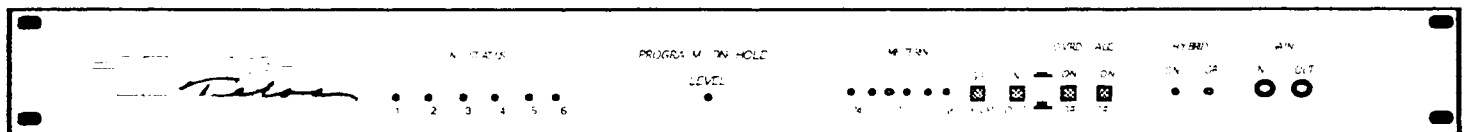
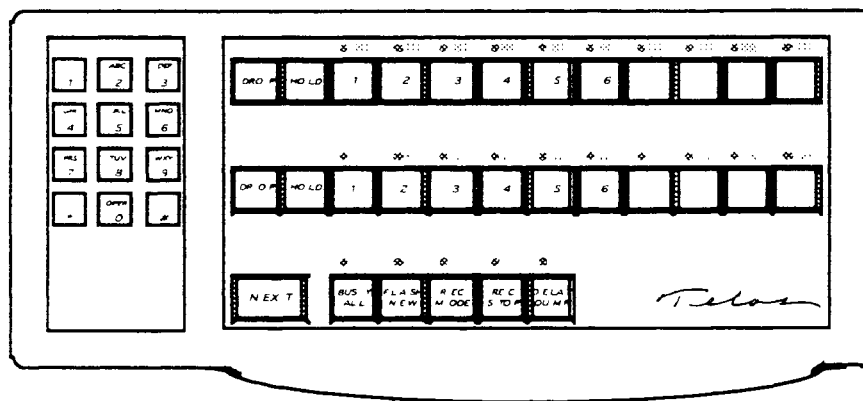


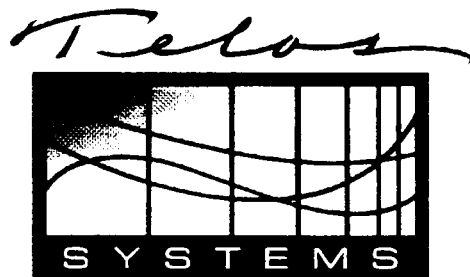
TELOS ONE-x-Six USER'S MANUAL

Telos ONE-x-Six

Complete Talk Show Telephone System



User's Manual
Revision C – September, 1995



Telos Systems
2101 Superior Avenue
Cleveland, OH 44114
(216) 241-7225
FAX: (216) 241-4103

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A personal note from Steve Church

December 1, 1993

At the NAB in 1985, I offered the first public demonstration of my Telos 10—the first broadcast audio device to use real time, digital signal processing (DSP). The response was quite positive because the Telos 10 incorporated the first telephone hybrid that actually worked!

The Telos 10 was far from perfect. You needed a 1A2 key system to connect the central office telephone lines. A wide ribbon cable was used between the Switch Console and the main unit. And, I must confess, I probably could have done a better job selecting the buttons for the Switch Console. (And those were among the most expensive switches I evaluated!)

As Telos grew, we replaced the Telos 10 with the widest assortment of equipment for telephone-to-broadcast interface. The performance of our hybrids continued to improve and, with the Direct Interface Module, we allowed direct connection to incoming phone lines. We grew to a “real company” and, as we added engineering resources, offered you more advanced technologies and enhanced operational features.

There remained, however, a nostalgia for the Telos 10. Its users forgot that it was expensive and limited in function, but remembered that it came packaged as a complete system. Additionally, we heard from many smaller installations who encouraged us to create a complete talk show system at a more moderate price.

The Telos ONE-x-Six is our response to your requests. The digital hybrid performance is spectacular, the unit connects to six central office lines directly, and the main unit comes packed with a Switch Console in the same carton. The ONE-x-Six is easy to install and maintains all of the features of our modular systems. And, best of all, we offer the ONE-x-Six to you at a price that makes it extremely affordable.

We trust you will like it.

Keep on keeping the GM happy...

Steve Church
President, Telos Systems

User's Manual Revision C, September 1995

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SECTION 1
INTRODUCTION

1.1 SYSTEM OVERVIEW

The ONE-x-Six is a complete six-line, on-air phone system designed for use in broadcast, teleconferencing, and other applications. The ONE-x-Six incorporates a Telos ONE digital hybrid telephone interface and a six-line switching system in a single height 19" rack-mount unit. For line selection, the unit comes packaged with one desktop Switch Console.

The ONE-x-Six connects to standard dial-up phone lines from the telco central office using industry standard RJ11C connectors. The ONE-x-Six communicates with the Switch Console (or optional console-mounted control surfaces) by sending and receiving serial data over a "skinny wire" data link. This serial link uses a modular phone type cable. The Switch Console is powered via the modular cable, as well.

The ONE-x-Six will switch up to six lines and can support two Switch Consoles directly. More switch consoles can be added by using external power supplies. The ONE-x-Six routes phone lines to its internal hybrid. Audio input and output are connected via XLRs. The balanced input can be mic or line level. Two balanced outputs are provided: one output has caller-only audio; the second output may be switched for either a second caller-only output or a mix of the input and caller signals.

The ONE-x-Six provides extra contact closures for the user-assignable buttons on the Switch Console and an IBM AT-style RS-232 serial port for computer control with software such as Telos' Call Screen Manager. The ONE-x-Six also has a Program-On-Hold input with AGC.

A standard, single line telephone set (user provided) is used for call screening. If full screening functions are not required, a second, external Telos hybrid may be connected to enhance conferencing callers.

The ONE-x-Six has been designed with careful attention to audio performance in order to insure that the caller audio arrives at your equipment with negligible degradation. Because the audio processing functions are performed in the digital domain and the telephone switching system is software driven, the hardware design of the Telos ONE-x-Six is quite simple.

1.2 DIGITAL HYBRID OVERVIEW

The Telos ONE-x-Six uses the same digital hybrid found in the Telos ONE digital hybrid telephone interface. The hybrid embodies a state of the art approach to interfacing telephone lines for broadcast, teleconferencing, distance learning, and other uses. The very fast and precise digital automatic nulling allows smooth, natural, simultaneous conversation without the usual speakerphone up-cutting effect or the audio distortion and feedback problems often experienced with analog hybrid-type interface devices.

The purpose of the digital telephone hybrid is to deliver to the console pure caller audio with as little of the send (announcer) audio as possible mixed in. Until digital signal processing techniques were applied to the telephone interface problem, there were two choices:

Switching. The send and receive paths were separated by having only one talk direction active at a time. Common "speakerphones" use this approach. The disadvantage is that natural conversation is impossible, since the caller is cut off when the announcer talks and vice-versa.

Analog hybrids. These were, on most phone lines, very poor at removing the send signal from the caller's audio. This meant that the announcer's voice would become distorted as the phone audio was added to the mix.

Telos hybrids use digital techniques to perform the hybrid function, i.e. the subtraction of the send audio from the receive audio. The input and caller audio signals are converted from analog to digital. Then they are manipulated in the digital domain to very effectively remove the announcer audio from the caller output while maintaining natural, simultaneous full-duplex conversation. Finally, the signals are returned to analog. The digital approach assures consistently good trans-hybrid loss regardless of varying phone line impedance.

The hybrid performs its functions automatically. When a call is initially established, a brief mute/adapt period provides an opportunity for the system to set up to the line before the call goes on the air. The caller hears a "noisy tone," but none of this tone is heard on the air since the output is muted during this time. This has the incidental benefit of removing the line switching "clunk." Adaption to the telephone line characteristics continues as the conversation proceeds using voice as the driving signal.

1.2.1 SPECIAL HYBRID FEATURES

The Telos ONE-x-Six incorporates sophisticated audio processing in the digital domain for gain control and filtering.

- A digital high-pass filter is used to reduce hum and other low frequency interference. High frequency noise above the telephone frequency range is also attenuated.
- Smart digital automatic gain control smooths input and output levels. A noise-gate/downward expander is provided on the receive path to reduce phone line noise during caller pauses.
- A switchable override function is provided to allow ducking of the caller while the announcer is speaking. The override function includes an acoustic ducker which dynamically reduces send audio when caller audio is present in order to reduce feedback and aid natural conversation.
- A unique feedback reduction function uses pitch-shifting to prevent feedback buildup. The input (send) audio is shifted downward in frequency by 4 Hz.
- Front panel metering is provided for input level, output level, and gain reduction.

The process of analog-to-digital and digital-to-analog conversion is critical to audio quality and hybrid performance. The Telos ONE-x-Six uses integrated circuits called CODECs for the analog-to-digital and digital-to-analog conversions. These ICs are better than the usual telephone CODECs because they can use oversampling and digital filtering techniques for the anti-aliasing and reconstruction filters rather than the usual switched-capacitor filter approach. Thus noise and distortion are quite good.

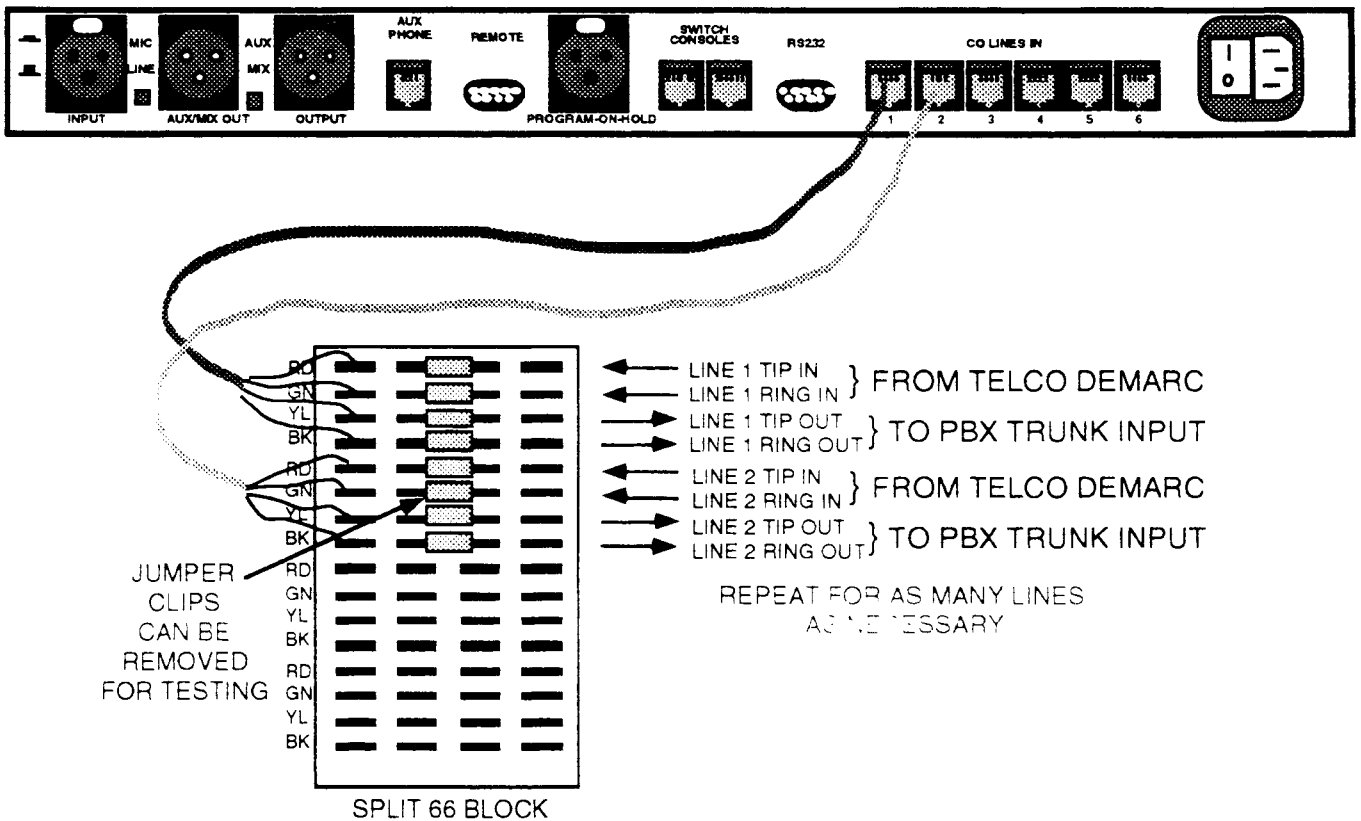
SECTION 2
INSTALLATION

2.1 CONNECTION TO TELCO LINES

2.1.1 THE CENTRAL OFFICE CONNECTION

Telco lines are brought into the ONE-x-Six with standard RJ11C cables. Plug the Telco lines directly into the appropriate modular receptacles on the 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. If your phone installer provides your individual lines on RJ11C jacks, you should have no problem simply running the cables between those jacks and the back of the ONE-x-Six.

Note that the ONE-x-Six 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.

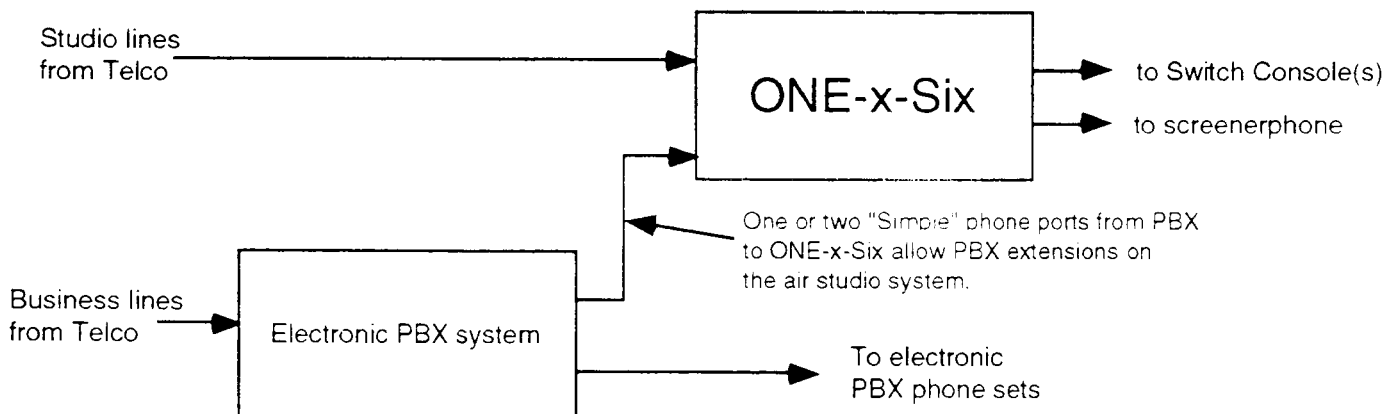
A. Using the ONE-x-Six "behind the PBX"

In this manual, we refer to any phone system other than the ONE-x-Six 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 ONE-x-Six, 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:

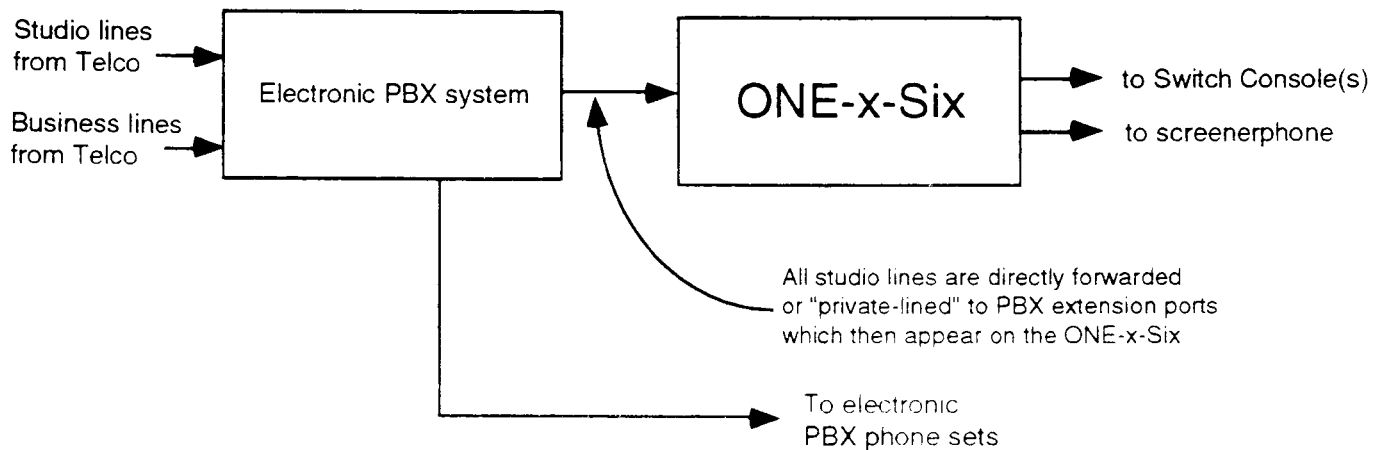
Behind the PBX Approach #1 is to segregate the studio lines to the ONE-x-Six only, bypassing the electronic system altogether. An extension or two off the electronic system would allow airing of calls received on the station's main switchboard, local in-station calls, etc. If calls need to be answered off-air, such as for a talk show "screener," a standard telephone set is used, which plugs into the ONE-x-Six.



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. With this approach, the trunks assigned for on-air use can be programmed in the PBX as "multiple appearances" to ring on the analog ports the ONE-x-Six is using, as well as on certain PBX phones programmed for these lines. Once programmed correctly, these lines can be answered by the PBX phone or the ONE-x-Six. It may be possible to allow the PBX phones to have the lines ring to them only, when call screening is necessary on these phones. Once screened, the call can be transferred to the ONE-x-Six analog ports. Use the auto-answer function (described below) so the caller can get music-on-hold after being transferred to the on-air system. When call screening is not required, the calls can be auto-transferred to the air studio, usually by programming a "set busy" feature key on the PBX phone. This is especially useful when the AUX PHONE port of the ONE-x-Six is used for a second hybrid. (A full discussion on how to set up a second hybrid is in Section 2.3.2 A).

The Telos ONE-x-Six has an Auto-Answer function, which can be enabled from a button on the Switch Console. When the system is in the auto-answer mode it will automatically seize lines that are ringing in (after about two rings) and place them on hold. This may be of use if you choose a direct-forwarding method of call screening. See Section 2.4 for information on activating the Auto-Answer feature.



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

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 two kinds of ports for each line, not to mention the cost of having someone come and reprogram the PBX.

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 ONE-x-Six 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!

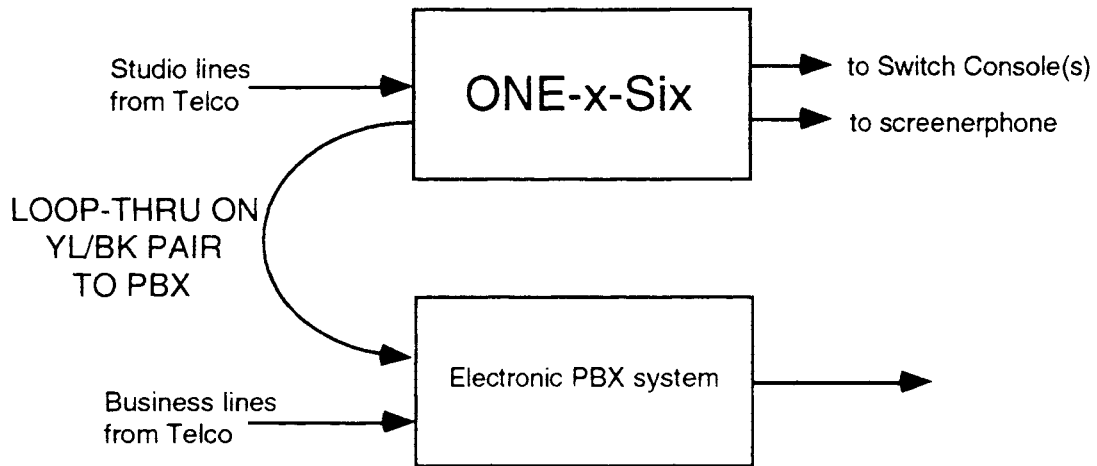
Behind the PBX Approach #3, an easy way for both systems to talk to each other, is to get Centrex® service from your phone company. Centrex® allows you to transfer lines to other Centrex® lines using hook-flash and 2, 3, or 4 digit "extension" numbers. This way you can keep on-air lines and business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

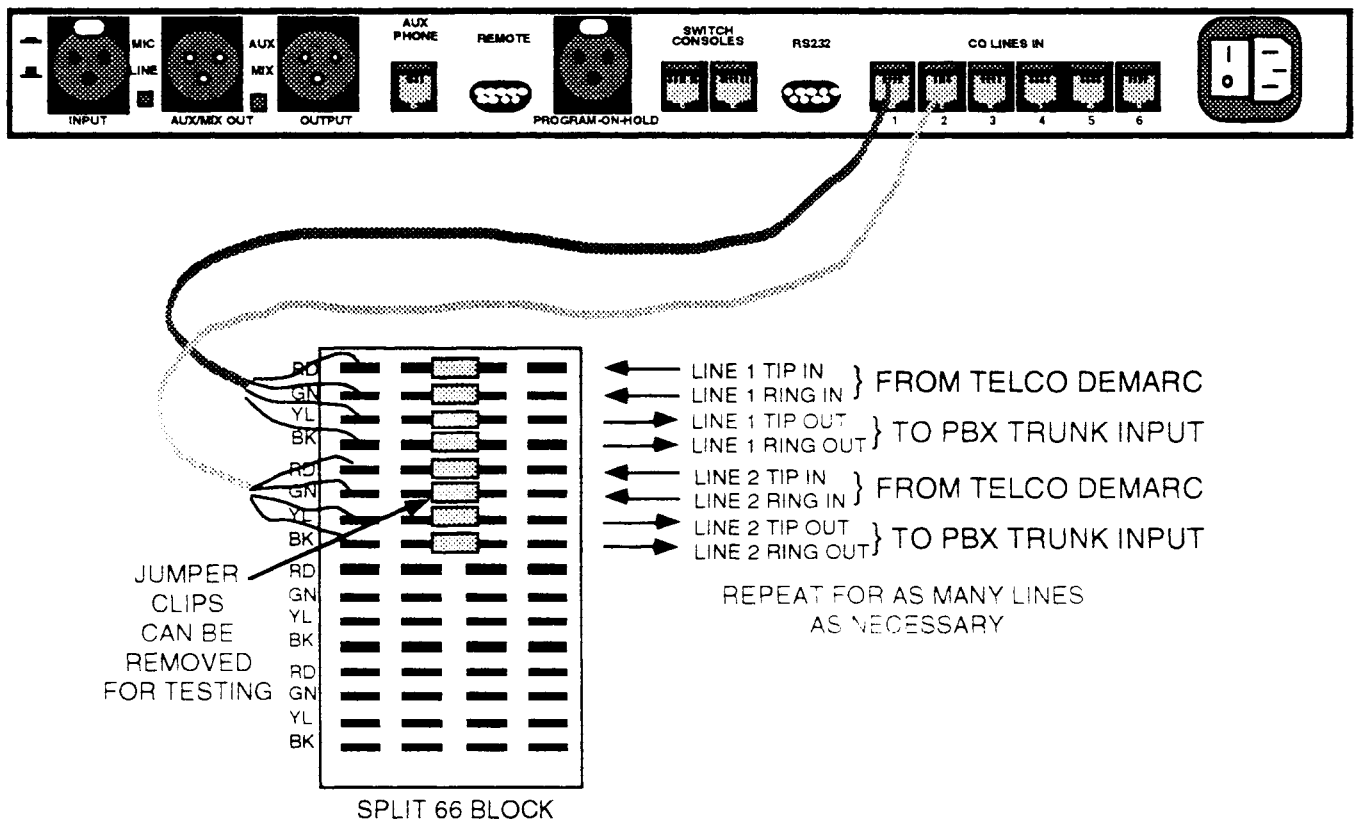
This approach uses the ONE-x-Six's YI/Bk (outer) pair on the CO line modular connectors to loop through to your PBX. Once connected to the PBX, all lines can be shared between systems. If a line is seized on the PBX, the ONE-x-Six detects loop current and will light the appropriate button on the Switch Console. *The ONE-x-Six cannot access any line that has been seized by the PBX first* See Section 2.4 on how to disable this option .Any line seized by the ONE-x-Six will disconnect the tip/ring loop-through pair away from the PBX so that on-air calls

cannot be disturbed by other phone users.

The ONE-x-Six knows when a line is off-hook on the PBX because each line has current sensing circuitry. Thus, the bar LED line status indicator on the Switch Console will be illuminated continuously (indicating a simple off-hook). If the PBX puts a line on hold, the ONE-x-Six will still keep the bar LED line status indicator illuminated continuously, since it can't differentiate electrically between talking and being "on hold." (The "talk" and "hold" circuits both draw loop current!) *Once again, the ONE-x-Six cannot access any line that has been seized by the PBX first. See Section 2.4 on how to disable this option.* Use a 66-block and punch down the Yl/Gn/Rd/Bk wires for each line to make interconnection easy. Refer to the diagrams on the next page for details.



Looping CO lines through the ONE-x-Six to the PBX



Using a split 66-block to wire the ONE-x-Six'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 the ONE-x-Six. Keep in mind that the Telos ONE-x-Six will NOT know when shared lines are off-hook or on hold from the other PBX (nor will the PBX know what the ONE-x-Six is doing). This may cause unintended interruption of calls on the air, calls being screened, and so forth.

2.2 AUDIO CONNECTIONS

2.2.1 MIX-MINUS

The ONE-x-Six audio input should be fed mix-minus audio. That is, the mix of all the sources you want to feed the phone *minus* the hybrid output itself. The sources that feed the mix-minus bus should be pre-fader, so that they are always feeding the hybrid and so the operators can't upset the send level to the hybrid. *Increasing the send level beyond a normal meter reading does not increase the level into the phone line, due to internal, digital limiting of the hybrid! Refer to Section 2.5.2 on how to set the send level to the hybrid.*

There are a number of ways to create a mix-minus feed.

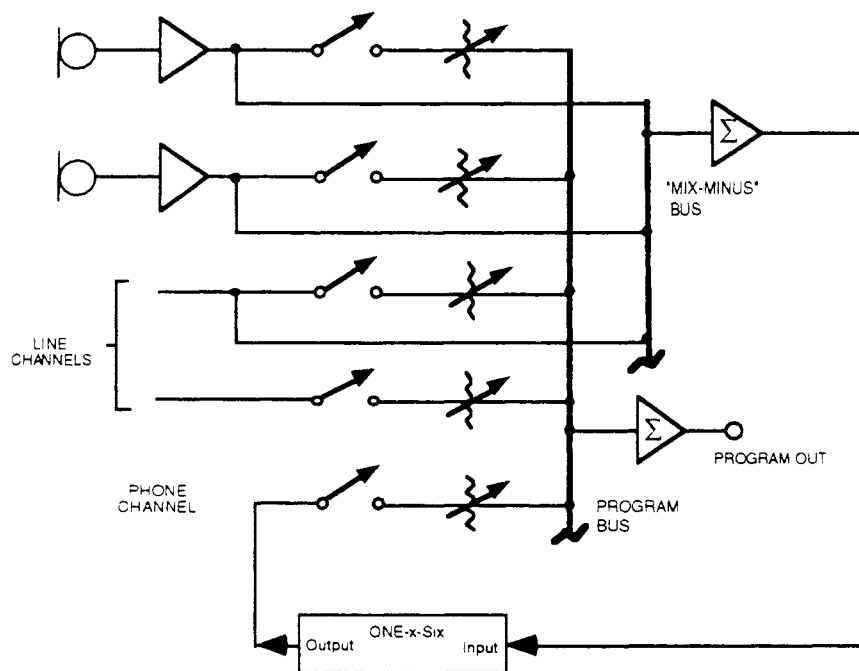
Simple Mix-Minus

For the simplest installation, you can just take the patch send or preamp output from the mic channel to feed the hybrid. This works well, but doesn't have much flexibility.

Another approach which allows more control is to use an outboard mixer to combine sources as desired. All of the desired sources are paralleled into the on-air board and the mixer and the mixer's output feeds the hybrid.

Sophisticated Mix-Minus

Most modern broadcast consoles have provisions for mix-minus. The best allow selective feeds to the telephone system. This is useful since you sometimes want only one mic feeding the phone, sometimes you want three or four mics (during the morning show, for instance), and sometimes you want to feed cart machines when callers need to hear and react to contest effects, etc. The diagram that follows illustrates in simplified form a portion of a broadcast console with a mix-minus bus.



Simplified mix-minus scheme

While on the subject of consoles and mix-minus, we'll digress here for a moment. Many hybrid installation problems are caused by an inadvertent signal path which creates a loop from the hybrid's output to its own input. Some console designs allow this to happen when certain control combinations are user-selected. This is the first place to look when strange or erratic performance is experienced. The ONE-x-Six's front panel input meter should give you an immediate answer.

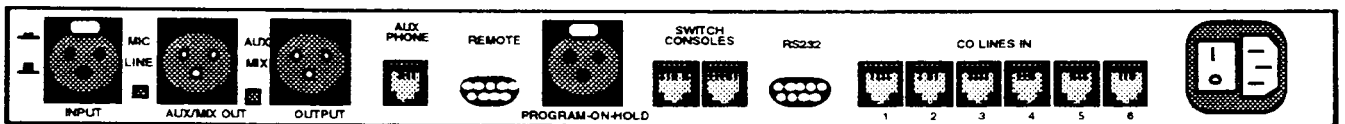
A Good Idea...

Here's a neat scheme for stations which do a lot of taping of calls for later play on the air. The mix-minus goes into the left channel of the studio tape machine, while the right channel input gets the hybrid output. The result is a two-track tape with the announcer and caller audio separated. When you play back on the air, you set the console input to mono and adjust the relative balance as desired. You also have a tape with caller and announcer audio separated, which makes it easier to do production for contest squeals, etc. If you only have mono tape decks, use the second output of the hybrid in the MIX position. See Section 2.2.3 on the second output.

2.2.2 INPUT AUDIO CONNECTION

The input has the following characteristics:

- Active balanced.
- Switch out = LINE position: -24 to +12dBv level.
- Switch in = MIC position: -68 to -35dBv level.
- Approximately 2K Ω impedance.
- Pin 1 is ground and pins 2 & 3 are the balanced audio inputs.



Unbalanced sources may be used by connecting pins 1 & 2 to the source ground while the signal hot is connected to pin 3.

2.2.3 OUTPUT CONNECTIONS

There are two separate and independent active differential audio outputs each with the following characteristics:

- Active balanced. If an unbalanced output is required, connect between ground and either of the hot pins. Do not ground the unused hot pin.
- Output level will vary from approximately -20dBm to +10dBm depending upon gain control adjustment, caller level and whether or not the AGC is engaged.
- Pin 1 is ground. Pins 2 and 3 are the balanced signal outputs.

Note that the output level meter is before the gain control; it displays actual phone level before processing. Use the output trimmer on the front panel to adjust the level to your mixing board.

OUTPUT

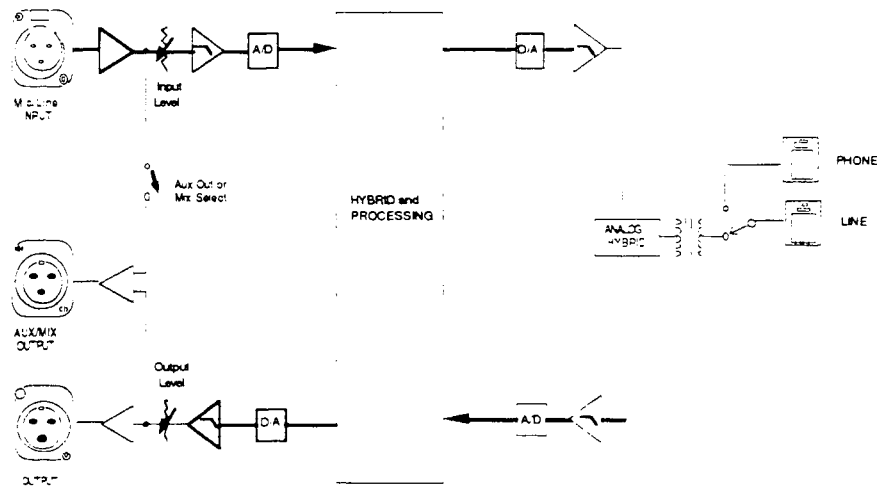
Caller-only audio appears on this male XLR.

AUX/MIX OUT

The AUX/MIX output is either a mix of the send and caller signals or an isolated second caller-only output, depending on the setting of the switch to the right of this male XLR.

- Switch out = mixed caller and send signal is present.
- Switch in = caller-only audio is present.

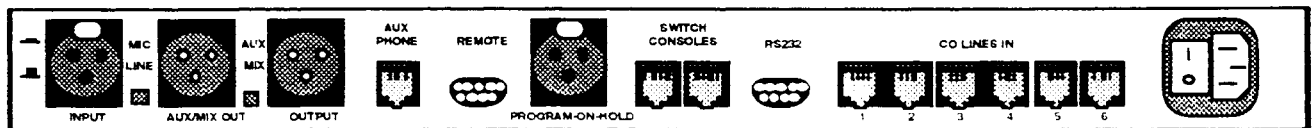
The input is passed to the MIX output at unity gain. Note from the block diagram below that the pass-through gain is not affected by the input or output gain controls. However, since the output gain control does affect the caller level in the mixed output, it can be used to adjust the balance between the send and caller signals.



Telos ONE audio block diagram

2.3 OTHER REAR PANEL CONNECTIONS

In addition to the six RJ11C modular jacks marked 1-6 under CO LINES IN and the hybrid XLR connectors as already described, the rear panel of the ONE-x-Six has three more RJ11C modular jacks, another female XLR, one male DB-9 connector, one female DB-9 connector and the AC receptacle.



2.3.1 AUX PHONE

The RJ11C jack labelled *AUX phone* is used for a standard, single line telephone. (These phones are sometimes referred to as “2500” sets. They are the type of single line phone you find practically everywhere at rather moderate cost.) Generally, this phone is used for call screening and other off-air conversations. Standard two (or four) conductor modular cables are required.

The bottom row of LINE buttons on the Telos Switch Console serves as the line selector. Lines must be manually selected each time the phone is taken off-hook. If screening is taking place outside the air studio, you will have to acquire another Telos Switch Console.

Telos does not provide an AUX phone with the ONE-x-Six. We recommend that you use a high quality instrument for this application.

2.3.2 SECOND HYBRID (OPTIONAL)

The ONE-x-Six allows you to connect a second, external hybrid for conferencing. When a second hybrid is used, caller-to-caller gain is improved, reducing the likelihood that your conferenced callers will have problems hearing each other. For your second hybrid, we recommend our Telos ONE or Telos 100 Delta digital hybrid telephone interface be used. (Did you expect us to recommend otherwise?)

There are three ways to use a second hybrid with the One-x-Six:

A. Connection to ONE-x-Six with control from Switch Console

The second hybrid is connected to the AUX phone connector on the back of the ONE-x-Six. All six lines can now be routed to the external hybrid by pressing the *bottom* row of buttons (formerly the screener buttons) on the Switch Console. Installation requires a standard two or four wire RJ11C cable. Simply run the cable from the ONE-x-Six’s AUX phone connector to the LINE connector on the hybrid. To control the second hybrid from the Switch Console, follow the instructions found in sections 2.3.6 and 2.4 of this manual to give the external hybrid its correct on/off control. Then, set up the hybrid according to the instructions in its manual.

When a second hybrid is connected through the ONE-x-Six, however, most caller screening capabilities are compromised. It is possible to work around this problem by using a single line phone looped through the second hybrid and taking care not to accidentally put the caller on the air during screening (this is done most easily by breaking the connection to the external hybrid’s on/off control signals;

however, once a call is established on the external hybrid, you won't be able to screen calls!). Alternately, the second hybrid's console fader can be put into cue mode for screening (as long as the input to the hybrid is switched, too!). See Section 2.1.2 for a discussion regarding "Behind the PBX Approach #2. This may offer some insight on system configuration.

B. Loop through a single, ONE-X-Six line

The second hybrid can be looped through one of the lines connected to the ONE-x-Six. Consider the second hybrid as an external phone system and install as instructed in section 2.1.1. This allows you to use all of your phone lines normally when only putting one caller on the air. When you want to conference in a special guest, dial-out on the line with the second hybrid, and then, instead of putting the guest on the air from the ONE-x-Six, use the second hybrid. Take care not to select the line a second time from the ONE-x-Six.

This method retains your screening capabilities, but you cannot turn the second hybrid on and off from the ONE-x-Six without giving up the functions of some of the special function buttons on the Switch Console. We recommend renaming the DELAY DUMP and RECORD STOP buttons "Guest On" and "Guest Off" and use the appropriate pins on the REMOTE connector. See sections 2.3.6 and 3.2.6.

C. Stand-alone second line

Use an additional phone line separate from the lines connected to your ONE-x-Six. This will allow you to install the hybrid as a separate "system." Use this phone line exclusively for guests and do not publish the phone number!

This method retains your screening capabilities, but you cannot turn the second hybrid on and off from the ONE-x-Six without giving up the functions of some of the special function buttons on the Switch Console, as described above. See sections 2.3.6 and 3.2.6.

Note: When using two hybrids, you must have two mix-minuses. (See section 2.2.1.) After establishing what console audio you want to feed to the callers, use external equipment (and the second output of our hybrids) to create a mix-minus for the internal hybrid that includes the desired console audio plus the output of the second hybrid. Conversely, the second hybrid requires a mix-minus consisting of the desired console audio plus the output of the internal hybrid. You may want to draw out the signal path ahead of time to make certain that neither hybrid is being fed its own audio.

Another note: For best operation, feed the outputs of the two hybrids to two

different console inputs. This gives you complete control over the relative mix of the two callers and helps to avoid mix-minus problems.

2.3.3 SWITCH CONSOLES

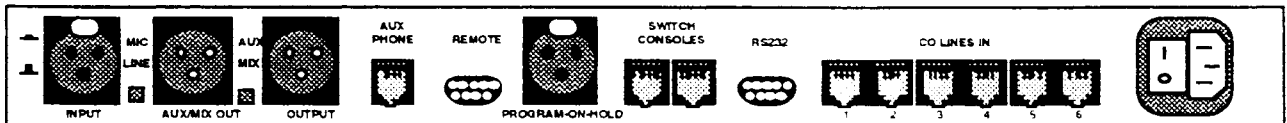
The two center modular connectors are for Switch Consoles or console mounted control surfaces. Plug your Telos Switch Consoles or console panel into either of these jacks (they are in parallel) using the six-conductor cord provided. *You must use 6-wire modular cables for the console connection; standard 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 ONE-x-Six. See the Appendix of this manual for more information on how the modular cables are wired.*

Each ONE-x-Six is capable of powering a total of two drop-in console panels or desktop Switch Consoles. (Switch Console powering capacity is reduced to one if you use the earlier metal-cased Switch Consoles instead of the one packaged with your ONE-x-Six.) An external Local Power Supply may be used if more panels and/or consoles are desired. Installation of the Local Power Supply is detailed in the Appendix of this manual.

The maximum cable length from the ONE-x-Six to the desktop control surfaces is 100'. 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 greater distances are required, use a Local Power Supply. Installation of the Local Power Supply is detailed in the Appendix of this manual.

A 25' cable to connect the ONE-x-Six to a Switch Console comes packaged with the unit. 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 plug at the end to end.*

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



2.3.4 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 -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.

2.3.5 RS-232

Using a male DB-9, this is the standard AT-style RS-232 serial port. Telos' Call Screen Manager software, designed for producer-to-talent communications, utilizes this port. Section 3.4 of this manual covers RS-232 application and has details on the pin-out, data protocol, etc. A null-modem cable works fine to connect the ONE-x-Six to your PC.

P3 - RS-232 Connector Pin-Out

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

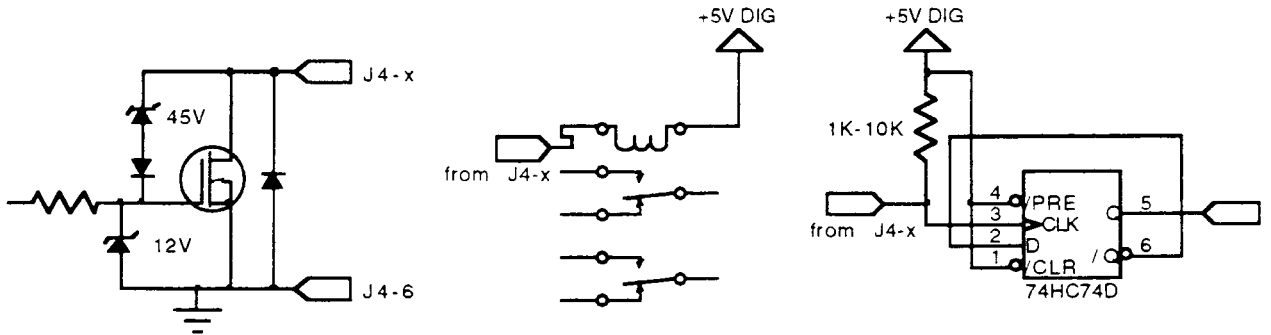
2.3.6 REMOTE

This is a female DB-9 connector which provides the user buttons' control outputs. All outputs are momentary open-collector closures to ground. These will require a weak pull-up resistor to +5VDC. Some equipment (like our hybrids) have pull-ups built into their control inputs. Check the device's manual to be sure. The pin-out is detailed below.

Remote Pin-Out

- 1 Delay Dump / User Output A
- 2 Not currently supported
- 3 Hybrid 2 (external) ON
- 4 Hybrid 2 (external) OFF
- 5 External STOP when internal hybrid turned OFF
- 6 Ground
- 7 Record Start
- 8 Record Stop / User Output B
- 9 External START when internal hybrid turned ON

All outputs are momentary open-collector closures to ground. Each output can sink up to 250 mA. For these outputs the maximum pull-up voltage is +45V. If these outputs are to drive inductive loads a back-EMF diode is built in, so none is required.



TYPICAL TPIC6259 OUTPUT

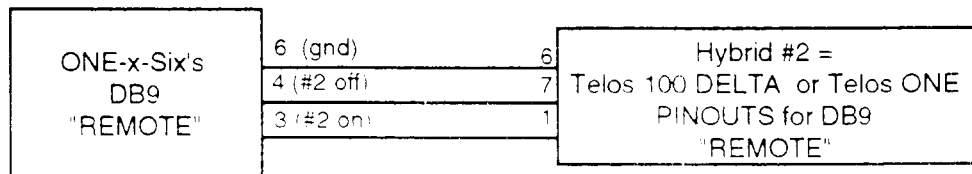
DRIVING A 5V RELAY

DRIVING A TTL INPUT

The external stop and start (pins 5 and 9) are controlled by the top row of LINE buttons on the Switch Console. When a line is selected to be put on-air, the external start can be used to start or reset a timer or any other application you wish. When a line is dropped, the stop function allows the timer to be stopped.

The Hybrid 2 (external) ON and OFF (pins 3 and 4) are controlled by the bottom row of LINE buttons on the Switch Console and are used when a second, external hybrid is installed in the "Aux Phone" port. When a line is selected to be put on the air, Hybrid 2 will turn ON. When a line is dropped or held, Hybrid 2 will turn OFF. Dip Switch #6-2 must be turned on to activate this function. (See Section 2.4.)

The diagram below shows how to connect the remote connector of the ONE-x-Six to either the Telos ONE or Telos 100 Delta digital hybrid telephone interfaces.



2.3.7 AC RECEPTACLE

The AC receptacle connects AC to the unit with an industry-standard IEC connector and provides a power on/off switch. The power supply inside the ONE-x-Six has a universal AC input, accepting an input range of 90-264VAC, 50-60Hz. A fuse is located on the power supply.

2.4 INTERNAL DIP SWITCHES

The ONE-x-Six has two 2-position DIP switches and one 4-position DIP switch to enable options. These switches are shipped from the factory in the OPEN position for default operation. The software incorporates the following functions:

Dip #5-1 - "Locked-on" Conferencing

OPEN: The factory setting for this DIP Switch is OPEN, 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 DROP will function normally.

Dip #5-2 - FLASH/NEW and AUTO-ANSWER

OPEN: 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 internal 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 ONE-x-Six, 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 console mounted control surface, refer to the manual for the panel for information on how to toggle this feature.

Dip #6-1 - Tone or Pulse Dialing

OPEN: This is the factory default and causes the phone pads on any Switch Consoles and console mounted control panels connected to the ONE-x-Six to dial out using DTMF Touch Tones®.

ON: This causes the phone pads on any Switch Consoles and console mounted control panels connected to the ONE-x-Six to dial out using “rotary pulses.” The cadence of the pulses is 10 Hz with a break/make ratio of 2:1. Time between digits dialled is 700 msec.

Note: The DTMF Touch Tones® or rotary pulses send by a telephone set to the ONE-x-Six via the “Aux Phone” port will pass through the system and cannot be affected by this switch.

Dip #6-2 - Optional Second hybrid control

OPEN: This is the factory default which disables the external hybrid on/off control (pins 3 & 4 on the “Remote” connector). Any lines seized on the bottom row of the Switch Console, in fact, will be routed to the “Aux Phone” port, where the screener phone is. When the screener puts lines on hold with the bottom row’s HOLD button, they will go to “Screened Hold.”

ON: This enables the external hybrid on/off control (pins 3 & 4 on the “Remote” connector). If a hybrid is connected to the “Aux Phone” port, any lines seized on the bottom row of the Switch Console will go to the external hybrid. Pins 3 & 4 on the “Remote” connector should be connected to the hybrid’s on/off control pins. Lines put on hold from the bottom row’s HOLD button will now go to regular “Hold” instead of “Screened Hold.”

Refer to section 3.2 for more details.

Dip #10-1 - “ELSEWHERE” override option

OPEN: This is the factory default which prevents lines from being seized by the system whenever they are off-hook via the loop-through (refer to manual Sections 2.1.2B and 3.4.2 for details on the “ELSEWHERE” state).

ON: This enables a user override of calls that are in the “ELSEWHERE” state. A line will go into this state whenever the line is active on the loop-through of that line (refer to your manual Sections 2.1.2B and 3.4.2). The console displays lines in this state by dimly lighting the BAR LEDs on both rows. When DIP SW 10-1 is off, lines in this state will be “locked out” and will not be allowed to interrupt the loop-through call in progress. When DIP SW 10-1 is on, lines in this state can be selected on either row of the console. This may be useful for those who use their PBX phone(s) to screen calls, when the lines are looped through the ONE-x-Six to the station PBX.

Dip #10-2 -Not currently enabled.

Dip #10-3 -Not currently enabled.

Dip #10-4 -Not currently enabled.

2.5 FRONT PANEL GAIN ADJUSTMENTS

There are two screwdriver-adjustable multi-turn trimmers recessed from the front panel, marked IN and OUT. These trimmers are used to set send (audio signal going down the phone line to the caller) and receive (audio output of the hybrid, i.e. caller audio) levels, respectively.

2.5.1 INPUT GAIN

The trim pot marked IN adjusts the audio level that is being sent to the hybrid’s input XLR, which should be a mix-minus feed. (See Section 2.2.3 for a discussion of mix-minus). The unit comes from the factory with the trimmer fully clockwise—that is, all the way up! Follow these steps to adjust the IN trimmer:

1. Press the G/R - LEVEL button so it is in the OUT position; press the IN/OUT button so it is in the IN position. This makes the LED meter read INPUT LEVEL.
2. Select MIC or LINE level range by pressing the switch located to the right of the input XLR on the rear panel.
3. Feed some audio at a normal level into the mix-minus bus. This can be a microphone, a tone generator, or a cart or CD playing your favorite tunes.
4. Look at the meter and begin turning the IN trimmer counterclockwise with a small screwdriver until most of the green LEDs are lit and the red LED only comes on every once in a while during peaks in the audio. Adjusting this level is just like setting the level to a tape deck. You wouldn’t peg the meters on a tape deck, would you?

IMPORTANT NOTE: *Increasing the send level beyond the “0” reading does NOT increase the level into the phone line. The level of the audio sent down the phone line is part of the digital signal processing and is set to provide the maximum level permitted. Due to the internal, digital limiting action of the hybrid excessive input level may cause unwanted aliasing distortion and poor adaption!*

2.5.2 OUTPUT GAIN

The trim pot marked OUT adjusts the audio level that is being sent from the hybrid’s output XLRs to your console. This trimmer changes both outputs the same amount. Once again, the unit is shipped with this trimmer fully clockwise– turned all the way up. Follow these steps to adjust the OUT trimmer:

1. Press the G/R - LEVEL button so it is in the OUT position; press the IN/OUT button so it is in the OUT position. This makes the LED meter read OUTPUT LEVEL. The meter is reading caller audio level on the phone line *before* the output trimmer. A “0” reading corresponds to an approximately -15dBm phone level. This can tell you if your phone line level is acceptable. *The meter will not change as you adjust the output trimmer.*
2. Connect one of the hybrid’s outputs to a line-level input on your mixer and set the mixer’s meter to read that input’s level.
3. Select a line on the top row of the Switch Console. This will bring dial tone to that fader. Run the fader up to a normal gain level.
4. Look at the meter on your console and adjust the output trimmer on the ONE-x-Six with a small screwdriver so that the console’s meter reads approximately +3dB. (Dial tone is typically a few dB hotter than most callers.) If you can’t get enough level out of the hybrid, press the button on the front panel marked AGC so it is in the IN position and readjust the trimmer. Or, if your console fader has a gain adjust on its input, increase gain there.
5. Repeat step 4, only this time call a friend and have him read the Gettysburg Address or your favorite poetry while you adjust the trimmer. Try this several times on different lines to ensure you have good range with the big fader. Once again, don’t peg the mixer’s meters!

2.6 INSTALLING SWITCH CONSOLE BUTTON LEGENDS

The LINE buttons are labeled by inserting a legend under a clear lens. *When changing the button legend, place the entire button cap on a flat surface, and then remove the clear lens. This will prevent damage to the button and the lens. Avoid installing legends with the buttons installed in the Switch Console as the pressure required to for cap installation may damage the button mechanism.* Buttons already installed in the Switch Console 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.

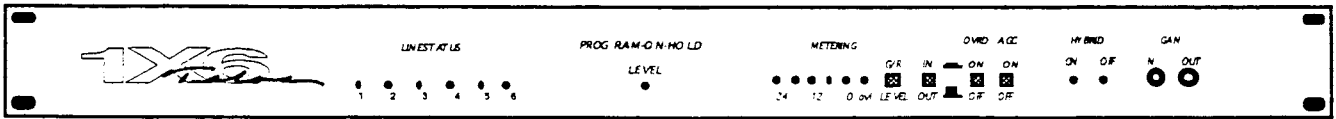
Telos includes a sheet of common legends which may be cut and placed into the appropriate LINE button caps. You can even make your own legends quite easily.

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.

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SECTION 3
OPERATION

3.1 FRONT PANEL CONTROLS AND INDICATORS



3.1.1 LINE STATUS LEDS

When a telephone line is in use, the front panel LED indicator corresponding to that line will illuminate and blink different cadences to indicate that line's status. These cadences differ from those of the Switch Console.

Very Slow Blink:	Line is Busied Out
Slow Blink:	Line is Ringing In
Very Fast Blink:	Line is On Hold
Very Fast Double Blink:	Line is On Screened Hold
Medium Blink:	Line is Off Hook but not On-Air
On Continuously:	Line is On-Air
Off Continuously:	Line is On Hook And Inactive

3.1.2 PROGRAM-ON-HOLD LEVEL LED

This indicator will illuminate when audio is present at the Program-On-Hold input.

3.1.3 METERING

The meter mode pushbuttons select the desired function:

- Input level
- Input gain reduction
- Output level
- Output gain reduction

The input level metering is after the input gain control and displays your mix-minus level to the hybrid.

The output level meter is placed before the output gain control. This is done so that the level may be adjusted to accommodate the equipment downstream of the hybrid without affecting the Telos' meter level. Note that when the AGC is switched out, the meter reads the telco line level and thus may be used to determine if there is a phone line level problem. The meter's "0" indication

corresponds to a phone line level of approximately -15dBm.

When viewing input gain reduction the meter will only have one or two LEDs lit. As the meter moves to the left, it indicates input gain reduction; when it moves to the right, it shows input gain expansion. Input AGC is always active.

The output gain reduction meter is only active when the AGC button is pressed in, since this button turns the caller AGC on and off. Its display functions just like the input gain reduction meter.

3.1.4 OUTPUT PROCESSING: OVERRIDE

This pushbutton engages two independent functions: the *caller ducking* and the *acoustic ducking* function. In most broadcast applications, you will find that engaging the override function results in better overall performance.

Caller Ducking

This function operates in the caller audio path. When active, there is approximately 6dB of ducking applied to the caller audio when the announcer speaks. However, very little change in caller level will be noticed due to the very high speed operation of the duck function and the masking provided by the presence of the send audio.

The purpose of this function is twofold:

- Aesthetic Preference. Many air talents prefer the effect of having some control over the caller when they speak.
- Improvement of “dynamic” trans-hybrid Loss.

Acoustic Ducking

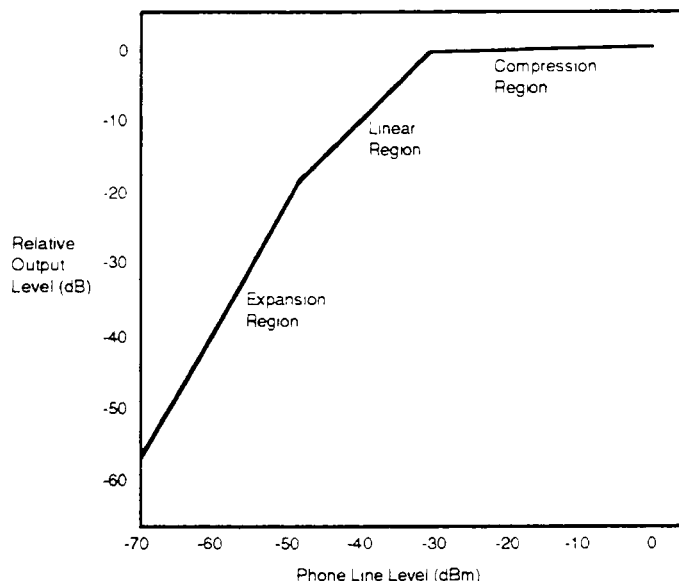
This function operates in the send audio path. The acoustic ducker works by reducing the send (announcer) signal dynamically when the caller speaks.

The acoustic ducker is used to prevent feedback when open speakers are being used to monitor callers. Also, since an open monitor causes callers to hear themselves fed back via the acoustic path from the speaker to the announce mic, this function has the additional benefit of allowing the caller to perceive a more natural sounding conversation.

The time constant is very fast, so the effect of the acoustic ducking usually is not noticed by the caller. The only disadvantage might be that the announcer may be less able to break in on a caller who is insisting upon shouting on.

3.1.5 OUTPUT PROCESSING: AGC

The telephone dynamic gain processing is enabled with this pushbutton. The output processing includes both an automatic gain control and a smart noise gate/downward expander function.



As can be seen in the graph which shows the relationship between telco line level and the Telos ONE output level, the AGC maintains a constant output level when the phone line level varies between approximately -30 and 0dBm. Below approximately -48dBm, a gentle noise gate/downward expander operates to reduce residual hybrid leakage and phone line noise.

According to AT&T statistical studies of the USA telephone network, the average level found on standard phone lines is -16dBm. *In our experience high-volume "choke network" lines generally have poorer levels*

3.1.6 HYBRID STATUS

These LEDs indicate whether the internal hybrid is ON or OFF. Indication of which phone lines are active to the hybrid can be seen on the Switch Console as well as the front panel's line status LEDs.

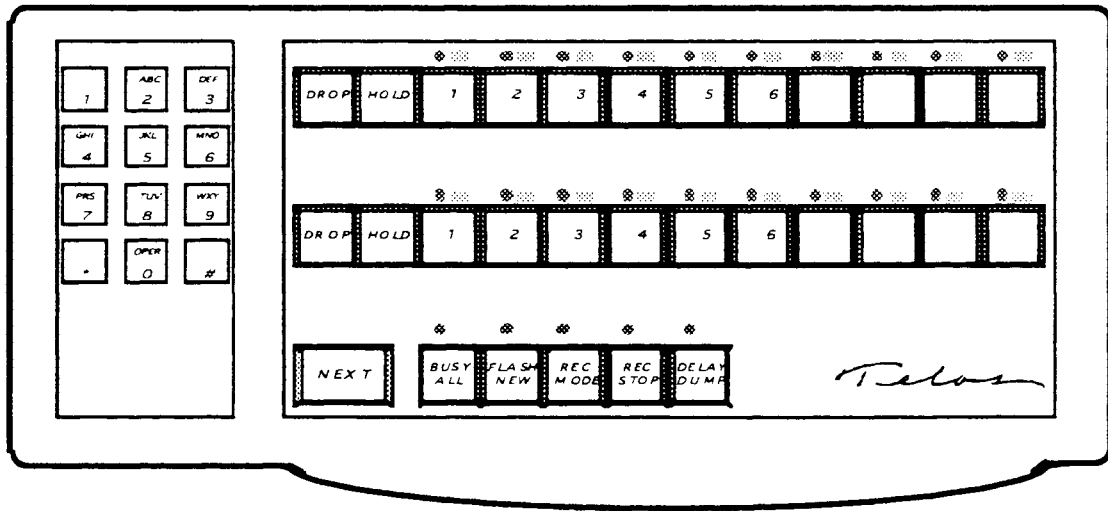
3.1.7 GAIN CONTROLS

These recessed trimmers adjust the send and receive levels. Refer to section 2.4 for many more details.

3.2 THE SWITCH CONSOLE

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.



Telos desktop Switch Console: Top row selects calls to go to air, bottom row selects calls for off-air screening via a standard telephone.

The Switch Console communicates by sending and receiving serial data over a "skinny wire" data link. The Switch Console sends data to the ONE-x-Six when a key press occurs and receives commands from the ONE-x-Six to illuminate the appropriate LEDs as determined by the ONE-x-Six's software.

When the Switch Console is first plugged into the ONE-x-Six, 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 Tones® are generated internally by the ONE-x-Six. An internal DIP switch in the ONE-x-Six, described in Section 2.4, allows pulse dialing where Touch Tone® dialing is not available.

A standard keypad is provided so that outgoing calls may be placed from the Switch Console. To dial out through the internal hybrid, select an available line on one of the top row's LINE buttons and dial. If you want to place a call on the auxiliary phone and there is no second hybrid connected, pick up the handset, select an available line on the bottom row of line buttons, and dial using the dialer on the phone. If a second, external hybrid is connected, select an available line on one of the LINE buttons on the top row and dial; once you're done dialling, press the line button directly below the line button you selected to dial out with to transfer the call to the external hybrid.

3.2.3 LINE BUTTONS AND LED INDICATORS

Operation for line selection, holding, etc. is very similar to familiar key phone sets. The maximum number of lines is six. The top row of LINE buttons corresponds to the internal hybrid. The bottom row connects lines either to the screener phone or, if connected, an external hybrid. Either or both rows can be disabled via a DIP switch inside the console. Refer to the Appendix for details.

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 ONE-x-Six.

LINE Buttons

Each row of LINE buttons has a DROP button, a HOLD button, and ten LINE selection buttons. Since the Switch Console included with the ONE-x-Six is identical to the unit used with our larger systems, the last four buttons on each row will be inactive when using the ONE-x-Six. During installation, up to six phone lines may be connected to the ONE-x-Six. The DROP and HOLD buttons affect only the row of LINE buttons on which they are located. The top row routes phone lines to the internal hybrid; the bottom row routes calls to the external "Aux Phone" port on the rear panel of the unit. All phone lines appear in the same relative positions on both banks. Each bank works independently of the other.

Red 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, by a computer command to the RS-232 input, or from an external phone system connected to the ONE-x-Six. 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.

<i>Red Bar LED Status</i>	<i>LINE Status</i>
Slow Blink	Line Is Busied Out
Medium Blink:	Line Is Ringing In
Very Fast Blink:	Line Is On Hold
Very Fast Bright Blink:	Line Is On Screened Hold
On Continuously:	Line Is on-air (or on screener phone)
Off Continuously:	Line Is On Hook And Inactive

Yellow Round LED Indicator

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

<i>Yellow Round LED Status</i>	<i>Hybrid Status on Indicated Line</i>
Blinking	on-air, standard mode
On Continuously	on-air, conference mode
Off Continuously	Not on-air or being screened

A quick run through the various line statuses will familiarize you with what each blink rate looks like and really means.

3.2.4 PLACING CALLERS on-air

Placing Callers on-air in Standard Mode

To place a caller on-air, push the desired LINE button on the top row. The round LED will flash and the bar LED will be lit continuously. 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 will seize the phone line associated with that button. Pressing the LINE button a second time will place that line in the conference mode. This is indicated on the Switch Console as BOTH LEDs lit continuously. The DROP and HOLD buttons will have no effect on any 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 (round LED blinking again, bar LED lit continuously) and the DROP and HOLD buttons of that row will affect that line as expected.

While the system software allows all of the lines to be conferenced together, caller-to-caller gain may be insufficient when there are fewer hybrids in the system than active callers.

The ability to place lines in conference mode may be disabled by a DIP switch inside the ONE-x-Six. See Section 2.4 for details.

Tips for Conferencing

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.

The system allows you to have more than one caller on the internal hybrid. To accomplish this, place a caller in the conference mode and then select one or more callers from the top row of LINE buttons on the Switch Console. This is called "hard mash" conferencing. When performing this "button mashing" your callers may not hear each other very well.

If you have a second, external hybrid installed, select your first caller from the top row of the Switch Console and the second caller from the bottom row. A DIP switch inside the ONE-x-Six must be set. See Section 2.4 for details.

3.2.5 SCREENING CALLERS

If a single-line desk phone is connected to the "AUX PHONE" port, the bottom row on the console must be used to select lines for screening. The buttons on the bottom row function exactly like the top row's, except that when the HOLD button is pressed, the line will go to SCREENED HOLD. The blink rate is the same as regular hold but brighter. When lines are in screened hold they go into the NEXT button's cue. See section 3.2.6. If DIP 6-2 is on, the HOLD button will put the line in regular hold and the line will not go into the NEXT button's cue. See section 2.4.

3.2.6 SPECIAL FUNCTION BUTTONS

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

NEXT

Puts the line that has been in SCREENED HOLD the longest to air through the internal hybrid. If no lines are in SCREENED HOLD, it selects the line that has been ringing in the longest. This function is frequently used for contests, when the system is in the auto-answer mode, or if your week-ender jocks need a simple way to use the system. If no calls are in SCREENED HOLD or RINGING in when the next button is pressed, the line that is on-air (and not locked in) will release.

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 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 top 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 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 button, third from the left, may be changed by a DIP switch inside the ONE-x-Six. (See Section 2.4.) Once enabled, 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 ONE-x-Six (after about two rings) and places them on screened hold. Once the line is connected to the hold circuit, 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 on continuously, will blink. The next time you press a LINE button to select a call to air, the RECORD START output on the Control connector on the back of the ONE-x-Six 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 or HOLD buttons are pressed and no lines are active on the hybrid (i.e. not in conference mode). To turn off the RECORD MODE, press its button again.

RECORD STOP

When this button is pushed, the RECORD STOP output on the Control connector on the back of the ONE-x-Six will be pulsed. (See Section 2.2.) This does not disable the RECORD MODE, but, rather, can stop the tape deck if you choose not to record the call anymore. This output can be used to stop a recording device or for any other desired function, like turning off a single-line external hybrid, starting a dedicated "station I.D." cart machine and so forth.

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 ONE-x-Six. (See Section 2.2.) This may be used to control a delay system or for any other desired function, like turning on a single-line external hybrid, starting a dedicated "station I.D." cart machine etc.

3.2.7 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.

3.3 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. 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.

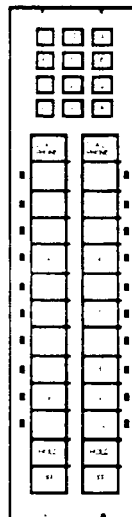


FIGURE 10. LINE PANEL BY PRR TELOS

3.4 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 accommodated easily with any computer/software system. Please let us know what you come up with!

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

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

Messages to The Talent

Host Screen of Call Screen Manager

3.4.1 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)

3.4.2 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>OFF</u> XX	Turns line XX off.
<u>ON</u> XX	Turns line XX on to the main bank.
<u>HOLD</u> XX	Puts line XX on hold.
<u>SCRNED HOLD</u> XX	Puts line XX in "screened hold" mode.
<u>CONF</u> XX	Turns line XX on to the "Aux Phone" port.
<u>LOCK</u> XX	Equivalent to switch console "double press."
<u>TONE</u> XX	Dials tone XX to on-air line. 11 = *; 12 = #.
<u>QUERY</u> XX	Causes Telos to return line status in format given below.
<u>UXX</u>	Virtual press of function button on console. BUSY -> DELAY/DUMP = U00 -> U04. NEXT = U05.
<u>Xternal</u>	Causes all function keys to transmit to computer only - the functions are not actually performed unless the computer echoes 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 ONE-x-Six will revert to normal mode after time-out to prevent problems with computer being turned-off, etc.
<u>Reset Xternal Mode</u>	Function keys back to normal operation.
<u>Monitor</u>	Causes Telos to return line status in format given below whenever any line status changes. Replies with: Line monitor ON.
<u>Don't Monitor</u>	Turns monitor mode off. Replies with: Line monitor OFF.
<u>Initialize</u>	Sets all lines to off, etc.
<u>?</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	XX Indicates line XX is active on the internal hybrid.
<u>H</u> OLD XX	Indicates line XX is on hold.
<u>S</u> CREENED HOLD XX	Indicates line is in "screened hold" mode.
<u>C</u> ONF XX	Indicates line XX is active on the "Aux Phone" port.
<u>B</u> USIED XX	Indicates line XX has been "busied-out."
<u>E</u> LSEWHERE XX	Indicates line XX is on "elsewhere." (Detected from loop current).
<u>R</u> INGING XX	Indicates line is ringing-in.
<u>U</u>	Indicates press of function button on console. BUSY -> DELAY/DUMP = U00 -> U04. NEXT = U05.

3.5 FEEDBACK CONTROL

Sometimes, even with the exceptional trans-hybrid loss produced by the digital process, trouble with feedback may occur when the system is being used with an open speaker. Generally, this happens only with poorer phone lines, or with very weak callers requiring lots of gain in the phone-to-speaker path.

Some suggestions for solution of this problem:

1. Enable the OVERRIDE function.
2. When mic processing is being used, connect the hybrid input in such a way that it gets the unprocessed mic signal. The problem here is that the mic processing combines with the ONE-x-Six's digital hybrid input AGC (always active) to increase gain in the feedback path when no announcer audio is present. Depending on the mic processor, the feedback margin could be reduced by many dB. The hybrid AGC has a smart adaptive gate to prevent inappropriate gain increase, but it is thwarted by additional processing. If it is not possible to wire around the processing, try to set the

mic processing gate function so that the gain is not “sucked-up” during pauses. You might also try reducing the input level to the hybrid. The send level will still be OK, since the AGC has considerable range, but the system won’t have as much room to reach for gain. In some difficult cases, it may be desirable to disengage the hybrid output AGC function since it could reduce feedback margin in the same way input AGC does.

3. Try repositioning the mics and/or speaker. Of course, it also helps to use mics and speakers that are directional.

4. Add equalization to the monitor path. Acoustic resonances usually cause pronounced peaks in the “feedback response” of a sound system. Since the largest peaks generally occur at just a few frequencies, reducing system gain at these frequencies with a graphic or notch EQ helps tremendously.

5. If necessary, soften acoustic reflections in your studio by adding curtains or wall treatment.

The foregoing is intended to help in those situations where you must have an open speaker. Whenever possible, it is best to use headphones to hear callers. When you have an open speaker, the on-air phone audio has both a direct and an acoustic path - from the speaker to the announce mic(s). Depending on the relative levels, phone audio quality may suffer.

Generally, the best scheme is to have the phone monitor speaker mute when the mic is turned on. If you have the announce mics active to the phone system input even when the mic channel is switched off, the system can still be used like a speakerphone when taking calls off the air. When the call is to be used on-air, the announce mike is on, so the speaker is muted.

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SECTION 4
TROUBLESHOOTING

4.1 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 units 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.

4.2 GENERAL TROUBLESHOOTING INFORMATION

Desoldering

While we socket the ICs that have the greatest potential for failure, many of the ONE-x-Six'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 ones from Radio Shack. We do not recommend that newly-soldered connections be defluxed.

Circuit Description Notation

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

The Microprocessors

As with most modern equipment, the Telos ONE-x-Six is based upon microprocessor control. *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 from Burndy, Cat. No. QILEXT-1 or equivalent).

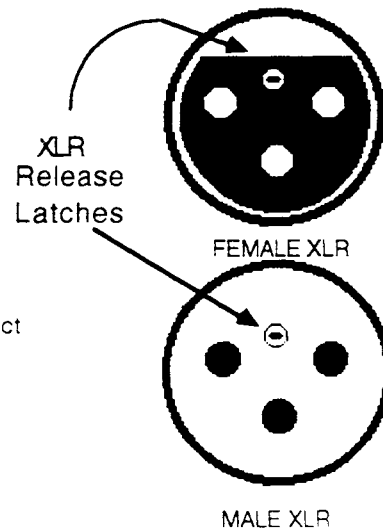
XLR Connectors

The XLR connectors have retaining screws which have to be turned in order to be released. Do this as illustrated below.

XLR CONNECTOR RELEASE:

Insert a small screwdriver into the holes in the connectors, shown at right. Turn the screwdriver about one eighth of a turn counter clockwise to release the connectors. A small screwdriver such as the Xcelite R3322 or R3324 need to be filed down some to fit the slots.

Remember to retighten the XLR latches when replacing the Telos ONE PCB. This will ensure correct support for the XLR connectors on the PCB.



CAUTION

The installation and servicing instructions in this manual are for use by qualified personnel only. To avoid electric shock do not perform any servicing other than that contained in the Operating Instructions unless you are qualified to do so. Refer all servicing to qualified service personnel.

4.3 POWER SUPPLY

The power supply inside the ONE-x-Six is manufactured by Autec Power Systems of Simi Valley, CA. This 30W switching supply (Model No. UPS30-4003) has a universal AC input, accepting an input range of 90-264 VAC (continuous), 47-440Hz. Its outputs provides three separate voltages: a +5V supply which powers all the digital circuits, a +12V supply for the RS-232 and the Switch Consoles, and a -12V supply for the -V rail of the RS-232. The $\pm 12V$ rails also drive two linear voltage regulators which provide $\pm 5V$ for the audio circuitry. A minimum load of 0.2A on the +5V 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

APPENDIX CONTENTS

Hybrid Specifications

ONE-x-Six Switch Console pin-outs

RJ11C format for Telos Switch Consoles

Telos ABS Switch Console Options

Dual 10-line Panel Options

Warranty and Application Note

HYBRID SPECIFICATIONS

System

True digital. Second generation Texas Instruments TMS320C25 processor. 8kHz sampling rate. Internal digital input and output gain processing, filtering.

Trans-hybrid Loss

>40dB with pink noise or voice as test input. Test set-up as specified in our *Telephone Q&A*. All dynamic enhancement processing is switched off. With the override and output expander functions switched-in, trans-hybrid loss is enhanced to >50dB.

Send Level to Phone Line

-10dBm average level. Maintained by internal digital AGC.

Frequency Response (caller to output)

200 - 3400Hz \pm 1dB.

Noise and Distortion (caller to output)

Distortion: Typical 0.4% THD+N, measured @1kHz at any level from -48dBm to -8dBm.

Signal-to-Noise: >72dB. Referred to 0dBm phone level.

Send Audio Input

XLR female connector. Active balanced. Accommodates -24dBm to +12dBm levels in LINE mode; -68dBm to -35dBm in MIC mode. Front panel screwdriver level adjust.

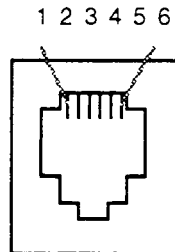
Caller Audio Output

XLR male connector. Active differential. Output levels to +14dBm depending upon caller telephone line level and adjustment of front panel level adjust. Will drive 600 Ω .

Aux/Mix Output

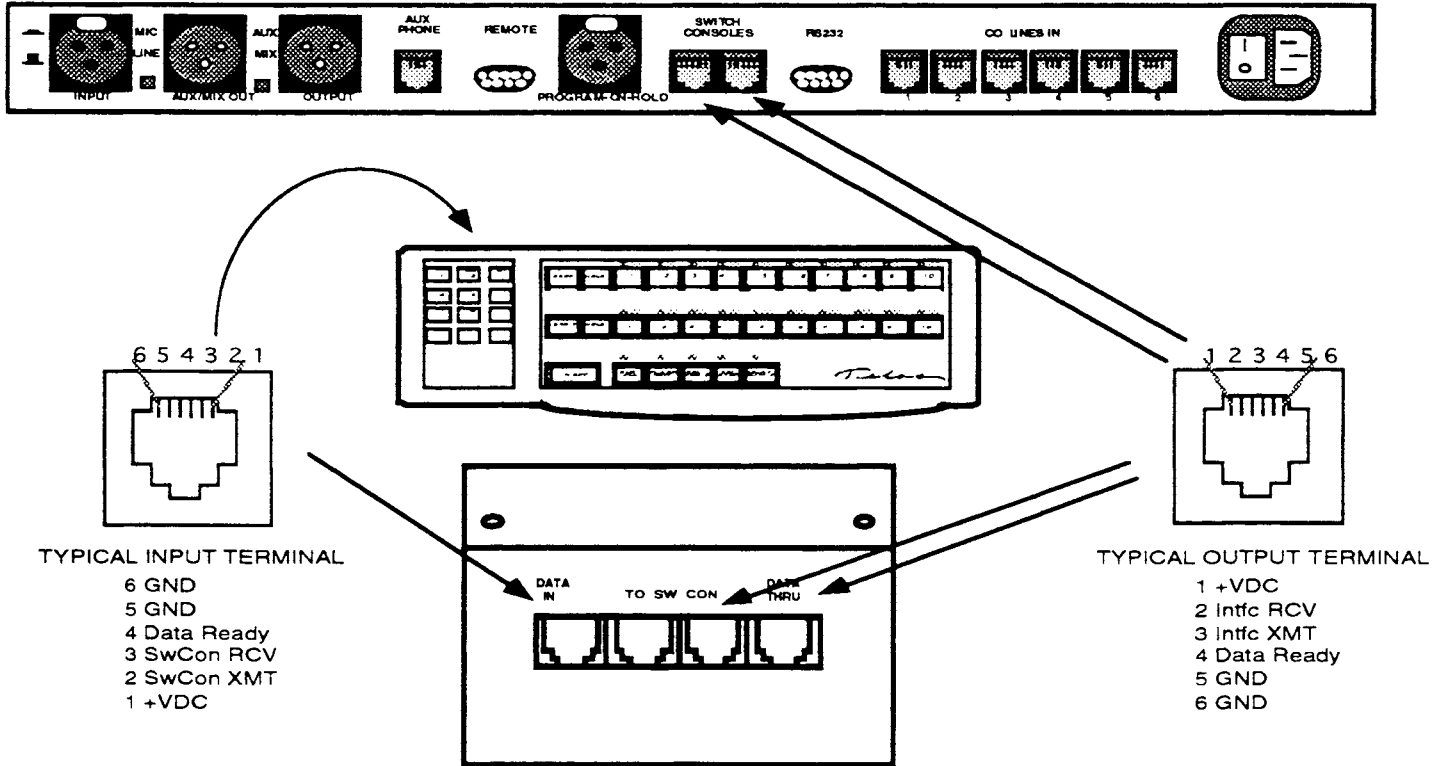
XLR male connector. Active differential. In AUX mode, this output is an isolated second output. In MIX mode, this is a combined send and caller output. INPUT to MIX Output: Unity gain. <0.04% THD; +12dBm clip point.

**ONE-x-Six Switch Console
Modular Connector Pin-Out (RJ11)**



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

RJ11C FORMAT FOR TELOS SWITCH CONSOLES



TYPICAL INPUT TERMINAL

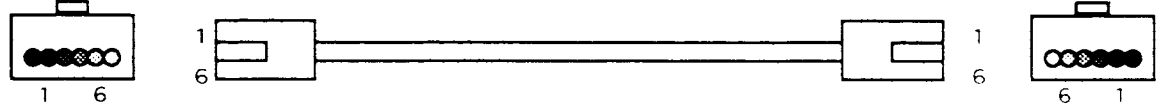
6 GND
 5 GND
 4 Data Ready
 3 SwCon RCV
 2 SwCon XMT
 1 +VDC

TYPICAL OUTPUT TERMINAL

1 +VDC
 2 Intfc RCV
 3 Intfc XMT
 4 Data Ready
 5 GND
 6 GND

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 ONE-x-Six to Switch Console WITH Aux P/S is 250 ft. Max. length WITHOUT Aux P/S is 100 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 data signal its own shield. Shields should be tied together and run to station ground for best results.

TELOS ABS SWITCH CONSOLE OPTIONS

The microprocessor board for the Telos ABS Switch Console operates as a universal panel for 10-, 20- and 30-line systems. Specific operation is set up using a four-position DIP switch located on the MPU board. Here is a brief description of its modes of operation.



NORMAL OPERATION (all DIPs off): This is the default setting for the units when they ship from the factory. This setting emulates the old panel functions: 10 lines available on hybrid #1 (top row) and hybrid #2 (bottom row). Most users will use this setting exclusively.



EXTENDED OPERATION #1 (DIP #1 on): This setting allows the panel to access lines 11-20 in a 20-line system. "Hold" and "Off" functions for both banks are duplicated for ease of operation..



EXTENDED OPERATION #2 (DIP #2 on): This setting allows the panel to access lines 21-30 in a 30-line system. Once again, "Hold" and "Off" functions for both banks are duplicated for ease of operation.



1A2 V8.x OPERATION #1 (DIPs #1 & #2 on): This setting must be used ONLY with a 10- or 20-line 1A2 Interface System that uses the 1A2 V8.x software. When in this mode the Switch Console becomes a single 20-line panel. Refer to the V8.x addendum for specific details on this special 20-line approach.



NORMAL - DISABLE TOP ROW (DIP #3 on): In this mode, the buttons on the top row are disabled, as well as the user buttons that can affect the top row (NEXT & FLASH). This may be useful if hybrid #1 is assigned to another studio. This option allows access to the #2 hybrid (bottom row) for lines 1-10.



EXTENDED - DISABLE TOP ROW (DIPs #1 & #3 on): In this mode, the buttons on the top row are disabled, as well as the user buttons that can affect the top row (NEXT & FLASH). This option allows access to the #2 hybrid (bottom row) for lines 11-20.



EXTENDED - DISABLE TOP ROW (DIPs #2 & #3 on): In this mode, the buttons on the top row are disabled, as well as the user buttons that can affect the top row (NEXT & FLASH). This option allows access to the #2 hybrid (bottom row) for lines 21-30.



1A2 V8.x- DISABLE TOP ROW (DIPs #1-3 on): In this mode, the buttons on the top row are disabled, as well as the user buttons that can affect the top row (NEXT & FLASH). This option allows access to lines 11-20 when used with the 1A2 V8.x software.



NORMAL - DISABLE BOTTOM ROW (DIP #4 on): In this mode, the buttons on the bottom row are disabled. This may be useful if hybrid #2 is assigned to another studio. This option allows access to the #1 hybrid (top row) for lines 1-10.



EXTENDED - DISABLE BOTTOM ROW (DIPs #1 & #4 on): In this mode, the buttons on the bottom row are disabled. This option allows access to the #1 hybrid (top row) for lines 11-20.



EXTENDED - DISABLE BOTTOM ROW (DIPs #2 & #4 on): In this mode, the buttons on the bottom row are disabled. This option allows access to the #1 hybrid (top row) for lines 21-30.



1A2 V8.x- DISABLE BOTTOM ROW (DIPs #1, #2 & #4 on): In this mode, the buttons on the bottom row are disabled. This option allows access to lines 1-10 when used with the 1A2 V8.x software.



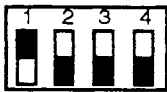
DISPLAY ONLY (DIPs #3 & #4 on): This setting disables ALL the buttons, including the user buttons. This can be useful when, perhaps, the PD wants to see phone activity during contests without being in the studio. DIPs #1 & #2 have no effect in this mode.

DUAL 10-LINE PANEL OPTIONS

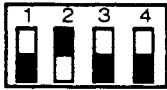
The microprocessor board for the dual 10-line panels operates as a universal panel for 10-, 20- and 30-line systems. Consoles supported include selected models from Auditronics, Broadcast Electronics, Harrison, Neve, Pacific Recorders & Engineering, Ward-Beck and Wheatstone. Specific operation is set up using a four-position DIP switch located on the MPU board. Here is a brief description of its modes of operation.



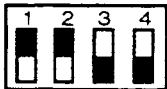
NORMAL OPERATION (all DIPs off): This is the default setting for the units when they ship from the factory. This setting emulates the old panel functions: 10 lines available on hybrid #1 (left side) and hybrid #2 (right side). Most users will use this setting exclusively.



EXTENDED OPERATION #1 (DIP #1 on): This setting allows the panel to access lines 11-20 in a 20-line system. "Hold" and "Off" functions for both banks are duplicated for ease of operation..



EXTENDED OPERATION #2 (DIP #2 on): This setting allows the panel to access lines 21-30 in a 30-line system. Once again, "Hold" and "Off" functions for both banks are duplicated for ease of operation.



USER BUTTON OPERATION #1 (DIPs #1 & #2 on): In this mode, the buttons for line 10 have been reassigned as the user buttons one would find on the desktop Switch Console. Refer to your interface manual for details on the user buttons. (Requires Dual 10 V1.1 software.)



SWAPPED BANK OPERATION (DIP #3 on): Dip Switch #3 reassigns the buttons that were on the left side to the right side and visa versa. This makes it easy for the unit to be, say, a horizontal panel or the Hybrid #1 bank on the single-bank BE panels.



SWAPPED & EXTENDED OPERATION #1 (DIPs #1 & #3 on): Use this setting to access lines 11-20 on a horizontal turret panel or just to swap the banks to completely confuse your operators.



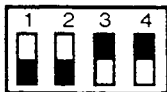
SWAPPED & EXTENDED OPERATION #2 (DIPs #2 & #3 on): This is the setting one would use to access lines 21-30 in a 30-line system on any horizontal panel.



SWAPPED USER BUTTON OPERATION #2 (DIPs #1, #2 & #3 on): This setting is good for those who have a BE panel and need to use the "Next" function with a Direct Interface. (Requires Dual 10 V1.1 software.)



1A2 V8.x OPERATION #1 (DIP #4 on): This setting must be used ONLY with a 10- or 20-line 1A2 Interface System that uses the 1A2 V8.x software. When in this mode the dual 10-line panel becomes a single 20-line panel. Refer to the V8.x addendum for specific details on this special 20-line approach.



SWAPPED 1A2 V8.x OPERATION #2 (DIPs #3 & #4 on): Once again, this setting must be used ONLY with 1A2 Interface Systems using V8.x software. Dip Switch #3 swaps the banks when using a turret panel or the single-bank BE panels.

WARRANTY and APPLICATION CAUTION

This Warranty covers "the Products," which are defined as the various audio equipment, parts, software and accessories manufactured, sold and/or distributed by TLS Corporation, d/b/a Telos Systems (hereinafter "Telos Systems").

With the exception of software-only items, the Products are warranted to be free from defects in material and workmanship for a period of one year from the date of receipt by the end-user. Software-only items are warranted to be free from defects in material and workmanship for a period of 90 days from the date of receipt by the end-user.

The terms and conditions of Telos Systems' warranty in effect at the time of shipment shall apply.

In order to invoke this Warranty, notice of a warranty claim must be received by Telos Systems within the above-stated warranty period and warranty coverage must be authorized by Telos Systems. Notice of a warranty claim may be made orally by telephoning Telos Systems at +1 (216) 241-7225 or in writing sent by facsimile to +1 (216) 241-4103. If Telos Systems authorizes the performance of warranty service and if Telos Systems will be performing the warranty service, the defective Product must be delivered, shipping prepaid, to: Telos Systems, 2101 Superior Avenue, Cleveland, Ohio 44114, USA. If Telos Systems authorizes the performance of warranty service and if it authorizes another entity to perform that warranty service, the Product must be delivered, shipping prepaid, to that entity, whose address will be provided by Telos Systems.

Telos Systems (or its designee) at its option will either repair or replace the Product and such action shall be the full extent of Telos Systems' obligation, and buyer's sole remedy, under this Warranty.

After the Product is repaired or replaced, Telos Systems (or its designee) will return it to the party that sent the Product and Telos Systems will pay for the cost of shipping.

Telos Systems will have no responsibility under this Warranty for any Products subject to: Acts of God, including (without limitation) lightning; improper installation or misuse, including (without limitation) the failure to use telephone and power line surge protection devices; accident; neglect or damage.

Telos Systems' dealers are not authorized to assume for Telos Systems any additional obligations or liabilities in connection with the dealers' sale of the Products.

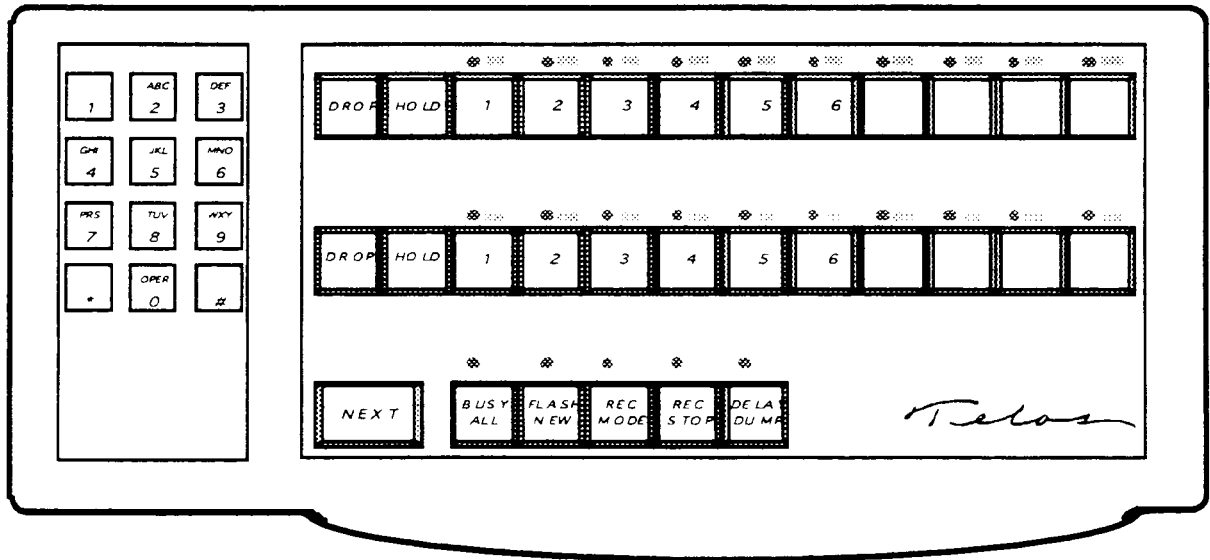
EXCEPT FOR THE ABOVE-STATED WARRANTY, TELOS SYSTEMS MAKES NO WARRANTIES, EXPRESS OR IMPLIED (INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE).

In no event will Telos Systems, its employees, agents or authorized dealers be liable for incidental or consequential damages, or for loss, damage, or expense directly or indirectly arising from the use of any Product or the inability to use any Product either separately or in combination with other equipment or materials, or from any other cause.

Telos products are to be used with registered protective interface devices which satisfy regulatory requirements in their country of use.

SECTION 6
SIMPLIFIED INSTRUCTIONS

THE SWITCH CONSOLE



TOUCH TONE® PAD

A standard keypad is provided so that outgoing calls may be placed from the Switch Console. To dial out through the external hybrid, select an available line on one of the LINE buttons on the top row and dial. If you want to place a call on the auxiliary phone and there is no second hybrid connected, pick up the handset, select an available line on the bottom row of line buttons, and dial using the dialer on the phone. If a second, external hybrid is connected, select an available line on one of the LINE buttons on the bottom row and dial.

LINE BUTTONS AND LED INDICATORS

Operation for line selection, holding, etc. is very similar to familiar key phone sets. The maximum number of lines is six. The top row of LINE buttons corresponds to the internal hybrid. The bottom row to the connects lines either to the screener phone or, if connected, an external hybrid. Either or both rows can be disabled via a DIP switch inside the console. Refer to the Appendix for details.

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 ONE-x-Six.

LINE Buttons

Each row of LINE buttons has a DROP button, a HOLD button, and ten LINE selection buttons. The last four buttons on each row are inactive. The DROP and HOLD buttons affect only the row of LINE buttons on which they are located.

Red 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, a connected computer, or an external phone system connected to the ONE-x-Six. 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.

Red Bar LED Status

Slow Blink:
Medium Blink:
Very Fast Blink:
Very Fast Bright Blink:
On Continuously:
Off Continuously:

LINE Status

Line Is Busied Out
Line Is Ringing In
Line Is On Hold
Line Is On Screened Hold
Line Is on-air (or on screener phone)
Line Is On Hook And Inactive

Yellow Round LED Indicator

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

Yellow Round LED Status

Flashing
On Continuously
Off

Hyb. Status on Indicated Line

on-air, standard mode
on-air, conference mode
Not on-air

Placing Callers on-air in Standard Mode

To place a caller on-air, push the desired LINE button on the top row. The round LED will flash and the bar LED will be lit 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

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.

The system allows you to 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. This is called "hard mash" conferencing. When performing this "button mashing" your callers may not hear each other very well.

If you have a second, external hybrid installed, select your first caller from the top row of the Switch Console and the second caller from the bottom row.

Special Function Buttons

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

NEXT

Puts the line that has been ringing-in the longest on-air through the internal hybrid. If no lines are ringing-in, it selects the line that has been waiting on screened hold the longest. This function is frequently used for contests, when the system is in the auto-answer mode, or if your week-ender jocks need a simple way to use the system. If no calls are in SCREENED HOLD or RINGing in when the next button is pressed, the line that is on-air (and not locked in) will release.

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 .

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.

This button can also be used to toggle on and off the Auto-Answer feature. When enabled, the system automatically answers lines that ring into the ONE-x-Six (after about two rings) and places them on hold. Once on hold, the callers will hear your Program-On-Hold source.

RECORD MODE

The record mode 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, the RECORD START output on the Control connector on the back of the ONE-x-Six will be pulsed. To turn off the RECORD MODE, press its button again.

RECORD STOP

When this button is pushed, the output on the back of the ONE-x-Six stops your recording device. This does not disable the RECORD MODE, but, rather, can stop the tape deck if you choose not to record the call anymore. 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.

SECTION 7
**PARTS LISTS and
SCHEMATICS**

PARTS LISTS

ONE-x-Six

1. Complete Parts List 63

Switch Console

2. Central Processor Unit 67
3. Actuator Board 68
4. DTMF Board 68

SCHEMATICS

ONE-x-Six

1. Telco Detect Circuits
2. MOH w/ AGC Schematic
3. Tip/Ring Routing and Control Schematic
4. Microprocessor Section Schematic
5. Hybrid Microprocessor Schematic
6. Phone and Control Schematic
7. Input and Output Audio Schematic

Switch Console

8. Central Processor Unit Schematic
9. Actuator Board Schematic

PARTS LIST

<u>Designation</u>	<u>Description</u>	<u>Designation</u>	<u>Description</u>
U1	DSP Microprocessor 320C25	U1	68-pin PLCC socket
U2	27C292-3JL EPROM	U2	24-pin DIP machined socket
U3	27C292-3JL EPROM	U3	24-pin DIP machined socket
U4	74AC244		not socketed
U5	74HCT374		not socketed
U6	74ACT138		not socketed
U7	watchdog DS1232		not socketed
U8	74HC590		not socketed
U9	74HC390		not socketed
U10	Saronix NCH080C-40Mhz osc		not socketed
U11	74HCT04		not socketed
U12	AMD7901CPC CODEC	U12	28-pin DIP machined socket
U13	AMD7901CPC CODEC	U13	28-pin DIP machined socket
U14	2912A filter	U14	16-pin DIP machined socket
U15	NE5532 op-amp	U15	8-pin DIP machined socket
U16	NE5532 op-amp		not socketed
U17	NE5532 op-amp		not socketed
U18	Microprocessor 80C188	U18	68-pin PLCC socket
U19	PPI 8255	U19	40-pin DIP machined socket
U20	Dual UART Z85C30-10PC	U20	40-pin DIP machined socket
U21	SRAM 6264LP-10	U21	28-pin DIP machined socket
U21	SmartSocket® DS1213		not socketed
U22	EPROM 27C512-25	U22	28-pin DIP machined socket
U23	74HC573		not socketed
U24	74ACT138		not socketed
U25	DTMF gen. TP5088	U25	14-pin DIP machined socket
U26	quad RS-232 receiver MC1489	U26	14-pin DIP machined socket
U27	quad RS-232 driver MC1488	U27	14-pin DIP machined socket
U28	LM6321 audio amp	U28	8-pin DIP machined socket
U29	NE5532	U29	not socketed
U30	TPIC6259 by TI	U30	20-pin DIP machined socket
U31	TPIC6259 by TI	U31	20-pin DIP machined socket
U32	TPIC6259 by TI	U32	20-pin DIP machined socket
U33	LC403 AGC	U33	16-pin DIP machined socket
U34	TPIC6259 by TI	U34	20-pin DIP machined socket
U35	NE5532		not socketed
U36	NE5532		not socketed
1U1-6U1	HCPL2731 dual optoisolator	1U1-6U1	8-pin DIP machined socket
U 37	TPIC6259 by TI	U 37	20-pin DIP machined socket

<u>Designation</u>	<u>Description</u>	<u>Designation</u>	<u>Description</u>
R1	3.3K Ω /1%	R42	47.5 Ω /1%
R2	15K Ω	R43	47.5 Ω /1%
R3	10K Ω	R44	511 Ω /1%
R4	1K Ω	R45	15K Ω
R5	562 Ω /1%	R46	1K Ω /1%
R6	4.99K Ω /1%	R47	10K Ω
R7	10K Ω	R48	10K Ω
R8	10K Ω	R49	2K Ω
R9	100 Ω	R50	2K Ω
R10	33.2K Ω /1%	R51	1.5K Ω
R11	10K Ω	R52	18.2K Ω /1%
R12	10K Ω	R53	82.5K Ω /1%
R13	1K Ω /1%	R54	39.2K Ω /1%
R14	1K Ω /1%	R55	221K Ω /1%
R15	1K Ω /1%	R56	39.2K Ω /1%
R16	1K Ω /1%	R57	10K Ω
R17	100K Ω /1%	R58	10K Ω
R18	100K Ω /1%	R59	30.1K Ω /1%
R19	1K Ω	R60	1M Ω
R20	2.43K Ω	R61	1M Ω
R21	10K Ω	R62	2.21K Ω /1%
R22	49.9 Ω /1%	R63	22.1K Ω /1%
R23	49.9 Ω /1%	R64	13.3K Ω /1%
R24	10K Ω	R65	10K Ω
R25	56.2K Ω /1%	R66	10K Ω
R26	1K Ω	R67	220K Ω
R27	7.5K Ω	1R1-6R1	150 Ω
R28	49.9 Ω /1%	1R2-6R2	150 Ω
R29	49.9 Ω /1%	1R3-6R3	2.21K Ω /1%
R30	10K Ω	1R4-6R4	47.5 Ω /1%
R31	10K Ω	1R5-6R5	100 Ω
R32	10K Ω	1R6-6R6	100 Ω
R33	10K Ω	1F1-6F1	4.7 Ω 1 SW
R34	47.5 Ω /1%	RP1	2.2K Ω x 10 SIP
R35	47.5 Ω /1%	RP2	330 Ω x 10 SIP
R36	<i>not stuffed</i>	RP3	330 Ω x 8 SIP
R37	<i>not stuffed</i>	RP4	10K Ω x 8 SIP
R38	47.5 Ω /1%	RP5	10K Ω x 8 SIP
R39	47.5 Ω /1%	RP6	10K Ω x 6 SIP
R40	47.5 Ω /1%	RP7	10K Ω x 6 SIP
R41	47.5 Ω /1%	RP8-RP13	680 Ω x 6 SIP

<u>Designation</u>	<u>Description</u>	<u>Designation</u>	<u>Description</u>
C1	0.01μF 50V mono	C43	1μF/25V tant
C2	0.01μF 50V mono	C44	0.1μF 50V mono
C3	0.1 Farad Gold Cap	C45	0.01μF 50V mono
C4	22pF 50V mono	C46	0.01μF 50V mono
C5	2000pF 50V mono	C47	0.01μF 50V mono
C6	2000pF 50V mono	C48	10pF 50V mono
C7	0.01μF 50V mono	C49	100pF 50V mono
C8	4.7μF/25V tant	1C1-6C1	0.47μF 250V film
C9	4.7μF/25V tant	1C2-6C2	47μF/10V tant
C10	0.01μF 50V mono		
C11	0.01μF 50V mono	D1	1N4730 3.9v zener
C12	22pF 50V mono	D2	1N4730 3.9v zener
C13	22pF 50V mono	D3	1N4148 or 1N914
C14	220pF 50V mono	D4	1N4148 or 1N914
C15	2.2μF/25V tant	1D1-6D1	15V zener 1N4744
C16	4.7μF/25V tant	1D2-6D2	rectifier 1N4004
C17	4.7μF/25V tant	1BR1-6BR1	bridge rectifier 2W04M
C18	0.1μF 50V mono	Q1	p-channel JFET J176
C19	0.1μF 50V mono	Q2	2N3906 pnp
C20	0.1μF 50V mono	L1	Green LED LTL-1234A
C21	0.1μF 50V mono	L2	Green LED LTL-1234A
C22	1000pF 50V mono	L3	Green LED LTL-1234A
C23	<i>not stuffed</i>	L4	Green LED LTL-1234A
C24	<i>not stuffed</i>	L5	Green LED LTL-1234A
C25	<i>jumpered</i>	L6	Red LED LTL-1224A
C26	4.7μF/25V tant	L7	Red LED LTL-1224A
C27	1μF 50V mono	L8	Green LED LTL-1234A
C28	0.001μF 50V mono	L9	Green LED LTL-1234A
C29	0.1μF 50V mono	L10	Green LED LTL-1234A
C30	220pF 50V mono	L11	Green LED LTL-1234A
C31	2.2μF/25V tant	L12	Green LED LTL-1234A
C32	2.2μF/25V tant	L13	Green LED LTL-1234A
C33	2.2μF/25V tant	L14	Green LED LTL-1234A
C34	2.2μF/25V tant	L15	Yellow LED LTL-1254A
C35	10pF 50V mono		
C36	10μF/25V tant	VR1	LM7905 -5v reg
C37	4.7μF/25V tant	VR2	LM7805 -5v reg
C38	0.1μF 50V mono		
C39	0.1μF 50V mono	1Z1-6Z1	varistor S14K175
C40	0.1μF 50V mono	Z1	varistor S14K250
C41	0.1μF 50V mono	1Z2-6Z2	varistor S7K25
C42	1000pF 50V mono	Z2	varistor S7K25

<u>Designation</u>	<u>Description</u>	<u>Designation</u>	<u>Description</u>
J1	Neutrik NC3FDHBAG XLR female	RF1	RF filter 27K51R1-05
J2	Neutrik NC3MDHBAG XLR male	RF2	RF filter 27K51R1-05
J3	Neutrik NC3MDHBAG XLR male	RF3	RF filter 27K51R1-05
J4	DB-9 female	RF4	RF filter 27K51R1-05
J5	DB-9 male	RF5	RF filter 27K51R1-05
J6	dual six-pos. RJ12		
J7	dual six-pos. RJ12	P1	10K rt angle multiturn trimpot
J8	dual six-pos. RJ12	P2	10K rt angle multiturn trimpot
J9	Neutrik NC3FDHBAG XLR female		
J10	single six-pos. RJ12		
J11	dual six-pos. RJ12	Y1	18.432MHz XTAL
J12	4-pos. locking header for P/S	Y2	3.579MHz XTAL
SW1	Alt action switch	1K1-6K4	AT&T solid state switch LH1503AB
SW2	Alt action switch	1K1-6K4	8-pin DIP machined socket
SW3	Alt action switch	1T1-6T1	MOH audio xfrmr SPT- 2105
SW4	Alt action switch	T1	Prem #SPT110 xfrmr
SW5	2-pos. DIP sw.		
SW6	2-pos. DIP sw.		
SW7	2-pos DIP sw		
SW8	Alt action switch		
SW9	Alt action switch		
SW10	4-pos. DIP sw.		

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	1N5339B
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

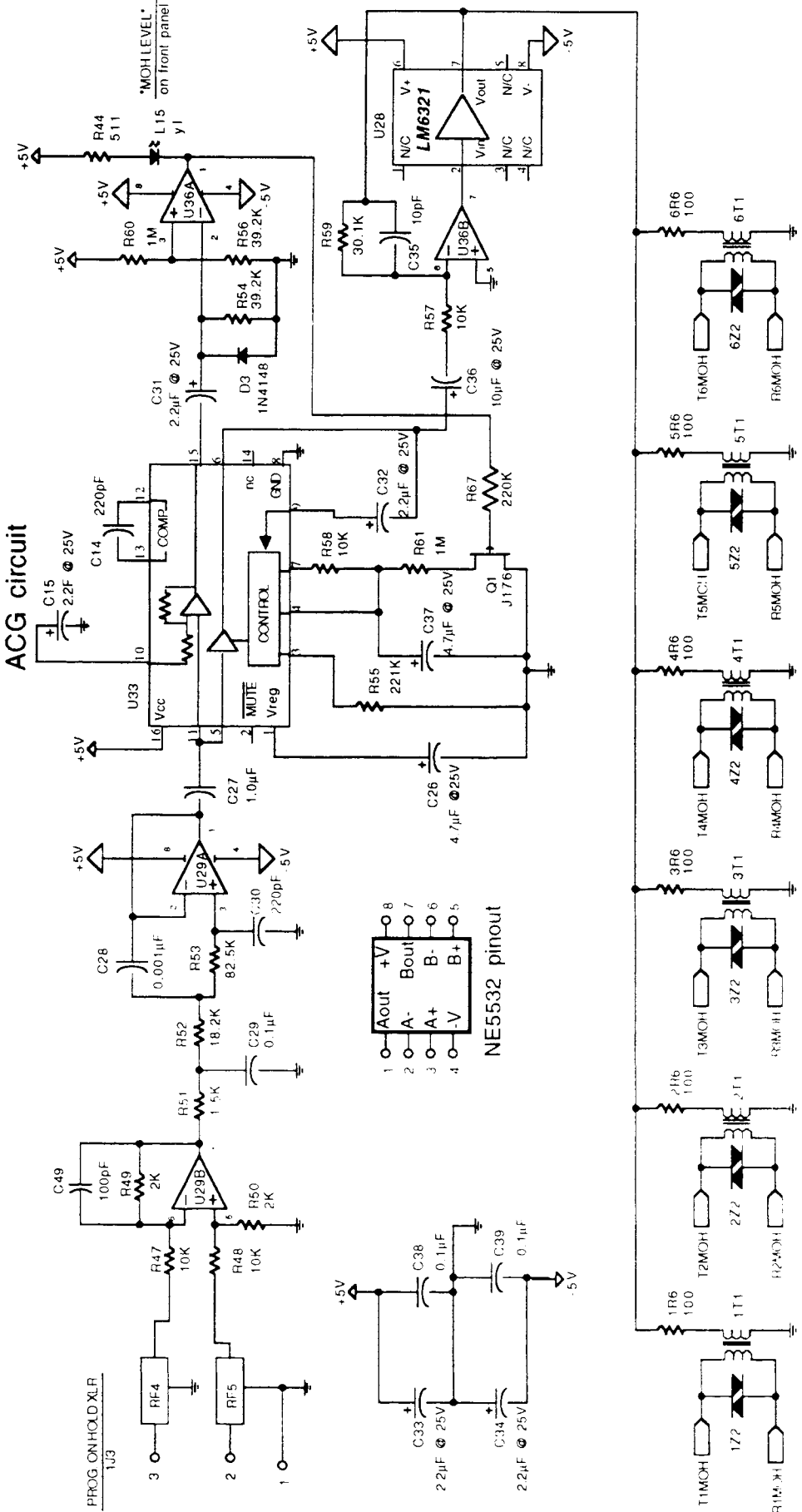
ACTUATOR BOARD PARTS LIST

<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 replaceable 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"

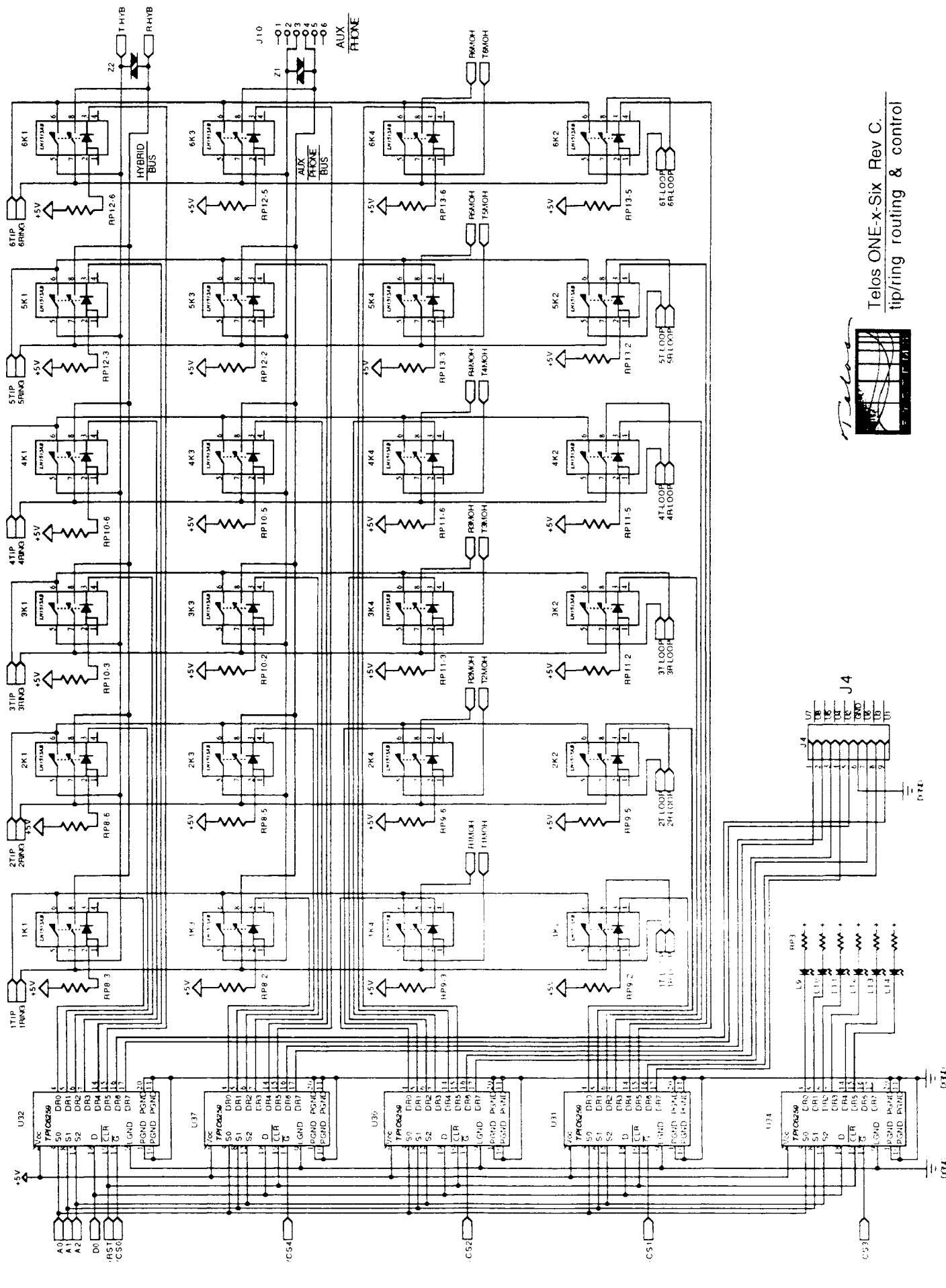
Telos Switch Console

DTMF BOARD PARTS LIST

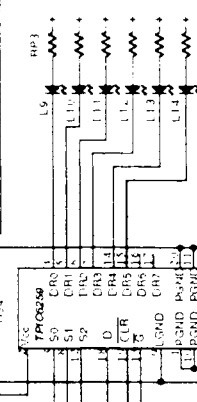
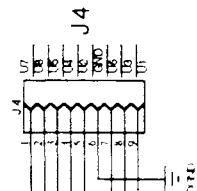
<u>Designation</u>	<u>Description</u>	<u>Designation</u>	<u>Description</u>
SW1-SW12	T-16R switch	J1	7-pin header
DTMF cap set	SwCaps "0-9", "*", "#"		



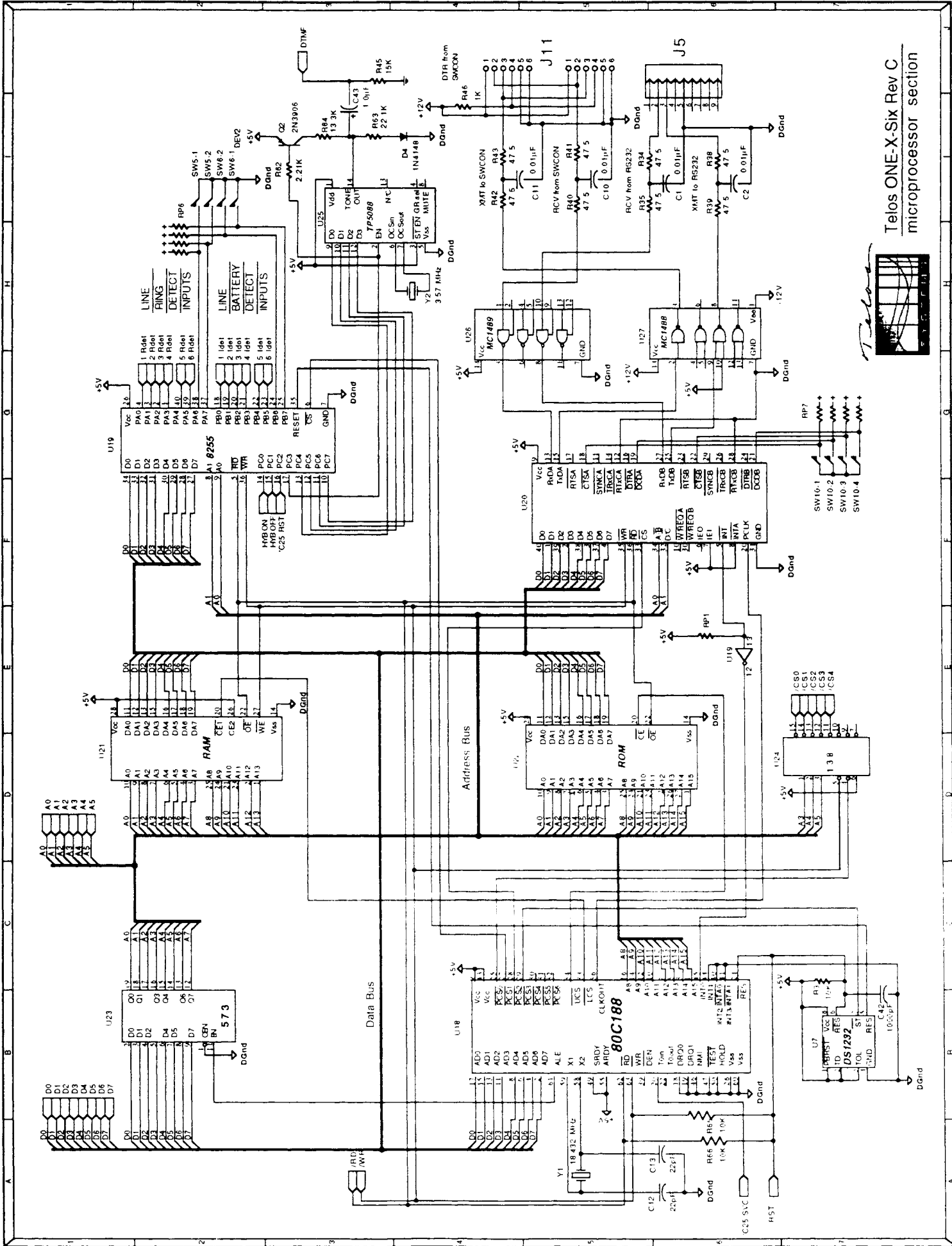
Telos ONE-X-SIX Rev C
MOH w/AGC



Telos ONE-x-Six Rev C.
tip/ring routing & control

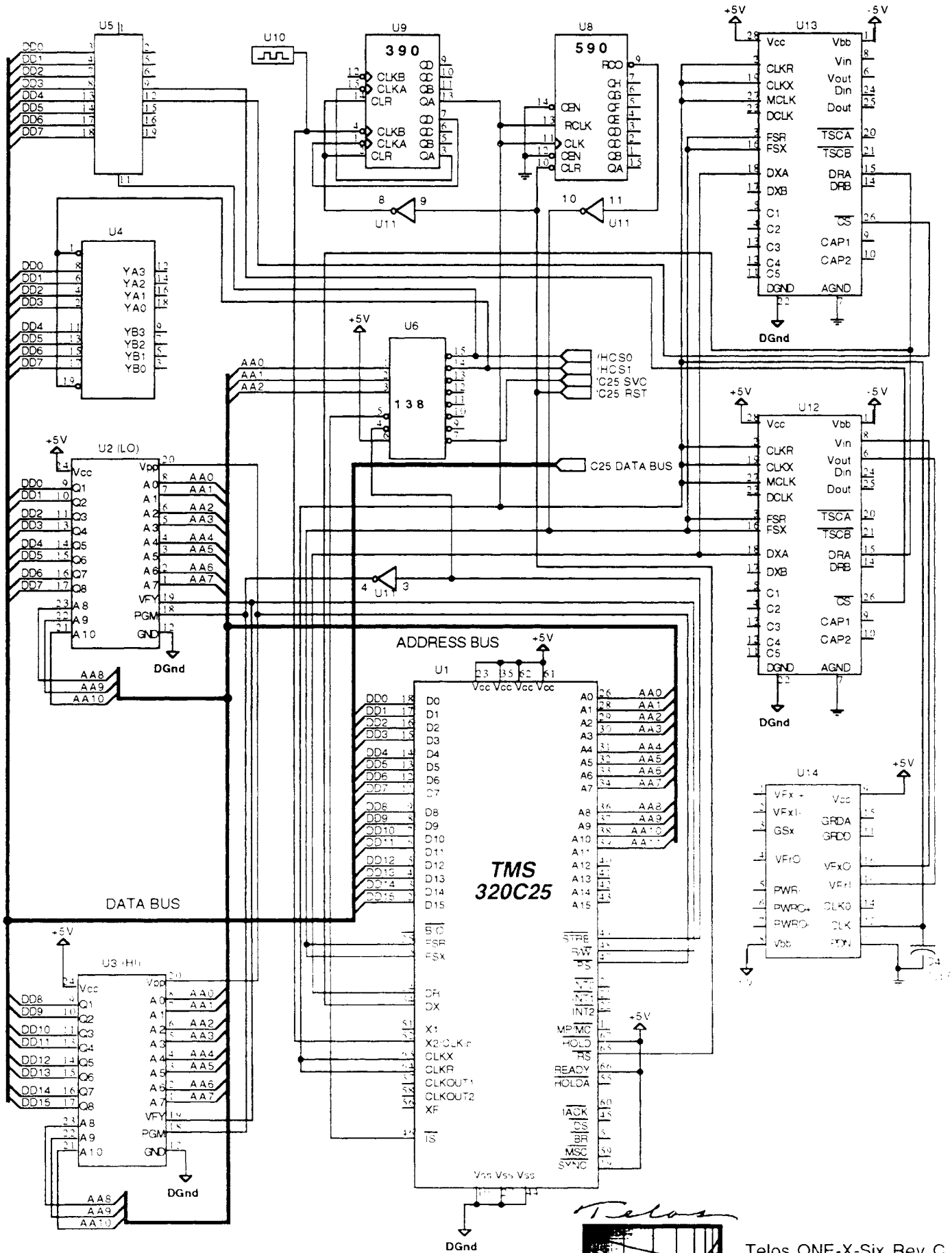


U32
U33
U34
U35

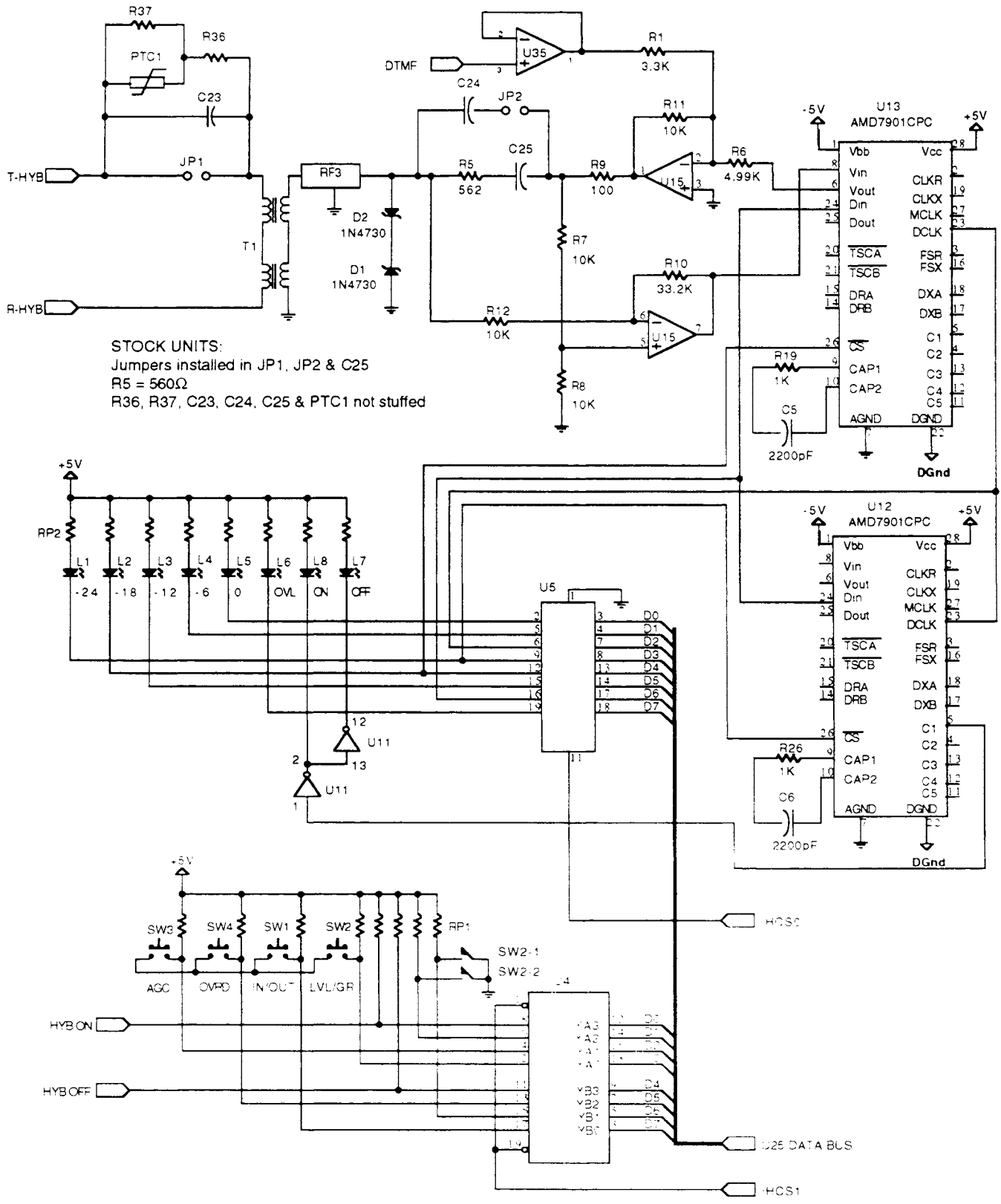


Telos ONE-X-Six Rev C
microprocessor section

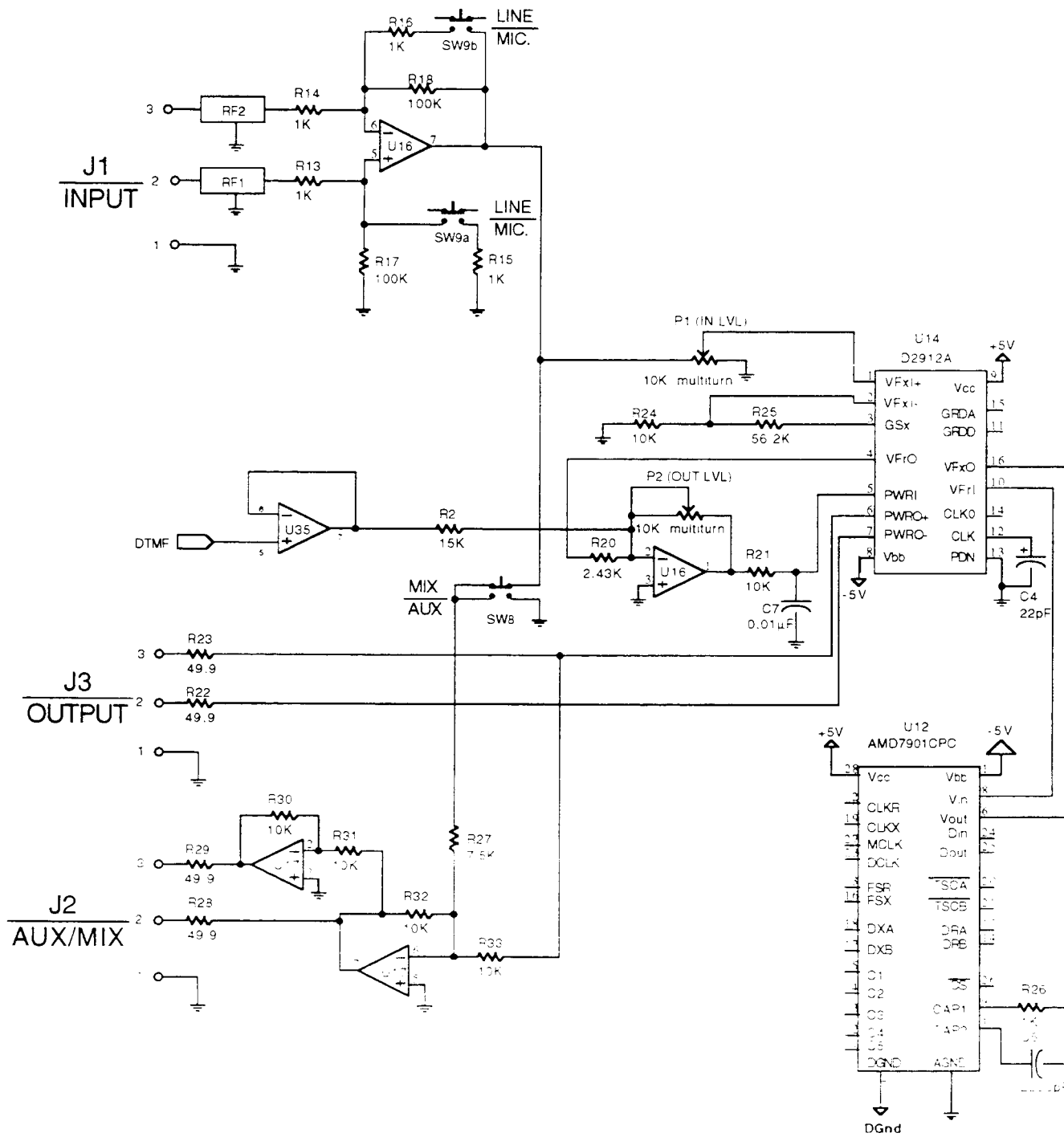




Telos ONE-X-Six Rev C
hybrid MPU

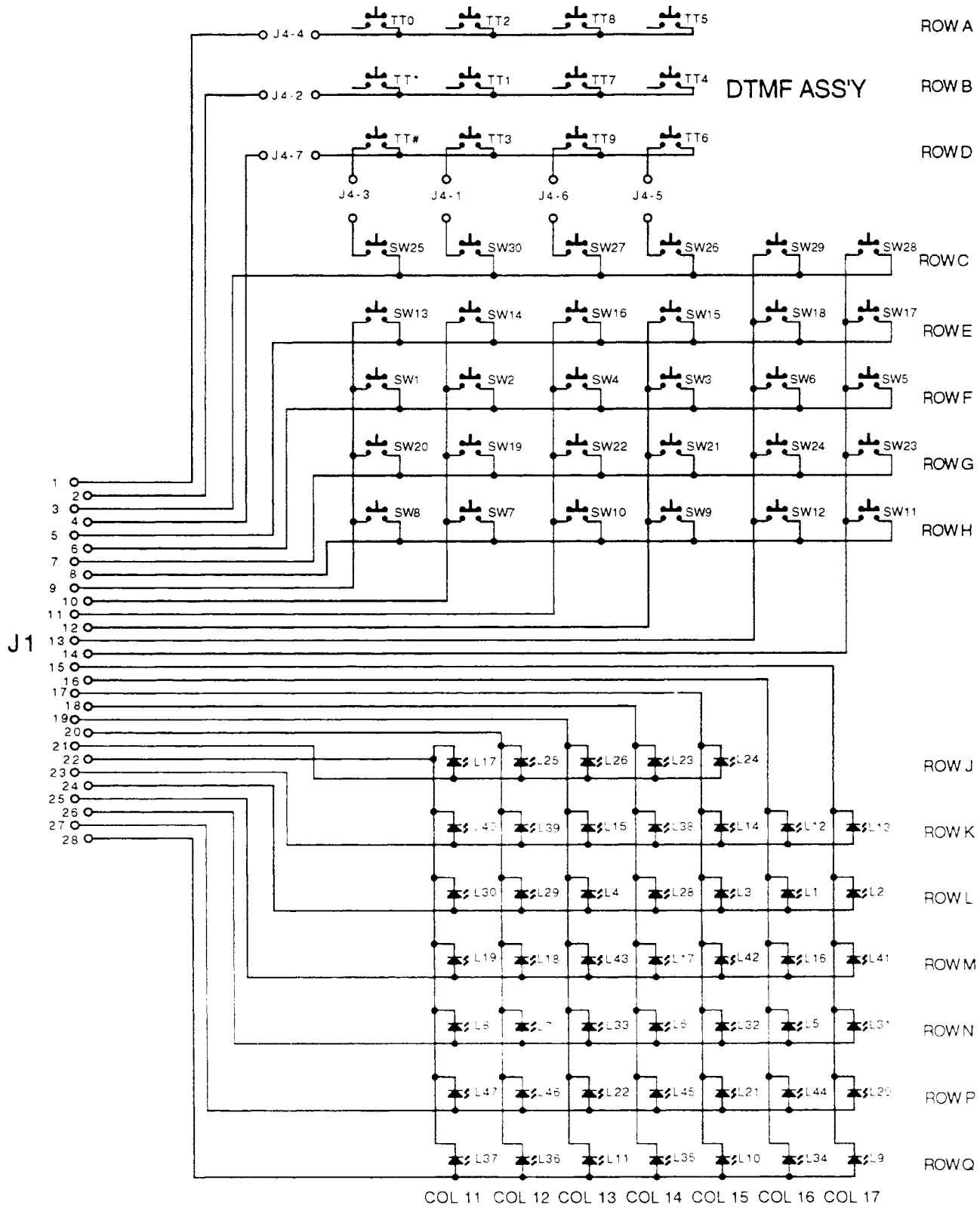


Telos ONE-X-Six Rev C
 phone & control



Telos ONE-X-Six Rev B
input & output audio

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

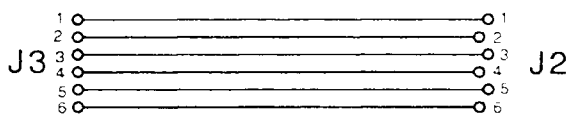


J1

DTMF ASSY

ROW A
ROW B
ROW D
ROW C
ROW E
ROW F
ROW G
ROW H
ROW J
ROW K
ROW L
ROW M
ROW N
ROW P
ROW Q

COL 11 COL 12 COL 13 COL 14 COL 15 COL 16 COL 17



Telos Switch Console
Actuator board