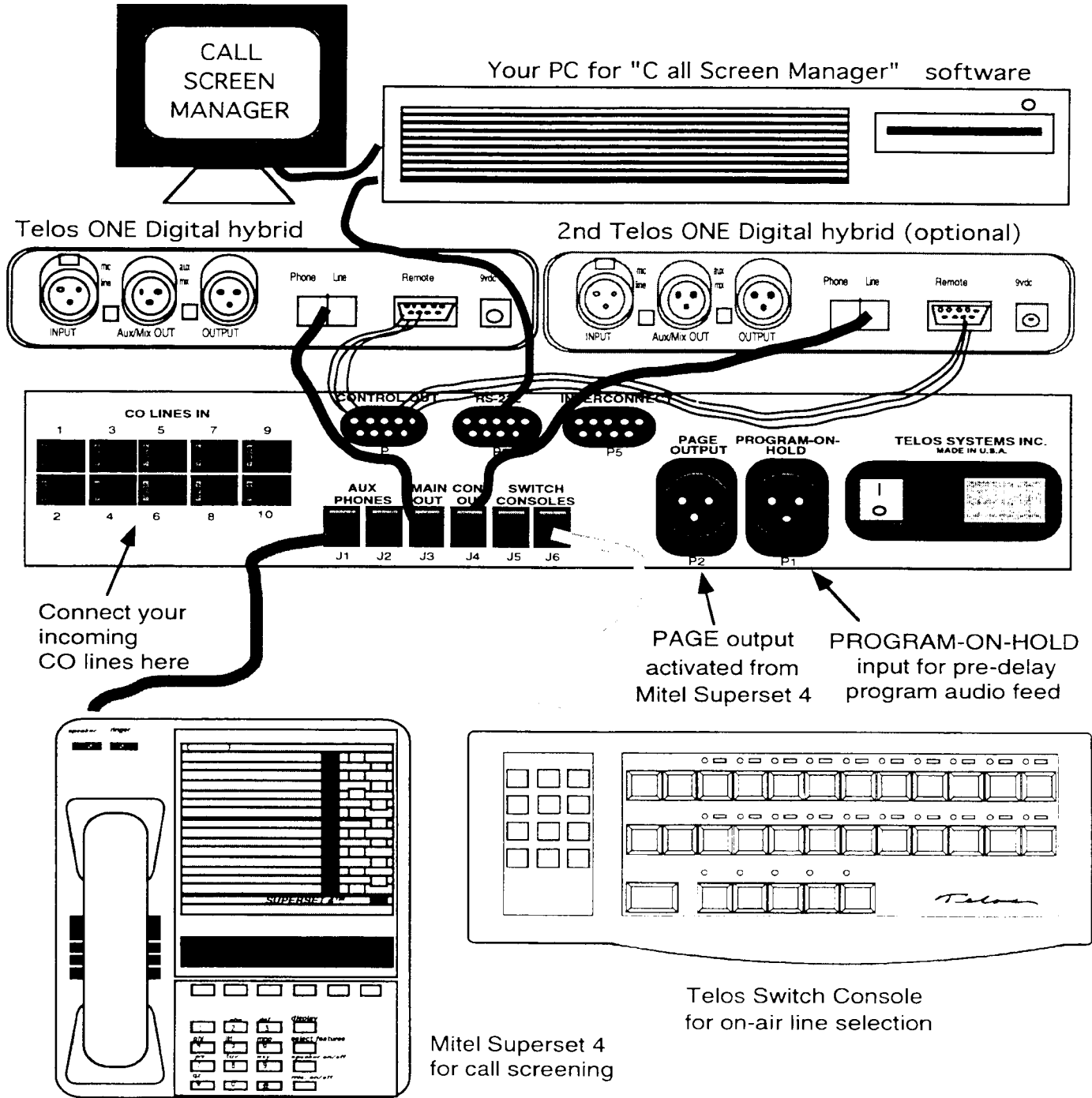
*Connection Scheme for Hybrid Control Functions
using Telos 100A hybrids*

Connection Scheme for Hybrid Control Functions

- 5) If used in your system, connect Mitel® Superset 4 phone(s) to one or both of the AUX PHONE (J1 or J2) jacks using a standard modular cable. As discussed earlier, a standard single-line phone can be connected to J2 as an option.
- 6) If used with your system, connect a computer to the RS-232 port. Refer to Section 2.2 of this manual and the manual that came with your computer for details on creating a cable with the correct connections.
- 7) Set the rotary switch inside the Direct Interface module to the appropriate position. If one hybrid is being used, the switch should be set to position #0; if two are being used, position #6.

Telos Digital Hybrids (top) & Direct Interface (below)
rear panel interconnections

NOTE: Hybrids can be Telos ONE, Telos 100 Delta, or Telos ONE + ONE
 (Two Telos ONEs shown)



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SECTION 3
OPERATION

3.1 GENERAL

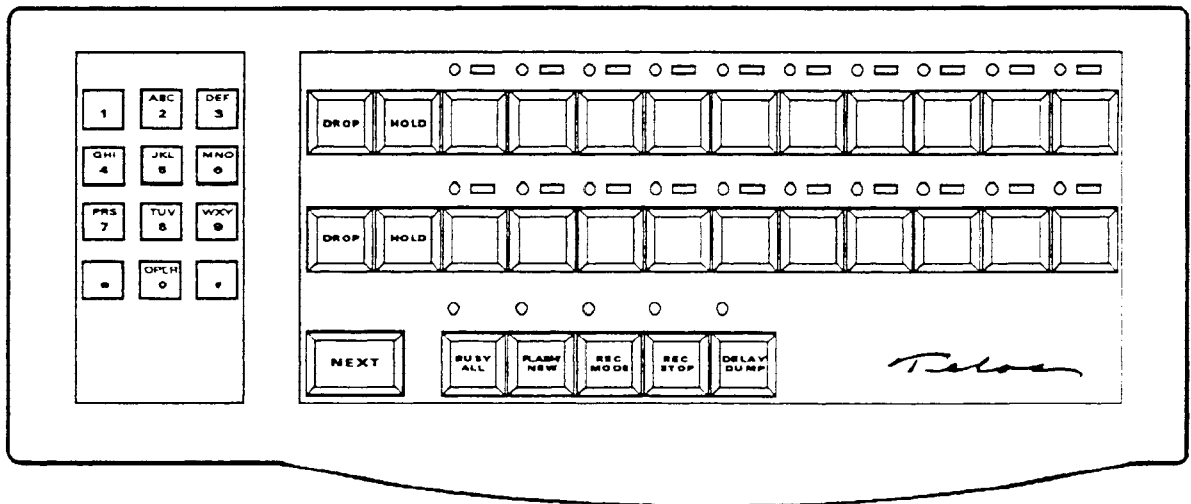
Users interact with the system using Telos switch consoles or console mounted control panels, optional Mitel® Superset 4 electronic feature phones, and/or a computer system connected to an RS-232 serial port running software such as our Call Screen Manager. Details follow on Switch Console and Mitel phone operation. While some information is provided for console mounted panels and Call Screen Manager, please refer to the manuals included with these products for comprehensive instructions.

3.2 THE SWITCH CONSOLE

The information below refers to the latest model of the Switch Console. Please see the note in Section 1.2 of this manual if you have the older version.

3.2.1 GENERAL

The Switch Console is the primary user interface. It provides pushbuttons for line selection and control, a "tone dialing" pad, and buttons for special functions that ease and enhance call-in programming.



The Switch Console communicates by sending and receiving serial data over a “skinny wire” data link. The Switch Console sends data to the Direct Interface Module when a key press occurs and receives commands from the Direct Interface Module to illuminate the appropriate LEDs as determined by the Direct Interface’s firmware.

When the Switch Console is first plugged into the Direct Interface Module, its indicator LEDs will at first all be illuminated and then will be refreshed to the current system and phone line status.

3.2.2 TOUCH TONE PAD®

A standard keypad is provided so that outgoing calls may be placed from the Switch Console. The actual DTMF Touch Tone® generation in response to the keypad is provided by the Direct Interface Module. An internal DIP switch adjustment in the Direct Interface Module, described in Section 2.4, allows pulse dialing where Touch Tone® dialing is not available.

To dial out, select an available line on one of the LINE buttons and dial.

3.2.3 LINE BUTTONS AND LED INDICATORS

Operation for line selection, holding, etc. is very similar to the familiar key phone sets. The maximum number of lines is ten. When two hybrids are connected to the Direct Interface Module, the top row of LINE buttons corresponds to the MAIN hybrid and the bottom row to the CONFERENCE hybrid.

There are two LEDs above each line selection button to indicate status of each of the phone lines and hybrids you have connected to the Direct Interface Module.

LINE Buttons

Each row of LINE buttons has a DROP button, a HOLD button, and ten LINE selection buttons. During installation, up to ten phone lines may be connected to the Direct Interface Module and they appear on both rows. The DROP and HOLD buttons affect only the row of LINE buttons on which they are located.

Bar LED Indicator

Above each line selection button is a bar LED to indicate line status. LINE status can be affected by pushing a LINE button on the Switch Console or from a Mitel phone, a connected computer, or an external phone system connected to the Direct Interface Module. The bar LED will therefore always reflect the true LINE status.

Information is provided by both the flash rate of an LED and its brightness.

Bar LED Status

Slow Flashing
Rapid Flashing
Bright Rapid Flashing
Solid
Off

LINE Status

Ringing
On Hold
Screened Hold
In Use
Not in use

Screened Hold

From a Mitel phone or Call Screen Manager software, a producer may place calls on hold. To help the on air talent differentiate among lines on hold, both a standard hold and a Screened Hold feature can be selected by the producer with a push of a button. The added brightness of the bar LED when Screened Hold is selected helps the talent choose the correct caller. See Section 3.3 for details on selecting Screened Hold from a Mitel phone.

Round LED Indicator

Above each line selection button is a round LED to indicate hybrid status

Round LED Status

Flashing
Solid
Off

Hybrid Status on Indicated Line

On air, standard mode
On air, conference mode
Not on air

3.2.5 PLACING CALLERS ON AIR

Placing Callers On Air in Standard Mode

To place a caller on air, push the appropriate LINE button for the phone line on which the caller is located. The round LED will flash and the bar LED will be solid. The line may be dropped or placed on hold using the DROP and HOLD buttons on the row you have selected. If you select another line on the same row, the line selected earlier will be dropped unless the line is placed in conference mode.

Placing Callers On Air in Conference Mode

Pushing a LINE button once places it on air. Pressing the LINE button a second time will place that line in the conference mode. The DROP and HOLD buttons will have no effect on a line in conference mode. If another line is selected on the same row, the line in the conference mode will remain on the air. When the LINE button is selected a third time, the LINE reverts to the standard mode.

The ability to place lines in conference mode may be disabled by a DIP switch inside the Direct Interface Module. See Section 2.4 for details.

Tips for Conferencing

Select your first caller from the top row of the Switch Console and the second caller from the bottom row. This should be your procedure whether you are using one or two hybrids.

If you want to keep a caller on air and add more callers, put the original caller in conference mode to avoid accidentally hanging up on him/her.

Although audio quality may decline, you can have more than one caller on a single hybrid. To accomplish this, place a caller in the conference mode and then select one or more callers from the same row of LINE buttons on the Switch Console. When performing this "button mashing" your callers may not hear each other very well.

3.2.5 SPECIAL FUNCTION BUTTONS

There are six special function buttons below the line selection buttons. From left to right, these function buttons are:

NEXT

Selects the line that has been ringing-in the longest. If no lines are ringing-in, it selects the line on hold the longest. This function is frequently used when the talent takes calls without a screener or producer.

BUSY ALL

With the first press of this button, all lines that are neither in use nor on hold are made busy. On the second press, those lines are dropped.

This function is helpful in preventing callers from jamming your phone lines just prior to your accepting calls for a contest.

The LED above BUSY ALL is normally lit. When the BUSY ALL button is pushed, this LED will blink. All of the LEDs above the LINE buttons for lines that have been busied will flash with a unique cadence. When the BUSY ALL button is pushed the second time, LED status reverts .

Creating a Custom Busy Pattern

By default, all ten lines are busied. However, it is possible to create a custom pattern of lines to be busied.

First, enter the special busy set-up mode by pressing in sequence: [*][*][#][#][BUSY ALL]. The LED above the BUSY ALL key will flash. Select the lines you want to be busied by toggling the line buttons on the *upper* row. Any line can be added or removed from the busy function by pressing its button again. When you have the pattern that you want, press the BUSY ALL key again to leave the special set-up mode. The software will save your set-up until it is reprogrammed.

FLASH/NEW or AUTO-ANSWER

The FLASH/NEW button is primarily for use with PBXs or Centrex® telco lines which require flashing to access features. Pressing it causes a 500 millisecond interruption on any active lines.

The FLASH/NEW button can also be used for a dropping a line - that is, to hang-up a line and get dial tone back on the selected line without going through the

usual OFF and LINE button press sequence. This button is useful for dropping a line when a wrong number is dialed or if many calls are to be made on the same line.

The function of this function button, third from the left, may be changed by an DIP switch inside the Direct Interface Module. (See Section 2.4.) With DIP #2 on, the AUTO-ANSWER feature is toggled when the console auto-answer button is pressed. The enabled condition is indicated by the LED above the button flashing. When enabled, the system automatically answers lines that ring into the Direct Interface Module (after about three rings) and places them on hold. Once on hold, the callers will hear your Program-On-Hold source. This feature is useful in some applications where there is no one screening calls, in distance learning, and in teleconferencing.

RECORD MODE

The record mode enables you to conveniently start and stop a tape recorder which is being used to record telephone calls. To ready the RECORD MODE, push the button once. The LED above the button, normally solid, will blink. The next time you press a LINE button, the RECORD START output on the Control connector on the back of the Direct Interface Module will be pulsed. (See Section 2.2.) This output can be used to start the recording device. The RECORD STOP output is pulsed when the DROP button is pressed.

RECORD STOP

When this button is pushed, the RECORD STOP output on the Control connector on the back of the Direct Interface Module will be pulsed. (See Section 2.2.) This output can be used to stop a recording device or for any other desired function.

DELAY DUMP/USER BUTTON

This button provides a pulse closure to ground on the DELAY DUMP/USER output of the Control connector on the back of the Direct Interface Module. (See Section 2.2.) This may be used to control a delay system or for any other desired function.

3.2.6 CHANGING BUTTON LEGENDS

The LINE buttons are labeled by inserting a legend under a clear lens. *When changing the button legend, remove the entire button cap, place the cap on a flat surface, and then remove the clear lens. This will prevent damage to the button and the lens.* Buttons are removed by careful lifting. No special tool is required. Gentle prying with your fingernail or thin blade is all that is required to remove the clear lens.

Telos includes a sheet of common legends which may be cut and placed into the appropriate LINE button caps. You may create your own legends quite easily. Imprinted button caps are provided for the function buttons. If you have dedicated a function for which an imprinted button cap is not provided, you may use one of the extra LINE button caps provided with your own legend inserted. LINE buttons and function buttons (with the exception of the NEXT button) have interchangeable caps.

3.2.7 USING A STANDARD DESK-SET PHONE IN THE STUDIO

The phone connected to Aux Phone jack J2 may either be a Mitel Superset electronic phone or a standard single-line desk-set instrument. An internal DIP switch selects the mode (Section 2.4). The default, OFF mode is for the Superset.

If the DIP switch is set for a standard telephone and the phone is connected to Aux Phone modular jack J2, it may be used to talk to callers who have been selected on the Switch Console. When this phone is off hook, the system routes the selected line(s) from the MAIN bank (top row) to the phone and removes the feed to air. The hybrid is turned off. When the phone is replaced on hook, the on air feed is restored and the hybrid is turned back on.

3.3 CONSOLE MOUNTED CONTROL PANELS

Telos provides console and turret mounted panels for a variety of models from several major broadcast manufacturers such as Pacific Recorders & Engineering and Broadcast Electronics. These panels operate in a manner very similar to the desktop Switch Console. For more details on their operation and installation, refer to the manual included with the unit you purchased.

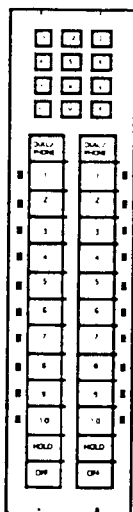


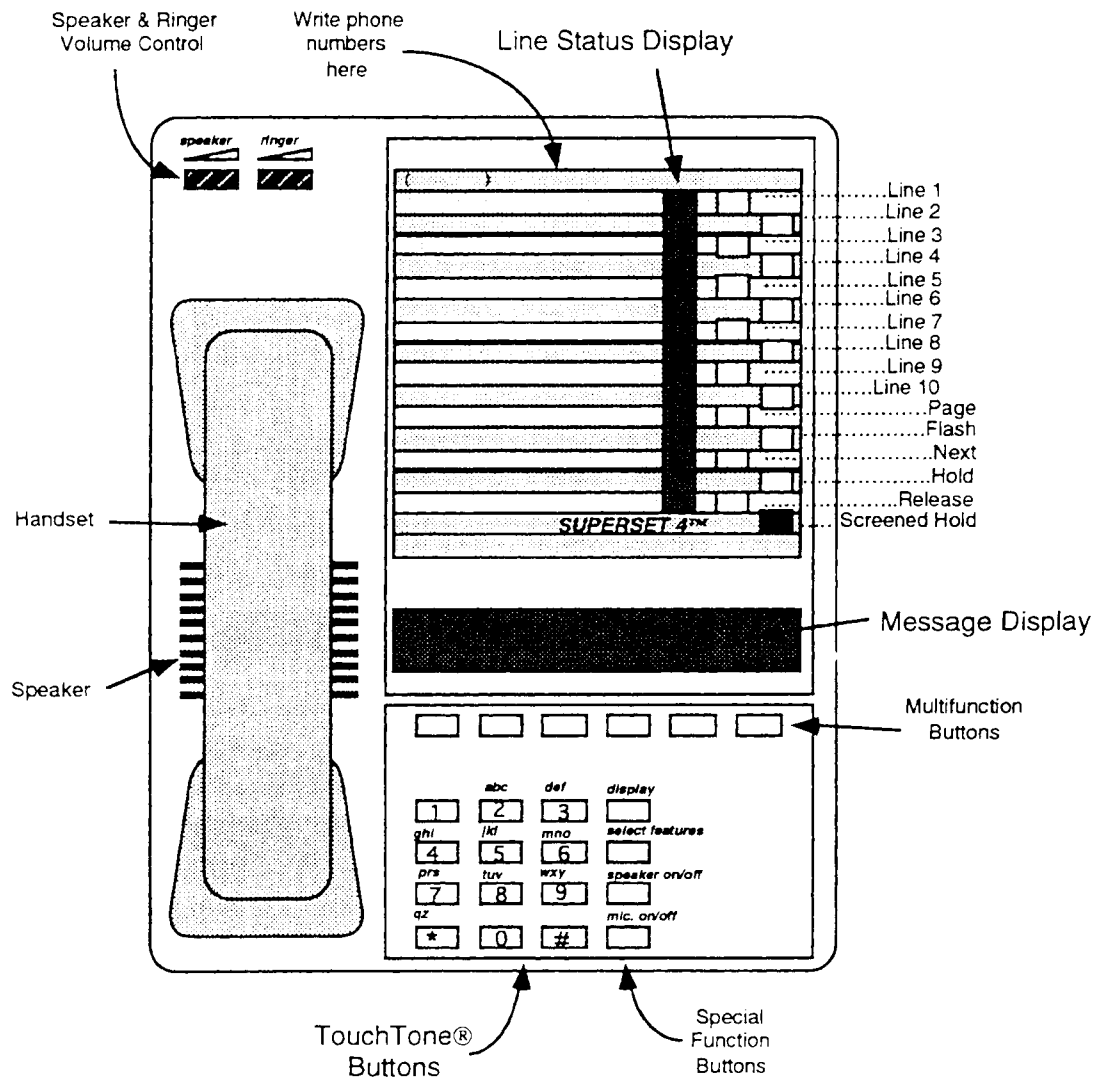
FIG. 10. Line Panel for MIT 4

3.4 THE MITEL® SUPERSET 4

The Telos Direct Interface uses the Mitel® Superset 4 for the call screener's position or for the in-studio phone. The Superset is an advanced electronic phone with a number of features:

- 15 LINE buttons
- 1 red hold button
- An LCD display which indicates each line's status
- Another, larger LCD display (for pertinent messages)
- 6 multi-function buttons (below the large LCD display)
- the standard 12 Touch Tone® buttons
- 4 special function buttons (next to the Touch Tone® pad)
- 2 wheels for ringer and speaker volume adjust
- a handset

Detailed operating instructions follow. In the back of this manual is a set of instructions for non-technical personnel that you may wish to duplicate for those who will be using the phone.



There are two symbols used in the Line Status Display, the DOT and the SQUARE. The following chart shows how these symbols indicate different line conditions.

	DOT off - SQUARE off	Line is on-hook
	DOT blinking slowly	Line is ringing in
	DOT blinking fast	Line is on hold
	DOT on - SQUARE blinking	Line is off-hook on phone
	DOT on - SQUARE on	Line is on-air
	DOT on - SQUARE off	Line is off-hook on other Mitel

The LINE buttons

These buttons correspond directly to the line numbers 1-10. On each phone there is ample room to type the line number (*Line 5*), the phone number (*555-1007*) or description (*Hot Line, REQ #2, etc.*) next to each button. These buttons function as one would expect: press a LINE button, seize that line! If the handset is on its cradle, the speakerphone will activate automatically. Any line seized by the Telos system will be protected from being seized by the Superset.

The PAGE button

Connects the phone audio to the page audio output. Normally used to feed the building PA system, but may also be used for announcer cueing or any other situation where an audio feed from the phone is desired.

The FLASH button

This button provides hook-flash to the line selected on the Mitel phone. This is useful when the call screener needs to access PBX options via hook-flash signalling (or if a wrong number is dialed!).

The NEXT button

When this button is pressed, the Mitel phone will seize the line that has been *ringing in* the longest.

The HOLD button

Pressing this button when any line is seized will put that line on hold and feed the caller program-on-hold audio (if connected).

The OFF button

Pressing this button when any line is seized will disconnect that line.

The SCREENED HOLD button

Pressing this button when any line is seized will put that line on hold and feed the caller program-on-hold audio (if connected). The indicator LED on the Switch Console will blink more brightly than calls placed on hold using the standard HOLD button as a way to call special attention to screened calls.

The line status LCD display

The vertical display next to the LINE buttons. It gives each line's status: off-hook, on hold, on air, etc. The chart on the previous page shows the line modes and the corresponding display indication.

The alpha-numeric LCD display

This display gives messages for use by the producer, such as “on-hook,” “off-hook,” time of calls that have been placed on air, display of numbers that are being dialed out on the Superset, status of the multi-function buttons, mic on, mic off, speaker on, speaker off and so forth.

To access the **on air call timer**, press the special function button marked DISPLAY.

The multi-function buttons

The first (leftmost button) sets the ringer volume to loud or soft. The actual ultimate volume is determined by a combination of this setting and the RINGER volume adjust wheel. Only this multi-function button is supported; the others have no effect when pressed. The default setting is for loud ringing.

The Touch Tone® buttons

Note that unlike many electronic phone systems, you hear real touch-tones in the receiver. See Section 2.4 if you require pulse dialing.

The special function buttons

As noted above, the DISPLAY button calls up the on air call timer. The large LCD display will indicate how long the current on air line has been on air. Pressing the SELECT FEATURES button gives the Telos firmware ID. SPEAKER ON/OFF and MIC. ON/OFF control the Superset speakerphone speaker and microphone respectively.

The speaker & ringer wheels

These two controls (located above the handset) set the speaker and ring warble volumes.

The handset

If the handset is lifted off the cradle while the speakerphone is in use, the speakerphone will be disabled. When replaced in its cradle, any active line will be released (if no other button is pressed first).

3.5 RS-232 SERIAL PORT

The RS-232 serial port can be used for computer control of the telephone system. Full status and control are available via this port. The communication protocol is very simple and should be easily accommodated by any computer/software system. Please let us know what you come up with!

Telos Call Screen Manager is an elegant software package implementing the Direct Interface's line status information from its RS-232 port. Other third-party vendors also have software designed specifically for use with the Direct Interface Module.

```
L 1: Name :Mark Dooner  
TIME  Town :La Palma  
3:10 Subject :Baseball  
  
L 2: Name :Linda LaRue  
HOLD  Town :Carson City  
      Subject :Moving to Tampa  
  
L 4: Name :Bob Stray  
HOLD  Town :Huntington  
      Subject :Pitching  
  
L 3:  
OFF  
  
L 5:  
OFF
```

Messages To The Talent

Host Screen of Call Screen Manager

3.5.1 PORT CHARACTERISTICS

The port connector is a standard IBM AT-style male DB-9. Cables may be easily fabricated or may be obtained from a well-stocked computer store. The physical protocol is as follows: 8 bits, 1 Stop Bit, No Parity, 1200 Baud.

P3 - RS-232 Connector Pin-Out

- 3 TX (Transmit from Telos to computer)
- 2 RX (Receive from computer to Telos)
- 5 GND (Ground)
- 4 DTR (Indicates when Telos is transmitting - usually not required)

3.5.2 DATA PROTOCOL

Computer-to-Telos Commands

All commands are ASCII characters so that any terminal program such as Crosstalk for the PC or Red Ryder for the Mac may be used to exercise the port.

Each command begins with a capital letter and is followed by a 2-digit line number (XX) where appropriate. Line numbers begin with Line #1 = 00.

<u>O</u> FF XX	Turns line XX off.
<u>O</u> N XX	Turns line XX on to the main bank.
<u>H</u> OLD XX	Puts line XX on hold.
<u>S</u> CRNED HOLD XX	Puts line XX in "screened hold" mode.
<u>C</u> ONF XX	Turns line XX on to the conference bank.
<u>L</u> OCK XX	Equivalent to switch console "double press."
<u>T</u> ONE XX	Dials tone XX to on-air line. 11 = *; 12 = #.
<u>Q</u> UERY XX	Causes Telos to return line status in format given below.
<u>U</u> XX	Virtual press of function button on console. BUSY -> DELAY/DUMP = U00 -> U04. NEXT = U05.
<u>P</u> XX	Virtual press of button on Mitel #1.
<u>Q</u> XX	Virtual press of button on Mitel #2.

XX	Mitel Function
00 - 09	Takes lines 1 - 10
10	Page
11	Flash
12	Next
13	Hold
14	Drop
15	Screened Hold
20-30	DTMF Buttons 0 - 9
31	DTMF *
32	DTMF #

<u>X</u> ternal	Causes all function keys to transmit to computer only - the functions are not actually performed unless the computer echos them. This permits the buttons to be used for various computer-related functions, or for computer intelligence to intervene in their processing. This command must be sent in intervals of one minute to maintain the mode; the DIM will revert to normal mode after time-out
-----------------	--

<u>R</u> eset Xternal Mode	to prevent problems with computer being turned-off, etc. Function keys back to normal operation.
<u>M</u> onitor	Causes Telos to return line status in format given below whenever any line status changes. Replies with: Line monitor ON.
<u>D</u> on't Monitor	Turns monitor mode off. Replies with: Line monitor OFF.
<u>I</u> nitialize	Sets all lines to off, etc.
<u>2</u>	Returns a status screen. Primarily for debugging, testing, etc.

The **bold** and underlined letter in each command is the only one which is sent. Line numbers must be padded - that is, they must always be two digits. Be sure to send CAPITAL letters!

Examples:

- To put a line 1 on hold, send "H00"
- To request line 5 status, send "Q04"
- To place in monitor mode, send "M"

Telos-to-Computer Commands

The line status is returned from Telos to the computer in the following format: a capital letter indicating the status followed by two digits indicating the line number.

<u>O</u> FF XX	Indicates line XX is off.
<u>O</u> N MAIN	XX Indicates line XX is active on main bank.
<u>H</u> OLD XX	Indicates line XX is on hold.
<u>S</u> CREENED HOLD	Indicates line is in "Screened Hold" mode.
<u>C</u> ONF XX	Indicates line XX is active on conference bank.
<u>B</u> BUSIED XX	Indicates line XX has been "busied-out."
<u>P</u> XX	Indicates line XX is being screened on Mitel phone #1.
<u>Q</u> XX	Indicates line XX is being screened on Mitel phone #2.
<u>E</u> LSEWHERE XX	Indicates line is on "elsewhere." (Detected from loop I).
<u>R</u> INGING	Indicates line is ringing-in.
<u>U</u> XX	Indicates press of function button on console.
	BUSY -> DELAY/DUMP = U00 -> U04. NEXT = U05.

SECTION 4
THEORY OF OPERATION

4.1 OVERVIEW

Philosophy

In the past few years, the nature of broadcast engineering has changed considerably. At many stations, the engineering staff has been reduced in size and new responsibilities have been added. At the same time, equipment has gotten more complicated and specialized. Thus, many practitioners of the broadcast electronic arts are forced to become "systems" engineers, emphasizing equipment application rather than component-level troubleshooting.

This is probably a positive development, since it really would be impossible for a station engineer to fully understand the internal nuances of all the wonderful new high-tech stuff that is now available to improve station operations! Also, as equipment becomes more sophisticated and specialized, stocking spare parts for every eventuality has become difficult.

Thus, we at Telos don't really expect that much component-level troubleshooting will occur. So, to support you when you need help, we keep spare boards available for fast overnight shipping. In most cases, we will swap boards with you at no cost. We do not charge for most repairs.

However, despite the comments above, we do provide full schematics and component level troubleshooting information in case you have the need or desire to tackle a repair (or modification) yourself. Another reason we provide the information is to satisfy your curiosity. If you are like us, you probably just have to know what's happenin' inside that fancy box. So we tell you.

General Troubleshooting Information

Removing the Line Cards

The five line cards are held in position with a retaining bar. In addition, the modular jacks protrude a bit through the rear panel and are held in place by it. In order to remove the line cards, it is best to loosen the rear panel screws so that it can be pulled back a bit allowing the line cards to be unplugged.

Desoldering

While we socket the ICs that have the greatest potential for failure, many of the Direct Interface Module's ICs are soldered in. That's because most of the time the socket is more likely to cause trouble than the IC. This is of no consolation when one of the soldered ICs appears to have failed. When you need to replace a soldered in chip, the right tool is essential. We use a vacuum desoldering system

made by Pace (the MBT-100) and highly recommend it. Cost is about \$450 - worth it if you do much PC board troubleshooting work. The only other real alternative is to clip the leads from the top and remove the solder from the holes with solder-wick. We've not had much luck with the non-heated, manual vacuum desoldering devices like the one from Radio Shack. We do not recommend that newly-soldered connections be defluxed.

4.2 CIRCUIT DESCRIPTIONS

Notation

Whenever a slash (/) is used after a signal designation in the text or on the schematics, an active low is signified

The Microprocessor

As with most modern equipment, the Telos Direct Interface is based upon microprocessor control. The processor circuit is a very basic "textbook" system. The module uses the Intel 80C188 microprocessor as its "brain." The 80C188 is a highly integrated CMOS microprocessor with an 8-bit data bus interface and a 16-bit internal architecture, effectively combining 15-20 of the most common 8088 system components onto one chip. Running at 18.432MHz, the 80C188 provides considerable processing power. There are six memory chip selects, seven peripheral chip selects, four maskable interrupts, two timers and a CLKOUT pin to synchronize external devices. The processor comes in a 68-pin plastic leadless chip carrier (PLCC). *Please do not attempt to remove the processor from its socket without the proper removal tool, as this may damage the socket and the MPU itself.* (Use PLCC extraction tool available from Burndy, Cat. No. QILEXT-1).

The processor's 8-bit data bus is multiplexed with the lower eight bits of address and demultiplexed by a 74HC373. The upper eight bits of address are available directly off the processor and are fed directly into the 27C512 EPROM. Also on the data bus are one AMD Z85C30 Serial Communications Controller (SCC), a 4364C-20L SRAM (used in conjunction with a Dallas Semiconductor Smart@Socket), a 74HC374 (used to set up the data to the four Mitel 4x8 analog switches) and one Intel 8255 Programmable Peripheral Interface (PPI). A DS1232 provides processor reset in the event of a loss of power. Address lines A0-A2 are used to set up data to the relay drivers, both internal switches and the hybrid/user controls. A0 and A1 can also choose registers on the SCC and PPI. Address lines A3-A5 run two 74HC138 3-to-8 line converters which, in turn, deliver chip selects to the relay drivers, both internal switches and the hybrid/user controls.

The processor's Read line (RD/) is connected to devices on the bus it needs to get information from, i.e. the RAM, ROM, SCC and PPI; the Write line (WR/), to get information to devices, i.e. the RAM, SCC, PPI and so forth. The processor's Address Latch Enable (ALE) goes to the 74HC373 to demultiplex the addresses from the data. X1 and X2 provide the inputs for the 18.432MHz crystal oscillator. The CLKOUT pin drives the SCC and the two AUX phone cards at one half the crystal frequency.

The Programmable Peripheral Interface

Intel's 8255 PPI has two bit-programmable 8-bit I/O ports and one byte-programmable 8-bit I/O port. The 8255 connects to the data bus and uses A0 and A1 to select internal registers. These internal registers are used to configure the I/O ports. In the Direct Interface Module, PA0-PA7 and PC2-PC3 are used as input ports to detect loop current from the line cards. PB0-PB7 and PC0-PC1 are programmed as inputs to detect ring voltage from the CO on the line cards. PC4-PC7 are programmed as inputs for the BCD switch and 4-position DIP switch, which are used by the system firmware to differentiate among other Direct Interface Modules on the common Telos serial bus and configure the system (number of hybrids, etc.).

The Serial Ports

The AMD Z85C30 Serial Communications Controller (SCC) is used to interface serial data from the Switch Consoles, other Direct Interface Modules and other Telos equipment to the data bus. Since the device has two fully independent UARTs one is dedicated to the Switch Consoles; the other is for the RS-232 port. Each channel is supported by a Linear Technology LT1032 dual RS-232 driver/receiver which converts the TTL signals to the appropriate RS-232 voltage levels. Low-pass filters on the XMT, RCV, and DTR lines keep noise out of these lines. Address lines A0-A1 access different registers to set word length, parity, stop bits, baud rate and so forth. The SCC has its own peripheral chip select line (PCS2/). One input pin on the SCC (DCDA/) is used for the "mute" input.

Memory

The Direct Interface Module has its program stored in a 27C512 EPROM which is backed up by a 4364C-20L SRAM. The Dallas Semiconductor DS1213 Smart®Socket performs five circuit functions to battery back-up the SRAM. It provides power fail detection circuitry which will enable a switch to its internal lithium batteries. An internal comparator will decide which of the two batteries to use, based on which has a higher voltage. Every time the Smart®Socket is

powered up by Vcc, an internal comparator checks the battery. If the battery voltage is less than 2.0V the second memory cycle is inhibited. A simple read/write cycle can determine if data has been corrupted. Finally, if the power failure occurs when the Chip Enable line is active (low), the write protection will be delayed until the last memory cycle is completed. In the event of a power failure, the SRAM will remember what the status of the system was before the outage. When power is returned, all consoles on line will be returned to their previous state. The line cards will be immediately queried for its status and the system will then reflect any changes.

Audio Circuits

Audio from the phone lines is routed through a DPDT relay to a transformer on the line card. The transformer will draw loop current from the CO to tell the CO a line has been seized. The audio then is routed to a Mitel 4x8 Switch Matrix. The firmware will configure the appropriate analog switch to connect the line to

- a) the main hybrid bus,
- b) the conference hybrid bus,
- c) either of the two AUX phones, or
- d) the program-on-hold circuit. The hybrid busses are terminated into audio transformers which balance the audio for the hybrids. The AUX phone cards handle the unbalanced audio on board.

Each line has its own program-on-hold buffer, so folks on hold can't talk to each other. The program-on-hold circuit incorporates a PMI LH403 AGC chip to provide good level to those lines on hold. The input is active, balanced to accept levels between -20dBm and +4dBm. The front panel LED will "ride" with your Program-On-Hold source level. The AGC can be bypassed by moving the internal jumper JP1 to "AGC BYP." The last audio path to be discussed is the page output. The page output can be activated from either of the Supersets. (For a review of the Superset, see Section 3.4 of this manual.) When the PAGE button on the Superset is pressed the firmware connects that phone's audio to the page output (P2). This output is transformer balanced and will provide a nominal 0dBm to your in-house paging system.

Line Cards

Each line card handles two CO lines. A metal-oxide varistor (MOV) protects the unit from overvoltage conditions on the phone line. A diode bridge rectifier sends ring voltage to one optocoupler and loop current to another optocoupler. The DPDT relay loops the phone line to the yellow/black pair (for connection to other phone systems) on the normally-closed contacts. It feeds the phone line to a transformer when the system firmware energizes the relay. The transformer then sends the

dry, unbalanced audio to the audio matrix.

The Mitel Superset Cards

Each Aux Phone port is driven by its own daughter board. Each provides appropriate phone power, and creates and listens to the required serial data stream with a UART in combination with a special modem IC.

In the Mitel scheme data, voice, and power are all on the same two (red/green) wires. The board uses an Intel 82050 UART that sits on the parallel system data bus to generate and receive the serial data. The Mitel voice-over-data modem chip modulates and demodulates a 32kHz carrier (ASK) for communication to the Superset. The power for the phone is generated in a Maxim MAX641-based voltage boost circuit. Voltage from this circuit ranges from 30 to 48 volts depending upon the current load which varies depending upon the phone's operational condition.

Loop current is sensed by an optocoupler in series with the phone power supply.

The opamps are configured as a back-to-back hybrid to separate the send and receive signals and provide some gain. The top opamp Section (U3A) acts as a low-pass audio filter.

A Note About Firmware

The module's firmware is written in the high-level language "C." With processing power becoming relatively inexpensive, it no longer makes sense to write control code in machine language.

4.3 POWER SUPPLY

The power supply inside the Direct Interface Module is manufactured by Autec Power Systems of Simi Valley, CA. This 65W switching supply (Model No. UPS65-1004) has a universal AC input, accepting an input range of 90-264 VAC (continuous), 47-440Hz. Its outputs provides four separate voltages: a +5V supply which powers all the audio circuits; a +12V supply for the RS-232 and the Switch Consoles; a -12V supply for the -V rail of the RS-232; and a -5V supply for the audio circuits. The microprocessor and related ICs are also driven by the +5V supply, but a series inductor is inserted to keep the MPU noise out of the audio circuitry. A 3.3 Farad Gold Cap keeps the +5V rail up in the event of a power drop. A minimum load of 0.5A on the +5V rail and 0.1A on the +12V rail is required to maintain proper operation of the other outputs. MEASURING OUTPUTS WITH NO LOAD WILL YIELD MEANINGLESS RESULTS.

Here's a list of compliance standards for the Autec UPS65 Series:

FCC Class 'B' compliance

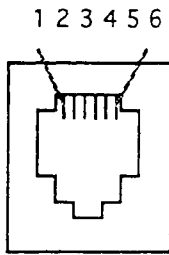
UL 1950 File No. E133148

CSA 1402C Level 3 File No. LR89164

VDE Approval to EN60950

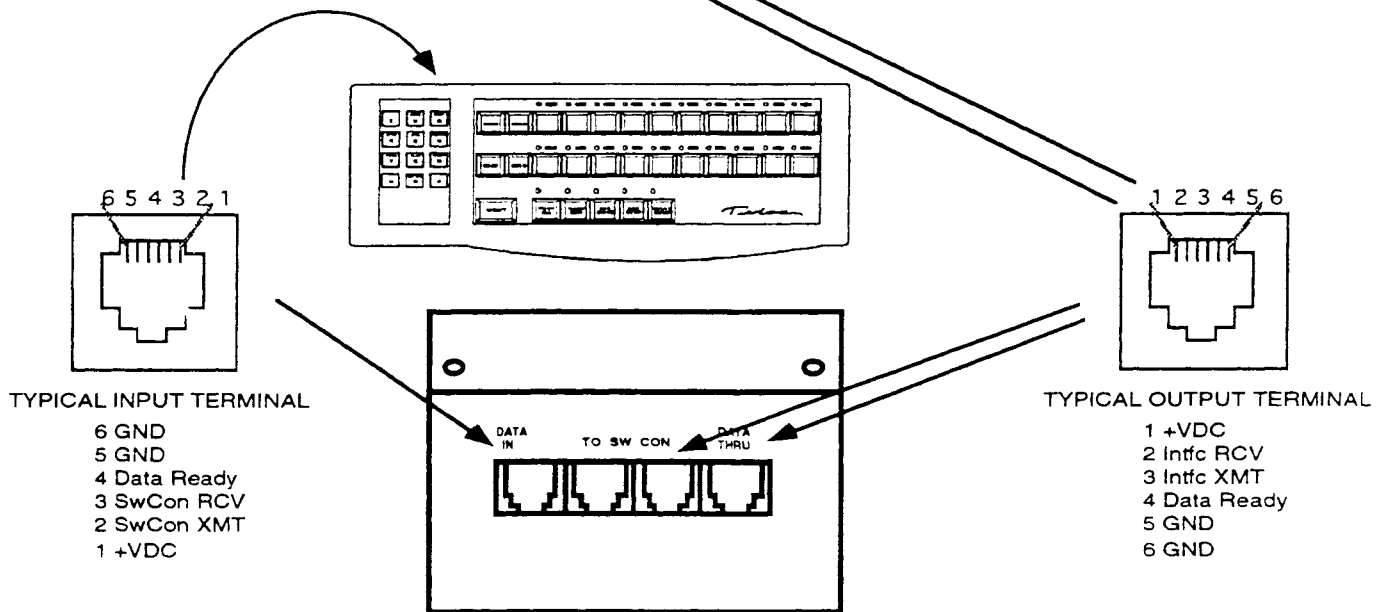
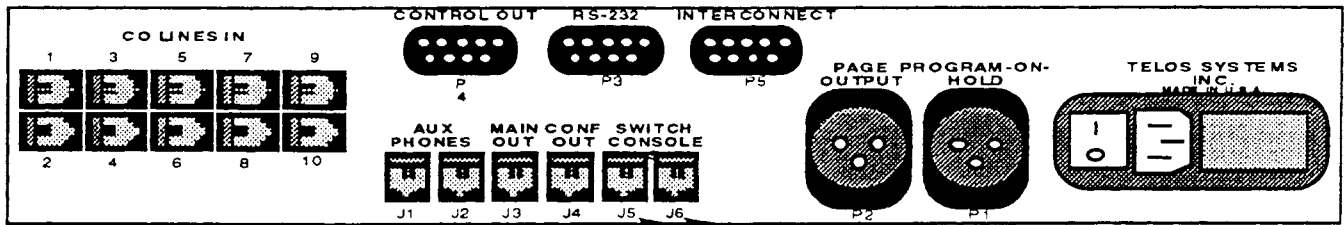
SECTION 5
APPENDIX

***Direct Interface Module Switch Console
Modular Connector Pin-Out (J4, J5)***



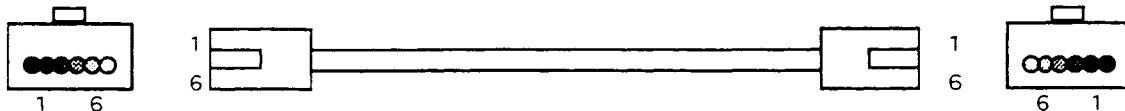
- 1 +9VDC (power to Switch Console)
- 2 RCV (from Switch Console to 1A2 Module)
- 3 XMIT (to Switch Console from 1A2 Module)
- 4 Ready/Busy (low signifies Switch Console sending)
- 5 Ground
- 6 Ground

RJ11C FORMAT FOR TELOS SWITCH CONSOLES



NOTES:

1) Connections to Switch Consoles MUST use 6-conductor, inverting cables:



2) Cables to "DATA IN" or from "DATA THRU" can be 4-conductor if necessary, but must invert the signals as shown above.

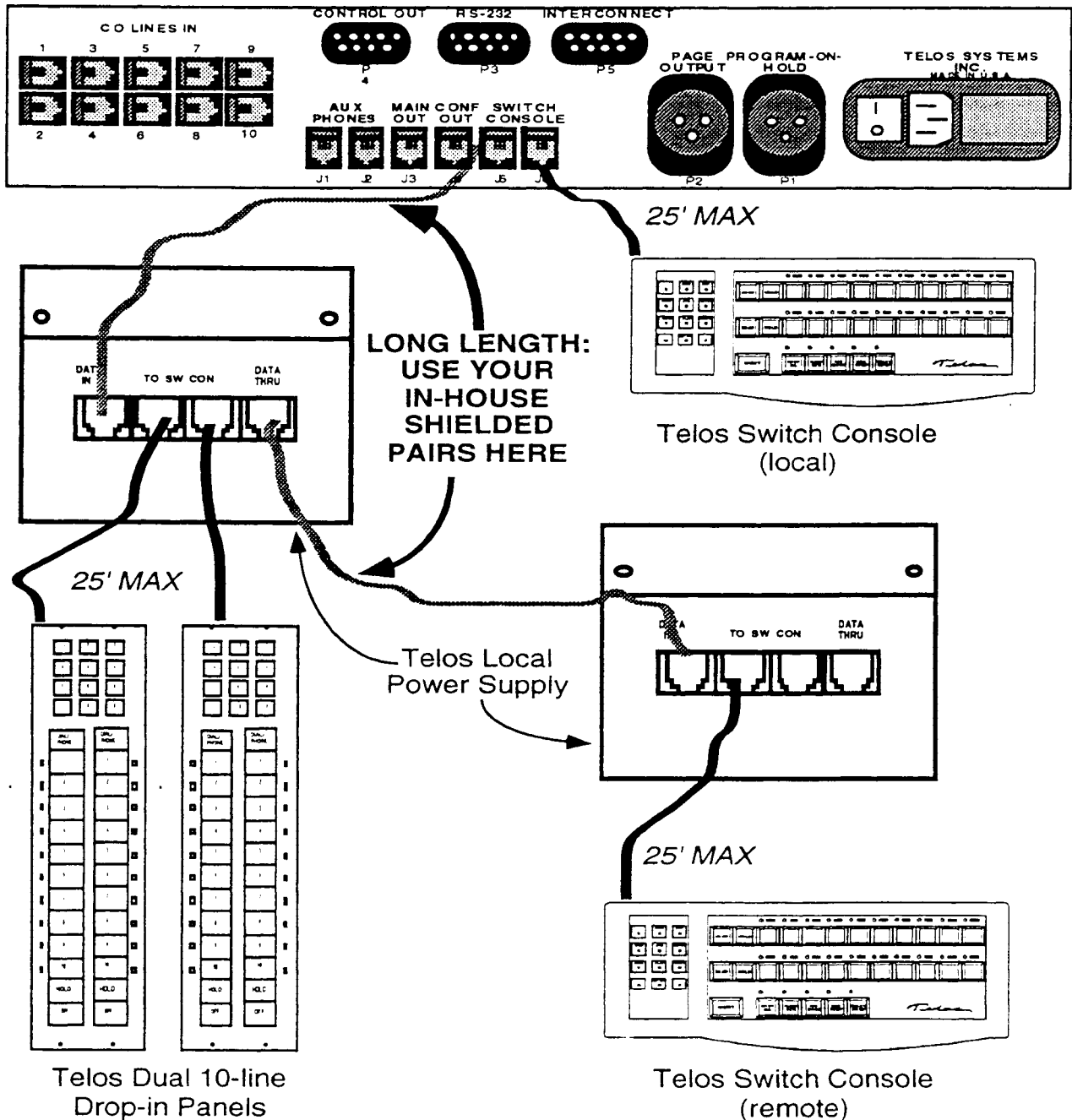
3) Maximum length from 1A2 Interface to Switch Console WITH Aux P/S is 250 ft. Max. length WITHOUT Aux P/S is 25 ft.

4) Each Aux. Power Supply can power up to two (2) Switch Consoles.

5) 6-pos. RJ11-to-Insulation displacement converter connectors available from AMP (P/N 553983-1; IBM equiv. 8310575). Also available from Digikey (P/N A4004-ND).

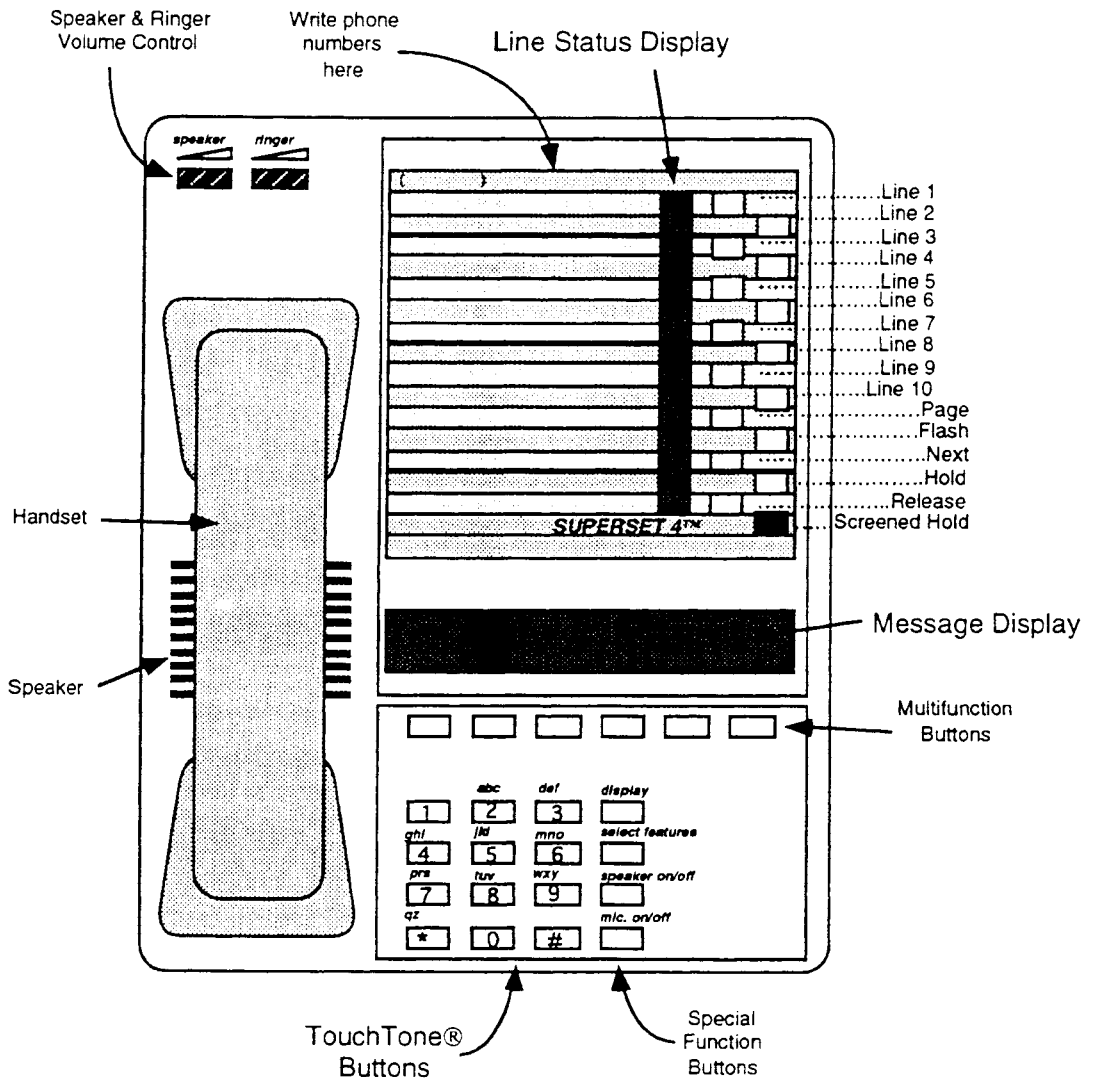
These connectors are excellent to use when trying to connect the RJ11C format to your in-house shielded pairs. If possible, give each datasignal its own shield. Shields should be tied together and run to station ground for best results.

LOCAL POWER SUPPLY INSTALLATION



Any Telos Switch Console can be placed up to 250 ft. away from the DirectInterface by using the Telos LocalPower Supply.

SECTION 6
SIMPLIFIED INSTRUCTIONS



There are two symbols used in the Line Status Display, the DOT and the SQUARE. The following chart shows how these symbols indicate different line conditions.

	DOT off - SQUARE off	Line is on-hook
	DOT blinking slowly	Line is ringing in
	DOT blinking fast	Line is on hold
	DOT on - SQUARE blinking	Line is off-hook on phone
	DOT on - SQUARE on	Line is on-air
	DOT on - SQUARE off	Line is off-hook on other Mitel

MITEL® SUPERSET 4 INSTRUCTIONS

The LINE buttons

These buttons correspond directly to the line numbers 1-10. These buttons function as one would expect: press a LINE button, seize that line! If the handset is on its cradle, the speakerphone will activate automatically. Any line seized by the Telos system will be protected from being seized by the Superset.

The PAGE button

Connects the phone audio to the page audio output. Normally used to feed the building PA system, but may also be used for announcer cueing or any other situation where an audio feed from the phone is desired.

The FLASH button

This button provides hook-flash to the line selected on the Mitel phone. This is useful when the call screener needs to access PBX options via hook-flash signalling (or if a wrong number is dialed!).

The NEXT button

When this button is pressed, the Mitel phone will seize the line that has been *ringing in* the longest.

The HOLD button

Pressing this button when any line is seized will put that line on hold and feed the caller program-on-hold.

The OFF button

Pressing this button when any line is seized will disconnect that line.

The SCREENED HOLD button

Pressing this button when any line is seized will put that line on hold and feed the caller program-on-hold. The indicator LED on the Switch Console will blink more brightly than calls placed on hold using the standard HOLD button as a way to call special attention to screened calls.

The line status LCD display

The vertical display next to the LINE buttons. It gives each line's status: off-hook, on hold, on air, etc. The chart on the previous page shows the line modes and the corresponding display indication.

The alpha-numeric LCD display

This display gives messages for use by the producer, such as "on-hook," "off-hook," time of calls that have been placed on air, display of numbers that are being dialed out on the Superset, status of the multi-function buttons, mic on, mic off, speaker on, speaker off and so forth.

To access the **on air call timer**, press the special function button marked DISPLAY.

The Touch Tone® buttons

Note that unlike many electronic phone systems, you hear real touch-tones in the receiver.

The special function buttons

As noted above, the DISPLAY button calls up the on air call timer. The large LCD display will indicate how long the current on air line has been on air. Pressing the SELECT FEATURES button gives the Telos firmware ID. SPEAKER ON/OFF and MIC. ON/OFF control the Superset speakerphone speaker and microphone respectively.

The "multi-function" buttons

These are the buttons directly under the LCD alpha-numeric display. The first (leftmost button) sets the ringer volume to loud or soft. The actual ultimate volume is determined by a combination of this setting and the RINGER volume adjust wheel. Only this multi-function button is supported; the others have no effect when pressed. The default setting is for loud ringing.

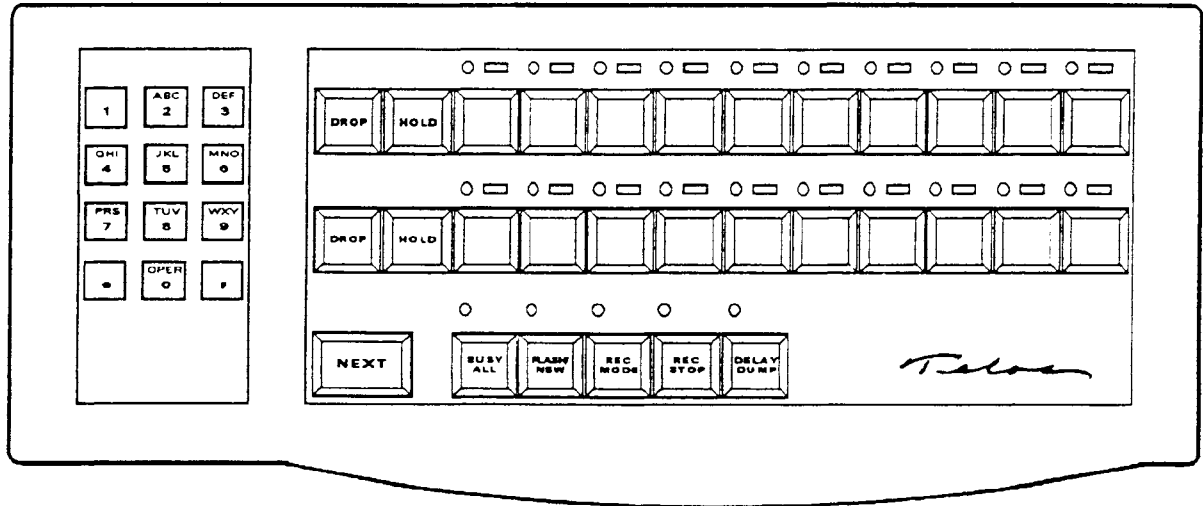
The speaker & ringer wheels

These two controls (located above the handset) set the speaker and ring warble volumes.

The handset

If the handset is lifted off the cradle while the speakerphone is in use, the speakerphone will be disabled. When replaced in its cradle, any active line will be released (if no other button is pressed first).

THE SWITCH CONSOLE



When the Switch Console is first plugged into the Direct Interface Module, its indicator LEDs will at first all be illuminated and then will be refreshed to the current system and phone line status.

Touch Tone Pad®

A standard keypad is provided so that outgoing calls may be placed from the Switch Console. To dial out, select an available line on one of the LINE buttons and dial.

Line Buttons and Led Indicators

Operation for line selection, holding, etc. is very similar to the familiar key phone sets. When two hybrids are connected to the Direct Interface Module, the top row of LINE buttons corresponds to the MAIN hybrid and the bottom row to the CONFERENCE hybrid.

There are two LEDs above each line selection button to indicate status of each of the phone lines and hybrids you have connected to the Direct Interface Module.

LINE Buttons

Each row of LINE buttons has a DROP button, a HOLD button, and ten LINE selection buttons. The DROP and HOLD buttons effect only the row of LINE buttons on which they are located.

Bar LED Indicator

Above each line selection button is a bar LED to indicate line status. LINE status can be effected by pushing a LINE button on the Switch Console or from a Mitel phone, a connected computer, or an external phone system connected to the Direct Interface Module. The bar LED will therefor always reflect the true LINE status.

Information is provided by both the flash rate of an LED and its brightness.

Bar LED Status

Slow Flashing
Rapid Flashing
Bright Rapid Flashing
Solid
Off

LINE Status

Ringing
On Hold
Screened Hold
In Use
Not in use

Screened Hold

From a Mitel phone or Call Screen Manager software, a producer may place calls on hold. To help the on air talent differentiate among lines on hold, both a standard hold and a Screened Hold feature can be selected by the producer with a push of a button. The added brightness of the bar LED when Screened Hold is selected helps the talent choose the correct caller.

Round LED Indicator

Above each line selection button is a round LED to indicate hybrid status

Round LED Status

Flashing
Solid
Off

Hybrid Status on Indicated Line

On air, standard mode
On air, conference mode
Not on air

Placing Callers on Air

Placing Callers On Air in Standard Mode

To place a caller on air, push the appropriate LINE button for the phone line on which the caller is located. The round LED will flash and the bar LED will be solid. The line may be dropped or placed on hold using the DROP and HOLD buttons on the row you have selected. If you select another line on the same row, the line selected earlier will be dropped unless the line is placed in conference mode.

Placing Callers On Air in Conference Mode

Pushing a LINE button once places it on air. Pressing the LINE button a second time will place that line in the conference mode. The DROP and HOLD buttons will have no effect on a line in conference mode. If another line is selected on the same row, the line in the conference mode will remain on the air. When the LINE button is selected a third time, the LINE reverts to the standard mode.

Tips for Conferencing

Select your first caller from the top row of the Switch Console and the second caller from the bottom row. This should be your procedure whether you are using one or two hybrids.

If you want to keep a caller on air and add more callers, put the original caller in conference mode to avoid accidentally hanging up on him/her.

Although audio quality may decline, you can have more than one caller on a single hybrid. To accomplish this, place a caller in the conference mode and then select one or more callers from the same Switch Console row of LINE buttons. When performing this "button mashing" your callers may not hear each other very well.

Special Function Buttons

There are six special function buttons below the line selection buttons. From left to right, these function buttons are:

NEXT

Selects the line that has been ringing-in the longest. If no lines are ringing-in, it selects the line on hold the longest.

BUSY ALL

With the first press of this button, all lines that are neither in use nor on hold are made busy. On the second press, those lines are dropped. (Your Switch Console may have been programmed so that certain lines are not affected by this button.)

This function is helpful in preventing callers from jamming your phone lines just prior to your accepting calls for a contest.

The LED above the BUSY ALL is normally lit. When the BUSY ALL button is pushed, the LED will blink. All of the LEDs above the LINE buttons for lines that have been busied will flash with a unique cadence. When the BUSY ALL button is pushed the second time, LED status reverts.

FLASH/NEW or AUTO-ANSWER

Only one of these features is active on this button, the third from the left. Check with your engineer or program director to determine which has been selected.

The FLASH/NEW function is primarily for use with PBXs or Centrex[®] telco lines which require flashing to access features.

The FLASH/NEW button can also be used for dropping a line - that is, to hang-up a line and get dial tone back on the selected line without going through the usual OFF and LINE button press sequence. This button is useful for dropping a line when a wrong number is dialed or if many calls are to be made on the same line.

This button can also be used to toggle on and off the AUTO-ANSWER feature. The AUTO-ANSWER feature automatically answers lines that ring into the Direct Interface Module and place them on hold. Once on hold, the callers will hear your Program-On-Hold source.

RECORD MODE

This button enables you to conveniently start a tape recorder. To ready the RECORD MODE, push the button once. The LED above the button, normally solid, will blink. The next time you press a LINE button, an output on the back of the Direct Interface Module will be activated to start a recording device. To deactivate the RECORD MODE, press its button again. The LED above the button will then go solid again.

RECORD STOP

When this button is pushed, an output on the back of the Direct Interface Module stops the recording device. This will NOT disable the RECORD MODE! Your engineer may have assigned another function to this button.

DELAY DUMP/USER BUTTON

This button activates your external profanity delay. Your engineer may have assigned another function to this button.

Using a Standard Desk-Set Phone in The Studio

If a standard telephone is provided for use with the Switch Console, it may be used to talk to callers who have been selected on it. When this phone is off hook, the system routes the selected line(s) from the MAIN bank (top row) to the phone and removes the feed to air. The hybrid is turned off. When the phone is replaced on hook, the on air feed is restored and the hybrid is turned back on.

SECTION 7
**PARTS LISTS and
SCHEMATICS**

PARTS LISTS

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Switch Console

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4. Actuator Board 69
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Switch Console

7. Central Processor Unit Schematic 83
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MPU BOARD REV B PARTS LIST

<u>Designation</u>	<u>Description</u>	<u>Designation</u>	<u>Description</u>
U1	Microprocessor 80C188	C1	10pF 100V mono
U2	SRAM 6264LP-10	C2	22pF 100V mono
U2	SmartSocket® DS1213	C3	0.1µF 50V mono
U3	EPROM 27C512-25	C4	0.1µF 50V mono
U4	74HCT373	C5	0.1µF 50V mono
U5	Dual UART Z85C30-10PC	C6	0.1µF 50V mono
U6	PPI 8255	C7	0.1µF 50V mono
U7	watchdog DS1232	C8	0.1µF 50V mono
U8	74ACT138	C9	2.2µF@25V tant
U9	74HCT374	C10	2.2µF@25V tant
U10	NE590	C11	2.2µF@25V tant
U11	NE590	C12	0.1µF 50V mono
U12	3x8 crosspoint sw.MT8804AE	C13	220pF 100V mono
U13	3x8 crosspoint sw.MT8804AE	C14	3.3 Farad gold cap
U14	3x8 crosspoint sw.MT8804AE	C15	2.2µF@25V tant
U15	3x8 crosspoint sw.MT8804AE	C16	0.1µF 50V mono
U16	DTMF generator PCD3311	C17	0.1µF 50V mono
U17	quad RS-232 driver LT1032	C18	220pF 100V mono
U18	quad RS-232 driver LT1032	C19	2.2µF@25V tant
U19	74HC04	C20	2.2µF@25V tant
U20	NE5532	C21	2.2µF@25V tant
U21	NE5532	C22	4.7µF@25V tant
U22	NE5532	C23	4.7µF@25V tant
U23	NE5532	C24	1.0µF 50V mono
U24	NE5532	RP1	10KΩ x 10 SIP
U25	NE5532	RP2	10KΩ x 10 SIP
U26	LM1489	RP3	10KΩ x 10 SIP
U27	74ACT138	T1	audio xfrmr SPT-128
U28	NE590	T2	audio xfrmr SPT-128
U30	AGC LH403	T3	audio xfrmr SPT-128
X1	18.432MHz XTAL	RF1	RF filter 27K51R1-05
X2	3.579MHz XTAL	RF2	RF filter 27K51R1-05
SW1	BCD rotary	Q1	p-channel JFET J176
SW2	4-pos. DIP sw.	L1	filter choke IHA204
D1	1N4148		

MPU BOARD REV B PARTS LIST (continued...)

<u>Designation</u>	<u>Description</u>	<u>Designation</u>	<u>Description</u>
R1-R12	47Ω 1/4W 5%	P1	XLR- female
R13	620Ω 1/4W 5%	P2	XLR-male
R14	10KΩ 1/4W 5%	P3	10-pos. shrouded hdr.
R15	2.2KΩ 1/4W 5%	P4	10-pos. shrouded hdr.
R16	100KΩ 1/4W 5%	P5	10-pos. shrouded hdr.
R17-R26	620Ω 1/4W 5%	J1-6	six-pos. RJ12
R27	10KΩ 1/4W 5%	J7	5-pos. locking header
R28	10KΩ 1/4W 5%	HDR1-10	6-pos. male header
R29	2KΩ 1/4W 5%	HDR11	36-pos. male header
R30	2KΩ 1/4W 5%.	HDR12	36-pos. male header
R31	1.5KΩ 1/4W 5%	HDR13	16-pos. shrouded hdr
R32	18KΩ 1/4W 5%	JP1	3-pos. male header
R33	82KΩ 1/4W 5%	JP2	2-pos. male header
R34	100KΩ 1/4W 5%	U1	68-pin PLCC socket
R35	10KΩ 1/4W 5%	U2,U3	28-pin DIP machined socket
R36	39KΩ 1/4W 5%	U4	20-pin DIP machined socket
R37	1MΩ 1/4W 5%	U5,U6	40-pin DIP machined socket
R38	39KΩ 1/4W 5%	U7	8-pin DIP machined socket
R39	10KΩ 1/4W 5%	U8	16-pin DIP machined socket
R40	1MΩ 1/4W 5%	U9	20-pin DIP machined socket
R41	220KΩ 1/4W 5%	U10,U11	16-pin DIP machined socket
R42	10KΩ 1/4W 5%	U12-U15	24-pin DIP machined socket
R43	10KΩ 1/4W 5%	U16	16-pin DIP machined socket
R44	10KΩ 1/4W 5%	U17,U18,U19	14-pin DIP machined socket
R45	220KΩ 1/4W 5%	U20-U25	8-pin DIP machined socket
		U26	14-pin DIP machined socket
		U27,U28	16-pin DIP machine socket
		U29	8-pin DIP machined socket
		U30	16-pin DIP machine socket
		U31	8-pin DIP machined socket

LINE CARD REV D PARTS LIST

<u>Designation</u>	<u>Description</u>	<u>Designation</u>	<u>Description</u>
U1	4N33	C1	0.47 μ F 250V mono
U2	4N33	C2	47 μ F @ 10V tant
U4	4N33	C3	10 μ F@16V tant
U5	4N33	C4	0.47 μ F 250V mono
R1	100K Ω 1/4W 5%	C5	47 μ F @ 10V tant
R2	150 Ω 1/4W 5%	C6	10 μ F@16V tant
R3	2.2K Ω 1/4W 5%	BR1	bridge rectifier 2W04M
R4	100 Ω 1/4W 5%	BR2	bridge rectifier 2W04M
R5	47 Ω 1/4W 5%	D1	zener 1N4739
R6	100K Ω 1/4W 5%	D2	rectifier 1N4004
R7	150 Ω 1/4W 5%	D3	zener 1N4730
R8	100K Ω 1/4W 5%	D4	zener 1N4730
R9	150 Ω 1/4W 5%	D5	rectifier 1N4004
R10	2.2K Ω 1/4W 5%	D6	zener 1N4739
R11	100 Ω 1/4W 5%	D7	rectifier 1N4004
R12	47 Ω 1/4W 5%	D8	zener 1N4730
R13	100K Ω 1/4W 5%	D9	zener 1N4730
R14	150 Ω 1/4W 5%	D10	rectifier 1N4004
K1	DPDT relay G5V-2-H	MOV1	varistor S14K250
K2	DPDT relay G5V-2-H	MOV2	varistor S14K250
T1	xfrmr SPT195	F1	fuse 4.7 Ω 1/8W
T2	xfrmr SPT195	F2	fuse 4.7 Ω 1/8W
JX1	Rt. angle RJ11	HDR1	6-pos. female rt. angle
JX2	Rt. angle RJ11	HDR2	6-pos. female rt. angle
U1	6-pin DIP machined socket		
U2	6-pin DIP machined socket		
U4	6-pin DIP machined socket		
U5	6-pin DIP machined socket		

MITEL CARD REV B PARTS LIST

<u>Designation</u>	<u>Description</u>	<u>Designation</u>	<u>Description</u>
U1	UART 82050	C1	22 μ F@63V electro
U2	4N33	C2	10 μ F@35V tant
U3,U4	NE5532	C3	1.0 μ F@35V tant
U5	MAX641	C4	100 μ F@63V electro
U6	MT8840AE	C5	0.001 μ F 50V mono
R1	5.62K Ω 1/4W 1%	C6	0.01 μ F 50V mono
R2	10K Ω 1/4W 1%	C7	0.001 μ F 50V mono
R3	18.2K Ω 1/4W 1%	C8	0.001 μ F 50V mono
R4	39.2K Ω 1/4W 1%	C9	0.01 μ F 50V mono
R5	4.75K Ω 1/4W 1%	C10	6800pF 50V mono
R6	44.2K Ω 1/4W 1%	C11	0.001 μ F 50V mono
R7	619 Ω 1/4W 1%	C12	1.0 μ F@35V tant
R8	10K Ω 1/4W 1%	C13	0.01 μ F 50V mono
R9	49.9K Ω 1/4W 1%	C14	0.1 μ F 50V mono
R10	100 Ω 1/4W 1%	C15	0.22 μ F 50V mono
R11	10K Ω 1/4W 1%	C16	0.01 μ F 50V mono
R12	1K Ω 1/4W 1%	X1	3.570MHz XTAL
R13	619 Ω 1/4W 1%	T1	xfrmr 6371
R14	1K Ω 1/4W 1%	L1	inductor 050AT5002H
R15	1.2K Ω 1/4W 1%	D1	diode 1N4935
R16	10K Ω 1/4W 1%	Q1	FET IRF530
R17	47 Ω 1/4W 1%	HDR1	36-pos female header
R18	200 Ω 1/4W 1%	U1	28-pin DIP machined socket
R19	27.4K Ω 1/4W 1%	U2	6-pin DIP machined socket
R20	1M Ω 1/4W 1%	U3	8-pin DIP machined socket
R21	22.1K Ω 1/4W 1%	U4	8-pin DIP machined socket
R22	47.5K Ω 1/4W 1%	U5	8-pin DIP machined socket
		U6	18-pin DIP machined socket

FRONT PANEL REV A PARTS LIST

<u>Designation</u>	<u>Description</u>	<u>Designation</u>	<u>Description</u>
L1	green LED LTL2233A	HDR1	16-pin shrouded hdr
L2	green LED LTL2233A	RP1	330Ω x 6 SIP
L3	green LED LTL2233A	RP2	330Ω x 6 SIP
L4	green LED LTL2233A	R1	330Ω 1/4 W 5%
L5	green LED LTL2233A	R2	560Ω 1/4W 5%
L6	green LED LTL2233A		
L6	green LED LTL2233A		
L7	green LED LTL2233A		
L8	green LED LTL2233A		
L9	green LED LTL2233A		
L10	green LED LTL2233A		
L11	yellow LED LTL2253A		
L12	red LED LTL2203A		

CPU BOARD PARTS LIST

<u>Designation</u>	<u>Description</u>	<u>Designation</u>	<u>Description</u>
U1	87C51	U1	40-pin machined socket
U2	74HC244	U2	20-pin machined socket
U3	74HC04	U3	14-pin machined socket
U4	UDN2540B	U4	16-pin machined socket
U5	UDN2540B	U5	16-pin machined socket
U6	UDN2580A	U6	18-pin machined socket
U7	DS1232	U7	8-pin machined socket
U8	MC1489	U8	14-pin machined socket
U9	LT1280	U9	18-pin machined socket
P1	28-pin male header	R1-R6	47 Ω 1/4 W
P2	6-pin male header	R7	68K Ω 1/4 W
VR1	78ST105HC	R8	39K Ω 1/4 W
VR2	78ST105HC	RP1	4.7 Ω x 7 DIP
Y1	9.216 MHz XTAL	RP2	10K Ω x 10 SIP
C1	1000 μ F @ 25V electr.	RP3	10K Ω x 6 SIP
C2	100 μ F @ 25V electr.	RP4	100K Ω x 10 SIP
C3	1 μ F @ 35V tant.	RP5	1K Ω x 8 SIP
C4,C5	22pF mono	FB1-FB3	ferrite bead
C6-C9	1 μ F @ 35V tant.	D1	1N5338
C10,C11	1 μ F mono	D2	1N4148
C12-C14	0.01 μ F mono	D3	1N4148
C15	0.1 Farad Gold Cap	SW1	4-pos DIP switch
C16-C18	0.1 μ F mono		

Telos Switch Console

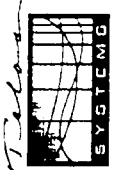
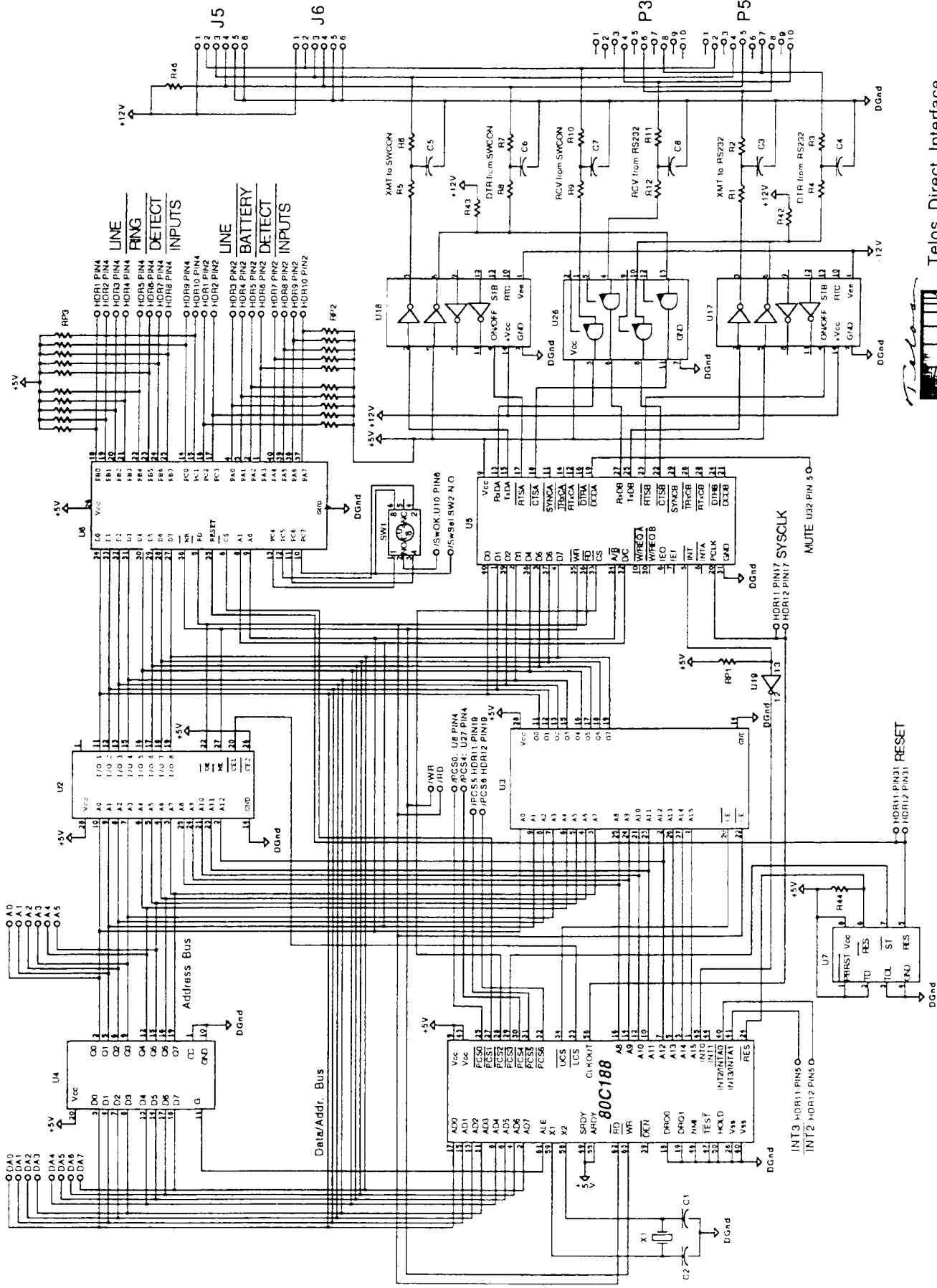
ACTUATOR BOARD PARTS LIST

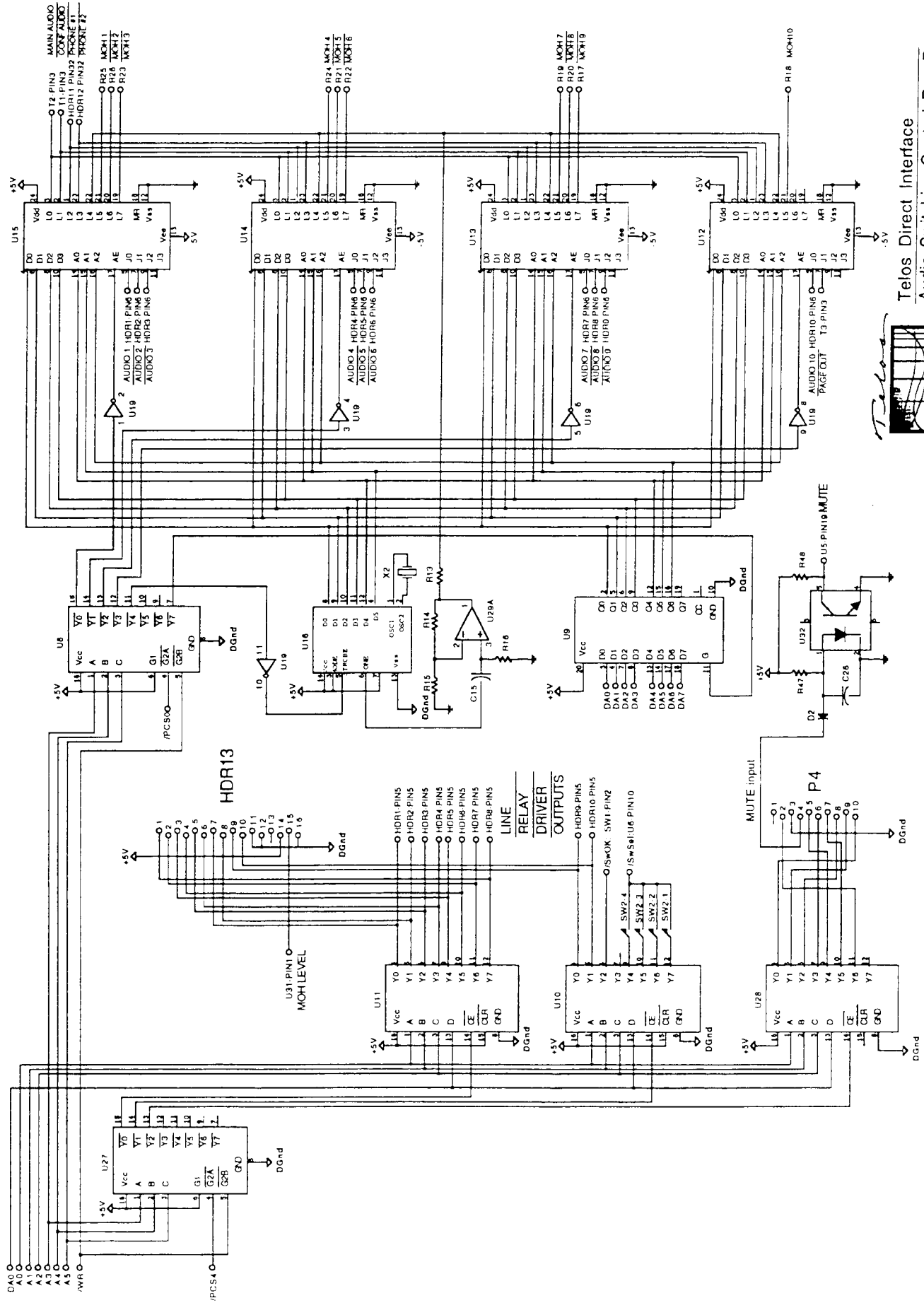
<u>Designation</u>	<u>Description</u>	<u>Designation</u>	<u>Description</u>
SW1-SW30	T-16D switch	SW1	Sw Cap " DROP"
SW1-SW30	T-16 dust cover	SW2	Sw Cap "HOLD"
L2-L11	L-424YTD 3mm LED	SW3-SW12	Sw Cap replacable legends
L2-L11	1/16" spacer	SW13	Sw Cap "DROP"
L13-L27	L-424YTD 3mm LED	SW14	Sw Cap "HOLD"
L13-L27	1/16" spacer	SW15-SW24	Sw Cap replacable legends
L28-L37	L-153SRDT retangular LED	SW25	Sw Cap "BUSY ALL"
L38-L47	L-153SRDT retangular LED	SW26	Sw Cap "FLASH/NEW"
J1	28-pin header	SW27	Sw Cap "REC MODE"
J2	6-pin header	SW28	Sw Cap "REC STOP"
J3	SS-6566 RJ11C	SW29	Sw Cap "DELAY DUMP"
J4	7-pin header	SW30	Sw Cap "NEXT"

Telos Switch Console

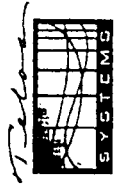
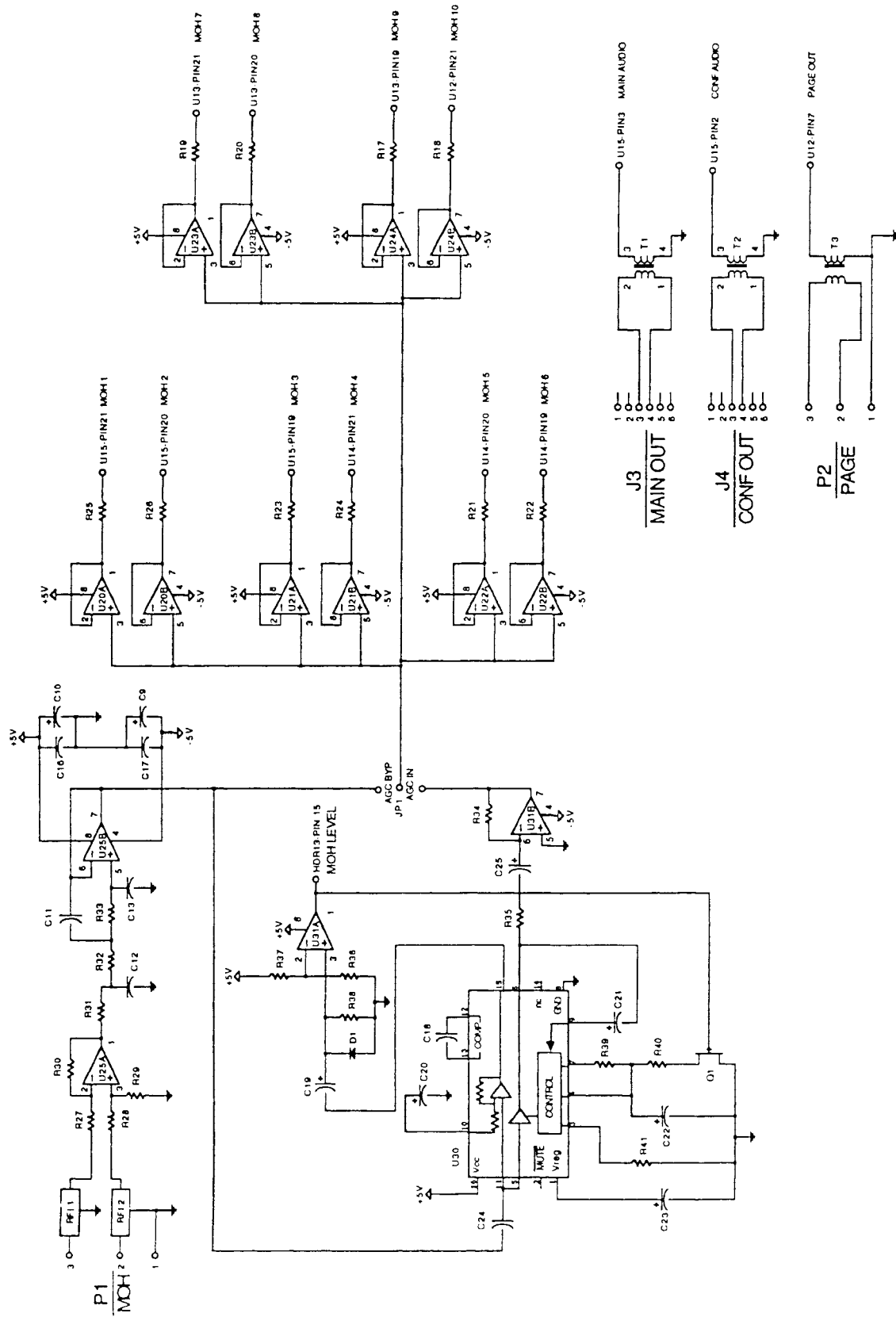
DTMF BOARD PARTS LIST

<u>Designation</u>	<u>Description</u>	<u>Designation</u>	<u>Description</u>
SW1-SW12	T-16R switch	J1	7-pin header
DTMF cap set	SwCaps "0-9", "*", "#"		

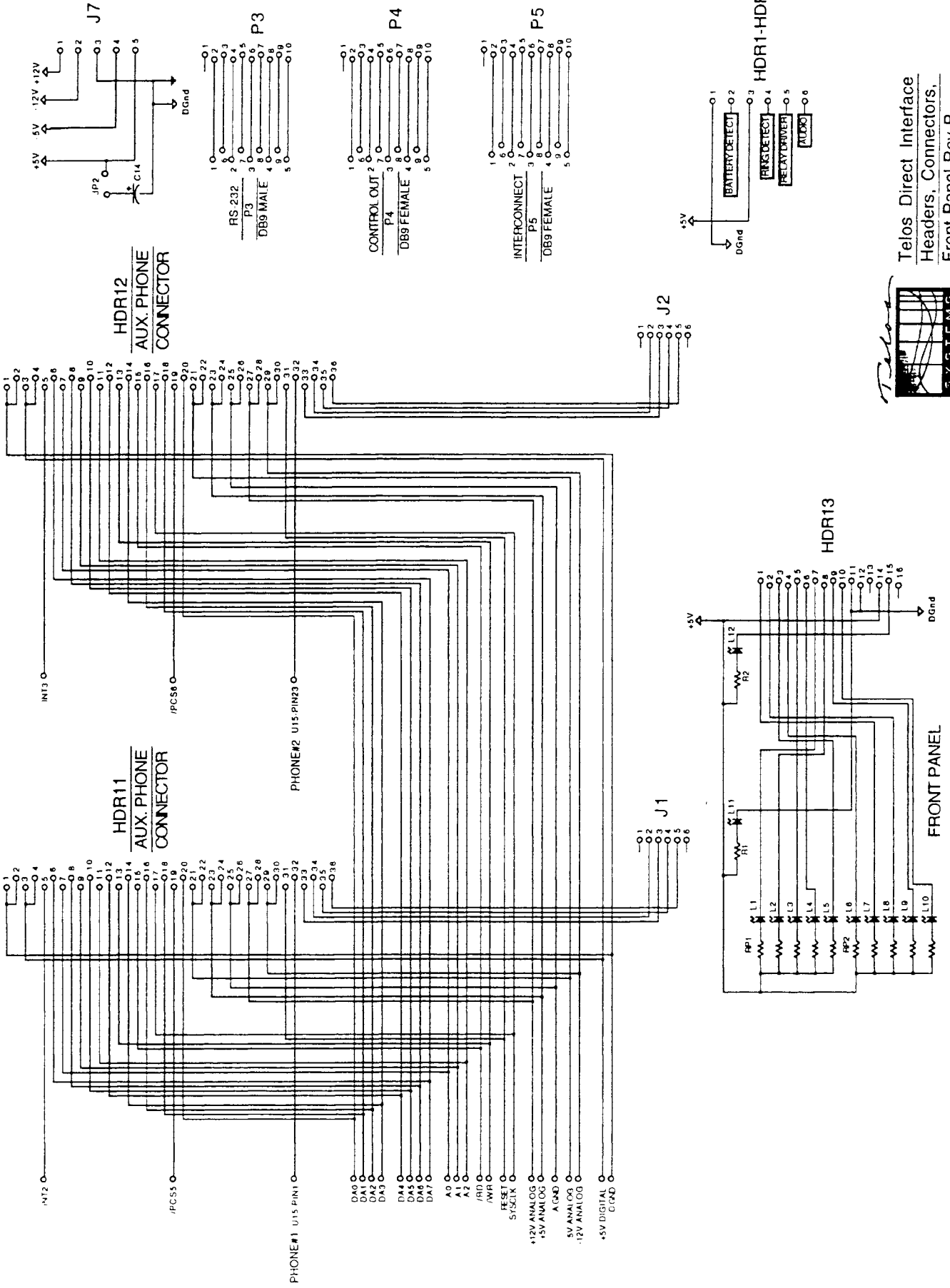




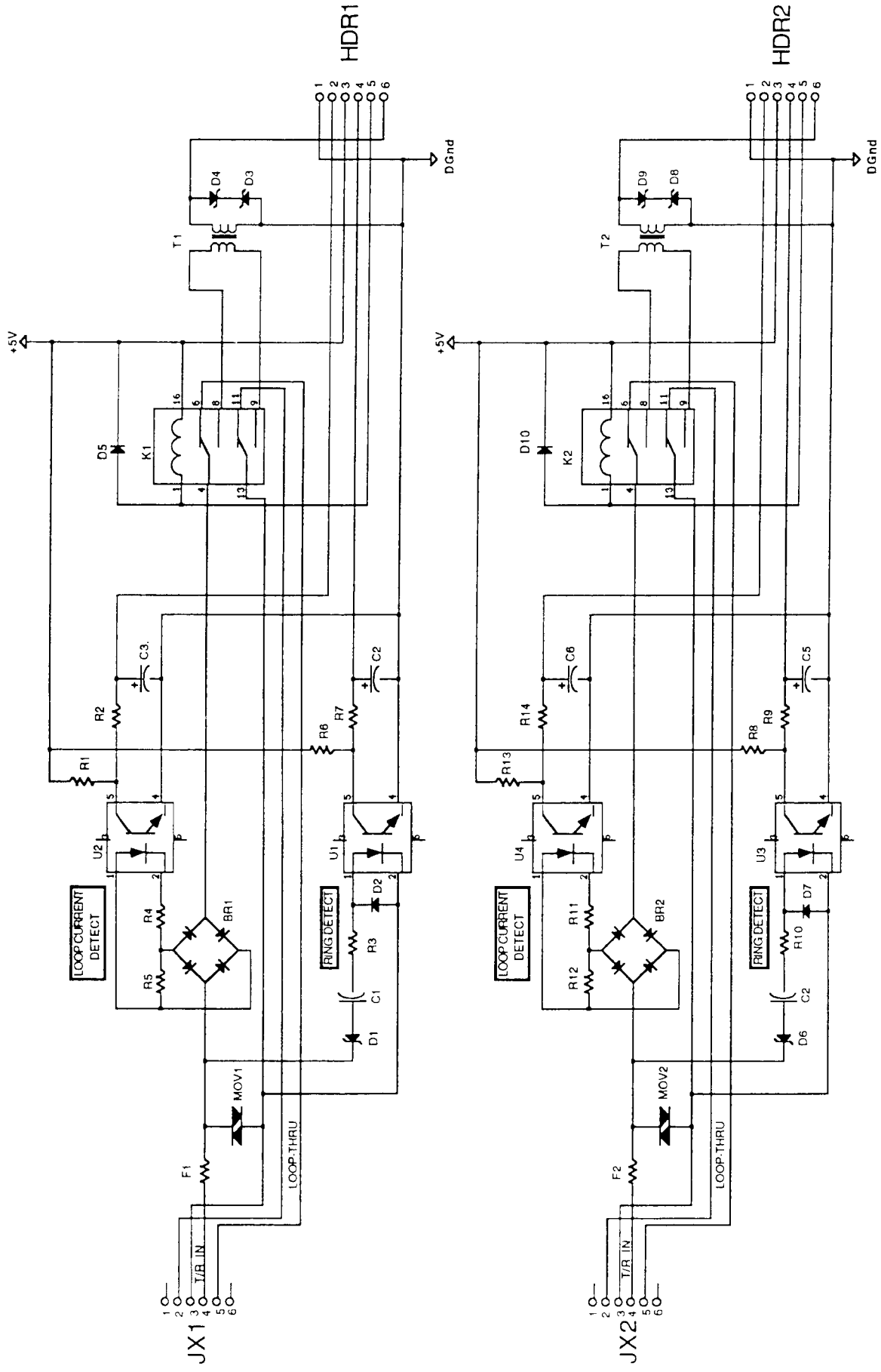
Telos Direct Interface
Audio Switching Control Rev B



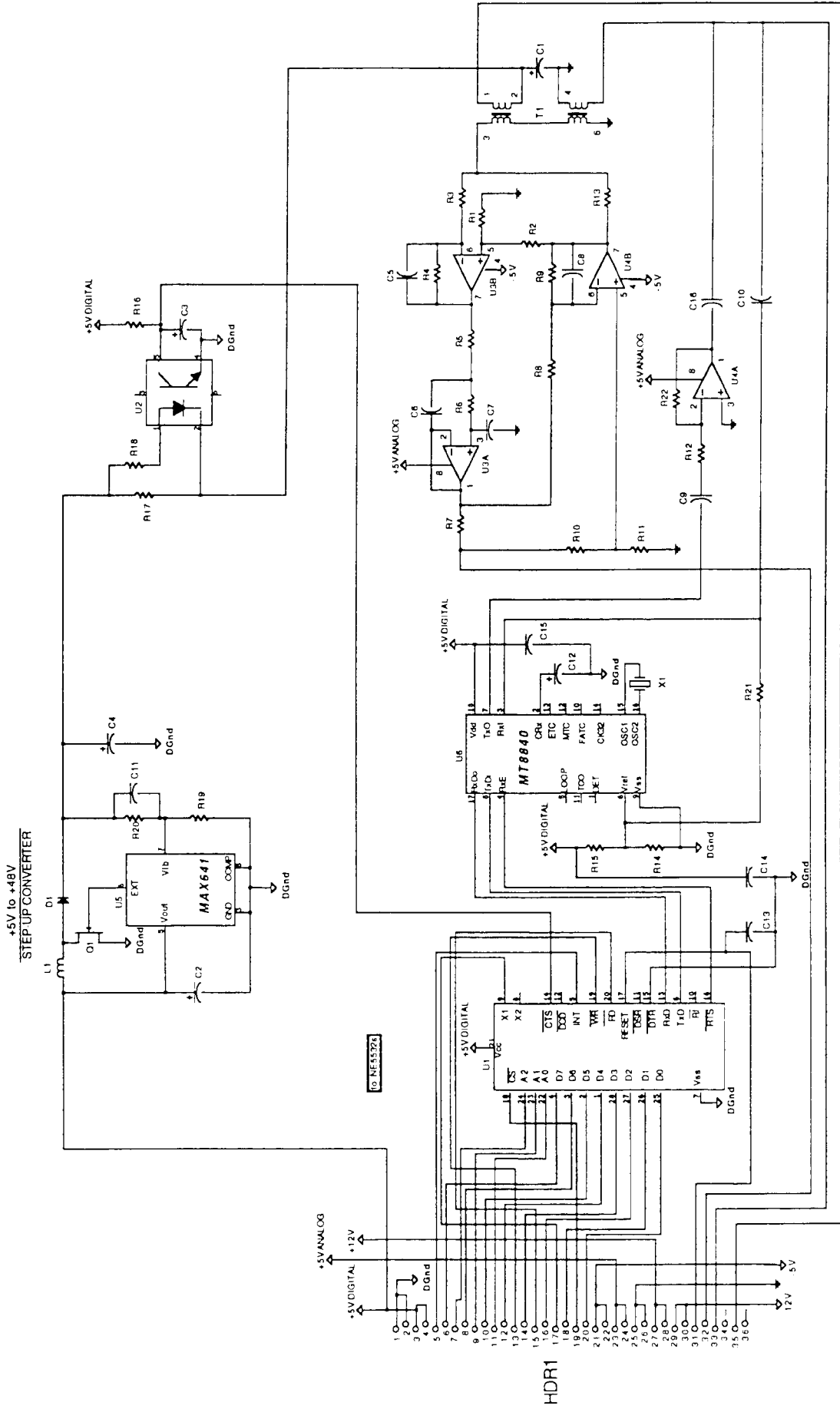
Telos Direct Interface
 MOH, AGC, Audio I/O Rev B

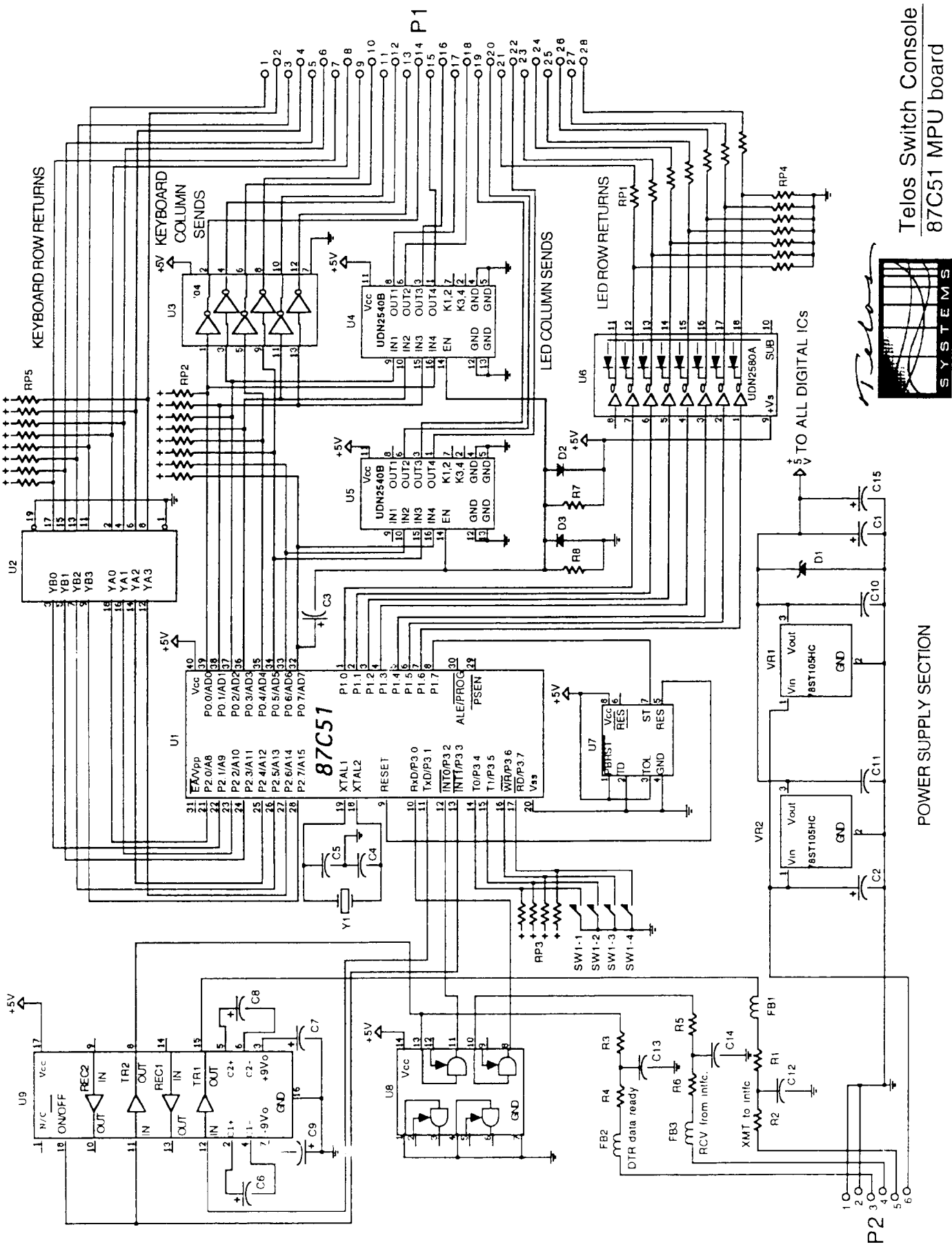


Telos Direct Interface
 Headers, Connectors,
 Front Panel Rev B



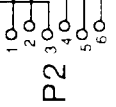
LINE CARD CANNOT BE USED FOR PARALLELING
 TELCO LINES TO ANOTHER PBX; LOOP-THRU IS
 PROVIDED ON THE YL/BK PAIR OF EACH RJ11C
 REFER TO SEC. 2.6 FOR DETAILS



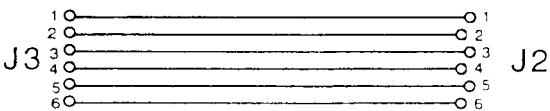
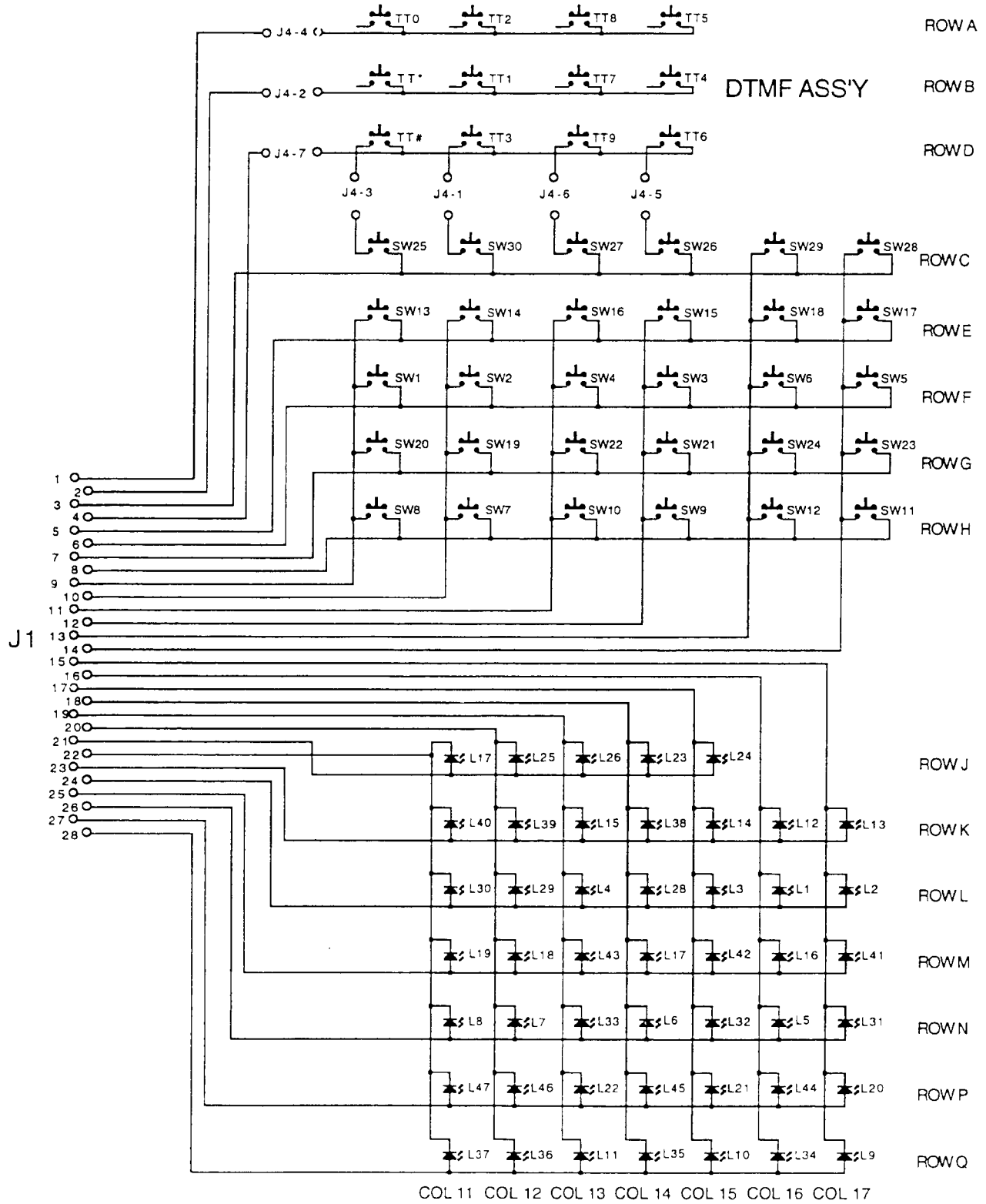


Telos Switch Console
87C51 MPU board

POWER SUPPLY SECTION



COLUMN 1 COLUMN 2 COLUMN 3 COLUMN 4 COLUMN 5 COLUMN 6



Telos Switch Console
Actuator board