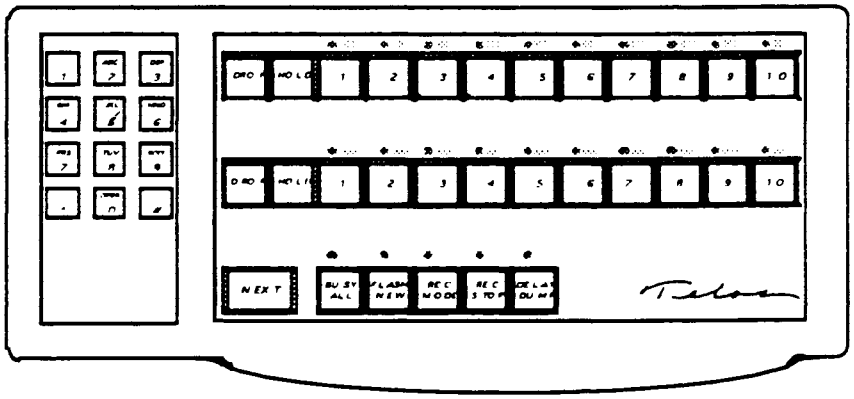
Telos
1A2 Interface Module and Switch Console



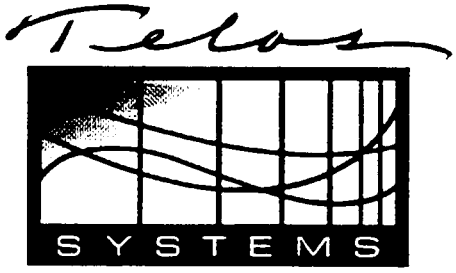
User's Manual

Revision D4 – March, 1995

For Software Versions 5.4x and 8.4x

User's Manual Rev. D4

1A2 INTERFACE MODULE



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SECTION 1

INTRODUCTION

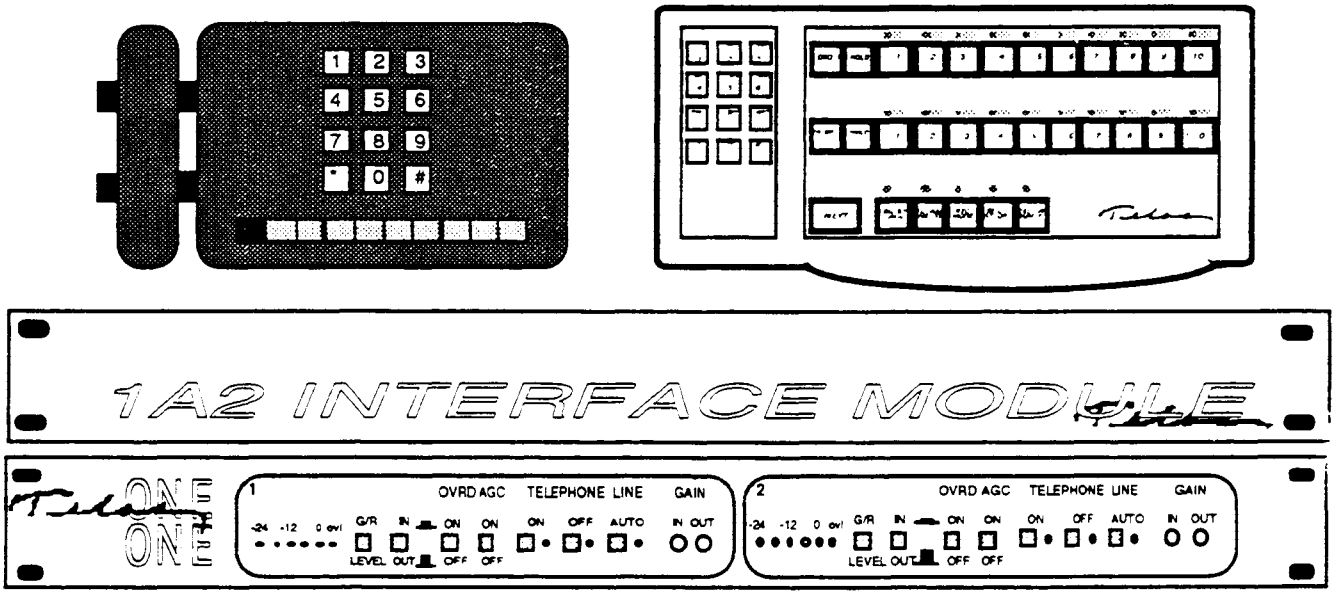
1.1 INTRODUCTION

General

The Telos 1A2 Interface Module is intended to be used with other members of the Telos family of telephone interface products. It provides physical connection between one or more Telos digital telephone hybrids and a 1A2 key system and generates the required control functions to update and read the Telos Switch Console.

The 1A2 Interface Module connects to a 1A2 key system through a standard 50-pin connector on the rear of the unit. These connections permit the Interface Module to manage the key system.

The 1A2 Interface Module communicates with the Switch Console by sending and receiving serial data over a "skinny wire" data link. This is a serial link which uses a modular phone type cable. Power for the Switch Console is also transmitted through the modular cable.



Here is a complete 1A2 Interface system with two hybrids (the Telos ONE+ONE), a Telos Desktop Switch Console, and a key phone for call screening.

1.2 OVERVIEW

The 1A2 Interface Module appears to the key system as if it were a key telephone with all of the required inputs and outputs being simulated. The Interface Module analyzes the system's lamp leads to determine the status of the key system and the tip & ring, while "A leads" are operated upon to cause the key system to perform the appropriate functions.

Each 1A2 Interface Module will switch 10 lines from a key system into as many as two hybrids and will accommodate up to two Telos Switch Consoles. (More consoles can be added in parallel by using our Local Power Supply. See appendix.) It provides the main and conference audio for Telos digital hybrids, extra contact closures for the user-assignable buttons on the Switch Console, a serial connection for controlling other Telos equipment, and an IBM AT-style RS-232 serial port for computer control with software such as Telos' Call Screen Manager™. The 1A2 Interface Module also generates DTMF tones in response to the touch-tone pad on the Switch Console.

A system may be configured for as many as 30 lines and 4 hybrids by using multiple 1A2 Interface Modules. How many 1A2 Interface Modules are used for each type of system? The chart below explains

Phone Line Capacity	Hybrid Capacity	1A2 Interfaces Required	Software Versions
10	2	1	5.X recommended; 8.X possible
20	2	2	5.X with console panels; 8.X with Switch Consoles
30	2	3	5.X only
10	4	2	8.X only
20	4	4	8.X only

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SECTION 2

INSTALLATION

2.1 GENERAL KEY SYSTEM INFORMATION

Why key?

With electronic phones having nearly completely displaced key systems, why would we want to use the old-style key equipment for broadcast on-air application? Because it's a standard system readily available at low cost which has zero noise and distortion and very good reliability. We don't need or want all the fancy features that the new systems provide in an on-air application. We usually want, for instance, a simple one-to-one correspondence between lines and buttons rather than any kind of stacking or concentration.

A reconditioned KSU equipped for 10 lines can be purchased for around $300, so cost is favorable. Spare cards are about $6, so you can keep them around for quick repair. Compare this to the hundreds of dollars for spare boards for the electronic systems or the long waits for "official" repair service.

Integration With Electronic Phone Systems

Most of the electronic systems 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, etc., they can be connected as inputs to key system channels, just as a CO line would. For instance, this scheme allows the studio key 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 behind the PBX."

Within this general concept, there are two approaches to consider. One is to segregate the studio lines onto the key system only, with these lines going directly to the KSU, bypassing the electronic system altogether. An extension or two off of the electronic system would allow airing of calls received on the main station switchboard, local in-station calls, etc. If non-studio answering of calls is desired, such as for a talk-show "screener," a key phone is used in the usual fashion.

The second approach is to route all of the lines through the electronic system so they can be answered on any system phone which has been programmed for the studio lines. Generally, the electronic systems can be programmed to send "private lines" to a particular extension, so that the studio lines can be directly used without being answered by the station operator. This approach has the advantage that the lines can be answered on any system phone which has been properly programmed. Also, no old-looking key phones need mar modern studio aesthetics! The disadvantages are:

1) **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.

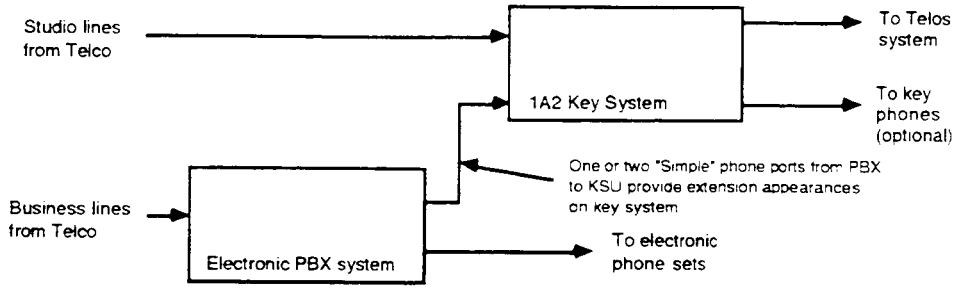
2) **Cost** You need both input (Central Office) ports and output (extension) ports for each of the studio lines. This can get very expensive, especially when compared to the very low cost of key equipment.

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

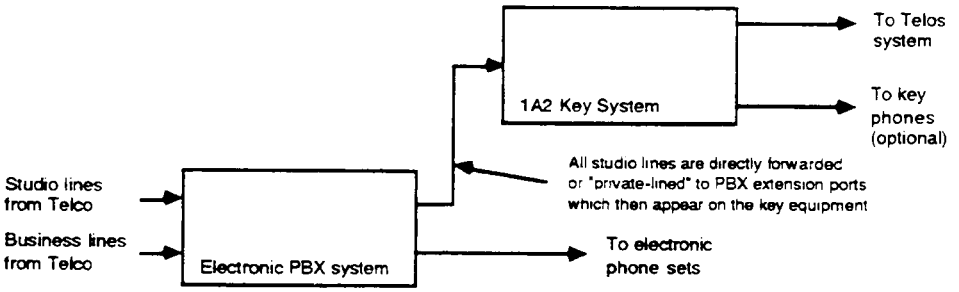
4) **Hybrid performance may worsen** somewhat since you are throwing another impedance bump into the talk path.

There is yet a third approach. Some electronic systems have "A" lead connections available which can be paralleled to the key system "A" leads for "supervision" back and forth. This allows easy intermixing of the two systems. The CO lines are paralleled to each system and Off-Hook and Hold status are communicated from system to system. Some of the electronic systems which have this feature are the Toshiba Strata, the Northern Telecom Norstar and the EAGLE/ONE made by Eagle Telephonics, Hauppauge, NY.

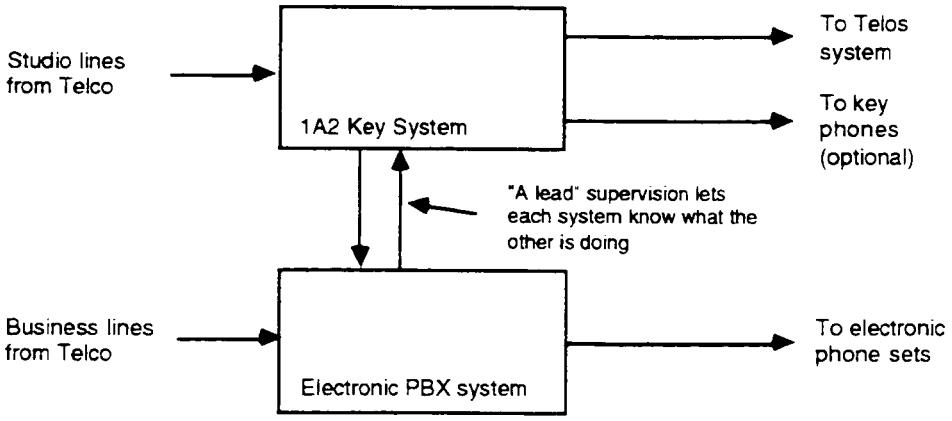
The next page has summary block diagrams of each of the approaches discussed.



Approach #1: Segregate Studio and Business Lines



Approach #2: Route all Lines Through Electronic System



Approach #3: "A lead" Supervision

Key System Operation: Nuts & Bolts

Key systems are very simple "bells & buzzers" type equipment. Don't be intimidated by all the wires - it's mostly repetition of a small very simple sequence. Also, if you are reading this manual for the first time, don't worry, you may discover that you need not know any of this material in order to install the Telos system. We just want to make sure the information is available to you in case you should need it for special applications, troubleshooting, etc. So, on we go...

Each line in a key system has a line card associated with it mounted in the KSU frame. Each card takes the incoming central office line pair and connects to phones using Tip, Ring, "A," "A Common," Lamp, and Lamp Ground wires. The function of these connections is as follows:

Tip & Ring - The name originated with the tips and rings of the patch cords telephone operators used to use to connect callers. The Tip/Ring pair is the actual telephone line connected through from the incoming lines. They may be located with headphones or a telephone.

"A" Leads - These tell the key system which lines are off hook. Any time a line is selected on a phone and taken off-hook, a connection is made from the "A" lead to the "A Common" (sometimes called "A1"). The "A" lead is usually at -24VDC with respect to the "A Common" when the line is not active. It goes to ground when the line is active.

If the A lead connection is broken before the Tip/Ring load is disconnected, the key system puts the line on hold. These lines may be found by using a voltmeter while selecting lines on a nearby phone. Clip leads may be used to short the connection while observing the lamps on the phone.

Lamp leads - These light the lamps on the phone's line buttons. The lamps are powered by a 10VAC power supply at the KSU. The lamp circuit is completed through the "LG" lamp ground wires.

All of the "LG" wires are tied together at the KSU and are usually connected to the "A common" wires. Multiple wires are used to distribute the current to reduce the voltage drop when a number of lamps are lit.

In standard old style "six-wire-fanout" systems, the A common is re-named A1 and is bussed to each line so that there are a full six leads devoted to each line: Tip/Ring, A/A1 and L/LG.

The tables on following pages show the Telos 1A2 Module pin-out scheme as well as the standard Telco wiring schemes. Nineteen- line phones have two 50 pin connectors to accommodate the extra lines, with the second group of lines repeating, for the most part, the first group. "Call Director" type phones with multiple rows of five buttons each usually repeat the 5-line scheme for each bank of lines.

> ***Note that the Telos connection scheme is identical to the standard 9-line fan-out with the exception that the Telos line #10 doesn't exist in the standard scheme.*** A 9 (or 19) line key phone has 10 (or 20) buttons per row, but one button is the HOLD button.

You really don't have to understand any of this stuff if you already have a key system and you just want to get nine lines sequenced as they appear on the phone. All you have to do is connect in-parallel with any phone. A "Bridging Adapter" such as the Ortronics #OR-19252-01 makes this task a breeze. Telos includes one for this purpose. If you want 10 or more lines, you have some wire punching to do!

Key systems wired for 20-button sets have only 9 lines on the first 25-pair bundle (lines 1-9) and 10 lines on the second bundle (lines 10-19). The "extra" 10th line must be connected to the special line 10 wires (Violet/Green, Violet/Brown, Yellow/Orange and Orange/Yellow) shown in the wiring chart on page 11. Phones sharing this bundle CANNOT have these wires connected to them.

We recommend keeping the 1A2 Interface on one side of a local split 66-block. Then just lift the jumper clips for the special line 10 wires and connect 20-button sets on the other side of the split 66-block. A pre-wired 66-block makes the job easy. See the suggest punch block configurations on pages 12 and 13.

If you need to use all ten (or twenty) lines, or you want to pick only certain lines to appear on the key system, or you want to change the sequence, you will have to cross wire using punch blocks. Pre-wired and/or connectorized punch blocks are readily available from phone equipment suppliers.

Telos 100 1A2 Interface Module Wiring Chart

Pin #	Wire Color	Telos 1A2 Intfc	10-button set	6-button set
26	WHITE/BLUE	Line 1 tip	Line 1 tip	Line 1 tip
1	BLUE/WHITE	Line 1 ring	Line 1 ring	Line 1 ring
27	WHITE/ORANGE	Line 1 A	Line 1 A	Line 1 A
2	ORANGE/WHITE	A circuit common(gnd)	A circuit common(gnd)	A circuit common(gnd)
28	WHITE/GREEN	Line 1 lamp ground	Line 1 lamp ground	Line 1 lamp ground
3	GREEN/WHITE	Line 1 lamp	Line 1 lamp	Line 1 lamp
29	WHITE/BROWN	Line 2 tip	Line 2 tip	Line 2 tip
4	BROWN/WHITE	Line 2 ring	Line 2 ring	Line 2 ring
30	WHITE/SLATE	Line 2 A	Line 2 A	Line 2 A
5	SLATE/WHITE	Line 9 A	Line 9 A	A circuit common(gnd)
31	RED/BLUE	Line 2 lamp ground	Line 2 lamp ground	Line 2 lamp ground
6	BLUE/RED	Line 2 lamp	Line 2 lamp	Line 2 lamp
32	RED/ORANGE	Line 3 tip	Line 3 tip	Line 3 tip
7	ORANGE/RED	Line 3 ring	Line 3 ring	Line 3 ring
33	RED/GREEN	Line 3 A	Line 3 A	Line 3 A
8	GREEN/RED	Line 8 A	Line 8 A	A circuit common(gnd)
34	RED/BROWN	Line 3 lamp ground	Line 3 lamp ground	Line 3 lamp ground
9	BROWN/RED	Line 3 lamp	Line 3 lamp	Line 3 lamp
35	RED/SLATE	Line 4 tip	Line 4 tip	Line 4 tip
10	SLATE/RED	Line 4 ring	Line 4 ring	Line 4 ring
36	BLACK/BLUE	Line 4 A	Line 4 A	Line 4 A
11	BLUE/BLACK	Line 7 A	Line 7 A	A circuit common(gnd)
37	BLACK/ORANGE	Line 4 lamp ground	Line 4 lamp ground	Line 4 lamp ground
12	ORANGE/BLACK	Line 4 lamp	Line 4 lamp	Line 4 lamp
38	BLACK/GREEN	Line 5 tip	Line 5 tip	Line 5 tip
13	GREEN/BLACK	Line 5 ring	Line 5 ring	Line 5 ring
39	BLACK/BROWN	Line 5 A	Line 5 A	Line 5 A
14	BROWN/BLACK	Line 6 A	Line 6 A	A circuit common(gnd)
40	BLACK/SLATE	Line 5 lamp ground	Line 5 lamp ground	Line 5 lamp ground
15	SLATE/BLACK	Line 5 lamp	Line 5 lamp	Line 5 lamp
41	YELLOW/BLUE	Line 6 tip	Line 6 tip	
16	BLUE/YELLOW	Line 6 ring	Line 6 ring	
42	YELLOW/ORANGE	•Line 10 tip	BL, AG, or spare	BL, AG, or spare
17	ORANGE/YELLOW	•Line 10 ring	SG, LK, or spare	SG, LK, or spare
43	YELLOW/GREEN	Line 6 lamp ground	Line 6 lamp ground	
18	GREEN/YELLOW	Line 6 lamp	Line 6 lamp	
44	YELLOW/BROWN	Line 7 tip	Line 7 tip	
19	BROWN/YELLOW	Line 7 ring	Line 7 ring	
45	YELLOW/SLATE	B or B1	B or B1	B or B1
20	SLATE/YELLOW	R or R1	R or R1	R or R1
46	VIOLET/BLUE	Line 7 lamp ground	Line 7 lamp ground	
21	BLUE/VIOLET	Line 7 lamp	Line 7 lamp	
47	VIOLET/ORANGE	Line 8 tip	Line 8 tip	
22	ORANGE/VIOLET	Line 8 ring	Line 8 ring	
48	VIOLET/GREEN	•Line 10 A	Line 9 lamp ground	
23	GREEN/VIOLET	Line 9 lamp	Line 9 lamp	
49	VIOLET/BROWN	•Line 10 lamp	Line 8 lamp ground	
24	BROWN/VIOLET	Line 8 lamp	Line 8 lamp	
50	VIOLET/SLATE	Line 9 tip	Line 9 tip	
25	SLATE/VIOLET	Line 9 ring	Line 9 ring	

• Indicates special "10th line" wires; these wires should be disconnected from and taped *inside* any key phone sharing this 25-pair bundle (not necessary if 10th line not used by Telos 1A2 Intfc.)

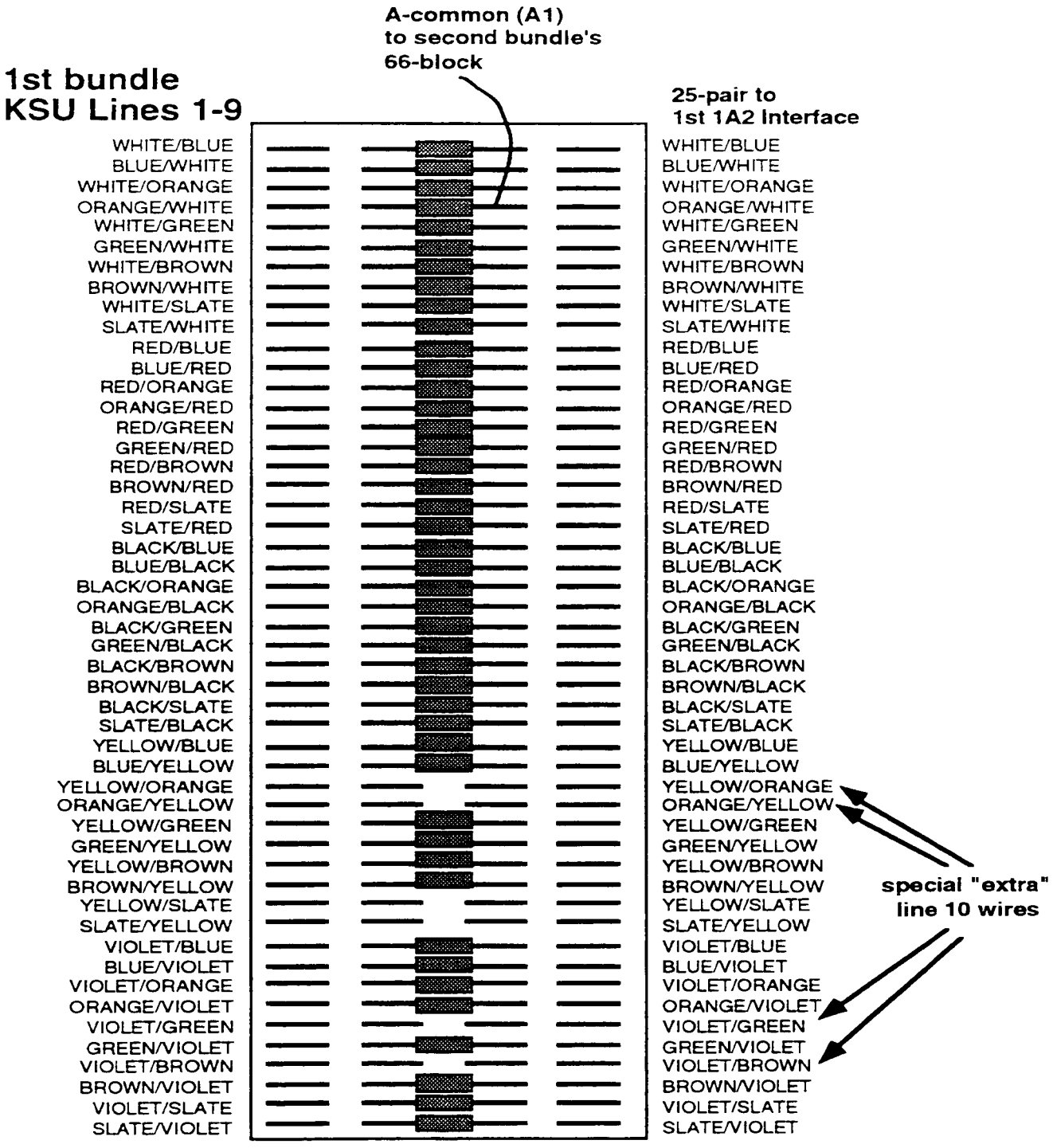
Telos 100 1A2 Interface Module wiring vs. Standard KSU 20-Button Set wiring

Pin #	Wire Color	Telos 1A2 Module	KEY PHONE Lines 1-9	Lines 10-19
26	WHITE/BLUE	Line 1 tip	Line 1 tip	Line 10 tip
1	BLUE/WHITE	Line 1 ring	Line 1 ring	Line 10 ring
27	WHITE/ORANGE	Line 1 A	Line 1 A	Line 10 A
2	ORANGE/WHITE	A circuit common(gnd)	A circuit common(gnd)	*Line 19 A
28	WHITE/GREEN	Line 1 lamp ground	Line 1 lamp ground	Line 10 lamp ground
3	GREEN/WHITE	Line 1 lamp	Line 1 lamp	Line 10 lamp
29	WHITE/BROWN	Line 2 tip	Line 2 tip	Line 11 tip
4	BROWN/WHITE	Line 2 ring	Line 2 ring	Line 11 ring
30	WHITE/SLATE	Line 2 A	Line 2 A	Line 11 A
5	SLATE/WHITE	Line 9 A	Line 9 A	Line 18 A
31	RED/BLUE	Line 2 lamp ground	Line 2 lamp ground	Line 11 lamp ground
6	BLUE/RED	Line 2 lamp	Line 2 lamp	Line 11 lamp
32	RED/ORANGE	Line 3 tip	Line 3 tip	Line 12 tip
7	ORANGE/RED	Line 3 ring	Line 3 ring	Line 12 ring
33	RED/GREEN	Line 3 A	Line 3 A	Line 12 A
8	GREEN/RED	Line 8 A	Line 8 A	Line 17 A
34	RED/BROWN	Line 3 lamp ground	Line 3 lamp ground	Line 12 lamp ground
9	BROWN/RED	Line 3 lamp	Line 3 lamp	Line 12 lamp
35	RED/SLATE	Line 4 tip	Line 4 tip	Line 13 tip
10	SLATE/RED	Line 4 ring	Line 4 ring	Line 13 ring
36	BLACK/BLUE	Line 4 A	Line 4 A	Line 13 A
11	BLUE/BLACK	Line 7 A	Line 7 A	Line 16 A
37	BLACK/ORANGE	Line 4 lamp ground	Line 4 lamp ground	Line 13 lamp ground
12	ORANGE/BLACK	Line 4 lamp	Line 4 lamp	Line 13 lamp
38	BLACK/GREEN	Line 5 tip	Line 5 tip	Line 14 tip
13	GREEN/BLACK	Line 5 ring	Line 5 ring	Line 14 ring
39	BLACK/BROWN	Line 5 A	Line 5 A	Line 14 A
14	BROWN/BLACK	Line 6 A	Line 6 A	Line 15 A
40	BLACK/SLATE	Line 5 lamp ground	Line 5 lamp ground	Line 14 lamp ground
15	SLATE/BLACK	Line 5 lamp	Line 5 lamp	Line 14 lamp
41	YELLOW/BLUE	Line 6 tip	Line 6 tip	Line 15 tip
16	BLUE/YELLOW	Line 6 ring	Line 6 ring	Line 15 ring
42	YELLOW/ORANGE	•Line 10 tip	BL, AG, or spare	*Line 19 lamp ground
17	ORANGE/YELLOW	•Line 10 ring	SG, LK, or spare	*Line 19 lamp
43	YELLOW/GREEN	Line 6 lamp ground	Line 6 lamp ground	Line 15 lamp ground
18	GREEN/YELLOW	Line 6 lamp	Line 6 lamp	Line 15 lamp
44	YELLOW/BROWN	Line 7 tip	Line 7 tip	Line 16 tip
19	BROWN/YELLOW	Line 7 ring	Line 7 ring	Line 16 ring
45	YELLOW/SLATE	B or B1	B or B1	*Line 19 tip
20	SLATE/YELLOW	R or R1	R or R1	*Line 19 ring
46	VIOLET/BLUE	Line 7 lamp ground	Line 7 lamp ground	Line 16 lamp ground
21	BLUE/VIOLET	Line 7 lamp	Line 7 lamp	Line 16 lamp
47	VIOLET/ORANGE	Line 8 tip	Line 8 tip	Line 17 tip
22	ORANGE/VIOLET	Line 8 ring	Line 8 ring	Line 17 ring
48	VIOLET/GREEN	•Line 10 A	Line 9 lamp ground	Line 18 lamp ground
23	GREEN/VIOLET	Line 9 lamp	Line 9 lamp	Line 18 lamp
49	VIOLET/BROWN	•Line 10 lamp	Line 8 lamp ground	Line 17 lamp ground
24	BROWN/VIOLET	Line 8 lamp	Line 8 lamp	Line 17 lamp
50	VIOLET/SLATE	Line 9 tip	Line 9 tip	Line 18 tip
25	SLATE/VIOLET	Line 9 ring	Line 9 ring	Line 18 ring

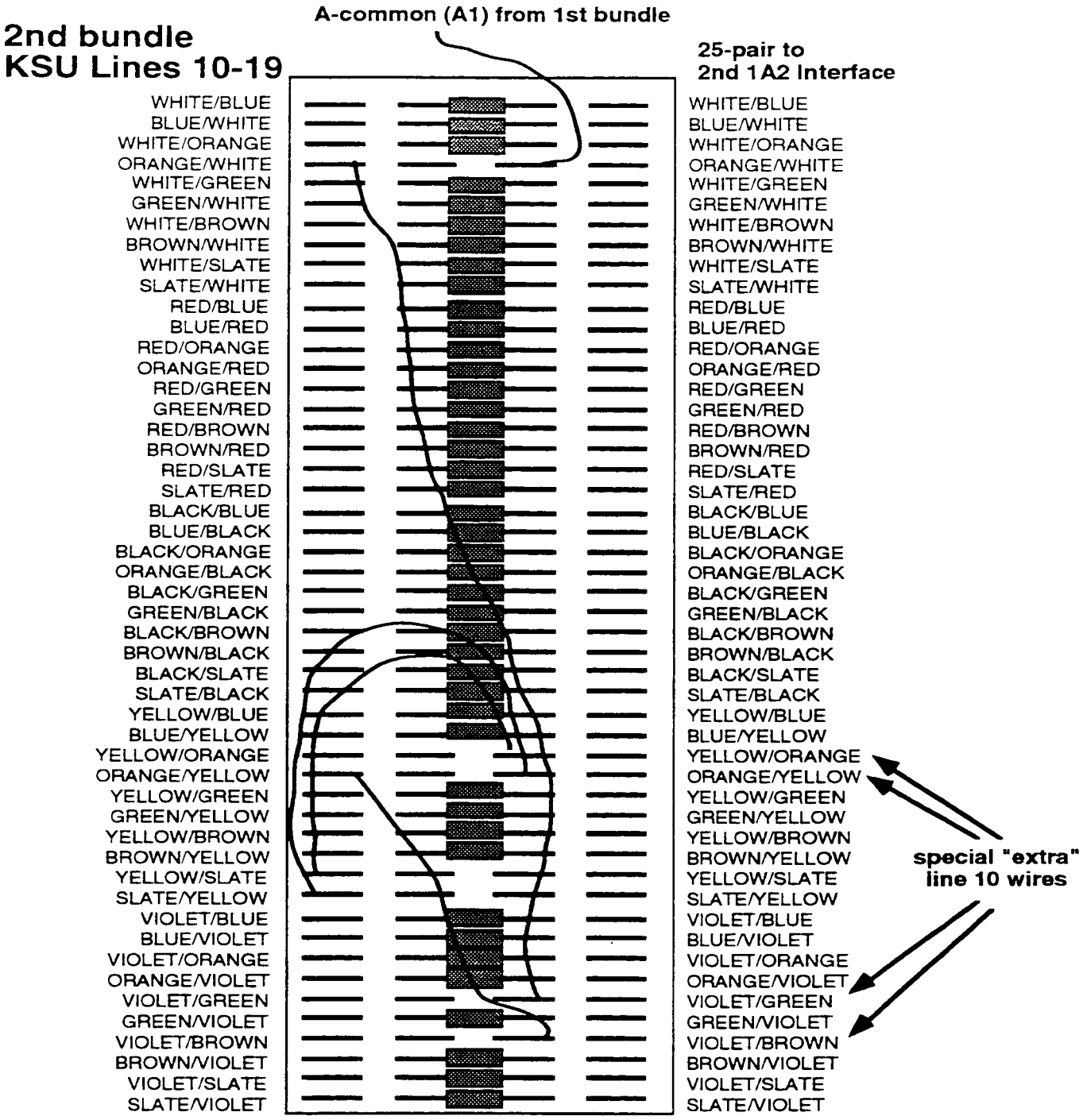
•Special wires for line 10. These wires should be disconnected inside any phone connected to the 1A2 Interface 25-pair bundle.

*Wires used for line 19 in the 2nd 25-pair bundle; note differences compared to 1A2 Intfc. wiring.

BE SURE TO WIRE BOTH INTERFACES TO MATCH COLUMN 3!!!!

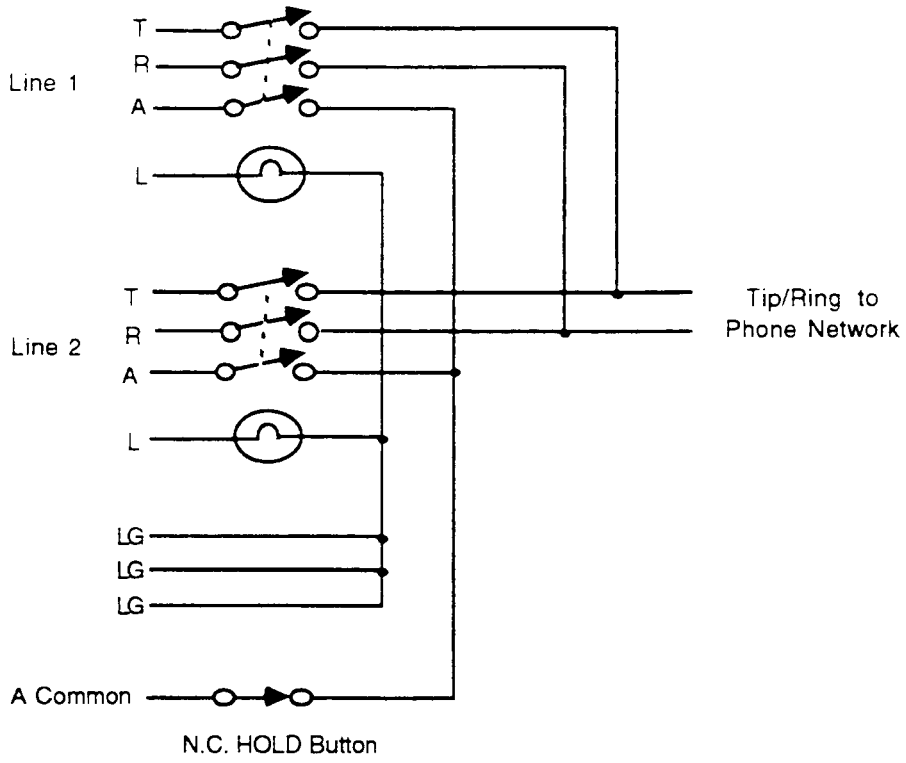


Use split 66-block to interconnect 1A2 Interface to KSU.
Parallel the 20-button set on left side of 66-block.
Note missing bridging clips and jumper wire.



Use split 66-block to interconnect 1A2 Interface to KSU.
Parallel the 20-button set on left side of 66-block.
Note missing bridging clips and jumper wires.

To further assist understanding, the circuit diagram below shows in simplified form how a key phone works. Of course, there would be a button and lamp for each line.



Simplified Telephone Switching Circuit

Music on hold

This is one of the most variable and confusing issues with regard to key equipment. Each line card with Music-On-Hold capability has two pins devoted to the music input. Unfortunately, many key systems have these pins wired for another function, so the systems have to be modified to bring the music into each card.

Special cards are made which usually have six transformers, one for each of six lines, and an amplifier on them. These are usually mounted in special add-on shelves in the KSU. The transformers are used to provide isolation from line-to-line so that callers cannot talk to each other while they are together on hold. If possible, you should try to get a system pre-wired and set up for Music-On-Hold. Remember to specify MOH line cards, if you want this feature.

Where to Get Key Equipment

You face a choice here. You can buy the equipment outright and install and maintain it yourself or you can find a private interconnect company to do the work for you. If finances are a consideration, you should strongly consider the "do-it-yourself" plan as installed key systems may well cost five to ten times as much as the equipment purchased without installation. We strongly recommend not leasing key equipment, because of its low cost.

Many local interconnect suppliers have key systems available either for direct sale or as part of an installed package. Look in the phone book yellow pages for telephone equipment suppliers or interconnect companies. Unfortunately, some of the interconnect companies are very reluctant to sell installation supplies and equipment without installation, etc. Best to shop elsewhere if you encounter this attitude.

One good source of new key equipment and installation supplies is Graybar Electric. They have branches in a number of cities.

If you cannot find a local source, you could try the following suppliers. We've purchased from each of these, and find their service and prices acceptable. They have used and reconditioned equipment in addition to new systems.

Consolidated Communications, Inc.
28 Calvert Street
Harrison, NY 10528
(914) 835-5000

Phonotronics, Inc.
15229 S. State Avenue
Middlefield, OH 44062
(216) 632-0236

Incidentally, the Northern Telecom phones are much more attractive than the standard ITT or Western Electric sets. The button banks are less rugged, however.

If all else fails, call us at Telos for advice.

To Wrap Up on Key Systems ...

As we were saying, this stuff is really pretty simple circuitry. It just looks intimidating because of all the wires and punch blocks. You have met the guys from the phone company that used to do this work, haven't you?

More information is in the appendix, where you will find:

1) A schematic of a standard 20 button key telephone set. (A 10-button set is the same , just without the second 25 pairs of wires.)

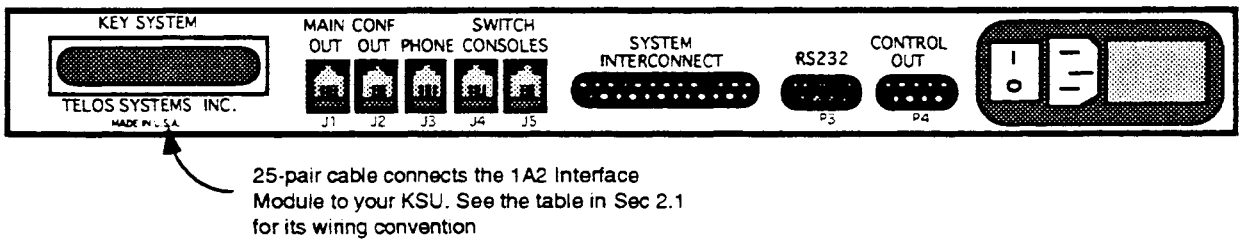
2) A schematic of a common key system line card. All cards are different; some may use lots of relays, some have more electronic components. The schematic, thus, is not likely to correspond to the cards in your system, but it is a starting point to help understand how key cards work. When you purchase a key system, you should get both a system and a card schematic from the supplier.

2.2 REAR PANEL CONNECTIONS

On the back panel of the 1A2 Interface Module there are five (5) six-position/six-contact RJ-11-sized modular plugs, one (1) male DB-25 connector, one (1) male DB-9 connector, one (1) female DB-9 connector, the AC receptacle and one (1) 50-pin male KSU connector.

Key System Connector

The 50-pin male "blue ribbon" type connector makes the connection from the key system to the 1A2 Interface Module.



The key system thinks this is a key phone, so it plugs in wherever a phone would go. The interface comes with a 25-pair cable to connect the unit to the KSU.

A simple way to hook things up is to use a "Bridging Adapter." This is a small box which has one male and two female 50-pin connectors allowing a connection from the key system to any phone to be paralleled in a hassle-free manor. One such adaptor is the Ortronics #OR-19252-01. These are available from most local phone supply or interconnect companies. One of these is included with the interface.

Because the standard key system fanout provides only 9 lines, a straight parallel connection will not activate the Telos line #10, but the other nine will work correctly. We "borrowed" some unused wires to get T10, R10, L10 and A10. (Keep in mind we DO need the ability to access ten lines, because a 20-line phone has 9 lines on one bundle, but 10 lines on the second bundle. Ditto for the third bundle on a 30-button set. See the schematic of a standard 20 button key telephone set in the appendix.) A little extra work is required to utilize the 10th line. If you need it, you will have to use a 66 block for cross connection. One possibility: your main studio's "Hot Line" could be on line #10; that way, it would only appear on the Telos studio system and not on any phone.

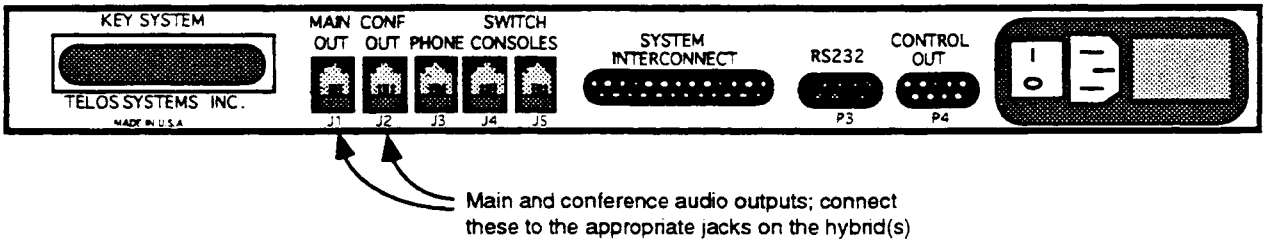
Very important notes regarding connection to Line 10:

The signals for line 10 must be wired into the 25-pair at the KSU. Furthermore, no phones can share this 25-pair UNLESS these wires are physically disconnected from the key phone, either inside the phone or on a 66-block. If a phone is NOT modified in this way, access to line 10 may blow a fuse on the KSU. Why? The 1A2 Interface uses the lamp ground wires from lines 8 and 9 for its line 10 lamp and line 10 A-lead. As soon as the line 10A is connected to the 1A2 Interface, if a phone uses that wire (Violet/Green) for lamp ground, the -24VDC supply will short to ground. Then key system will apply 10VAC on the line 10 lamp lead (Violet/Brown), thus shorting out the lamp circuit. So, a "home run" may be desirable just for the 1A2 Interface. We recommend keeping the 1A2 Interface on one side of a local split 66-block. Then just lift the jumper clips for the special line 10 wires (Violet/Green, Violet/Brown, Yellow/Orange and Orange/Yellow) and connect 10-button sets on the other side of the split 66-block. A pre-wired 66-block makes the job easy.

The previous section on key systems has the pin-out table for this connector as well as other general information on key systems.

J1 & J2 - Main and Conference Audio Outs

These are telephone tip/ring audio which go to the hybrid(s). Each is a direct relay connection to the selected central office line.

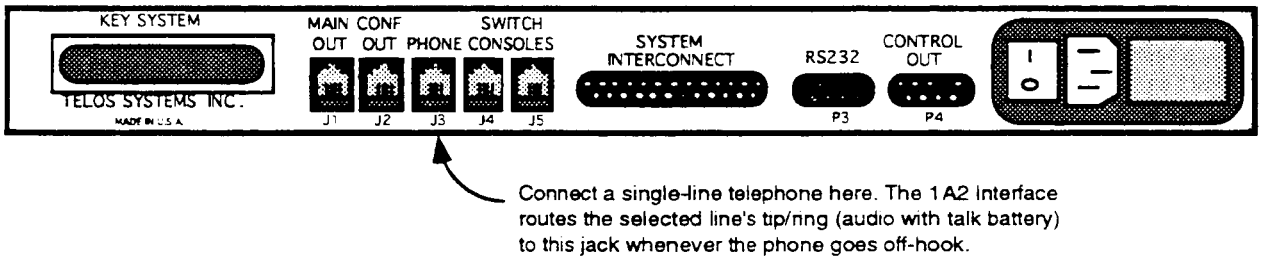


In dual hybrid systems, the MAIN output contains only the call which has been selected in the non-conference mode and the CONFERENCE output has the audio for callers who are in conference mode. In single hybrid systems, the MAIN out will be active for calls who have been selected in both conference and non-conference mode.

A standard two (or four) conductor modular cable is used for the hybrid connection. When using the Telos hybrids, the appropriate jack at the hybrid end is the one labeled J1 (Line).

J3 - Phone

The third modular connector is for a desk phone for taking calls in the usual way without using a hybrid, microphone, speaker, etc.

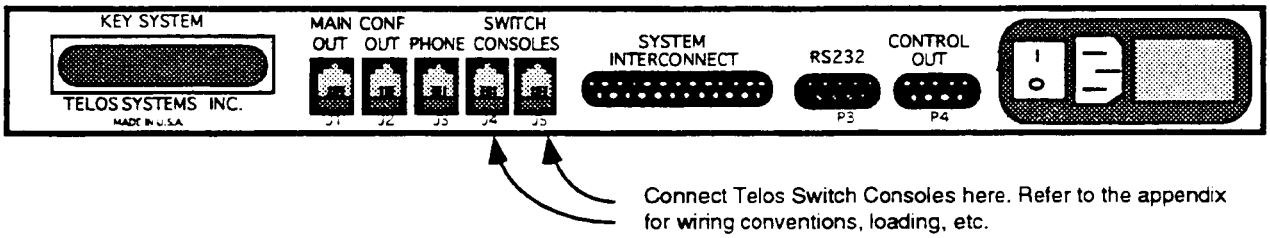


A standard two (or four) conductor modular cable is used for this connection. Any standard single-line desk phone may be used.

When the 1A2 Interface Module detects that this phone is "off-hook," the selected tip/ring will be routed to the phone instead of to the hybrid and the hybrid will turn off. Placing the phone on-hook will restore the hybrid feed. Use the console to select lines, as always. Refer to section 3.2.7 for details.

J4 & J5 - Switch Consoles

The two rightmost modular connectors are for Switch Consoles. You plug your Telos Switch Consoles into either of these jacks (they are in parallel) using the six-conductor cord provided.



Very important notes regarding connection of switch consoles:

1) Each 1A2 Interface Module is capable of powering two consoles provided that they are being used for a maximum of 10 telephone lines. If a multiple interface module system is being used to increase line capacity to 20, only one console may be powered from each interface module. Since, in this case, you have more modules, multiple consoles may be accommodated.

   Since the concern here is power capacity and has nothing to do with the data flow, external power supplies may be used if more consoles are desired. See the appendix for information on using a local power supply.

2) The maximum cable length is 100' when using modular cables. Again, the concern is not the data, but the power situation. There is significant voltage drop in even short lengths of modular cable due to the small wire size. The Switch Console has local regulation, so cable voltage drop will not affect illumination until the drop-out point is reached, but past that point, very flaky operation will likely occur.

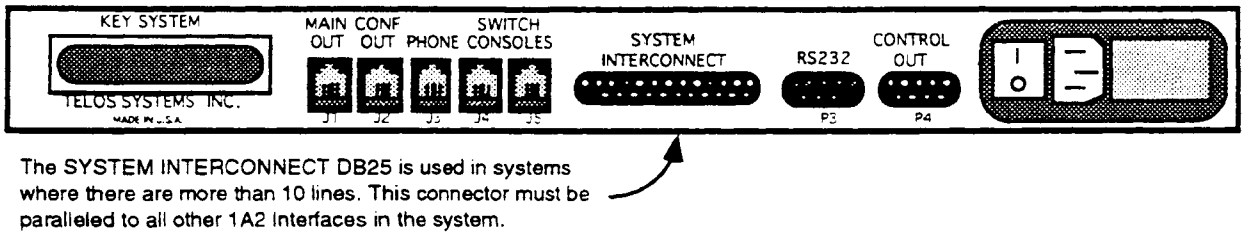
   The Local Power Supply can be used to increase the cable length to 250'. See the appendix for details.

3) You must use **6-wire** modular cables for the console connection; **standard 4-wire cables will not work.** Refer to the appendix for its wiring convention.

On the next page, we move on to the DB-25 and DB-9 connectors.

P2 - System Interconnect

This female DB-25 connector provides interconnect between 1A2 Interface Modules when more than one interface module is being used.

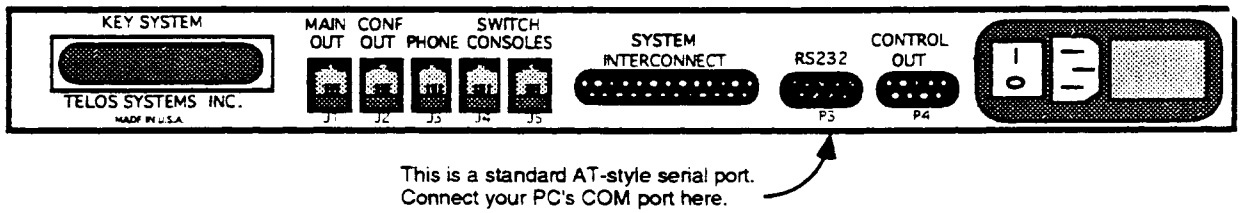


The SYSTEM INTERCONNECT DB25 is used in systems where there are more than 10 lines. This connector must be paralleled to all other 1A2 Interfaces in the system.

These are simply paralleled using a flat ribbon cable, Telos part number 012. One cable should have been specified with your system if it was originally ordered for more than 10 lines or more than two hybrids.

P3 - RS-232

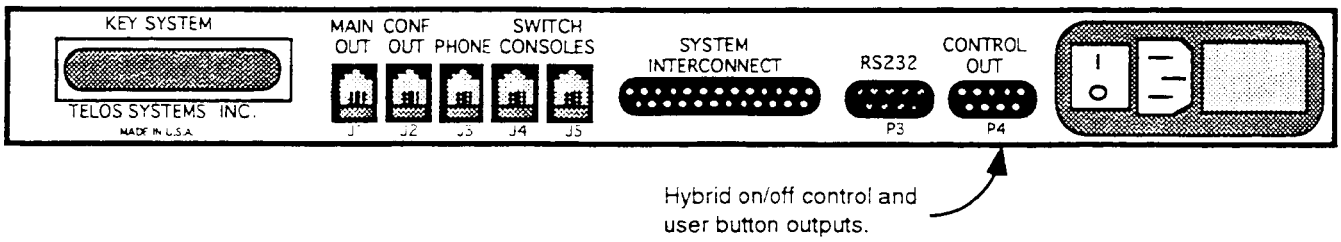
Using a male DB-9, this is the standard RS-232 serial port. Use a null-modem cable to connect this to your PC.



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

P4 - Control Out

This is a female DB-9 connector which provides the on-off control information to the hybrids, as well as the user button outputs. See Section 2.5 for more details on hybrid on/off control.



The current software version of the 1A2 Interface Module (Version 5.40) supports all of the Switch Console's special function buttons. To check which version your unit has, either read the sticker on the EPROM, (U5 on the circuit board) or type a "?" to the serial port (refer to Sec 3.4 of this manual for details on the serial port). Please call Telos for a free upgrade if your version is lower than V5.40.

Old-style, metal Switch Console users should consider upgrading to the current Switch Console model. Contact your dealer for special, trade-in pricing.

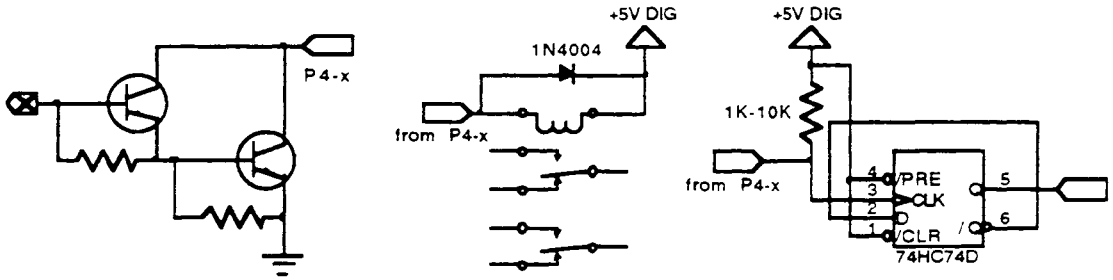
P4 - CONTROL OUT Pin-Out using 1A2 V5.4x

Pin	Function	ABS Console's button	Metal Console's button
5	Hybrid #1 OFF	see Sec. 2.5	see Sec. 2.5
9	Hybrid #1 ON	see Sec. 2.5	see Sec. 2.5
4	Hybrid #2 OFF	see Sec. 2.5	see Sec. 2.5
3	Hybrid #2 ON	see Sec. 2.5	see Sec. 2.5
7	Record START	any line button when REC MODE is on	not supported
8	Record STOP	REC STOP	not supported
1	Delay Dump	DELAY DUMP	not supported
6	Ground		

P4 - CONTROL OUT Pin-Out when using 1A2 V8.4x

Pin	Function	ABS Console's button	Metal Console's button
5	Hybrid #1 OFF	see Sec. 2.5	see Sec. 2.5
9	Hybrid #1 ON	see Sec. 2.5	see Sec. 2.5
4	Hybrid #2 OFF	see Sec. 2.5	see Sec. 2.5
3	Hybrid #2 ON	see Sec. 2.5	see Sec. 2.5
7	User Output 1	FLASH/NEW	User #1 (leftmost button under keypad)
8	User Output 2	BUSY ALL	User #2 (middle button under keypad)
1	User Output 3	NEXT	User#3 (rightmost button under keypad)
6	Ground		

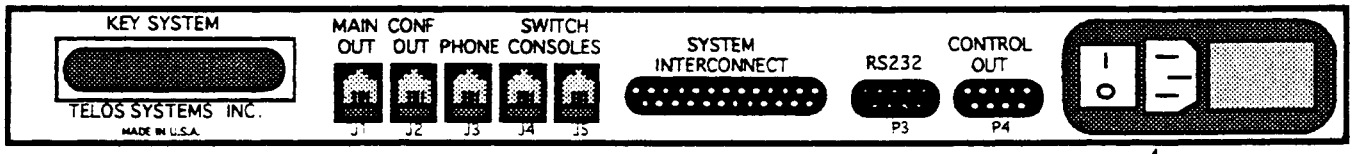
All outputs are momentary open-collector closures to ground. Each output can sink up to 150 mA. The hybrid on & off outputs, when connected to Telos hybrids, will be pulled up through 10K resistors inside the hybrid to +5V. For these outputs the maximum pull-up voltage is +7V. If these outputs are to drive inductive loads (like a relay) be sure to provide a back-EMF diode.



TYPICAL NE590 OUTPUT DRIVING A 5V RELAY DRIVING A TTL INPUT

AC Receptacle

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



90-264 VAC @47-440Hz input, power switch and fuse holder. Industry standard IEC plug.

Connection to the AC service is made with a standard IEC 3-prong cable, supplied with the unit. The 1A2 Interface Module uses a universal-input switching power supply. See Section 4 of this manual for more information on the power supply .

2.3 THE INTERNAL ROTARY SWITCH

The screwdriver adjusted rotary switch inside the 1A2 Interface Module box tells the system software

- which interface box "this one" is
- how many total hybrids there are in a system

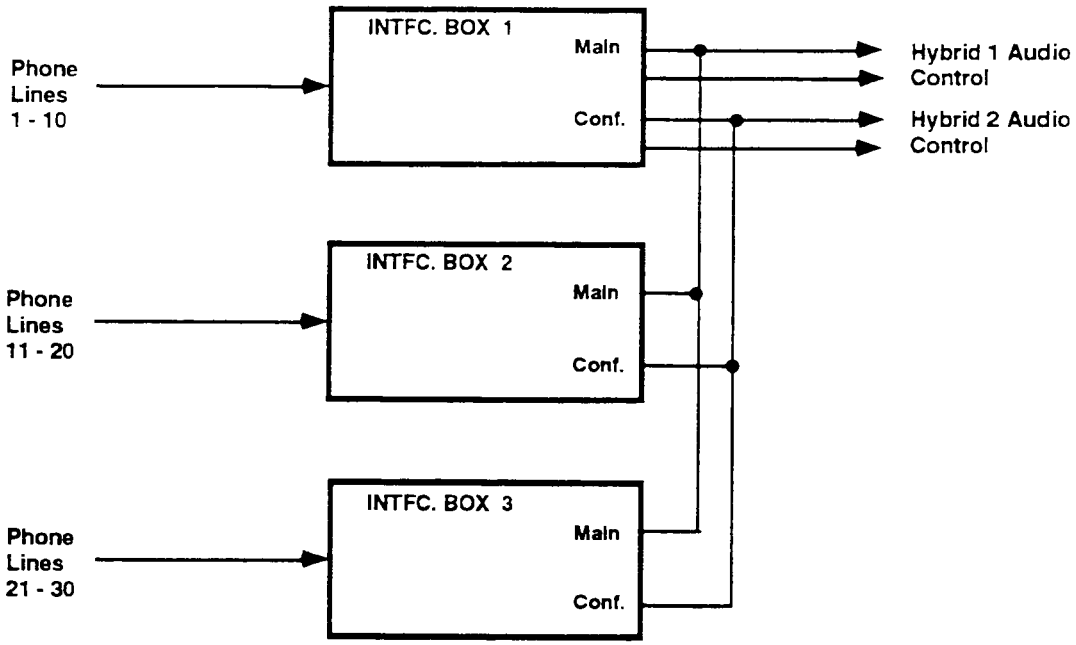
It should be set according to the tables based on the software version you have installed in your 1A2.

2.3.1 ROTARY SWITCH POSITIONS FOR STANDARD SOFTWARE

NUMBER OF HYBRIDS IN SYSTEM	NUMBER OF PHONE LINES	WHICH BOX IS THIS ONE?	SWITCH POSITION
1	10	1 (LINES 1-10)	0
	20	1 (LINES 1-10)	1
	20	2 (LINES 11-20)	2
	30	1 (LINES 1-10)	3
	30	2 (LINES 11-20)	4
	30	3 (LINES 21-30)	5
2	10	1 (LINES 1-10)	6
	20	1 (LINES 1-10)	7
	20	2 (LINES 11-20)	8
	30	1 (LINES 1-10)	9
	30	2 (LINES 11-20)	A
	30	3 (LINES 21-30)	B
Not Used			C D E F

Internal Rotary Switch Settings for software version 5.X.

Most systems will use the standard software, 1A2 V5.x. Use this table as a guide for setting your interface's rotary switch. The unit is shipped with the switch at position 0: one hybrid and ten lines. On the next page are a few examples of various configurations and a block diagram of a fully expanded system. If you need assistance setting this up, feel free to call Telos and ask for Customer Service!



Configuration for a fully expanded system using two hybrids with V5.x software. Other configurations are simply a subset of this system. Hybrid outputs are paralleled as required. It is not necessary to parallel the hybrid control signals.

Example:

System has one interface module, two hybrids; the switch in the only interface box is set to position 6.

Another example:

System has two interface modules and two hybrids (additional module is being used to expand system line capacity); box #1 has switch set to position 6 and box #2 has switch set to position 7.

Yet another:

System has one module and one hybrid; box #1 is set to position 0.

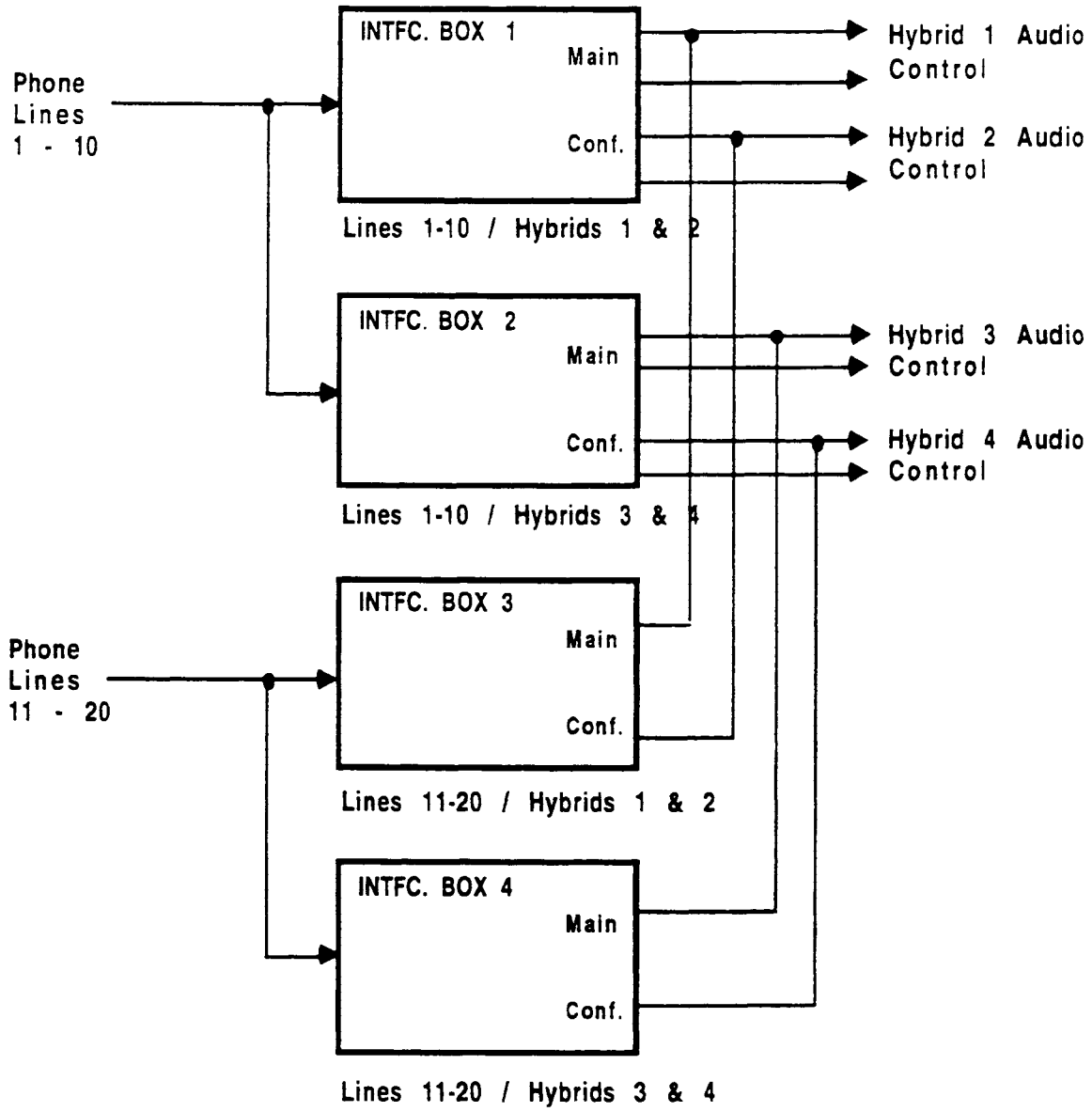
2.3.2 ROTARY SWITCH POSITIONS FOR SPECIAL SOFTWARE

If your system is running 1A2 V8.x special software, use this table as a guide for setting your interface's rotary switch. The unit is shipped with the switch at position 0: one hybrid and ten lines.

WHICH INTERFACE BOX IS THIS ONE	PHONE LINES	NUMBER OF HYBRIDS IN SYSTEM	SWITCH POSITION
1	1 - 10	1	0
1		2	1
1		3	2
1		4	3
2	1 - 10	1	4
2		2	5
2		3	6
2		4	7
3	11 - 20	1	8
3		2	9
3		3	A
3		4	B
4	11 - 20	1	C
4		2	D
4		3	E
4		4	F

Internal Rotary Switch for software version 1A2 V8.x.

Use the following block diagrams, showing a fully expanded system, to help figure out what setting(s) you'll need. If you need assistance setting this up, feel free to call Telos and ask for Customer Service!



Configuration for a fully expanded system using four hybrids. ***This requires software version 1A2 V8.x.*** *Other configurations are simply a subset of this system. KSU lines and hybrid outputs are paralleled as required. Hybrid control signals must be wired to each hybrid from P4 of Box #1 & #2, depending on the number of hybrids in the system.*

Example:

System has 20 lines, two hybrids; the switch in the first interface (box 1) is set to position 1; the second interface (box 3) is set to position 9.

2.4 INTERNAL 4-POSITION DIP SWITCH

On Revision D 1A2 Interfaces a 4-position DIP switch is provided for extra options. The version 5.x software incorporates the following functions:

Position #1 ON This will deactivate the "locked on" feature. Double-pressing any line button WILL NOT lock the line on, nor will the LED indicator stop flashing and remain lit. If any other line button is pressed, the previous line WILL BE DROPPED. "HOLD" and "OFF" will still function normally.

Position #2 ON Not supported; future use.

Position #3 ON Not supported; future use.

Position #4 ON When using software version 1A2 V8.x only, this disables the buttons for lines 11-20. This is recommended when using version 1A2 V8.x with multihybrid, 10-line systems so that the operator does not think the lower row of buttons is functional. Not supported in V5.x.

These switches MUST BE OFF on ALL older Revision A, B & C interface modules.

2.5 ONE MODULE SYSTEMS

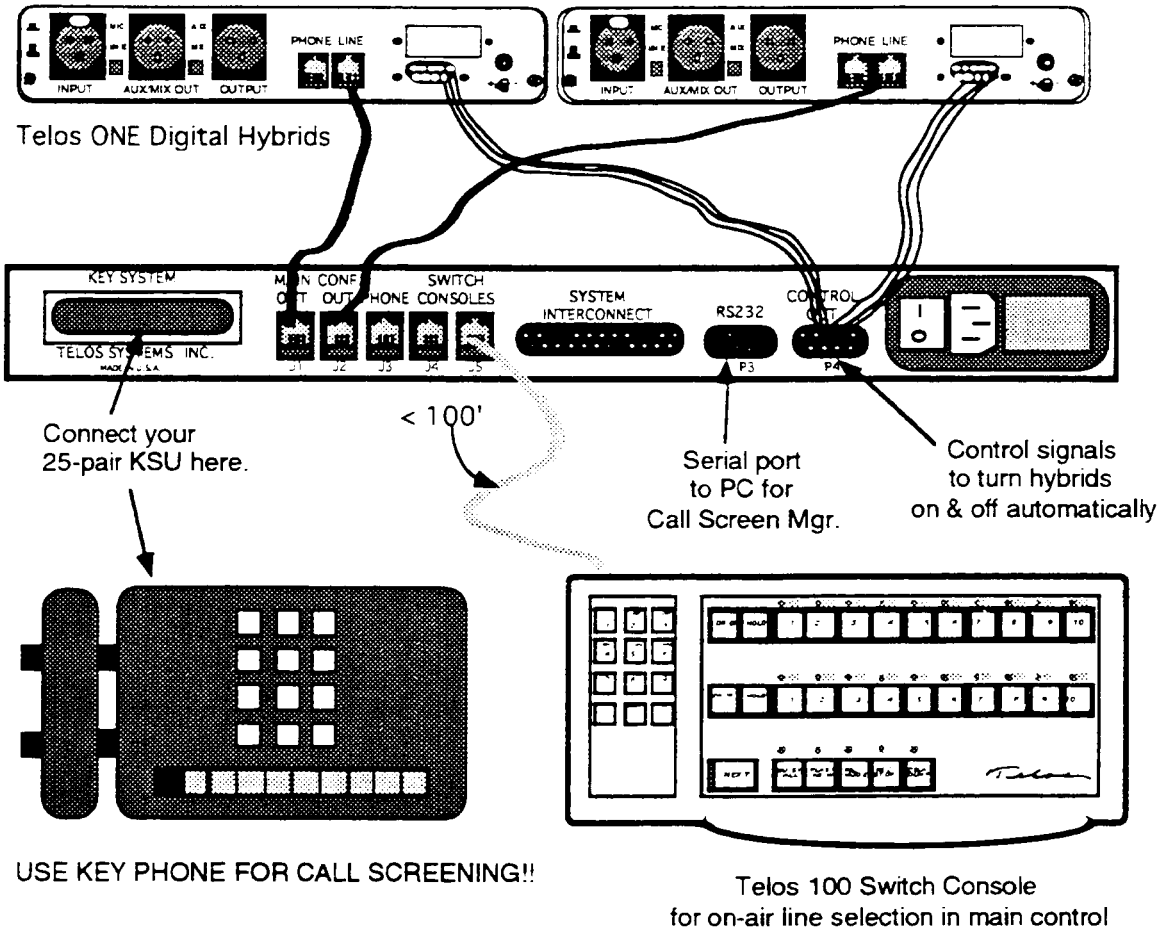
Systems with one 1A2 Interface Module may have up to 10 lines and as many as 2 hybrids. Connection is straight-forward. Use the diagram on the next page as a guide.

The steps to implementing a one module system are as follows:

1) Connect the KSU to the 1A2 Interface Module either directly in parallel with any key phone or by cross-connecting the various lines as desired. Refer to the section on key systems for details on the KSU 25-pair connector.

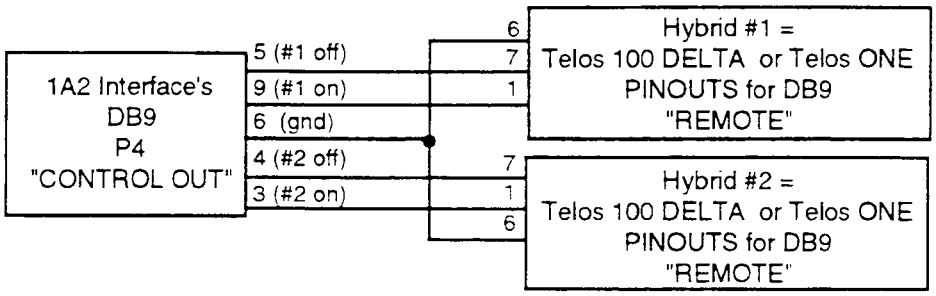
2) Plug one or two Switch Consoles into the appropriate modular jacks. The Switch Console manual and the section "Rear Panel Connections" of this manual have more information.

3) Connect the audio to the hybrid(s) using a standard modular cable. MAIN OUT (J1) goes to the hybrid #1 telco input. If 2 hybrids are being used, CONF OUT (J2) goes to the hybrid #2 telco input.

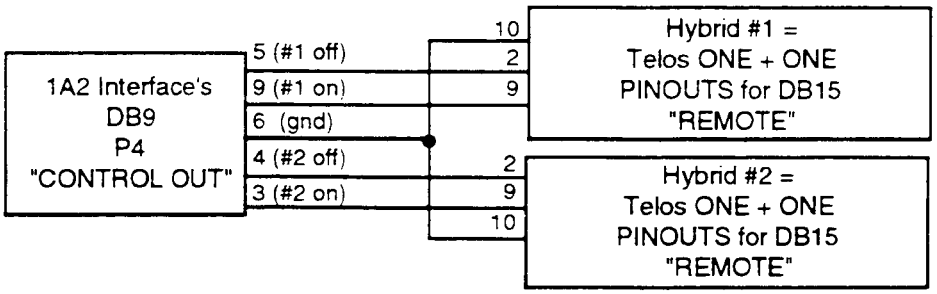


Rear panel interconnections for a 10-line 2-hybrid system with one 1A2 Interface Module (10 lines maximum). Telos ONE Digital Hybrids shown.

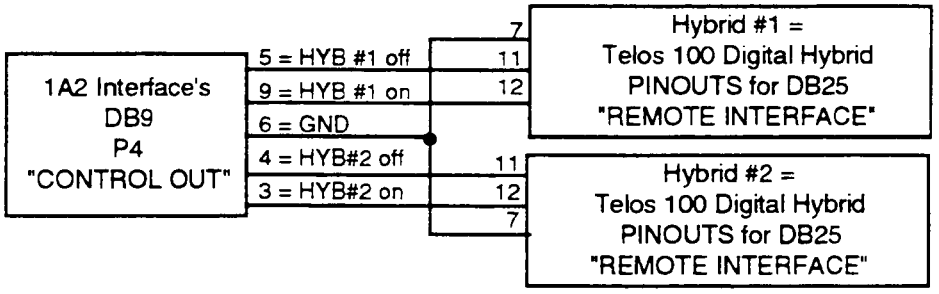
4) Connect the hybrid on/off control functions from CONTROL OUT (P4) to the hybrid control connector(s) using the charts below as a guide. A male DB-9 (solder cup style) is included with the 1A2 Interface Module. All Telos hybrids are packed with their appropriate DB connector, as well. The control functions are two-fold: first, they turn the hybrids on and off automatically as lines are selected and dropped. Secondly, while the hybrid adapts (when it turns on) the hybrid output is muted, which will prevent any line switching "clunk" from going out on the air as lines are selected.



Connection Scheme for Hybrid Control Functions
using Telos ONE or Telos 100 Delta hybrids



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



Connection Scheme for Hybrid Control Functions
using Telos 100A hybrids

5) If desired, connect a desk-set phone to PHONE (J3) using a standard modular cable.

6) Set the internal rotary switch inside the 1A2 Interface Module to the appropriate position. If one hybrid is being used, the switch should be set to position #0; if two are being used, set the switch to position #6.

2.6 SYSTEMS WITH MULTIPLE INTERFACE MODULES

Additional 1A2 Interface Modules may be used to add to the number of lines which may be accommodated. Telos manufactures dual 20-line panels (left) and dual 30-line panels (right) for these functions. Their operation is described in their separate manual.

What if, you ask, you can't use a dual 20-line or dual 30-line panel? The Telos desktop Switch Console and all the dual 10-line panels can be used with special software, 1A2 V8.X, to handle more than 10 lines. See section 3.3 for more details. Another option is to use multiple Switch Consoles; one for lines 1-10, a second for lines 11-20, and a third for lines 21-30. This last option is accomplished with version 5.X using consoles with properly set DIP switches. (Yes, it does take up a great deal of space on the desk!)

Whenever more than one 1A2 Interface is used in a system the 25-pin "SYSTEM INTERCONNECT" (P2) must be paralleled to all interfaces. These cables are available from your local computer store or Telos. Or you can make them up yourself! Refer to section and be certain the internal rotary switch is set to the appropriate position for each 1A2 Interface Module.

Expanding Number Of Hybrids

A system may have as many as four hybrids with an appropriate number of 1A2 Interface Modules. (See section 1.2.) The phone line input from the KSU is paralleled to both interface modules using either bridging adapters or ribbon cable assemblies.

Hybrid #1 goes to interface module #1 main, hybrid #2 goes to interface module #1 conference , hybrid #3 goes to interface module #2 main, and hybrid #4 goes to interface module #2 conference. The hybrid control signals come from interface module #1 for hybrids 1 & 2 and interface module #2 for hybrids 3 & 4. See section 2.3.

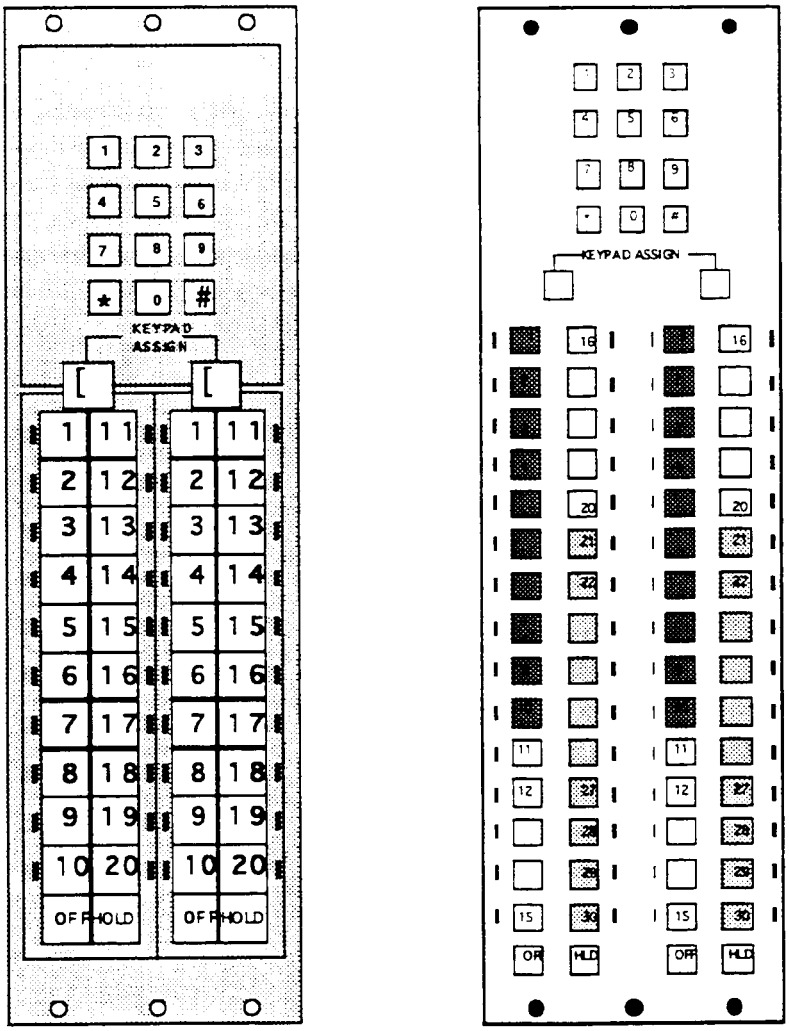
Expanding Number of Lines

Additional interface modules may be used to add to the number of lines which may be accommodated. In this case, the hybrid audio outputs, MAIN (J1) and CONF (J2), from each of the interfaces is paralleled using modular paralleling adapters. See section 2.3.

The hybrid control signals come from interface module #1 only. There is no need to parallel the hybrid control signals.

Expanding Both Hybrids and Lines

With four interface modules, the number of lines and the number of hybrids may be increased simultaneously using version 1A2 V8.x. Note that the expansion of just hybrids or just lines is simply a subset of the expanded system. When we are expanding lines, but not hybrids, interface modules 2 and 4 are just missing. That is why the rotary switch is set for interface module 3 when only two interface modules are being used to expand lines.



Dual 20-line panels (left) and dual 30-line panels (right) are available for the PR&E turrets and BMX3/ABX consoles.

2.7 SOFTWARE INSTALLATION

The special software version of the 1A2 Interface Module may require replacement of the EPROMs that hold the unit's operating system. The EPROM is identified on the schematic as U5 and has a sticker on it showing its software version.

> *If you are at all unsure about how to replace the EPROMs, you may send your unit to Telos Systems and we will perform the work for you at no charge. Please call or fax for return authorization and instructions.*

Make sure units are powered down before removing old EPROMs. Remove the "Gold Cap" jumper (JP1) inside the 1A2 Interface also. Carefully remove the EPROM at a static-safe workstation. Immediately place the old EPROM on antistatic material. Install the new EPROM, taking care its polarity is correct and all pins are seated before pressing the chip all the way down in the socket. Verify polarity is correct again before power-up. Replace "Gold Cap" jumper and verify operation before reinstalling unit.

SECTION 3

OPERATION

3.1 GENERAL

There are two possible operating modes:

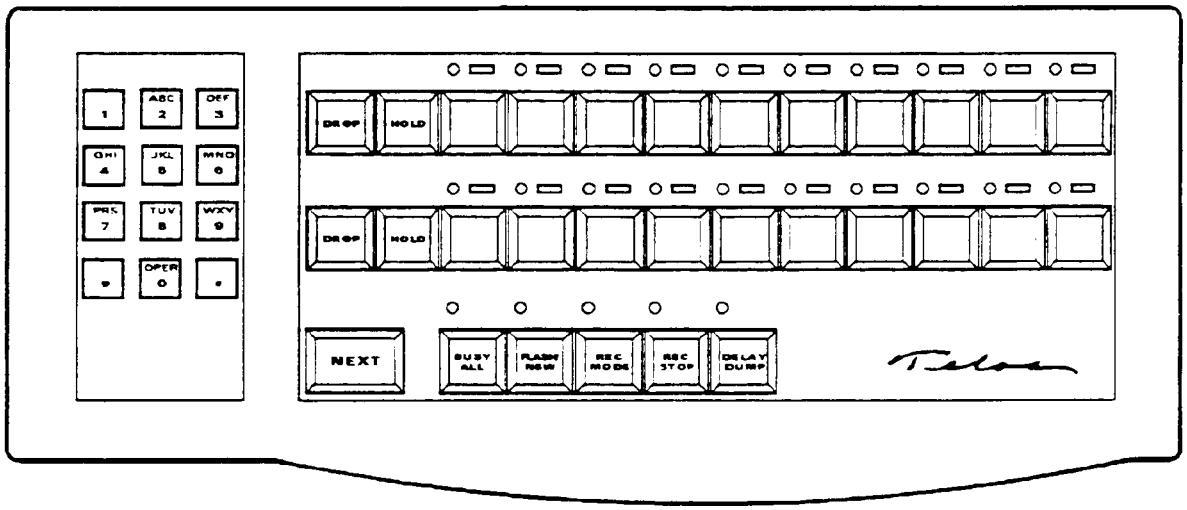
1) Standard 10-line operation with Switch Console or 20- or 30- line operation with console mounted panels. One or two hybrids can be used.
2) Special 20-line operation with Switch Console or up to 30 lines with up to 4 hybrids using console mounted panels. Up to four hybrids are supported in this mode.(See section 3.3 for installation considerations.)

The first two can be obtained with the standard (1A2 V5.X) software. The third requires a special EPROM (1A2 V8.x) which is available from us at no charge.

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.



The Switch Console communicates by sending and receiving serial data over a "skinny wire" data link. The Switch Console sends data to the 1A2 Interface Module when a key press occurs and receives commands from the 1A2 Interface Module to illuminate the appropriate LEDs.

When the Switch Console is first plugged into the 1A2 Interface Module, its indicator LEDs will at first all be illuminated and then will be refreshed to the current system and phone line status.

See the Switch Console DIP Switch information sheet in the Appendix for configuration options you may want to incorporate into your system. The vast majority of Switch Console users will use the factory default settings.

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 inside the 1A2 Interface Module.

The 1A2 Interface Module automatically assigns the dial pad and aux phone port to the bank of LINE buttons last selected line's bank. For example, if you select a line on the bottom row in a two-hybrid system, the DTMF generator will be sent to hybrid #2 and the aux phone will be available to speak with callers off-air using the bottom row. (See section 3.2.8) Should the aux phone go off hook, hybrid #2 will turn off and all lines that were on hybrid #2 will now route to the aux phone. Of course, returning the phone on-hook will restore the hybrid feed, just as before.

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

3.2.3 LINE BUTTONS AND LED INDICATORS

Operation for line selection, holding, etc. is very similar to the familiar key phone sets.

In the standard 10-line mode, the maximum number of lines is 10 with all lines appearing on both rows. When two hybrids are connected to the 1A2 Interface Module, the top row of LINE buttons corresponds to the MAIN hybrid and the bottom row to the CONFERENCE hybrid.

> In the special 20-line mode, lines 1 through 10 are assigned to the top row of buttons and lines 11 through 20 are assigned to the bottom row. All of the lines are treated as one continuous "bank." More details and instructions on use of this mode are found in section 3.3.

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 1A2 Interface Module.

LINE Buttons

Each row of LINE buttons has a DROP button, a HOLD button, and ten LINE selection buttons. During installation, up to ten phone lines may be connected to each 1A2 Interface Module. The DROP and HOLD buttons affect only the row of LINE buttons on which they are located.

Bar LED Indicator

Above each line selection button is a bar LED to indicate line status. LINE status can be affected by pushing a LINE button on the Switch Console or from a connected screener phone, a connected computer, or an external phone system connected to the 1A2 Interface Module. The bar LED will therefore always reflect the true LINE status.

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

Bar LED Status	*LINE Status*
Slow Flashing	Ringing
Rapid Blinking	On Hold
Slow Blinking	Busied Out
Solid (bright)	On Air
Solid (dim)	In Use Elsewhere
Off	Not in use

Round LED Indicator

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

Round LED Status	*Hybrid Status on Indicated Line*
Flashing	On air, single-caller status
Solid	On air, conference status
Off	Not on air

3.2.4 PLACING CALLERS ON AIR

Placing Callers On Air - Single-Caller

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

Placing Callers On Air - Conferencing

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

Tips for Conferencing

- In the standard mode, select your first caller from the top row of the Switch Console and the second caller from the bottom row. This should be your procedure whether you are using one or two hybrids.

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

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

- See section 3.3 for information on conferencing callers when using software version 1A2 V8.x.

3.2.5 SPECIAL FUNCTION BUTTONS

There are six special function buttons below the line selection buttons. These buttons are not currently supported for 1A2 V8.x. From left to right, these function buttons are:

NEXT

When pressed, this button will route the "next" caller to hybrid #1, just as if one were to press the LINE button itself. Any line that was on air and NOT locked into conference status will be dropped. Locked-in lines will continue to be active. The system will automatically renull the hybrid each time a call is selected via the NEXT button.

A line can get into the "next" queue by looking for lines that are in "screened hold" and then lines that are ringing-in. First, the system looks at lines in "screened hold" and takes the line that has been waiting the longest. (Lines can be put into "screened hold" from a command through the RS-232 port only, a function that

becomes available using Telos Call Screen Manager software.) If no lines are found to be in "screened hold," the system will then look for any lines ringing-in. The line that has been ringing-in the longest will go to air. If no lines are either in screened hold or ringing in, the system will drop any line(s) on hybrid #1, if they are not locked-in.

BUSY ALL

The "busy" function keeps lines from ringing-in to the system by placing them on hold automatically. This may be used for contests, when you want to "clear the deck" of calls before announcing the contest.

The first press of BUSY will seize the first line in the "busy group," then place it on hold. It will then scroll through the rest of the "busy group" one at a time. If BUSY is pressed a second time, all lines in the "busy group" will be seized and then released, one at a time, thus freeing those lines for new incoming calls. This way, no call can "jump the gun" to get into your contest sweep first.

Should a line be manually released while in this mode by depressing the LINE button, the key system will release the call from hold, whereupon the interface will seize and hold the line again.

The system can place calls into "busy" only if hybrid #2 is idle. *The busy sequence will halt the instant hybrid #2 becomes active.* If this should happen, lines that released while in "busy" will no longer continue to be re-busied. If the system was in the process of un-busying, this function will halt also. The system will return to its normal busy sequence once hybrid #2 becomes inactive. The LED above the BUSY button will blink whenever the system is in the "busy" mode. If a line that is in the "busy group" is active on either hybrid when BUSY is first pressed, it too will be busied out as soon as it is released from the hybrid.

Assigning Lines to the "Busy Group"

A special key sequence will access the "busy group" assign function, so that you can decide which lines should be allowed to "busy out." Pressing the button sequence "* * # # BUSY" will access the "busy group" assign function. When the system is in this mode, the console cannot affect line status or hybrid status nor can it show line status. Once in this special assign function, all lines that are currently in the "busy group" will blink their BAR LED at a very slow rate. (The system will default to all ten lines upon first-time power-up.) Lines not in the "busy group" will have no LEDs lit. The TOP row of buttons on the console toggle the respective line in and out of the "busy group." Use the TOP row buttons to select and deselect what lines you want in the "busy group" by pressing those line buttons. To save your set-up and exit this special mode, press BUSY again.

FLASH/NEW

This button will create a hook-flash on any lines active, but it follows the "Keypad Select" function. For example, Line 4 is active on hybrid #1 and Line 6 is active on hybrid #2. The keypad select is on the conference bank. If FLASH is pressed, a hook-flash will be generated on Line 6 ONLY. Line 4 will remain on-air through hybrid #1. This can be used to access Centrex® functions or can be used just to drop a line to get new dial tone. The LED above this button will blink during the hook-flash sequence.

RECORD MODE

When this button is pressed, it puts the system into a special control mode, to provide auto-start and auto-stop of a tape deck one would use to record calls with. It works like this: The first press of the button makes its LED blink, indicating that the system is in "record mode." Every time a new line is selected (top or bottom row of the console) the 1A2 Interface generates a momentary pulse to ground on pin 7 of P4 (the CONTROL OUT DB-9 on the rear panel of the interface). Connect this pin to the tape deck's REC START control. When the are no more active lines on either hybrid, the system generates another momentary pulse to ground on pin 8 of P4. Connect this pin to the tape deck's STOP control input. To escape the "record mode," press REC MODE again, and its LED will stop blinking and remain lit. Remember that this button only controls the "record mode" function, not the actual hardware controlling the tape deck!

RECORD STOP

Whenever this button is pressed, the system generates a momentary pulse to ground on pin 8 of P4, regardless if the system is in "record mode" or not. One can use this to manually stop the tape deck, or the button can be relabeled and then be used as a general purpose output. Perhaps it may be used to start a cart machine that has a sound effect or contest jingle loaded. Its LED will blink once each time it is pressed. It will not affect "record mode" in any way.

DELAY DUMP/USER BUTTON

Whenever this button is pressed, the system generates a momentary pulse to ground on pin 1 of P4. If P4-pin 1 is connected to your broadcast delay unit's "dump" input, the delay will be dumped. Or, the button can be relabeled and used as a general purpose control output. Its LED will blink once each time it is pressed.

3.2.6 CHANGING BUTTON LEGENDS

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

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

Special function button caps, with the exception of the NEXT button, are interchangeable among themselves and with the LINE buttons.

3.2.7 ADDITIONAL FUNCTIONS/FEATURES

Incorporated into software 1A2 V5.4x are a few other interesting things.

DIAL OUT

Users of the desktop console with earlier versions of 1A2 software could only dial out on hybrid #1 (the top bank of buttons on the console). This version automatically assigns the dial pad and aux phone port to the *last selected line's bank.* See section 3.2.2 for details.

DUAL 10-LINE PANELS

Users of the Telos dual 10-line console and turret panels have keypad assign buttons at the top of each row. These buttons still work as they used to, but their lamps will indicate which bank is active for the aux phone and tone generator as lines are being selected. Note that the keypad assign buttons are disabled whenever the phone on the AUX PHONE port is off-hook.

If your panel has DIP # 1 AND DIP #2 "on," a limited number of special function buttons are available to you as listed below:

Line 10 MAIN	changes to	NEXT
Line 10 CONF	changes to	BUSY
Keypad Assign CONF	changes to	FLASH.

Keypad assignment is to hybrid #1 always when your panel is in this mode.

20-LINE AND 30-LINE SYSTEMS

If the system is set up for more than 10 lines, all special function buttons are disabled. The dial assign buttons will have the same functionality as described above for 10-line console panels.

3.2.8 AUX PHONE

A standard single-line desk-set telephone instrument may be connected to jack J3 to talk to callers off air. The system *automatically* assigns the aux phone and DTMF generator to the *last selected line's bank*.

If the phone on the AUX PHONE port (J3) goes off-hook, any calls on that bank will route to that phone removing the feed to air. The hybrid is turned off. As long as the phone is off-hook, the auto-routing is disabled and the dial assign buttons on Dual 10-line panels will not function. Once the phone on the AUX PHONE port goes back on-hook, the system will auto-route again; the hybrid feed will be restored (i.e., the appropriate hybrid will turn back on automatically) and the dial assign buttons on Dual 10-line panels will again function as expected. This is done so that calls on the air are not disturbed while the aux phone is in use.

3.2.9 OLDER-STYLE METAL SWITCH CONSOLE

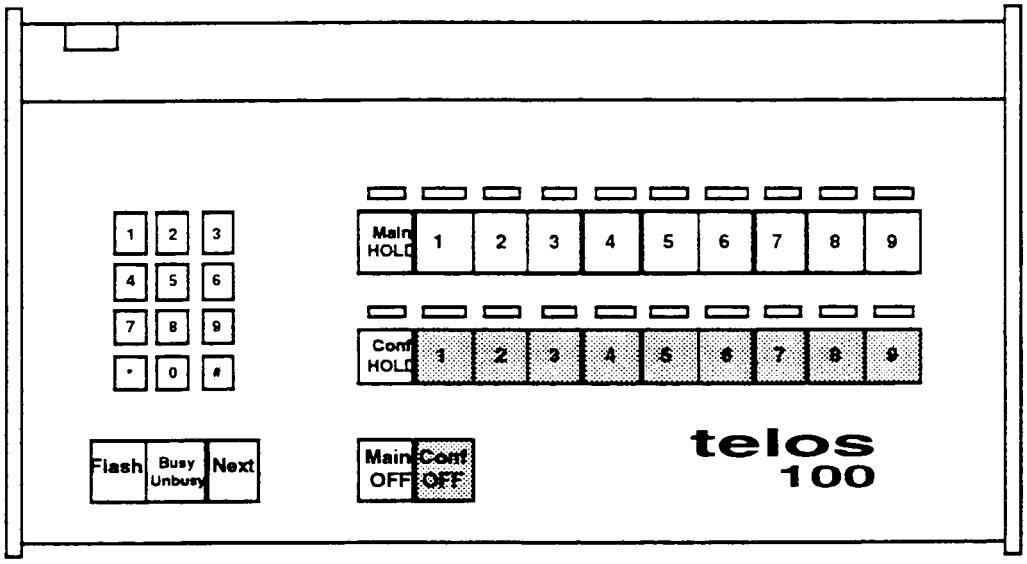
The older-style Switch Consoles (see the diagram) can also be used with 1A2 V5.4x software with the following limitations:

Because the older consoles only have three user buttons, only FLASH, BUSY and NEXT can be used. The features that cannot be implemented are REC MODE, REC STOP and DELAY DUMP.

The older consoles do not support lamp indications for the user buttons, so when these buttons are pressed, their associated lamp will not light or blink in any fashion.

The BUSY function will cause all lines in the busy group to blink their buttons rapidly while in the BUSY mode. Also, because these consoles do

not have dedicated Line 10 buttons, Line 10 cannot be removed from the busy group. However, due to some software incompatibility with the older consoles, the HOLD buttons will indicate line 10's status. When BUSY is activated, both HOLD buttons will blink at the new BUSY rate. One can use this as an indication that the system is in the BUSY mode, or one can simply remove the lamps from those buttons. The buttons themselves still act as the HOLD keys for each row.



Older metal-cased Switch Console showing User Button positions for 1A2 V5.4x

Your Telos dealer can provide you an economical upgrade to the latest version Switch Console.

3.3 SPECIAL 20-LINE OPERATIONAL MODE

In this mode, as many as twenty lines may be controlled from a standard Switch Console. The essential difference from the standard mode is that all of the line buttons are considered to be one "bank." Using this mode requires changing EPROMs to 1A2 V8.x. If you would like to do this, please contact us for the parts. See section 2.7 for information on replacing EPROMs.

> ***The most common problems reported by users or version 1A2 V8.x are due to incorrect settings of the rotary switch or incorrect settings of the DIP switches in the 1A2 Interface Module or Switch Console. Telos Customer support is pleased to help you set up the proper settings for your installation.***

The **advantages** of this software version are:

- The ability to have 20 lines controlled from the Switch Console.
- The ability to have three or four hybrids connected to the system.

The **disadvantages** of this software are:

- Increased likelihood of operator error due to confusion over which caller is on what line.
- In multihybrid systems, it is not always possible to predict which hybrid is handling which caller. Users of version 1A2 V8.x should sum the outputs of all hybrids which sacrifices your ability to adjust the relative level of each caller.

As all of the lines on both Switch Console rows are used as a single bank, conferencing does not need to start with a caller from the top row and one from the bottom row. Each successive caller put into conference status (by pressing the line button twice) will be assigned to an available hybrid, up the number of hybrids on your system. Callers placed on the conference that exceed the number of hybrids will be "mashed" onto the last hybrid in the system. It is recommended that the number of callers in your conference not exceed the number of hybrids in your system.

All LINE buttons operate as in the standard software mode and all LEDs provide the same indications. Special function buttons are not supported, as of this writing.

Conferencing Callers with more than one hybrid with 1A2 V8.x

In multiple-hybrid systems calls released from conference will free up that hybrid for the next conferenced line. Multiple lines can be sent to Hybrid #1 by sending calls to other hybrids and then returning them to Hybrid #1 by pressing that line button again.

When configuring mix-minus for multiple hybrids be sure that any hybrid is NOT fed its own output through the mix-minus scheme (i.e., three hybrids = three different mix-minuses, etc.). Each hybrid output should feed the other hybrids' inputs through a mix-minus bus and have its own fader on the audio console. This is called "conferencing with gain," which allows gain riding for each hybrid(caller) and a caller-to caller gain path. Many broadcast consoles have provision for at least one or two mix-minus busses. If your console doesn't, you will have to use a stand-alone mixer to create the mix-minuses.

> ***A Helpful Suggestion***
> All Telos hybrids have a maintained signal output, available on the hybrid's rear panel connector, which goes "low" while the hybrid is active (ON). Use this signal to turn on the console fader/channel assigned to that hybrid. (Be sure to check the type of control signal required for your console's line card.) With this scheme, whenever a hybrid becomes active, its console channel automatically turns on.

TWO HYBRIDS

All lines put in the conference status (as discussed above) will be routed to Hybrid #2. Pressing the line button again will bring that line back to standard status and to Hybrid #1. Keep in mind the "OFF" and "HOLD" functions affect ALL lines on Hybrid #1.

THREE HYBRIDS

The first line placed in conference status will be routed to Hybrid #2. Any more lines placed in conference afterward will go to Hybrid #3. Releasing a call on Hybrid #2 or Hybrid #3 to standard status will return it to Hybrid #1. Keep in mind the "OFF" and "HOLD" functions affect ALL lines on Hybrid #1.

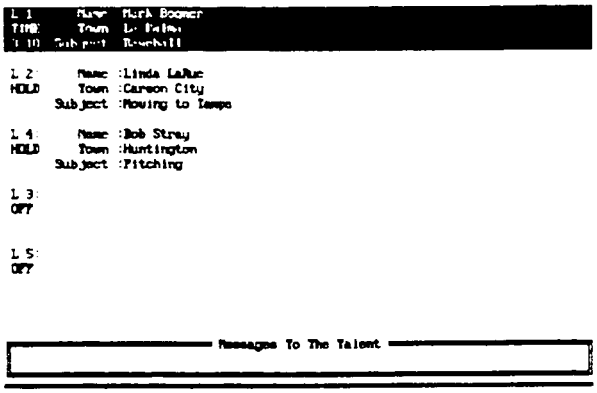
FOUR HYBRIDS

A four-hybrid system functions like a three-hybrid system, except that the third line put in conference will now go to Hybrid #4. Any more lines placed in conference afterward will go to Hybrid #4. Releasing a call from Hybrids #2, 3 or 4 to standard status will return it to Hybrid #1. Of course the "OFF" and "HOLD" functions will affect ALL lines on Hybrid #1.

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

Telos Call Screen Manager is an elegant software package implementing the 1A2 Interface's line status information from its RS-232 port. Other third-party vendors also have software designed specifically for use with the 1A2 Interface Module.



Host Screen of Call Screen Manager

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)

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 where appropriate.

OFF XX	Turns line XX off.
ON XX	Turns line XX on to the main bank.
HOLD XX	Puts line XX on hold.
SCRNED HOLD XX	Puts line XX in "screened hold" mode.
CONF XX	Turns line XX on to the conference bank.
LOCK XX	Equivalent to switch console "double press."
TONE XX	Dials tone XX to on-air line. 01 = 1, 02= 2, etc.; 11 = *, 12 = #.
QUERY XX	Causes Telos to return line status in format given below.
UXX	Virtual press of function button on console. BUSY -> DELAY/DUMP = U00 -> U04. NEXT = U05.
Xternal various	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 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 1A2 Interface will revert to normal mode after time-out to prevent problems with computer being turned-off, etc.
Reset Xternal Mode	Function keys back to normal operation.
Monitor	Causes Telos to return line status in format given below whenever any line status changes. Replies with: `Line monitor ON.`
Don't Monitor	Turns monitor mode off. Replies with: `Line monitor OFF.`
Initialize	Sets all lines to off, etc.
?	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- and they are offset by one (i.e. line 1=00, line 6=05, etc.)

Examples:	To put a line 1 on hold, send "H00"
	To request line 5 status, send "Q04"
	To place in monitor mode, send "M"
	To re-initialize the system, send "I"

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.

OFF XX	Indicates line XX is off.
ON MAIN XX	Indicates line XX is active on main bank.
HOLD XX	Indicates line XX is on hold.
SCREENED HOLD XX	Indicates line is in "Screened Hold" mode.
CONF XX	Indicates line XX is active on conference bank.
LOCK XX	Indicates line XX has been locked on.
BUSIED XX	Indicates line XX has been "busied-out."
ELSEWHERE XX	Indicates line is on "elsewhere."
RINGING XX	Indicates line is ringing-in.
UXX	Indicates press of function button on console. BUSY -> DELAY/DUMP = U00 -> U04. NEXT = U05.

Special Note on Screened Hold

The Screened Hold option can only be activated from the RS232 port. Furthermore, the line must be put on hold before the S command is sent. The reason for this is that the 1A2 Interface Module cannot control the tip/ring and A-lead of the key phone that is being used to screen the calls. Should the line be put into Screened Hold while the 1A2 Interface Module is in any other state, that line's status will eventually revert to its previous state. Lines can be put into Screened Hold if the call is established on the MAIN or CONF bank of the Switch Console, just as if the HOLD command were entered; the key system will hold the line and its hybrid will re-null or turn off as usual.

If you have any questions regarding operation of the Screened Hold feature through the RS232 port, please call Telos' Customer Support.

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SECTION 4

THEORY OF OPERATION

4.1 OVERVIEW

Philosophy

In recent 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, in a way, 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 loaner units available for fast overnight shipping. In most cases, the cost of the repair is nothing more than your shipping costs.

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 me, you probably just have to know what's happening' inside the fancy box. So we tell you!

4.2 DIGITAL SECTION

4.2.1 Theory of Operation

Notation

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

The Microprocessor

As with most modern equipment, the Telos 1A2 Interface is based upon microprocessor control. The processor circuit is a very basic "textbook" system. The module uses the Intel 80C188 microprocessor as its "brain." The 80C188 is a highly

integrated CMOS microprocessor with an 8-bit data bus interface and a 16-bit internal architecture, effectively combining 15-20 of the most common 8088 system components onto one chip. Running at 18.432MHz, the 80C188 provides considerable processing power. There are six memory chip selects, seven peripheral chip selects, four maskable interrupts, two timers and a CLKOUT pin to synchronize external devices. The processor comes in a 68-pin plastic leadless chip carrier (PLCC). DO NOT ATTEMPT TO REMOVE THE PROCESSOR FROM ITS SOCKET WITHOUT THE PROPER REMOVAL TOOL, AS THIS MAY DAMAGE THE SOCKET AND THE MPU ITSELF. (Use PLCC extraction tool available from Burndy, Cat. No.QILEXT-1 or equivalent).

The processor's 8-bit data bus is multiplexed with the lower eight bits of address and demultiplexed by a 74AC373. The upper eight bits of address are available directly off the processor and are run directly into the 27C512 EPROM. Also on the data bus are two Intel 82050 UARTs, a 4364C-20L SRAM (used in conjunction with a Dallas Semiconductor Smart®Socket) and one Intel 8255 Programmable Peripheral Interface (PPI). A DS1232 provides processor reset in the event of a loss of power. Address lines A3-A5 run a 74HC138 3-to-8 line converter which, in turn, drive four NE590 relay drivers. A6 toggles between the PPI and the 74HC138 to memory-map the two devices. This ensures no conflict between the devices for the data bus.

The processor's /RD line is connected to devices on the bus it needs to get information from, i.e. the RAM, ROM, UARTs and PPI; the /WR line, to get information to devices, i.e. the RAM, UARTs, 3-to-8 line converter and PPI. The processor's Address Latch Enable (ALE) goes to the 74HC373 to demultiplex the addresses from the data. X1 and X2 provide the inputs for the 18.432MHz crystal oscillator. The CLKOUT pin drives both UARTs at one half the crystal frequency.

The Programmable Peripheral Interface

Intel's 8255 PPI has two bit-programmable 8-bit I/O ports and one byte-programmable 8-bit I/O port. The 8255 connects to the data bus and uses A0 and A1 to select internal registers. These internal registers are used to configure the I/O ports. In the 1A2 Interface Module, PA0-PA5 are used as output ports to drive the PCD3311 DTMF generator. PB0-PB7 and PC0-PC1 are programmed as inputs to detect lamp leads from the LM1489s. PC4-PC7 are programmed as inputs for the BCD switch, which is used by the system software to differentiate among other 1A2 Interface Modules on the common Telos serial bus.

PC2 is used as an input to detect an off-hook condition of the auxiliary telephone. When this phone is taken off-hook, the software will energize relay K21, which will switch the main audio path from its usual route (through the hybrid and your console) to the desk phone. Talk battery is provided to the telephone by a MAX641 operating in a voltage boost circuit. When the auxiliary phone is hung

up, the relay will be turned off and the main audio will return to its usual path. This is especially helpful when an operator's significant other is on the line and the boss walks into the studio!

The Serial Ports

Intel's 82050 asynchronous communications controller is very fancy UART and is used to interface serial data from the Switch Consoles, other 1A2 Interface Modules and other Telos equipment to the data bus. One 82050 is dedicated to the Switch Consoles; the other 82050 is for the RS-232 port. Each 82050 is supported by a Linear Technology LT1080 dual RS-232 driver/receiver which generates the appropriate RS-232 voltage levels. Address lines A0-A2 can access different registers to set word length, parity, stop bits, baud rate and so forth. Each UART has its own peripheral chip select line direct from the processor.

Memory

The 1A2 Interface Module has its program stored in a 27C512 EPROM which is backed up by a 4364C-20L SRAM. The Dallas Semiconductor DS1213 Smart®Socket performs five circuit functions to battery back-up the SRAM. It provides power fail detection circuitry which will enable a switch to its internal lithium batteries. An internal comparator will decide which of the two batteries to use, based on which has a higher voltage. Every time the Smart®Socket is powered up by Vcc, an internal comparator checks the battery. If the battery voltage is less than 2.0V the second memory cycle is inhibited. A simple read/write cycle can determine if data has been corrupted. Finally, if the power failure occurs when the Chip Enable line is active (low), the write protection will be delayed until the last memory cycle is completed. In the event of a power failure, the SRAM will remember what the status of the system was before the outage. When power is returned, all consoles on line will be returned to their previous state. The key system will be immediately queried for its status and the system will then reflect any changes.

Interface to the Key System

The 1A2 Interface Module obviously must connect to the 1A2 Key System somehow and tell it what to do. First, lamp voltage on the "L" leads are run into LM1489 quad receivers. The 60-cycle 10-20 volt sine waves are converted to TTL levels by the LM1489s. These signals are then run into the PPI. Software polls the ports regularly to see what each line's lamp is doing, i.e. ringing, on line, on hold or off. Software will energize the appropriate relays or opto-isolators through NE590 relay drivers to accomplish the desired function for each line. Each line's tip and ring are connected to two separate relays: one for main audio, the other for conference audio. Opto-isolators drive the "A" leads. The A leads are broken by the optos before the relays break tip and ring to cause a "hold" condition.

A Note About Software

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

4.2.2 Troubleshooting

Desoldering

While we socket the ICs that have the greatest potential for failure, many of the Telos 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, I'm sure, when one of the soldered ICs appears to have failed. When you need to replace a soldered in chip, the right tool is essential. We use a vacuum desoldering system made by Pace (the MBT-100) and highly recommend it. Cost is about $450 - worth it if you do much PC board troubleshooting work. The only other real alternative is to clip the leads from the top and remove the solder from the holes with solder-wick. We've not had much luck with the non-heated, manual vacuum desoldering devices like the one from Radio Shack. We do not recommend that newly-soldered connections be defluxed.

4.3 POWER SUPPLY

The power supply inside the 1A2 Interface Module is manufactured by Autec Power Systems (model no. UPS51-2002). This 50W supply is a universal-input switching supply, accepting an input range of 90-264VAC (continuous), 47-440Hz. It provides a +5VDC output for the digital circuits and a +12VDC output to power the Switch Consoles. DO NOT ATTEMPT TO REPAIR THE SUPPLY! MANY EXPOSED PARTS OF THE SUPPLY ARE ELECTRICALLY HOT! Rather, disconnect the AC power and carefully remove the unit. Then call Telos for a replacement power supply.

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SECTION 5

APPENDIX

APPENDIX CONTENTS

Parts Lists and Schematics

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.

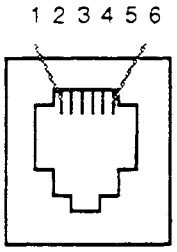
Telos Systems' dealers are not authorized to assume for Telos Systems any additional obligations or liabilities in connection with the dealers' sale of the Products.

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.

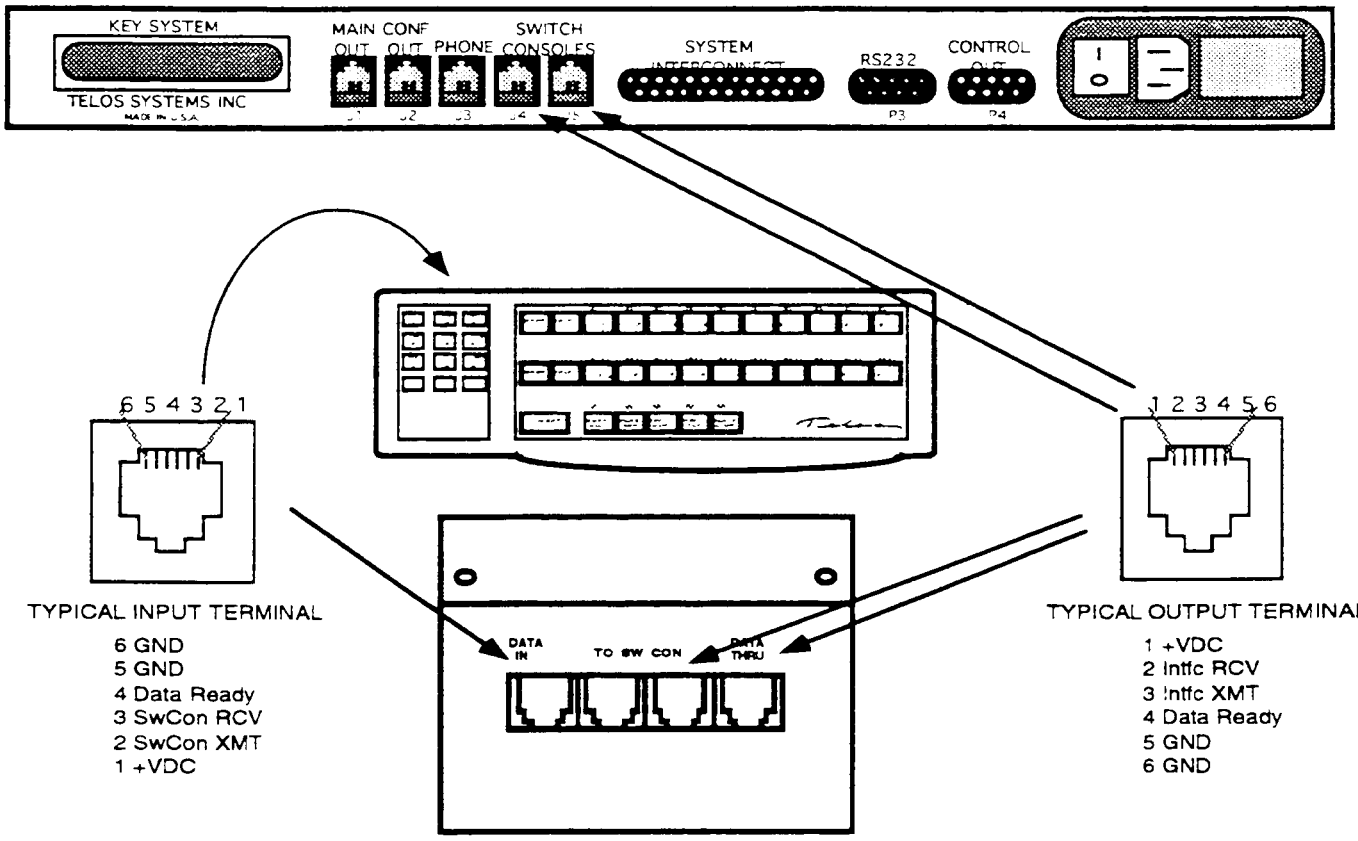
Telos products are to be used with registered protective interface devices which satisfy regulatory requirements in their country of use.

1A2 Interface Module Switch Console Modular Connector Pin-Out (J4, J5)



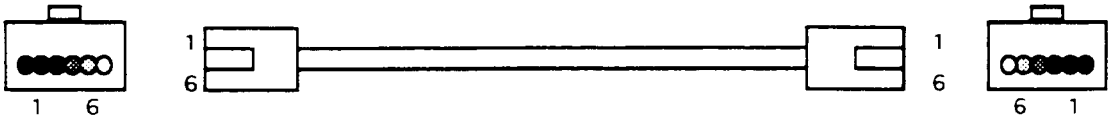
1 +12 VDC (power to Switch Console)
2 RCV (from Switch Console to 1A2 Module)
3 XMT (to Switch Console from 1A2 Module)
4 Ready/Busy (low signifies Switch Console sending)
5 Ground
6 Ground

RJ11C FORMAT FOR TELOS SWITCH CONSOLES



NOTES:

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



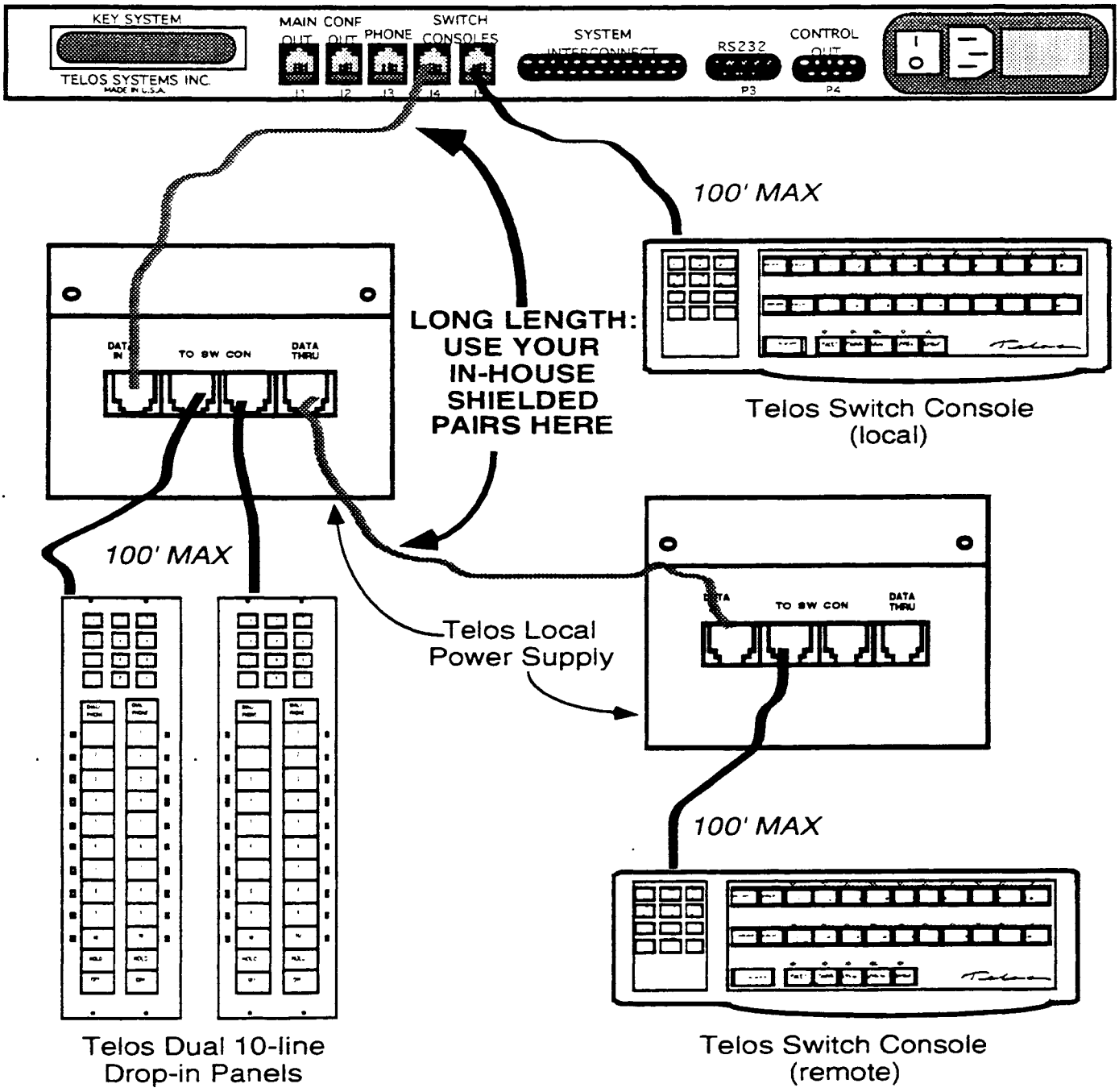
2) Cables to "DATA IN" or from "DATA THRU" can be 4- or 6-conductor, but must invert the signals as shown above.

3) Maximum TOTAL length from 1A2 Interface to Switch Console WITH local P/S is 250 ft. Max. length WITHOUT local P/S is 100 ft.

4) Each local power supply can power up to two (2) Switch Consoles.

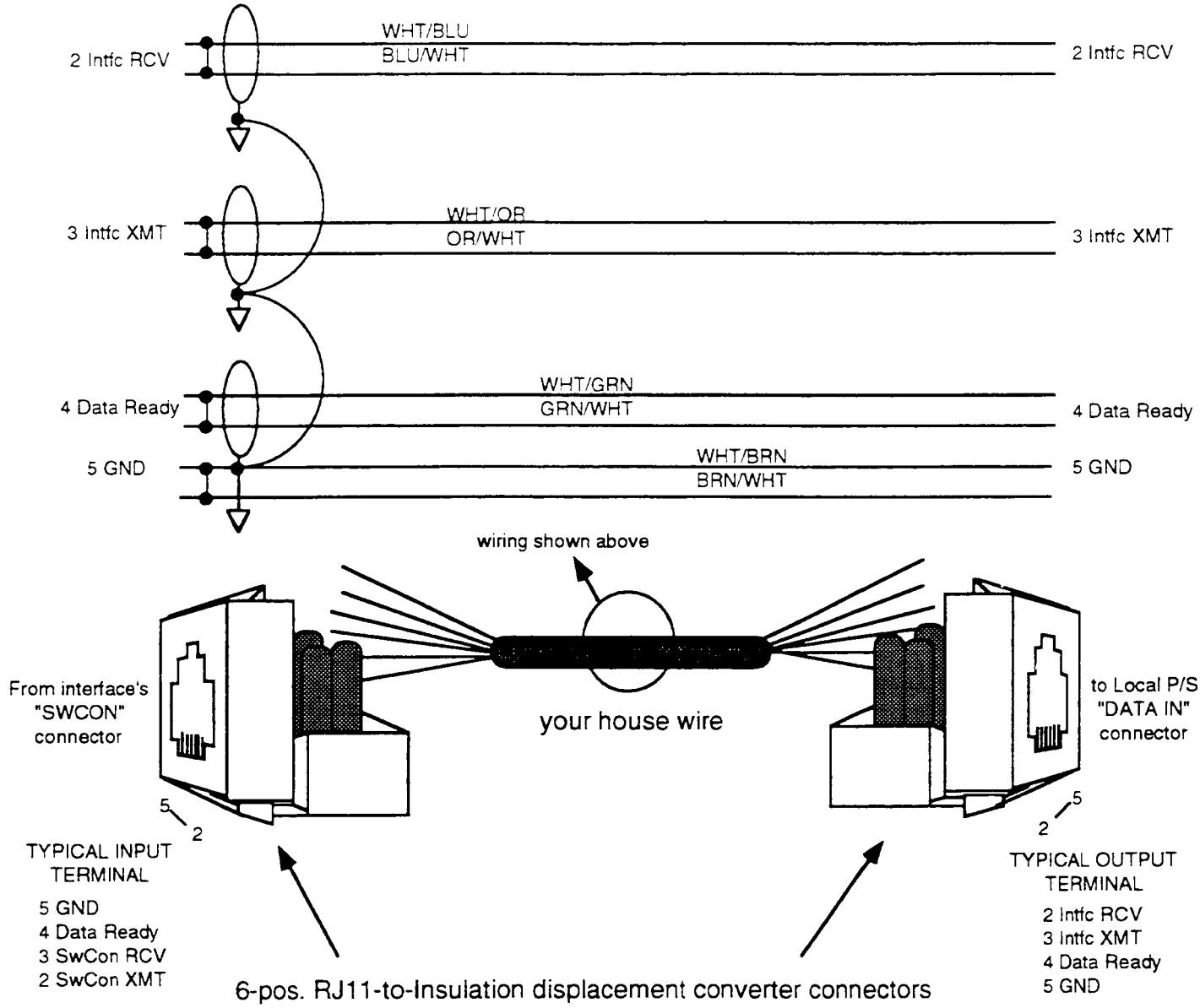
5) 6-pos. RJ11-to-Insulation displacement converter connectors available from AMP (P/N 553983-1; IBM equiv. 8310575). Also available from Digikey (P/N A4004-ND). These connectors are excellent to use when trying to connect the RJ11C format to your in-house shielded pairs. If possible, give each data signal its own shield. Shields should be tied together and run to station ground for best results.

LOCAL POWER SUPPLY INSTALLATION



Any Telos Switch Console can be placed up to 250 ft. away from the Telos 1A2 Interface by using the Telos LocalPower Supply.

TYPICAL WIRING BETWEEN LOCAL P/S AND INTERFACE



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

- Use one shielded twisted pair (stranded) for each data signal and tie the two conductors together in the pair. (Telco-type twisted pairs are OK, too, but will provide no EMI/RFI protection. Also, most telco-type wire is solid conductor, which is OK for permanent installations, but not good for mobile/road-worthy applications. Single conductors can be used, but the data signals may cross-talk over long lengths.)
- Tie all shields together at the interface and connect to station ground.
- Use only pins 2-5 from the RJ11 connector.
- Short-length RJ11-to-RJ11 cables can be made up to connect interface and Local Power Supply to this cable. Follow the 'ring convention as described on the sheet, "RJ11C FORMAT FOR TELOS SWITCH CONSOLES" for these short cables. ese also only need to be 4-conductor wires. (Pre-made cables can be purchased at Radio Shack, Graybar, or your favorite telco parts supplier.)

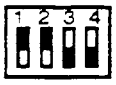
TELOS ABS SWITCH CONSOLE OPERATION

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.

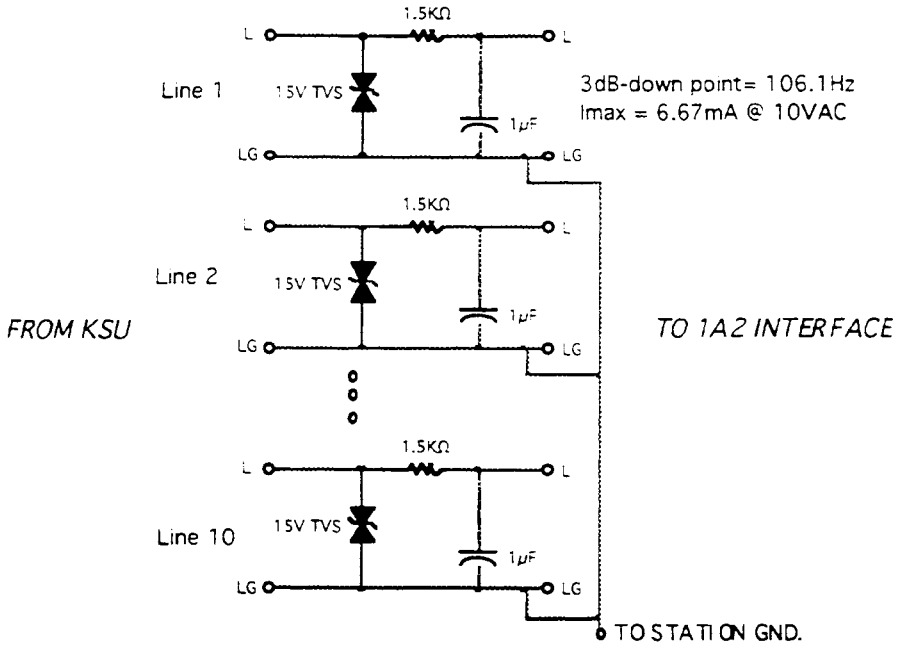
EXTENDED - DISABLE BOTTOM ROW (DIPs #1 & #4 on): In this mode, the buttons on the bottom row are disabled. This option allows access to the #1 hybrid (top row) for lines 11-20.

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 bottomrow 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.

PROTECTION CIRCUIT FOR 1A2 INTERFACE MODULE



Functional description: The RC network provides a low-pass filter to keep high-frequency noise out of the interface and current limiting to protect the interface's lamp detect ICs' inputs from overcurrent damage. We recommend placing a metal oxide varistor (MOV) and a transient voltage suppressor (TVS) across the KSU's lamp output, along with some kind of AC surge protector on the KSU's AC input. These parts are readily available from DIGIKEY (1-800-344-4539) or other electronics supply houses.

Here are the following parts we recommend:

PART	MFG P/N	DIGIKEY P/N	PRICE
MOV	Panasonic EZR-C20DK270	P7156-ND	$1.19
TVS	General Instrument 600 W series	P6KE15-CAGICT-ND	0.84
Surge protector	Tripplite ISOBLOK2-0	TL002-ND	43.21

If your unit is in an RF field, your lamp circuits may conduct enough RF to false-trigger the lamp detect ICs, which will cause the console's indicators to blink erratically. We recommend the following additions:

RF MOD #1: All of the "LG" leads need to be soldered together on the solder side of the board. These are pins 28,31,34,37,40,43,46. Note the pin numbers on this connector are 1-25 on the side with the triangle (triangle indicates pin 1) and 26-50 on the side of the connector facing the rear of the unit (pin 26 is across from pin 1). You may need to tie LG to station ground at the KSU, as well.

RF MOD #2: The "A1" lead (pin 2) needs to go to chassis ground.

RF MOD #3: Replace U13-15 with National Semiconductor's DS14C89AN (available from DIGIKEY as P/N DS14C89AN-ND, $2.10/1 pc., $25.00/25 pcs.)

Installation: These circuits should be placed in series with the lamp circuits feeding the interface. They can be in the phone closet if there is a "home run" to just the interface; if other phones share that bundle, use a pre-wired, split 66-block between the bridging block and the interface, so that the current limiting action does not affect the lamps in the key phones. The MOV should be placed across the KSU's 10VAC output to ground, right on the KSU power supply. The 10 VAC terminal should be clearly marked on the power supply. Then connect the KSU's AC to the surge protector. You may want to connect all Vos units to a surge strip, as well. The TVS's can be placed on each individual lamp circuit as shown.

Telos 1A2 Interface Module Rev. D

PARTS LIST

Designation	Description
U1	Intel 80C188 MPU
U2	Intel 8255 PPI
U3	Intel 82050 UART
U4	Intel 82050 UART
U5	27C512 EPROM
U6	8Kx8 SRAM
U7	LT1080 RS232 driver
U8	LT1080 RS232 driver
U9	74HC373
U10	74HC138
U11	Signetics PCD3311PN
U12	DS1232 Watchdog
U13	LM1489 quad line rcvr
U14	LM1489 quad line rcvr
U15	LM1489 quad line rcvr
U16	Signetics NE590N
U17	Signetics NE590N
U18	Signetics NE590N
U19	Signetics NE590N
U20	Signetics NE590N
U21-U31	4N33 opto-coupler
U32	MAX641 volt. converter
U33	LM386N-1
U34	LM1489 quad line rcvr

Designation	Description
RP1	10KΩ 6-pin SIP (Bournes)
RP2	470Ω 6-pin SIP (Bournes)
RP3	470Ω 6-pin SIP (Bournes)
R1	10KΩ 5% 1/4W resistor
R2	1KΩ 5% 1/4W resistor
R3	1KΩ 5% 1/4W resistor
R4	510Ω 5% 1/4W resistor
R5	1KΩ 5% 1/4W resistor
R6	1MΩ 5% 1/4W resistor
R7	39KΩ 5% 1/4W resistor
R8	47Ω 5% 1/4W resistor
R9	47Ω 5% 1/4W resistor
R10	1.5KΩ 5% 1/4W resistor
R11	10KΩ 5% 1/4W resistor
R12	1KΩ 5% 1/4W resistor
R13	47Ω 5% 1/4W resistor
R14	47Ω 5% 1/4W resistor
R15	47Ω 5% 1/4W resistor
R16	47Ω 5% 1/4W resistor
R17	47Ω 5% 1/4W resistor
R18	47Ω 5% 1/4W resistor
R19	47Ω 5% 1/4W resistor
R20	47Ω 5% 1/4W resistor
R21	47Ω 5% 1/4W resistor
R22	47Ω 5% 1/4W resistor

C1	22pF monolithic cap
C2	10pF monolithic cap
C3	1.0µF@35V tant. cap
C4	1.0µF@35V tant. cap
C5	1.0µF@35V tant. cap
C6	2.2µF@35V tant. cap
C7	1.0µF@35V tant. cap
C8	1.0µF@35V tant. cap
C9	1.0µF@35V tant. cap
C10	2.2µF@35V tant. cap
C11	3.3 Farad "Gold" cap
C12	2.2µF@35V tant. cap
C13	0.22µF stacked metalized film cap
C14	10 µF@35V tant. cap
C15	10µF@25V tant. cap
C16	100µF @63V electrolytic cap
C17	0.1µF monolithic cap
C18	0.01µF monolithic cap
C19	0.1 µF monolithic cap
C20	0.1 µF monolithic cap
C21	0.1 µF monolithic cap
C22	0.1 µF monolithic cap
C23	0.1 µF monolithic cap
C24	2.2µF@35V tant. cap
C25	2.2µF@35V tant. cap
C26	0.1 µF monolithic cap
C27	0.01µF monolithic cap
C28	0.01µF monolithic cap
C29	0.01µF monolithic cap
C30	0.01µF monolithic cap
C31	0.01µF monolithic cap

Telos 1A2 Interface Module Rev. D

PARTS LIST

Designation	Description
D1-D23	1N4005 diode
D24	1N4935 Schottkey diode
D25	1N4005 diode
K1-K23	Omron DPDT relay (G5V-2-H-5VDC)
L1	50µH inductor
Q1	IRF 530 FET
T1	transformer (Prem SPT2105)
T2	transformer (Prem SPT117)
X1	18.432 MHz crystal
X2	3.579545 MHz crystal1
SW1	Hexidecimal rotary sw
SW2	4-position DIP sw.
HDR1	50-pin rib. header (Ansley 609-5027)
P1	50-pin rib. conn. (Ansley 609-50M)
P1	Strain relief (Ansley 609-5031)
P2	DB25 rt angle female
P3	DB9 rt angle male
P4	DB9 rt angle female
J1-5	6-pin RJ11 female
J6	4-pin 0.156" header
JP1	2-pin header 0.100"

Designation	Description
U1S	68-pin PLCC socket
U2S	40-pin machined socket
U3S	28-pin machined socket
U4S	28-pin machined socket
U5S	28-pin machined socket
U6S	28-pin machined socket
U7S	18-pin machined socket
U8S	18-pin machined socket
U9S	20-pin machined socket
U10S	16-pin machined socket
U11S	14-pin machined socket
U12S	8-pin machined socket
U13S	14-pin machined socket
U14S	14-pin machined socket
U15S	14-pin machined socket
U16S	16-pin machined socket
U17S	16-pin machined socket
U18S	16-pin machined socket
U19S	16-pin machined socket
U20S	16-pin machined socket
U21S-U31S	6-pin machined socket
U32S	8-pin machined socket
U33S	8-pin machined socket
U34S	14-pin machined socket

AC receptacle/ line filter/ fuse holder

Telos Switch Console

CPU BOARD PARTS LIST

Designation	Description
U1	87C51
U2	74HC244
U3	74HC04
U4	UDN2540B
U5	UDN2540B
U6	UDN2580A
U7	DS1232
U8	MC1489
U9	LT1280
P1	28-pin male header
P2	6-pin male header
VR1	78ST105HC
VR2	78ST105HC
Y1	9.216 MHz XTAL
C1	1000µF @ 25V electr.
C2	100µF @ 25V electr.
C3	1µF @ 35V tant.
C4,C5	22pF mono
C6-C9	1µF @ 35V tant.
C10,C11	1µF mono
C12-C14	0.01µF mono
C15	0.1 Farad Gold Cap
C16-C18	0.1µF mono

Designation	Description
U1	40-pin machined socket
U2	20-pin machined socket
U3	14-pin machined socket
U4	16-pin machined socket
U5	16-pin machined socket
U6	18-pin machined socket
U7	8-pin machined socket
U8	14-pin machined socket
U9	18-pin machined socket
R1-R6	47Ω 1/4 W
R7	68KΩ 1/4 W
R8	39KΩ 1/4 W
RP1	4.7Ω x 7 DIP
RP2	10KΩ x 10 SIP
RP3	10KΩ x 6 SIP
RP4	100KΩ x 10 SIP
RP5	1KΩ x 8 SIP
FB1-FB3	ferrite bead
D1	1N5338
D2	1N4148
D3	1N4148
SW1	4-pos DIP switch

Telos Switch Console

ACTUATOR BOARD PARTS LIST

Designation	Description
SW1-SW30	T-16D switch
SW1-SW30	T-16 dust cover
L2-L11	L-424YTD 3mm LED
L2-L11	1/16" spacer
L13-L27	L-424YTD 3mm LED
L13-L27	1/16" spacer
L28-L37	L-153SRDT retangular LED
L38-L47	L-153SRDT retangular LED
J1	28-pin header
J2	6-pin header
J3	SS-6566 RJ11C
J4	7-pin header

Designation	Description
SW1	Sw Cap "DROP"
SW2	Sw Cap "HOLD"
SW3-SW12	Sw Cap replacable legends
SW13	Sw Cap "DROP"
SW14	Sw Cap "HOLD"
SW15-SW24	Sw Cap replacable legends
SW25	Sw Cap "BUSY ALL"
SW26	Sw Cap "FLASH/NEW"
SW27	Sw Cap "REC MODE"
SW28	Sw Cap "REC STOP"
SW29	Sw Cap "DELAY DUMP"
SW30	Sw Cap "NEXT"

Telos Switch Console

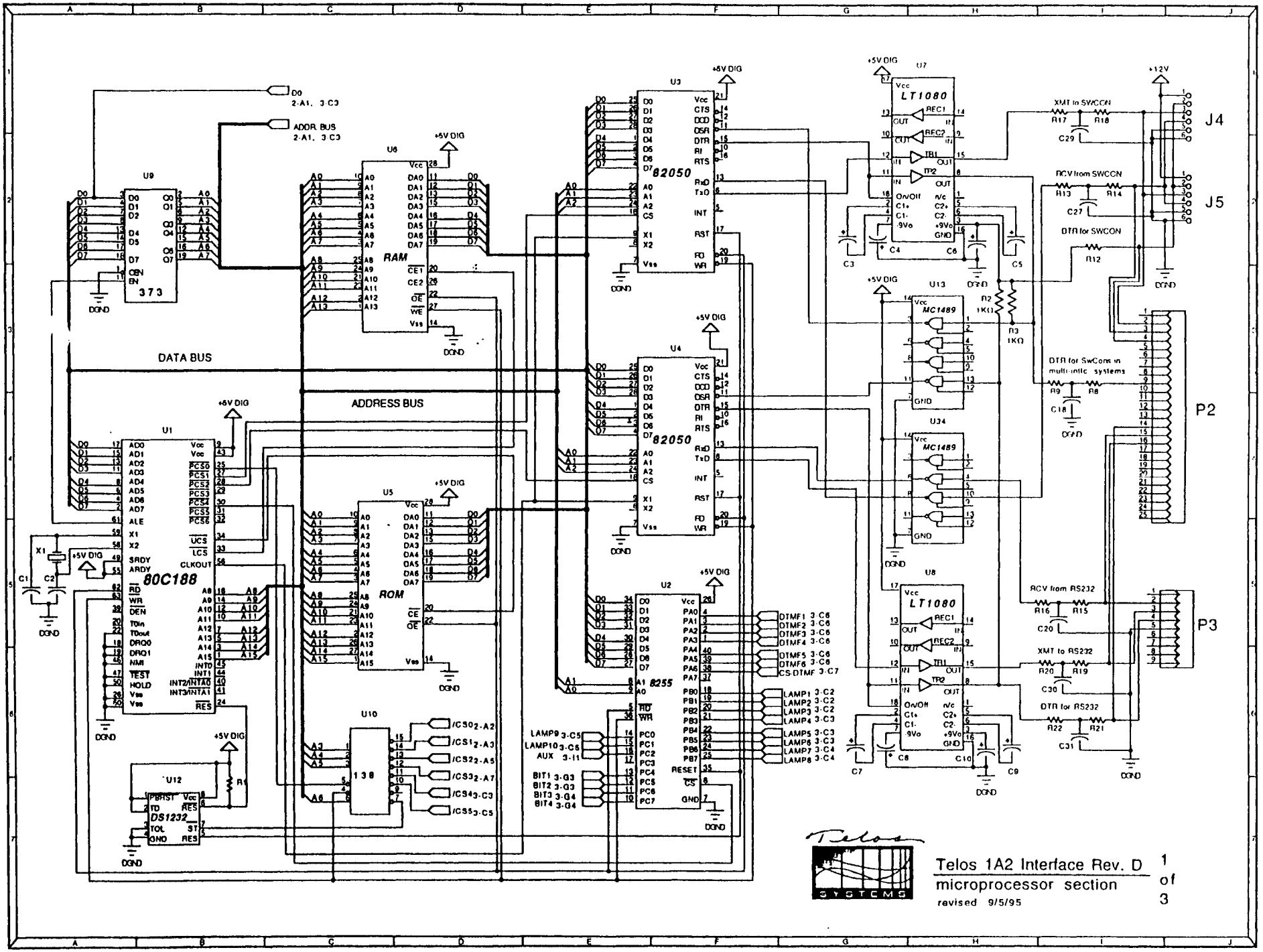
DTMF BOARD PARTS LIST

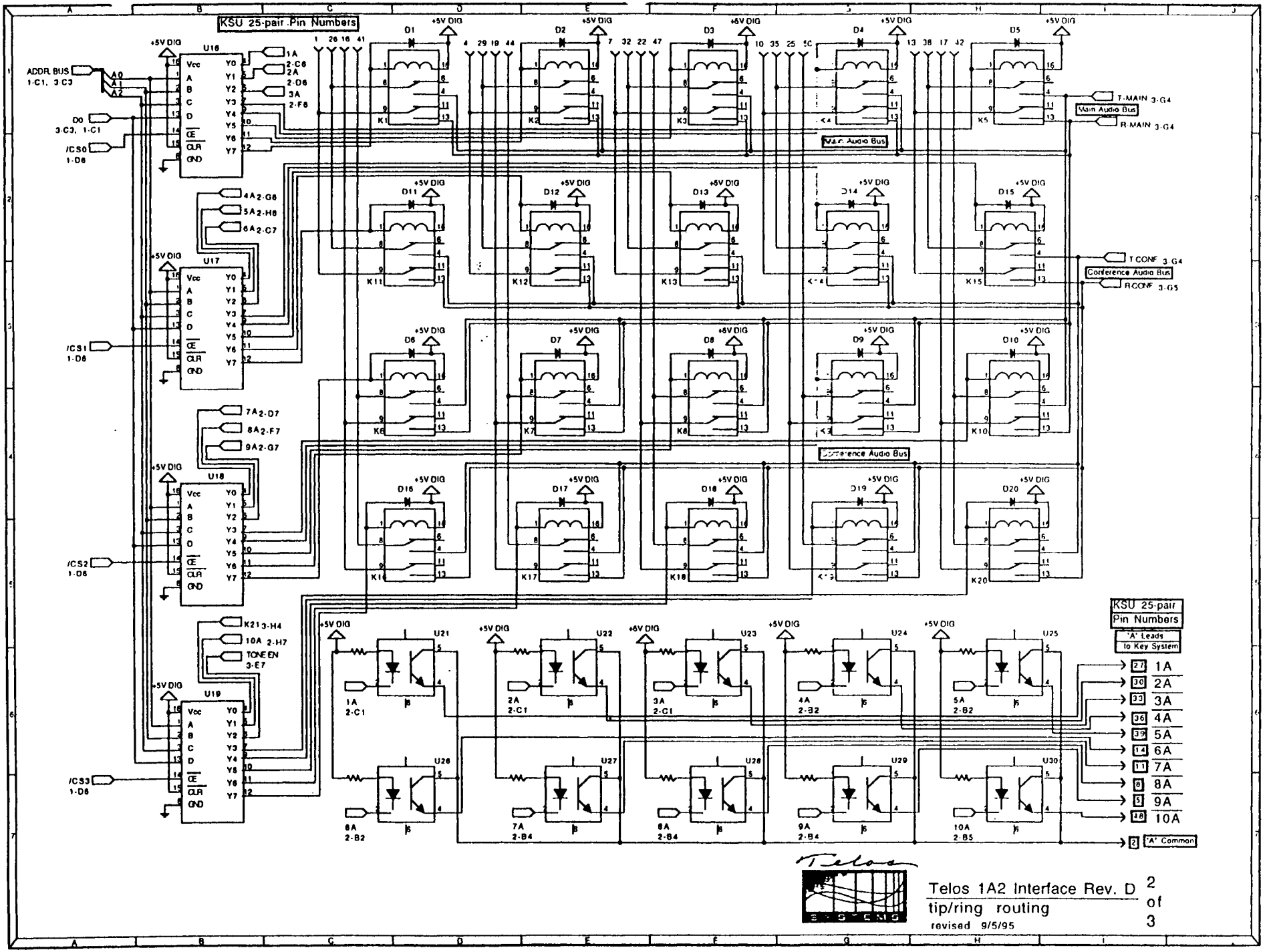
Designation	Description
SW1-SW12	T-16R switch
DTMF cap set	SwCaps "0-9","*","#"

Designation	Description
J1	7-pin header

APPENDIX CONTENTS

Parts Lists and Schematics

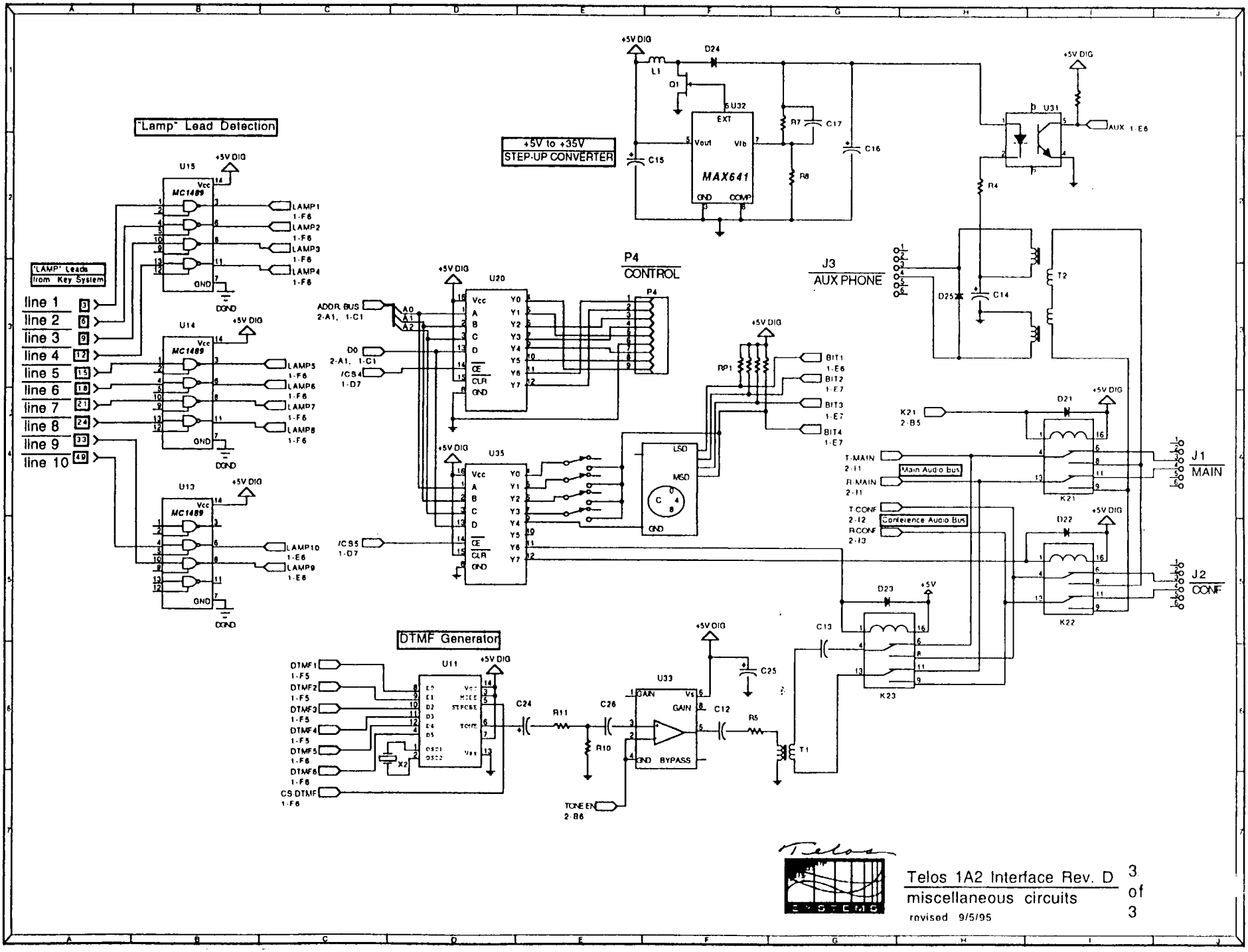

DATA BUS
ADDRESS BUS
80C188
RAM
ROM
82050
8255
LT1080
MC1489
DS1232
373
138
J4
J5
P2
P3
Telos 1A2 Interface Rev. D
microprocessor section
revised 9/5/95
1 of 3

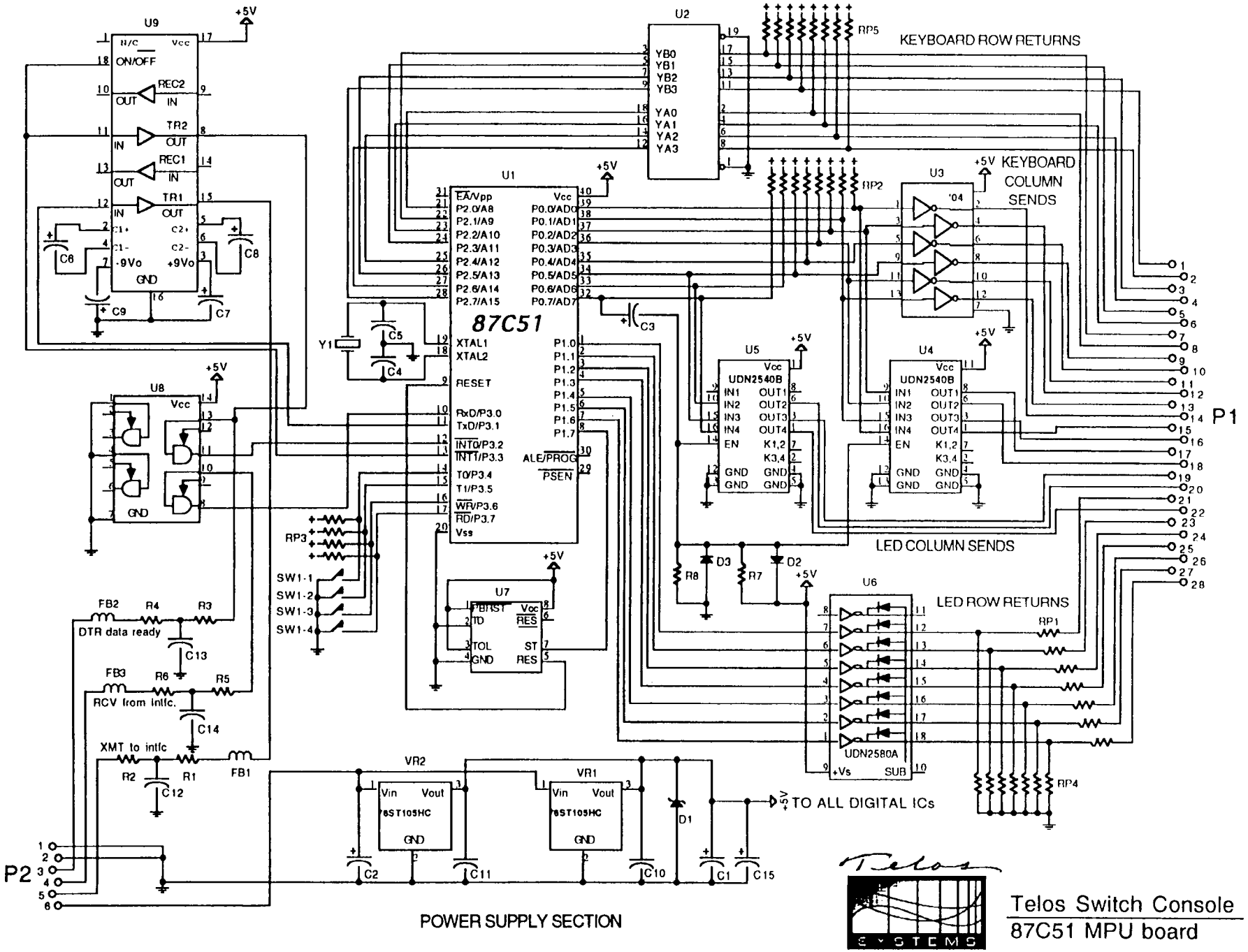


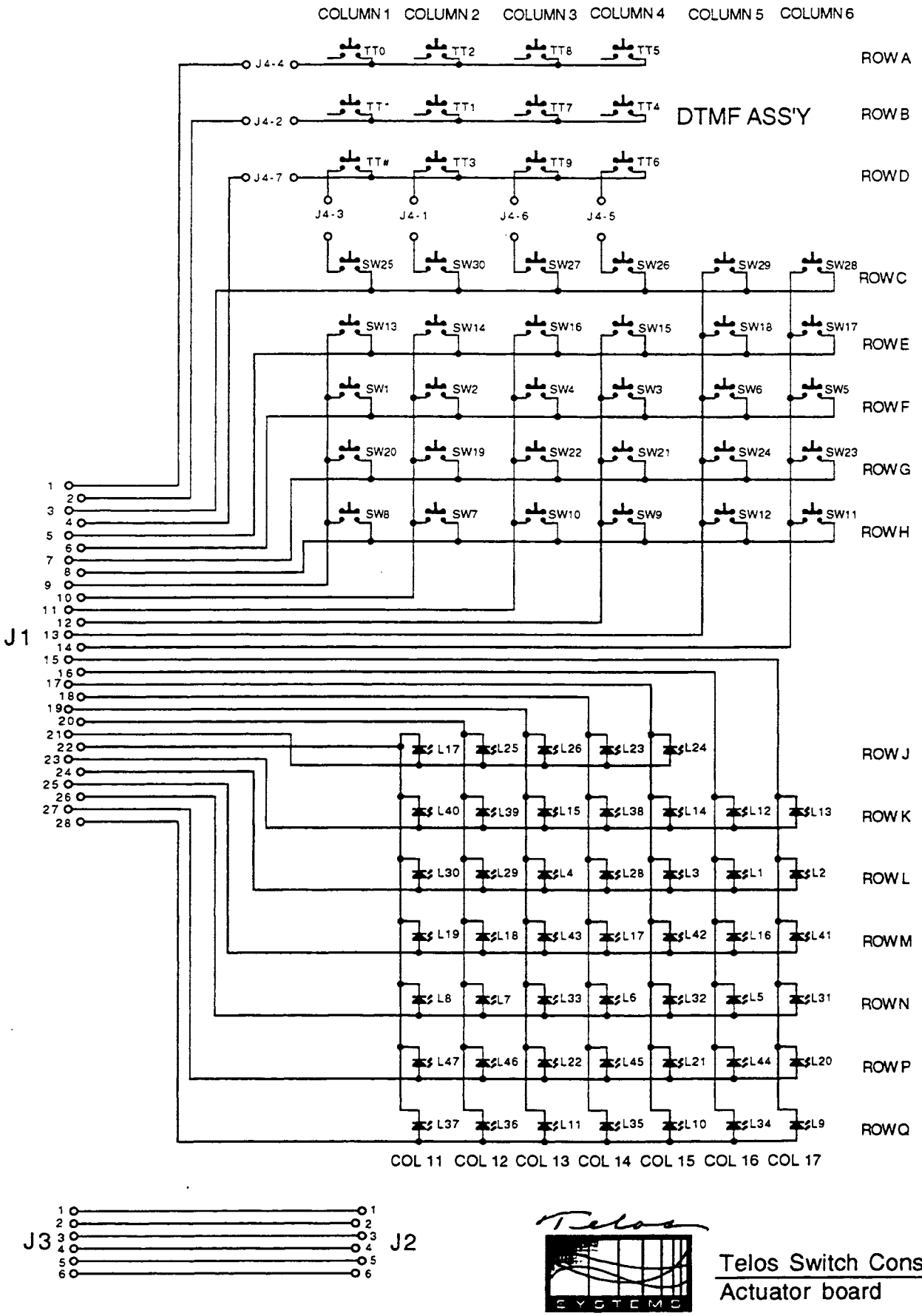
Telos 1A2 Interface Rev. D

tip/ring routing

revised 9/5/95

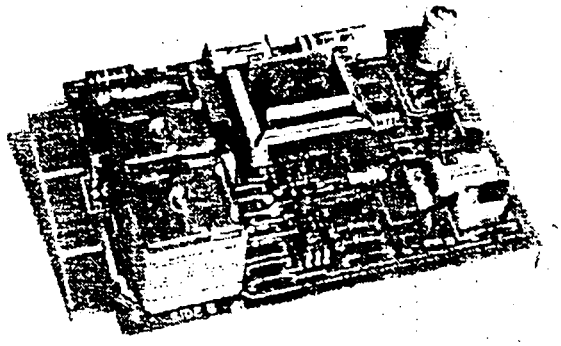

"Lamp" Lead Detection
"LAMP" Leads from Key System
line 1
line 2
line 3
line 4
line 5
line 6
line 7
line 8
line 9
line 10
U15
U14
U13
MC1489
LAMP1 1-F6
LAMP2 1-F6
LAMP3 1-F6
LAMP4 1-F6
LAMP5 1-F6
LAMP6 1-F6
LAMP7 1-F6
LAMP8 1-F6
LAMP10 1-E6
LAMP9 1-E6
+5V DIG
DGND
+5V to +35V STEP-UP CONVERTER
MAX641
P4 CONTROL
J3 AUX PHONE
AUX 1-E6
ADDR BUS 2-A1, 1-C1
D0 2-A1, 1-C1
/CS4 1-D7
/CS5 1-D7
BIT1 1-E6
BIT2 1-E7
BIT3 1-E7
BIT4 1-E7
T-MAIN 2-11
R-MAIN 2-11
T-CONF 2-12
R-CONF 2-13
Main Audio bus
Conference Audio Bus
K21 2-B5
J1 MAIN
J2 CONF
DTMF Generator
DTMF1 1-F5
DTMF2 1-F5
DTMF3 1-F5
DTMF4 1-F5
DTMF5 1-F6
DTMF6 1-F6
CS:DTMF 1-F6
TONE EN 2-B6
Telos 1A2 Interface Rev. D
miscellaneous circuits
revised 9/5/95
3 of 3


U9
+5V
N/C
Vcc
ON/OFF
REC2
OUT
IN
TR2
TR1
REC1
C1+
C2+
C1-
C2-
-9Vo
+9Vo
GND
C6
C8
C9
C7
U2
YB0
YB1
YB2
YB3
YA0
YA1
YA2
YA3
RP5
KEYBOARD ROW RETURNS
U1
87C51
EA/Vpp
Vcc
P2.0/A8
P2.1/A9
P2.2/A10
P2.3/A11
P2.4/A12
P2.5/A13
P2.6/A14
P2.7/A15
P0.0/AD0
P0.1/AD1
P0.2/AD2
P0.3/AD3
P0.4/AD4
P0.5/AD5
P0.6/AD6
P0.7/AD7
XTAL1
XTAL2
RESET
RxD/P3.0
TxD/P3.1
INT0/P3.2
INT1/P3.3
T0/P3.4
T1/P3.5
WR/P3.6
RD/P3.7
Vss
P1.0
P1.1
P1.2
P1.3
P1.4
P1.5
P1.6
P1.7
ALE/PROG
PSEN
Y1
C5
C4
C3
RP2
U3
'04
+5V KEYBOARD COLUMN SENDS
U5
UDN2540B
IN1
IN2
IN3
IN4
EN
OUT1
OUT2
OUT3
OUT4
K1,2
K3,4
GND
U4
P1
U8
RP3
SW1-1
SW1-2
SW1-3
SW1-4
U7
TBRST
TD
TOL
RES
ST
R8
D3
R7
D2
LED COLUMN SENDS
U6
UDN2580A
+Vs
SUB
LED ROW RETURNS
RP1
RP4
FB2
R4
R3
DTR data ready
C13
FB3
R6
R5
RCV from Intfc.
C14
XMT to intfc
R2
R1
FB1
C12
P2
VR2
VR1
78ST105HC
Vin
Vout
C2
C11
C10
D1
C1
C15
TO ALL DIGITAL ICs
POWER SUPPLY SECTION
Telos
SYSTEMS
Telos Switch Console
87C51 MPU board



Telos Switch Console
Actuator board

K400TPL
INTERFACE LINE CARD
(B60049-1000)



1.00 GENERAL

1.01 The K400TPL INTERFACE LINE CARD is a Key Telephone Unit (KTU) plug-in CO/PBX line circuit with interface circuitry. The K400TPL permits direct connection to be made to a telephone company (telco) line facility. The interface circuitry maintains ongitudinal balance on a telephone line while providing direct current (DC) isolation. Each card has a light emitting diode (LED) as a card status indicator to facilitate servicing the Key Telephone System (KTS).

1.02 The K400TPL is equipped with three jumper block/plug arrangements to provide the following options:

a. short time out (5-10 seconds),

b. interrupted ringing,

c. auxiliary common audible signal, and

d. music-on-hold.

NOTE: **MUSIC-ON-HOLD REQUIRES ADDITIONAL EQUIPMENT.**

1.03 The short time out option reduces the time out of a card from 25-35 seconds to 5-10 seconds when a calling party abandons a call prior to it being answered.

1.04 The K400TPL *does not* contain any power failure transfer circuitry. However, the Power Failure Transfer Card (B60052-0000) can be used in conjunction with a K400TPL Line Card to transfer a CO line to an emergency line, or an emergency telephone, in the event of local power failure. The Power Failure Transfer Card is not automatically shipped with the Interface Line Card; it must be ordered separately.

1.05 The K400TPL is registered with the FCC under the following number:

AS293P-67342-VP-E
Ringer Equivalence 0.4B

The VP Classification gives the K400TPL Interface Line Card fully protected status. *Any* key service unit requiring 400-type line cards can be used behind the K400TPL Line Card. Therefore, the K400TPL Interface Line Card *replaces* the K400TP and K400TP/TPL line cards because of its *less restrictive* classification.

2.00 LIMITATIONS

2.01 The K400TPL is interchangeable with the K400E line card except for the following features:

a. The K400TPL line card *does not* provide a steady illuminated lamp on *hold* (X Option).

b. The card *remains* on *hold* a *held* party abandons the call.

c. Central Office (CO) ringing *cannot* be bridged across the station TIP/RING leads.

d. If the A-lead is not grounded prior to bridging the station TIP and RING leads during troubleshooting, the Interface Line Card *will* go on continuous hold.

3.00 SPECIFICATIONS

3.01 The TIP/RING bridged impedance allowance is approximately ten times the minimum allowance.

3.02 The response time to a CO ringing signal is 100 to 200 milliseconds to avoid false ringing.

3.03 The normal time out of the card, when a calling party abandons a call before it is answered, is 25-35 seconds, or 5-10 seconds with the short time out option.

3.04 The K400TPL Line Card is environmentally tested to ensure reliability. Each unit shall be able to withstand ten repeated 24-hour tests consisting of two high cycles of 4.5 hours @ 55°C and 95% relative humidity without condensation, and one low cycle for 4.0 hours @ – 10°C. Each cycle must return to a reference temperature of + 18°C.

4.00 ORDERING

4.01 The card is ordered as follows:

K400TPL INTERFACE LINE CARD
Part Number B60049-1000

4.02 The power failure transfer unit is ordered as follows:

POWER FAILURE TRANSFER CARD
Part Number B60052-0000

5.00 INSTALLATION

5.01 The K400TPL Interface Line Card is installed one card per CO line required. The unit plugs into mounting connectors provided in the Key Service Unit (KSU), with the printed circuit side to the installer's left, (K1A2 KSU), or on the bottom (K36A and K76A KSU).

5.02 It is important that the KTU is plugged into the card holder firmly. Some KSU's include a Retaining Bar to ensure that the KTU's are held in position. Loosen and remove the Retaining Bar before installing the KTU's; insert the card(s), then install the Retaining Bar and tighten the two attaching screws securely.

5.03 The mounting connectors provide contact points for the inputs and outputs of the K400TPL. Some pin functions are common by a bare wire strap across the back of the mounting connectors.

CAUTION: **PIN 18 ON THE MOUNTING CONNECTOR MAY PROVIDE −24V FILTERED (A BATTERY). THIS CONNECTION MUST BE REMOVED TO AVOID POSSIBLE CIRCUIT DAMAGE TO THE K400TPL CARD.**

5.04 To remove an unwanted strap connection, as with Pin 18 in earlier KSU's, cut and remove the bare wire strap from the back of each mounting connector to be used. *ONLY* remove the bare wire strap and not the insulated conductor.

5.05 Pin functions of each mounting connector are brought out to the back of the KSU cabinet via a wiring harness. Depending on the KSU, the wiring harness either terminates on punch down blocks, or in 25-pair male plugs. From the blocks or plugs, individual CO line functions must be brought out of the KSU cabinet and terminated on KSU Blocks, mounted on the Main Distribution Frame (MDF), in accordance with manufacturer's instructions.

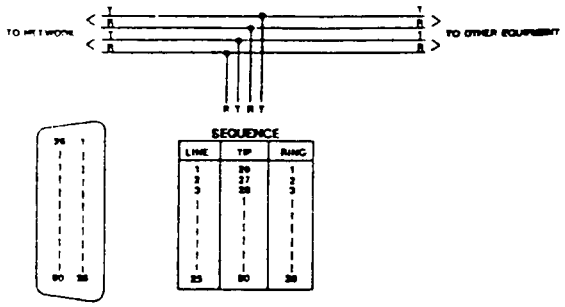
5.06 From the KSU Blocks, station CO line functions are cross connected to other system connection blocks, and necessary functions taken back to the station equipment. It is also from these blocks that CO/PBX TIP and RING functions are brought out to the telco provided equipment.

5.07 The telco will provide final network connection via a miniature 6-position jack, or a 50-position miniature ribbon jack. These mechanical arrangements are for single line and multiple line bridged TIP and RING electrical network connections respectively.

5.08 The miniature 6-position jack must be ordered by the customer from the telco under the Universal Service Order Code (USOC) designation **RJ11C** (RJ11W for portable wall mounted equipment). Conductors 1, 2, 5, and 6 are reserved for telco use; thus, conductors 3 and 4 are reserved for CO RING and CO TIP, respectively. The customer must provide a miniature 6-position plug, to complete the connection, with CO RING on position 3, and CO TIP on position 4. The cable attached to the plug shall terminate inside the KSU cabinet as a direct connection, and shall not be in excess of 25 linear feet.

NOTE: **THE 25 LINEAR FEET REQUIREMENT SHALL INCLUDE THE CABLE COMING FROM THE KSU CABINET TO THE KSU BLOCKS; THUS, THE LENGTH OF THE CABLE FOR THE CUSTOMER PROVIDED MINIATURE 6-POSITION PLUG MUST BE ADJUSTED ACCORDINGLY.**

5.09 The 50-position miniature ribbon jack must be ordered by the customer from the telco under the Universal Service Order Code (USOC) designation **RJ21X**. At the time the jack is ordered, the customer must specify the sequence in which the CO lines are to be connected to the jack. The telco will consecutively wire these lines to the jack as shown below without skipping any positions.



5.10 The customer must provide a 50-position ribbon plug, to complete the connection, with CO TIP and CO RING for each line in the same sequence. The cable attached to the ribbon plug shall terminate inside the KSU cabinet as a direct connection, and shall not be in excess of 25 linear feet (see note above).

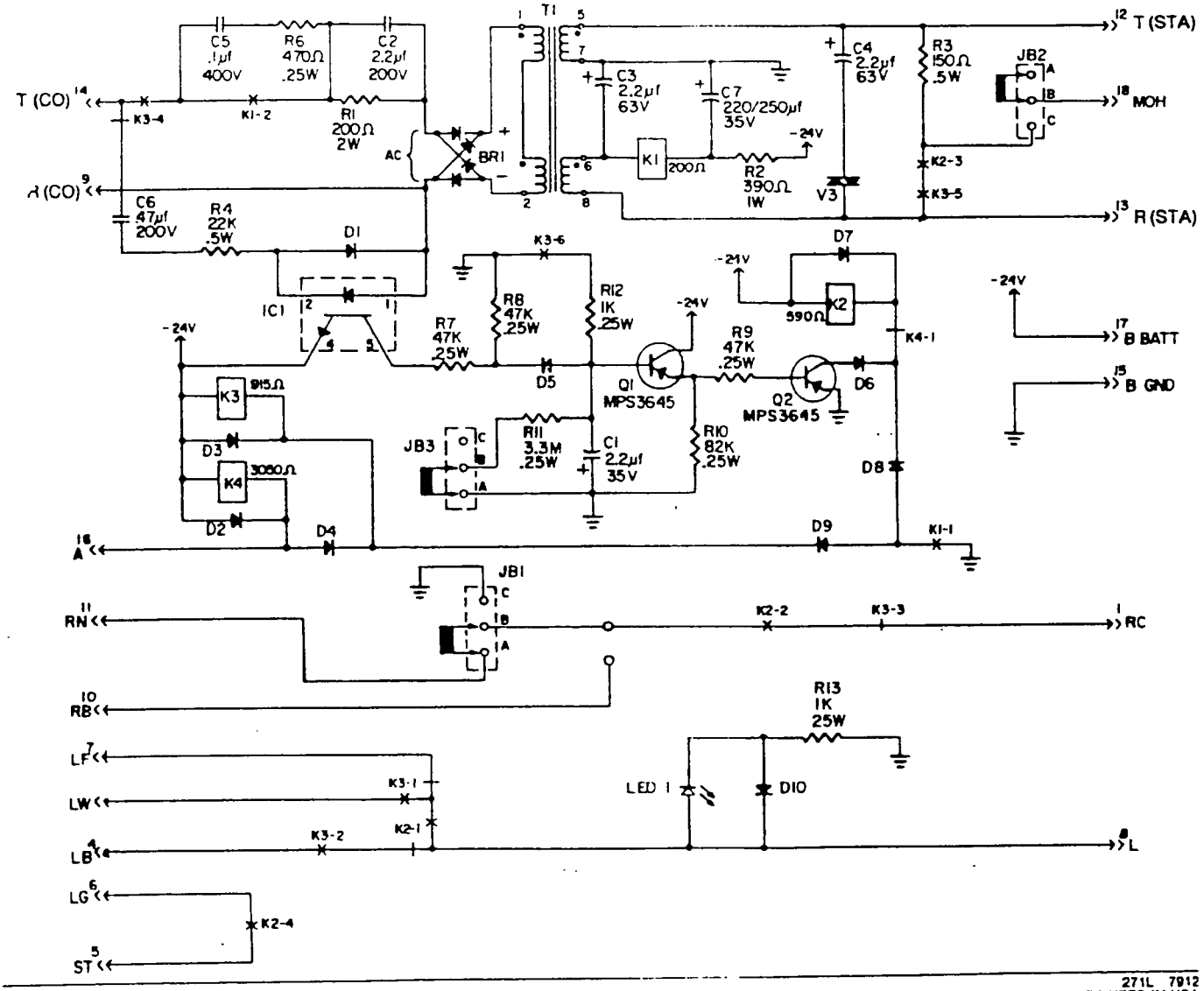
CIRCUIT DESCRIPTION

6.01 AC ringing voltage from the Central Office (CO) is applied to the CO TIP/RING (**Tabs 14 and 9**). Current flows via contact K3-4, C6, R4, and the LED portion of photo coupler IC-1 during negative cycles of the applied AC ringing voltage. During the positive cycles of ring voltage, current flows via contact K3-4, C6, R4, and D1, protecting the LED against reverse voltages. During the half cycles of ringing when current flows through the LED portion of IC-1, the phototransistor section is activated and applies −24V DC to **RING/HOLD** circuit. The **RING/HOLD** circuit activates Relay K2. Contact K2-2 then connects the ringing voltages or signals to the RINGER LEAD (**Tab 1**). Voltage from **GND** (**Tab 11**) may be selected by jumper block/plug **JB1**. If steady ringing is required, then solder a jumper wire as shown in the diagram to route the ring battery at **Tab 10** to K2-2. Contact K2-1 connects the LAMP FLASH VOLTAGE (**Tab 7**) to the LAMP LEAD (**Tab 8**) via inactive contact K3-1. Contact K2-4 connects **LG** (**Tab 6**) to the interrupter motor start [**ST**] (**Tab 5**), thus starting the key system interrupter.

6.02 The called party answers the telephone by taking the handset off-hook, either before or after depressing the line button associated with the incoming call. With the telephone off-hook and the button depressed, a sequence of two events occurs.

6.03 First, GND is connected to the A-lead (**Tab 16**) via the A-lead contact in the line button of the telephone. The presence of GROUND (**Tab 16**) activates Relay K3. The **RING/ HOLD** circuit now deactivates K2. Ringing signals, or voltages, are removed from Tab 1 via the contacts K2-2 and K3-3. LAMP BATTERY (**Tab 4**) is connected to the LAMP LEAD (**Tab 8**); and LAMP FLASH (**Tab 7**) is removed via contacts K3-2 and K2-1. Contact K3-4 removes the CO TIP/RING connection (**Tabs 14 and 9**) from the ring detector circuit and connects them to de-energized contact K1-2. Contact K2-4 opens, thus stopping the interrupter motor.

SCHEMATIC DIAGRAM



6.04 The second event is the connection of station TIP and RING (Tabs 12 and 13) to the subset. Current flows from GROUND through windings 5-7 of T1, the off-hook subset, windings 6-8 of T1, the coil of relay K1, and R2 to −24V DC. K1 now activates. Contact K1-2 completes the CO TIP/RING path to the isolation transformer T1 circuit. CO current now flows from CO TIP (Tab 14), through contact K3-4, contact K1-2, R1, and transformer windings 1-2 via bridge rectifier BR1 to CO RING (Tab 9). This DC current flow trips CO ringing. C2 provides an AC bypass around R1. Voice signals are coupled via T1 between the CO line and the called party.

6.05 When the subset hold button is depressed, the A-lead contact (wired to Tab 18) is broken before the TIP and RING contacts. When the GROUND is removed from Tab 18, K2 operates. R3 is connected across T(STA) and R(STA) via contacts K3-5 and K2-3 to provide a current path to keep relay K1 operated when the subset TIP and RING connection is broken. K1 maintains the CO TIP/RING connection via contact K1-2. Contact K2-1 removes the LAMP LEAD (Tab 8) from the LAMP BATTERY INPUT (Tab 4), and substitutes the LAMP WINK SIGNAL (Tab 2) via energized contact K3-1.

6.06 When the subset line button is depressed to go off *hold*, relay K2 is deactivated. Contact K2-1 removes LAMP WINK (Tab 2) and re-establishes LAMP BATTERY (Tab 4) to the LAMP LEAD (Tab 8). The K2-3 contact removes resistor R3 from the station TIP/RING circuit. Since the TIP/RING line button contacts have closed, the current path that keeps relay K1 operating remains unbroken.

6.07 When a line button is depressed to initiate a call, the A-lead is grounded operating relay K3 via Tab 18. Contact K3-2 connects LAMP BATTERY (Tab 4) to the LAMP LEAD (Tab 8) for a steady visual signal on all associated subsets. Contact K3-4 provides one of the connections necessary to draw central office current via CO TIP/RING (Tabs 14 and 9). When the subset line button connects station TIP and RING (Tabs 12 and 13) to the subset, relay K1 operates via R2 and the windings of T1. Contact K1-2 completes the CO DC circuit through T1 winding 1-2 and R1 via the CO TIP/RING (Tabs 14 and 9). Dial tone is now sent from the CO.

6.08 During dialing, the subset TIP/RING circuit is pulsed off/on by the action of dial contacts. Relay K1 follows this off/on pulsing and repeats this action to the CO via contact K1-2. R6 and C5 suppress noise and arcing during the pulsing of contact K1-2.

NOTE: **IF THE SUBSET IS EQUIPPED WITH A TONE DIAL PAD, THE GENERATED TONES ARE COUPLED VIA T1 TO THE CO DECODING CIRCUITS.**

6.09 MUSIC-ON-HOLD (MOH) is provided by connecting a music source between Tabs 12 and 18. The music signal can be connected to R3 via the jumper block/plug JB2. When the circuit is placed on hold, contacts K2-3 and K3-5 connect the music signal to T1 which couples the signal to the telephone line.

6.10 An LED is provided to give visual status indication to service/repair personnel. D10 protects the LED during negative half cycles of the incoming 10V AC lamp signals, and R13 limits the LED current.

6.11 D3 and D7 suppress inductive voltages when relays K3 and K2 are de-energized.

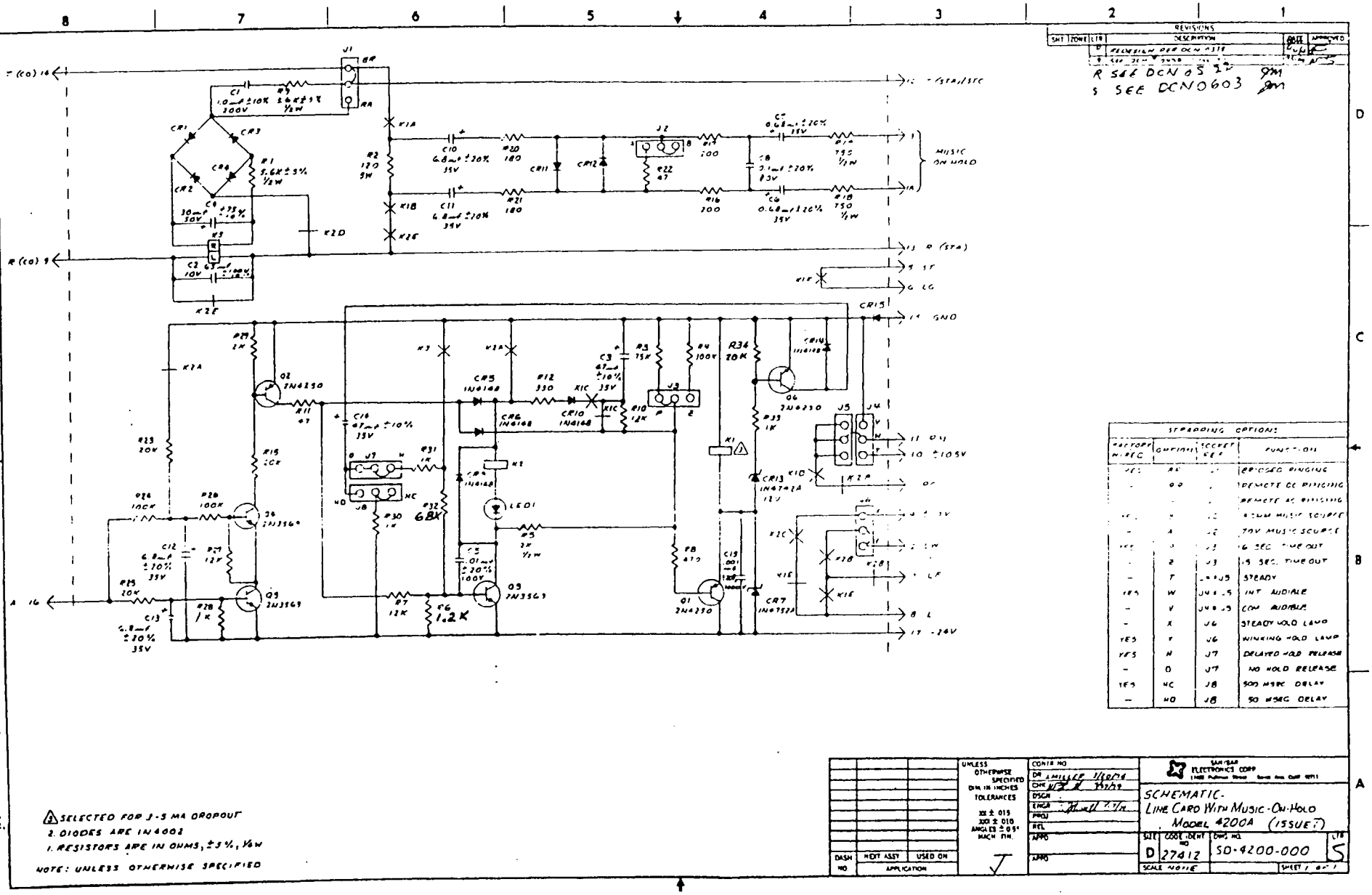
6.12 Bridge rectifier BR1 polarizes CO line current.

TYPICAL ITT KSU BLOCK ARRANGEMENTS

LINE	FUNCTION	COLOR CODE	TERMINAL OR PIN NUMBER			
			K501, K501A	K512, K512A	K36A	K76A
1	T1	WHT-BLU	Block C, Pos. 25	26	26	PLUG P1-26
	R1	BLU-WHT	26	1	1	PLUG P1-1
	1T	WHT-ORN	Block A, Pos. 1	27	27	PLUG P1-27
	1R	ORN-WHT	2	2	2	PLUG P1-2
	1A	WHT-GRN	3	28	28	PLUG P1-28
	A1	GRN-WHT	4	3	3	PLUG P1-25
	LG	WHT-BRN	5	29	29	PLUG P2-25
	1L	BRN-WHT	6	4	4	PLUG P1-3
	B	WHT-SLT	Block B, Pos. 19	30	30	PLUG P4-47
	R	SLT-WHT	20	5	5	PLUG P1-29
2	T2	RED-BLU	Block C, Pos. 27	31	31	PLUG P1-4
	R2	BLU-RED	28	6	6	PLUG P1-30
	2T	RED-ORN	Block A, Pos. 7	32	32	PLUG P1-5
	2R	ORN-RED	8	7	7	PLUG P1-31
	2A	RED-GRN	9	33	33	PLUG P1-6
	A1	GRN-RED	10	8	8	PLUG P1-25
	LG	RED-BRN	11	34	34	PLUG P3-50
	2L	BRN-RED	12	9	9	PLUG P1-32
	B	RED-SLT	Block B, Pos. 21	35	35	PLUG P4-47
	R	SLT-RED	22	10	10	PLUG P1-7
3	T3	BLK-BLU	Block C, Pos. 29	36	36	PLUG P1-33
	R3	BLU-BLK	30	11	11	PLUG P1-8
	3T	BLK-ORN	Block A, Pos. 13	37	37	PLUG P1-34
	3R	ORN-BLK	14	12	12	PLUG P1-9
	3A	BLK-GRN	15	38	38	PLUG P1-35
	A1	GRN-BLK	16	13	13	PLUG P1-25
	LG	BLK-BRN	17	39	39	PLUG P3-25
	3L	BRN-BLK	18	14	14	PLUG P1-10
	B	BLK-SLT	Block B, Pos. 23	40	40	PLUG P4-47
	R	SLT-BLK	24	15	15	PLUG P1-36
4	T4	YEL-BLU	Block C, Pos. 31	41	41	PLUG P1-11
	R4	BLU-YEL	32	16	16	PLUG P1-37
	4T	YEL-ORN	Block A, Pos. 19	42	42	PLUG P1-12
	4R	ORN-YEL	20	17	17	PLUG P1-38
	4A	YEL-GRN	21	43	43	PLUG P1-13
	A1	GRN-YEL	22	18	18	PLUG P1-25
	LG	YEL-BRN	23	44	44	PLUG P4-27
	4L	BRN-YEL	24	19	19	PLUG P1-39
	B	YEL-SLT	Block B, Pos. 25	45	45	PLUG P4-47
	R	SLT-YEL	26	20	20	PLUG P1-14
5	T5	VIO-BLU	Block C, Pos. 33	46	46	PLUG P1-40
	R5	BLU-VIO	34	21	21	PLUG P1-15
	5T	VIO-ORN	Block A, Pos. 25	47	47	PLUG P1-41
	5R	ORN-VIO	26	22	22	PLUG P1-16
	5A	VIO-GRN	27	48	48	PLUG P1-42
	A1	GRN-VIO	28	23	23	PLUG P1-25
	LG	VIO-BRN	29	49	49	PLUG P4-28
	5L	BRN-VIO	30	24	24	PLUG P1-17
	B	VIO-SLT	Block B, Pos. 27	50	50	PLUG P4-47
	R	SLT-VIO	28	25	25	PLUG P1-43

ITT TERRYPHONE CORPORATION
Post Office Box 4038, Harrisburg, PA 17111
Key System Reference v

SI-4200-00L
SH 2 OF 2



Key System Reference vi

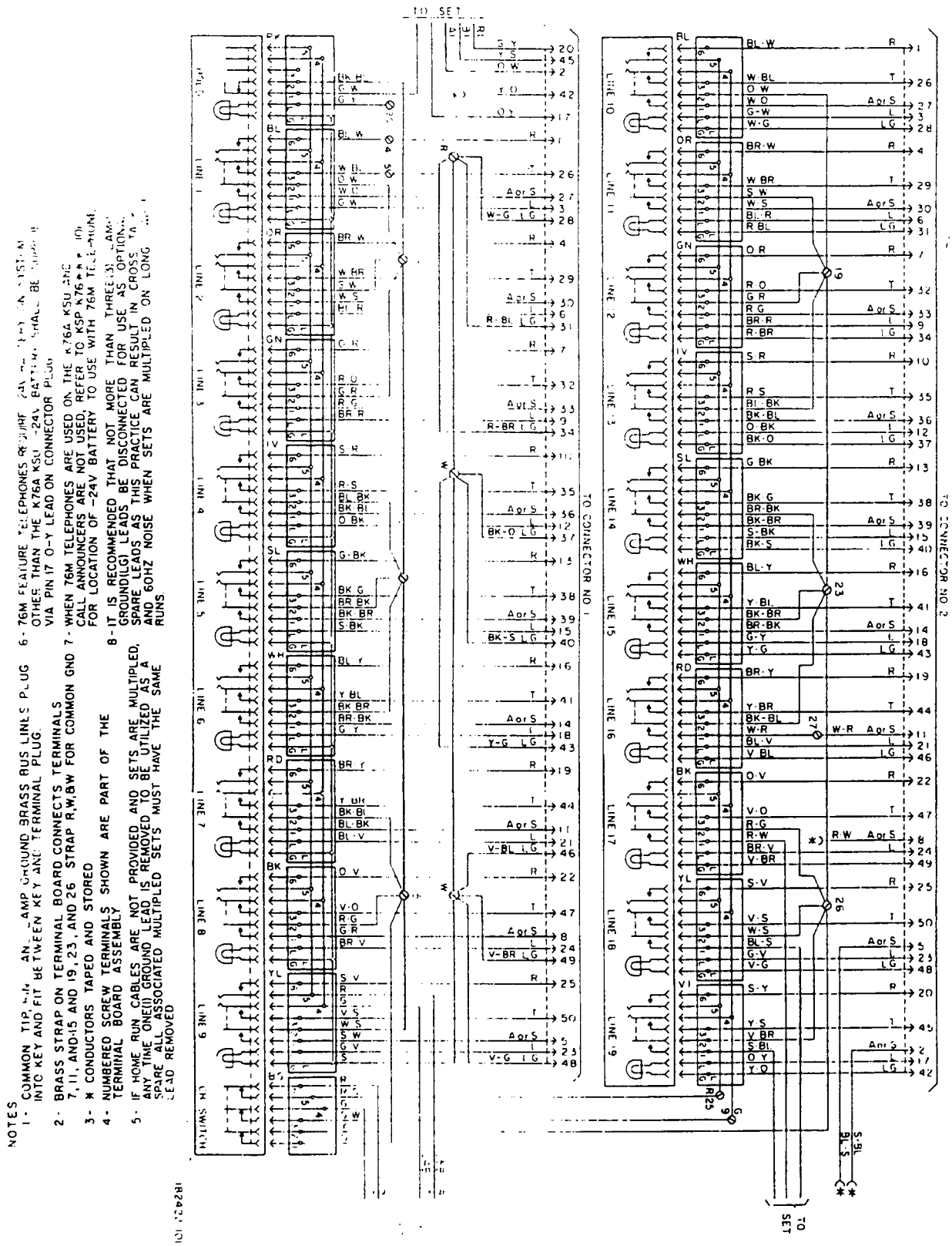


Fig. 13 - Key Wiring, 20 Button Sets, K631/76M and K2831/76M

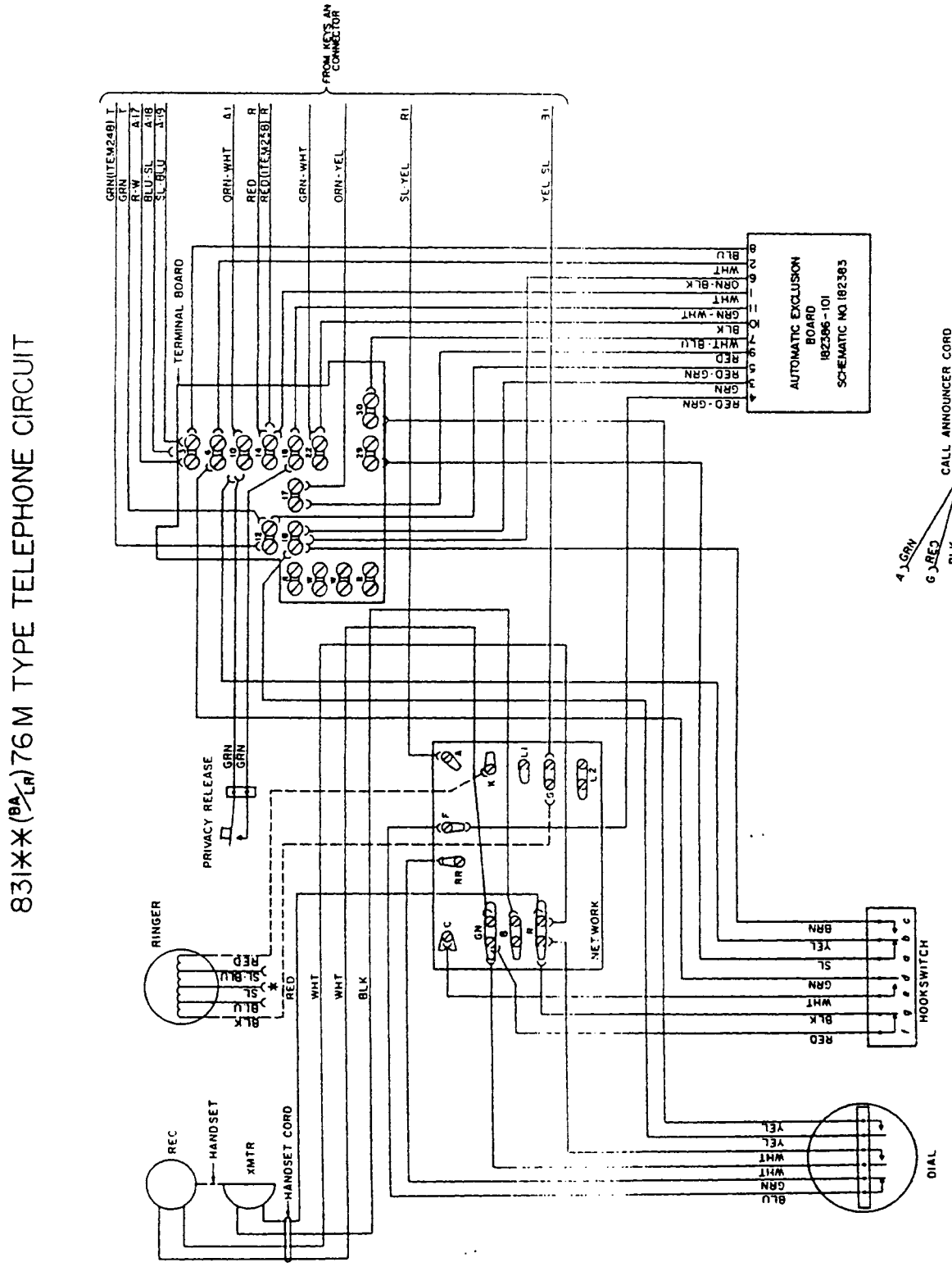


Fig. 14 - Set Wiring, K831/76M Exclusion Sets

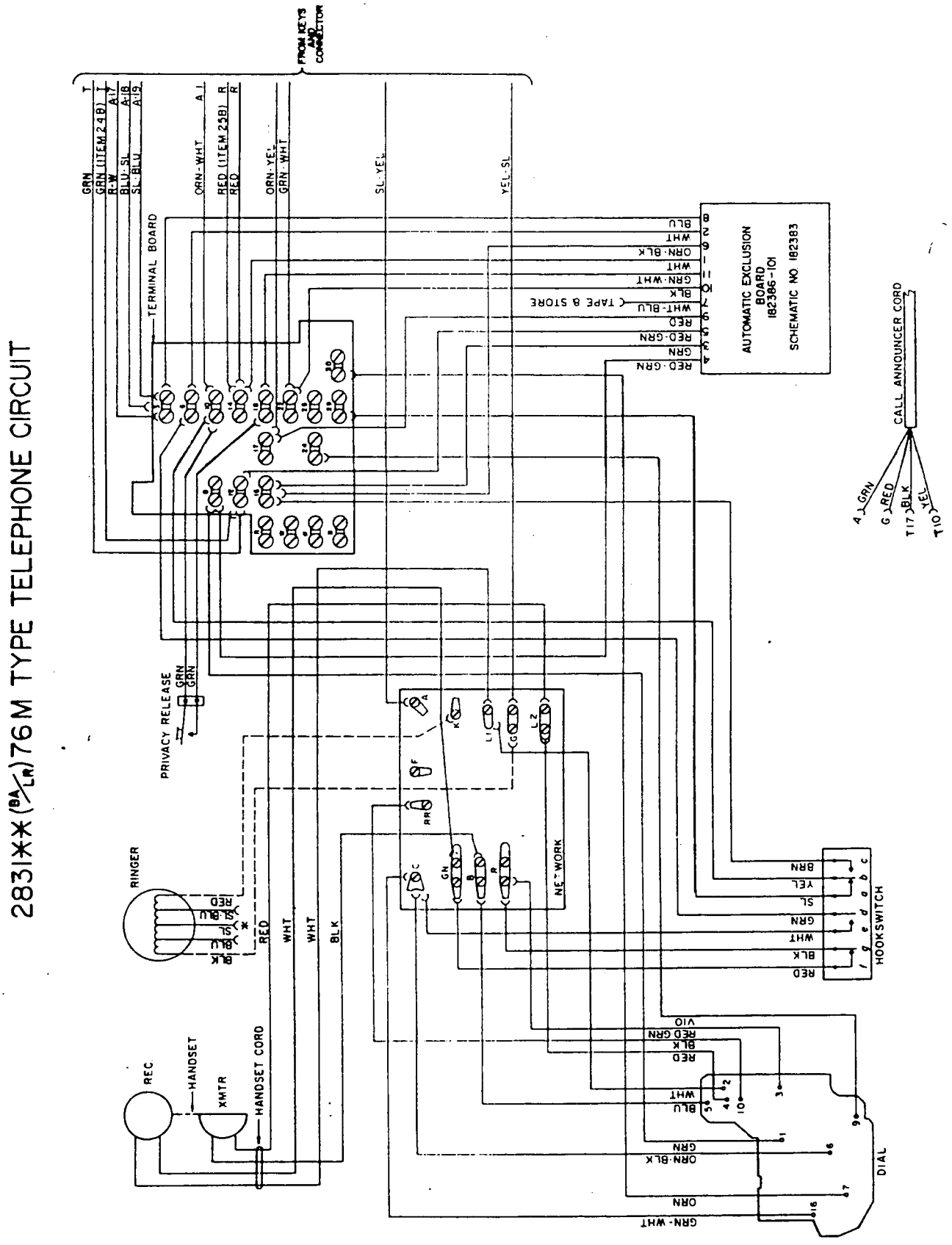


Fig. 15 - Set Wiring, K2831/76M Exclusion Sets

AUTEC POWER SYSTEMS

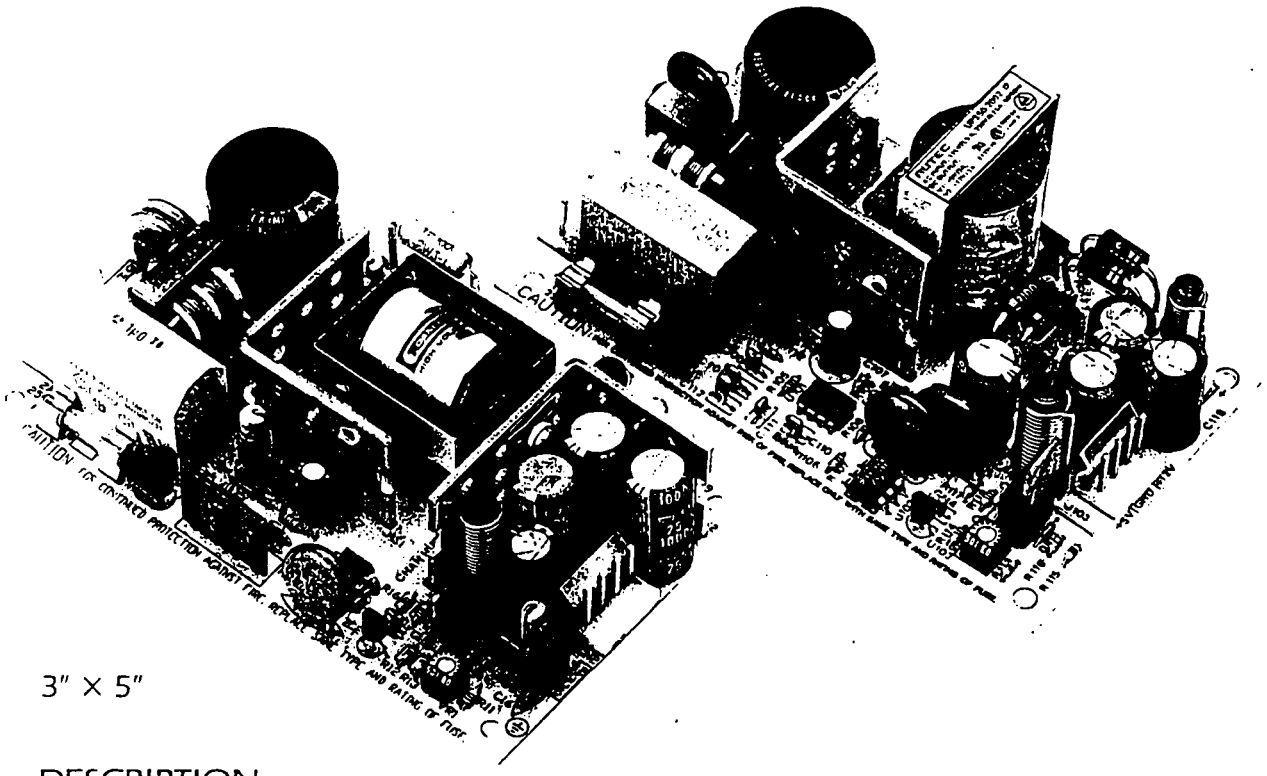
WORLD CLASS POWER HAS NO BOUNDARIES

20, 40 & 50 WATT
SWITCHING POWER SUPPLIES

UPS *VDE* SERIES

Features:

- VDE 0871 LEVEL 'B' and FCC CLASS 'B' COMPLIANCE
- UL 1950 FILE NO. E133148
- CSA 1402C LEVEL 3 FILE NO. LR89164
- TUV APPROVED TO IEC 950 FILE NO. R98290
- 90 - 260 VAC (CONTINUOUS) UNIVERSAL INPUT
- LOW MINIMUM LOAD
- HIGH +12V OUTPUT SURGE CURRENT FOR STARTING HARD DISK DRIVES
- INDUSTRY STANDARD 3" × 5" SIZE



3" × 5"

DESCRIPTION

These UL, CSA and TUV approved dual output switchers are the favorite choice among manufacturers of mass storage sub-systems. Compatible applications are 3½" hard drives, 5¼" Removable Cartridge drives, full height 5¼" hard drives, optical drives, helical scan tape drives and streaming tape drives. On board EMI filtering eases system approval to VDE and FCC class 'B' requirements. Industry standard 3" × 5" size, mounting holes and universal input ensures easy upgrades from units provided by COMPUTER PRODUCTS, POWER GENERAL and SKYNET. Standard AC & DC cables and enclosures are available options.

AUTEC POWER SYSTEMS

69 Moreland Road,
Simi Valley, CA93065

Tel: (805) 522-0888
Fax: (805) 522-8777

GENERAL SPECIFICATIONS

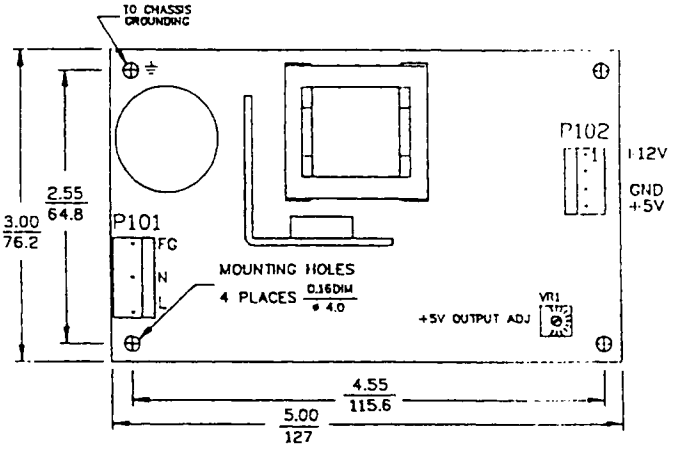
INPUT VOLTAGE	90-260 VAC 47-440 Hz (Universal)
INRUSH CURRENT	20A @ 115 VAC, 40A @ 230 VAC
HOLD-UP TIME	20 mS, minimum, see Note 3
DC OUTPUTS	See OUTPUT table below. Output 1 adjustable 5%. All other outputs track output 1
SWITCHING FREQUENCY	40 KHz
EFFICIENCY	70% Minimum
CONDUCTED EMI	VDE 0871 level 'B' & FCC Class 'B'
TEMPERATURE COEFFICIENT	0.02% / degree C
OVERLOAD	Foldback within 150% of total power
HI-POT ISOLATION	3750 VAC input to output for 1 minute.
FUSING	2A, 5TT for 115/230 VAC
OVERVOLTAGE PROTECTION	+5V output, 6.2 VDC ± 0.5V
TEMPERATURE:	Operating: 0° to 50° C at full rated power. Storage: −55° C to 85° C
OUTPUT POWER DERATING	Derate each output linearly to 50% rated output at 70° C.
HUMIDITY:	5% to 95% RH non-condensing
ALTITUDE	10,000 ft., 40,000 ft. non-operating
WEIGHT	7.5 oz. approximate

OUTPUT TABLE

MODEL / WATTAGE	OUTPUT VOLTAGE	LOAD MIN.	LOAD RATED	LOAD PEAK[1]	TOLERANCE ±	RIPPLE AND NOISE[4]	REGULATION LINE	REGULATION LOAD[2]
UPS20-2002 20W / 40W Pk	5.0V 12.0V	0.2A 0.1A	1.00A 1.50A	3.00A	3.00% 5.00%	50 mV 100 mV	0.5% 1.0%	3.0% 5.0%
UPS40-2002 40W / 60W Pk.	5.0V 12.0V	0.2A 0.1A	3.00A 2.00A	4.50A	3.00% 5.00%	50 mV 100 mV	0.5% 1.0%	3.0% 5.0%
UPS50-2002 50W / 70W Pk.	5.0V 12.0V	0.2A 0.1A	3.00A 3.00A	5.50A	3.00% 5.00%	50 mV 100 mV	0.5% 1.0%	3.0% 5.0%
UPS51-2002 50W / 70W Pk.	5.0V 12.0V	0.2A 0.1A	4.00A 3.00A	5.00A 5.50A	1.00% 5.00%	50 mV 100 mV	0.5% 1.0%	1.0% 5.0%

MECHANICAL

inch / mm



P102 PIN ASSIGNMENT

1	2	3	4
+12	COM	COM	+5

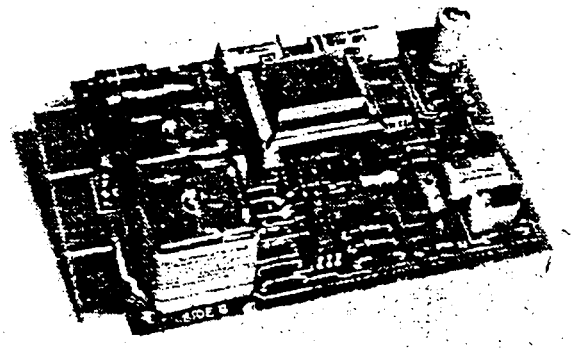
Max. Height	inch	mm
UPS20-2002 & UPS40-2002	1.10	27.94
UPS51-2002	1.20	30.48
UPS50-2002	1.70	43.18

CONNECTOR		MATING CONNECTOR
P101 AC INPUT	MOLEX 09-65-2058	MOLEX 09-50-1051
P102 DC OUTPUT	MOLEX 09-65-2048	MOLEX 09-50-1041

Notes:

1. Each output can provide up to its Peak current for 30 seconds. Total Peak wattage must not exceed value indicated with each output not exceeding its Peak rating. Each output can provide up to its total rated output provided the total continuous Wattage does not exceed value indicated above.
2. Load regulation is measured with the output being measured at 100% rated load, with all other outputs at 60% of their rated load. The load on the output being measured is varied from 60% - 100% rated load.
3. Hold-up time is measured at 120 VAC input and 80% of rated load.
4. Ripple & Noise are measured using a 12" twisted pair conductor terminated with a 47 uF capacitor.
5. All specifications are typical at nominal line, full load and 25°C, after a 1 minute warm-up period unless otherwise noted.
6. Specifications are subject to change without notice.

K400TPL
INTERFACE LINE CARD
(B60049-1000)



1.00 GENERAL

1.01 The K400TPL INTERFACE LINE CARD is a Key Telephone Unit (KTU) plug-in CO/PBX line circuit with interface circuitry. The K400TPL permits direct connection to be made to a telephone company (telco) line facility. The interface circuitry maintains longitudinal balance on a telephone line while providing direct current (DC) isolation. Each card has a light emitting diode (LED) as a card status indicator to facilitate servicing the Key Telephone System (KTS).

1.02 The K400TPL is equipped with three jumper block/plug arrangements to provide the following options:

a. short time out (5-10 seconds),

b. interrupted ringing,

c. auxiliary common audible signal, and

d. music-on-hold.

NOTE: **MUSIC-ON-HOLD REQUIRES ADDITIONAL EQUIPMENT.**

1.03 The short time out option reduces the time out of a card from 25-35 seconds to 5-10 seconds when a calling party abandons a call prior to it being answered.

1.04 The K400TPL *does not* contain any power failure transfer circuitry. However, the Power Failure Transfer Card (B60052-0000) can be used in conjunction with a K400TPL Line Card to transfer a CO line to an emergency line, or an emergency telephone, in the event of local power failure. The Power Failure Transfer Card is not automatically shipped with the Interface Line Card; it must be ordered separately.

1.05 The K400TPL is registered with the FCC under the following number:

AS293P-67342-VP-E
Ringer Equivalence 0.4B

The VP Classification gives the K400TPL Interface Line Card fully protected status. *Any* key service unit requiring 400-type line cards can be used behind the K400TPL Line Card. Therefore, the K400TPL Interface Line Card *replaces* the K400TP and K400TP/TPL line cards because of its *less restrictive* classification.

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Part Number B60049-1000

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CAUTION: **PIN 18 ON THE MOUNTING CONNECTOR MAY PROVIDE −24V FILTERED (A BATTERY). THIS CONNECTION MUST BE REMOVED TO AVOID POSSIBLE CIRCUIT DAMAGE TO THE K400TPL CARD.**

5.04 To remove an unwanted strap connection, as with Pin 18 in earlier KSU's, cut and remove the bare wire strap from the back of each mounting connector to be used. *ONLY* remove the bare wire strap and not the insulated conductor.

5.05 Pin functions of each mounting connector are brought out to the back of the KSU cabinet via a wiring harness. Depending on the KSU, the wiring harness either terminates on punch down blocks, or in 25-pair male plugs. From the blocks or plugs, individual CO line functions must be brought out of the KSU cabinet and terminated on KSU Blocks, mounted on the Main Distribution Frame (MDF), in accordance with manufacturer's instructions.

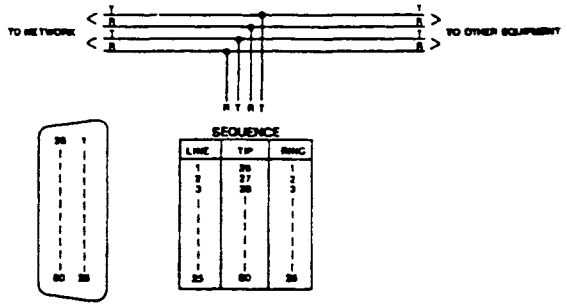
5.06 From the KSU Blocks, station CO line functions are cross connected to other system connection blocks, and necessary functions taken back to the station equipment. It is also from these blocks that CO/PBX TIP and RING functions are brought out to the telco provided equipment.

5.07 The telco will provide final network connection via a miniature 6-position jack, or a 50-position miniature ribbon jack. These mechanical arrangements are for single line and multiple line bridged TIP and RING electrical network connections respectively.

5.08 The miniature 6-position jack must be ordered by the customer from the telco under the Universal Service Order Code (USOC) designation **RJ11C** (RJ11W for portable wall mounted equipment). Conductors 1, 2, 5, and 6 are reserved for telco use; thus, conductors 3 and 4 are reserved for CO RING and CO TIP, respectively. The customer must provide a miniature 6-position plug, to complete the connection, with CO RING on position 3, and CO TIP on position 4. The cable attached to the plug shall terminate inside the KSU cabinet as a direct connection, and shall not be in excess of 25 linear feet.

NOTE: **THE 25 LINEAR FEET REQUIREMENT SHALL INCLUDE THE CABLE COMING FROM THE KSU CABINET TO THE KSU BLOCKS; THUS, THE LENGTH OF THE CABLE FOR THE CUSTOMER PROVIDED MINIATURE 6-POSITION PLUG MUST BE ADJUSTED ACCORDINGLY.**

5.09 The 50-position miniature ribbon jack must be ordered by the customer from the telco under the Universal Service Order Code (USOC) designation **RJ21X**. At the time the jack is ordered, the customer must specify the sequence in which the CO lines are to be connected to the jack. The telco will consecutively wire these lines to the jack as shown below without skipping any positions.



5.10 The customer must provide a 50-position ribbon plug, to complete the connection, with CO TIP and CO RING for each line in the same sequence. The cable attached to the ribbon plug shall terminate inside the KSU cabinet as a direct connection, and shall not be in excess of 25 linear feet (see note above).

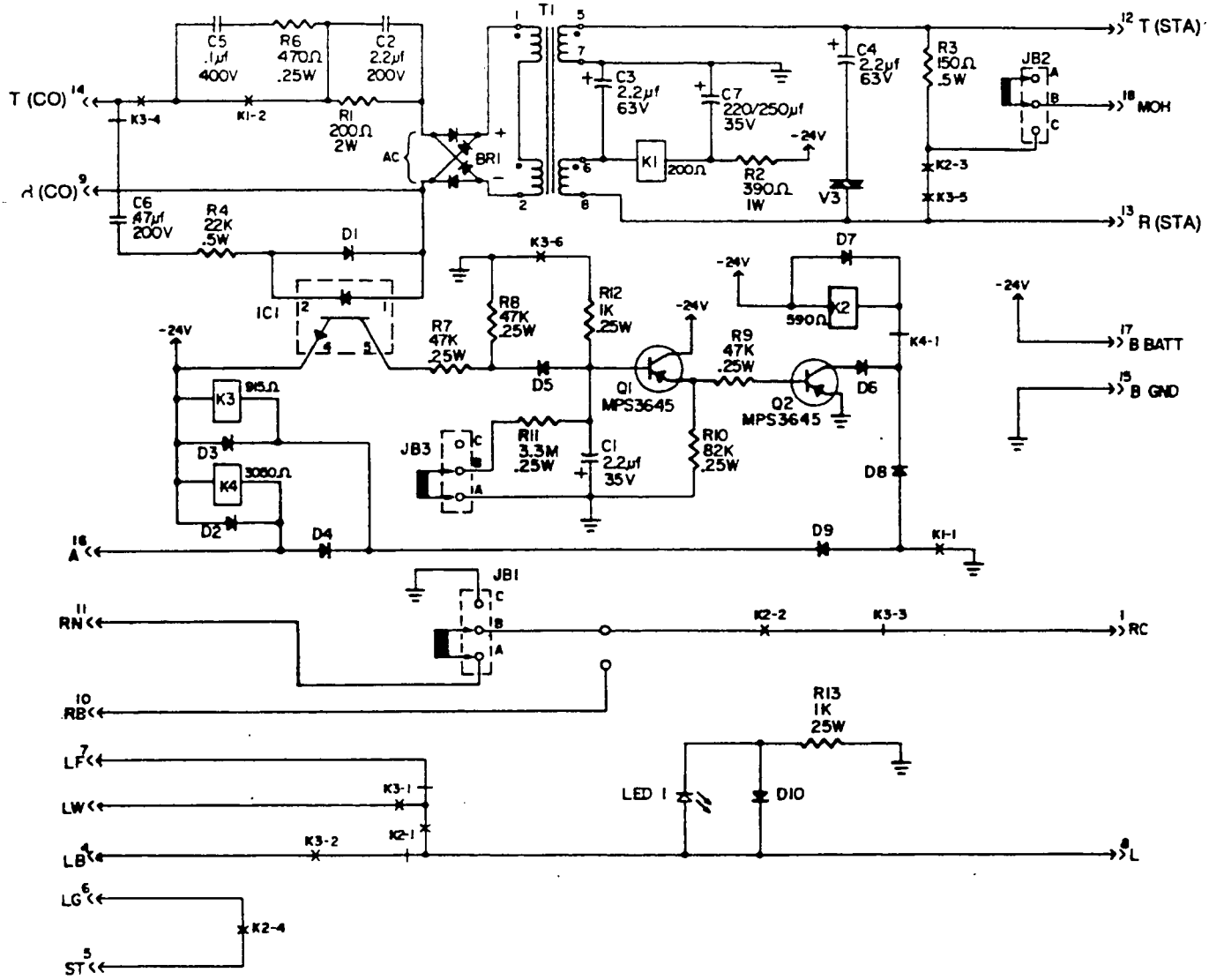
CIRCUIT DESCRIPTION

6.01 AC ringing voltage from the Central Office (CO) is applied to the CO TIP/RING (**Tabs 14 and 9**). Current flows via contact K3-4, C6, R4, and the LED portion of photo coupler IC-1 during negative cycles of the applied AC ringing voltage. During the positive cycles of ring voltage, current flows via contact K3-4, C6, R4, and D1, protecting the LED against reverse voltages. During the half cycles of ringing when current flows through the LED portion of IC-1, the phototransistor section is activated and applies −24V DC to **RING/HOLD** circuit. The **RING/HOLD** circuit activates Relay K2. Contact K2-2 then connects the ringing voltages or signals to the RINGER LEAD (**Tab 1**). Voltage from **GND** (**Tab 11**) may be selected by jumper block/plug **JB1**. If steady ringing is required, then solder a jumper wire as shown in the diagram to route the ring battery at **Tab 10** to K2-2. Contact K2-1 connects the LAMP FLASH VOLTAGE (**Tab 7**) to the LAMP LEAD (**Tab 8**) via inactive contact K3-1. Contact K2-4 connects **LG** (**Tab 6**) to the interrupter motor start [ST] (**Tab 5**), thus starting the key system interrupter.

6.02 The called party answers the telephone by taking the handset off-hook, either before or after depressing the line button associated with the incoming call. With the telephone off-hook and the button depressed, a sequence of two events occurs.

6.03 First, GND is connected to the A-lead (**Tab 16**) via the A-lead contact in the line button of the telephone. The presence of GROUND (**Tab 16**) activates Relay K3. The **RING/ HOLD** circuit now deactivates K2. Ringing signals, or voltages, are removed from **Tab 1** via the contacts K2-2 and K3-3. LAMP BATTERY (**Tab 4**) is connected to the LAMP LEAD (**Tab 8**); and LAMP FLASH (**Tab 7**) is removed via contacts K3-2 and K2-1. Contact K3-4 removes the CO TIP/RING connection (**Tabs 14 and 9**) from the ring detector circuit and connects them to de-energized contact K1-2. Contact K2-4 opens, thus stopping the interrupter motor.

SCHEMATIC DIAGRAM



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6.04 The second event is the connection of station TIP and RING (Tabs 12 and 13) to the subset. Current flows from GROUND through windings 5-7 of T1, the off-hook subset, windings 6-8 of T1, the coil of relay K1, and R2 to −24V DC. K1 now activates. Contact K1-2 completes the CO TIP/RING path to the isolation transformer T1 circuit. CO current now flows from CO TIP (Tab 14), through contact K3-4, contact K1-2, R1, and transformer windings 1-2 via bridge rectifier BR1 to CO RING (Tab 9). This DC current flow trips CO ringing. C2 provides an AC bypass around R1. Voice signals are coupled via T1 between the CO line and the called party.

6.05 When the subset hold button is depressed, the A-lead contact (wired to Tab 16) is broken before the TIP and RING contacts. When the GROUND is removed from Tab 16, K2 operates. R3 is connected across T(STA) and R(STA) via contacts K3-5 and K2-3 to provide a current path to keep relay K1 operated when the subset TIP and RING connection is broken. K1 maintains the CO TIP/RING connection via contact K1-2. Contact K2-1 removes the LAMP LEAD (Tab 8) from the LAMP BATTERY INPUT (Tab 4), and substitutes the LAMP WINK SIGNAL (Tab 2) via energized contact K3-1.

6.06 When the subset line button is depressed to go off *hold*, relay K2 is deactivated. Contact K2-1 removes LAMP WINK (Tab 2) and re-establishes LAMP BATTERY (Tab 4) to the LAMP LEAD (Tab 8). The K2-3 contact removes resistor R3 from the station TIP/RING circuit. Since the TIP/RING line button contacts have closed, the current path that keeps relay K1 operating remains unbroken.

6.07 When a line button is depressed to initiate a call, the A-lead is grounded operating relay K3 via Tab 16. Contact K3-2 connects LAMP BATTERY (Tab 4) to the LAMP LEAD (Tab 8) for a steady visual signal on all associated subsets. Contact K3-4 provides one of the connections necessary to draw central office current via CO TIP/RING (Tabs 14 and 9). When the subset line button connects station TIP and RING (Tabs 12 and 13) to the subset, relay K1 operates via R2 and the windings of T1. Contact K1-2 completes the CO DC circuit through T1 winding 1-2 and R1 via the CO TIP/RING (Tabs 14 and 9). Dial tone is now sent from the CO.

6.08 During dialing, the subset TIP/RING circuit is pulsed off/on by the action of dial contacts. Relay K1 follows this off/on pulsing and repeats this action to the CO via contact K1-2. R6 and C5 suppress noise and arcing during the pulsing of contact K1-2.

NOTE: **IF THE SUBSET IS EQUIPPED WITH A TONE DIAL PAD, THE GENERATED TONES ARE COUPLED VIA T1 TO THE CO DECODING CIRCUITS.**

6.09 MUSIC-ON-HOLD (MOH) is provided by connecting a music source between Tabs 12 and 18. The music signal can be connected to R3 via the jumper block/plug JB2. When the circuit is placed on hold, contacts K2-3 and K3-5 connect the music signal to T1 which couples the signal to the telephone line.

6.10 An LED is provided to give visual status indication to service/repair personnel. D10 protects the LED during negative half cycles of the incoming 10V AC lamp signals, and R13 limits the LED current.

6.11 D3 and D7 suppress inductive voltages when relays K3 and K2 are de-energized.

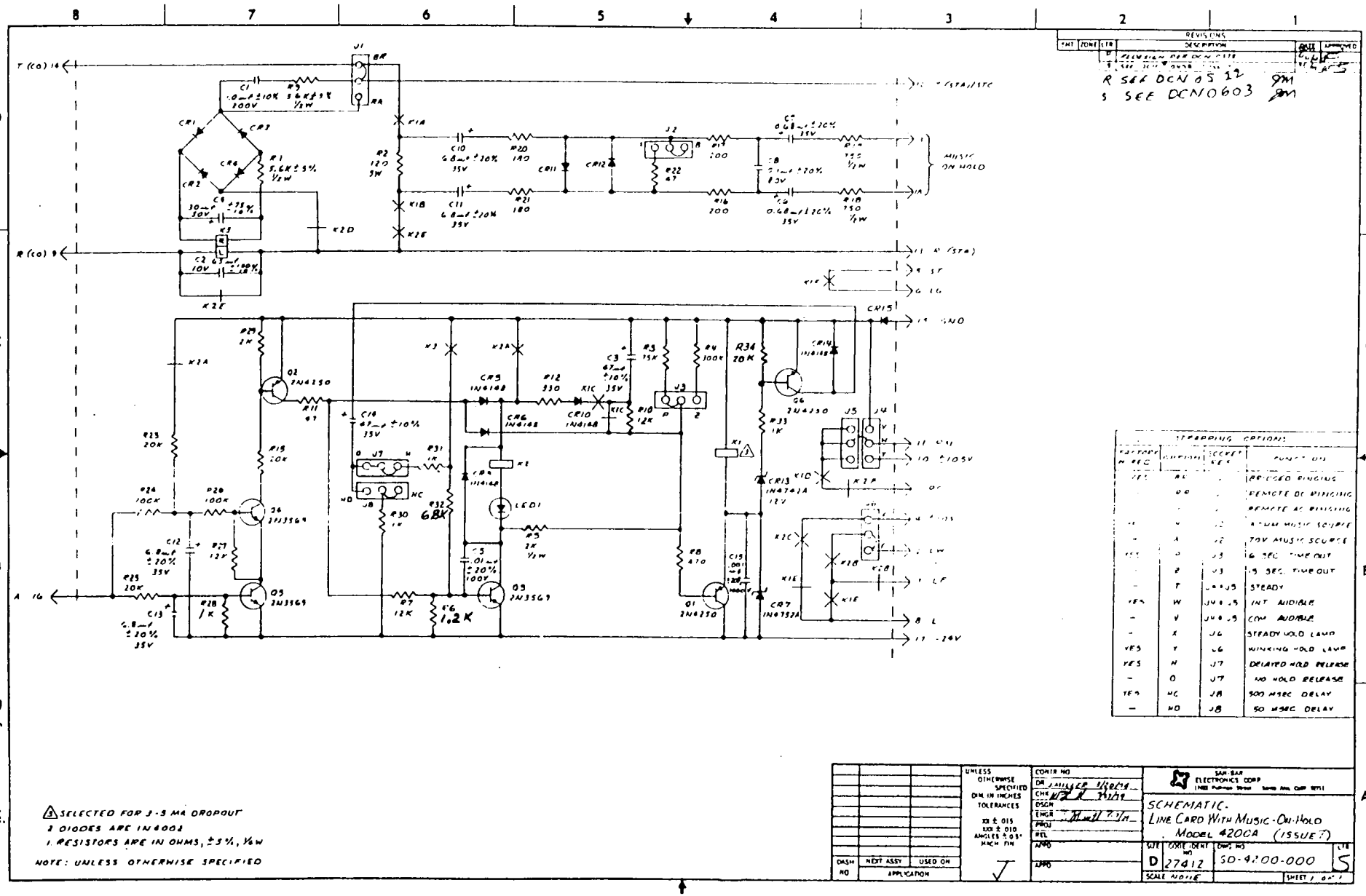
6.12 Bridge rectifier BR1 polarizes CO line current.

TYPICAL ITT KSU BLOCK ARRANGEMENTS

LINE	FUNCTION	COLOR CODE	TERMINAL OR PIN NUMBER			
			K501, K501A	K512, K512A	K36A	K76A
1	T1	WHT-BLU	Block C, Pos. 25	26	26	PLUG P1-26
	R1	BLU-WHT	26	1	1	PLUG P1-1
	1T	WHT-ORN	Block A, Pos 1	27	27	PLUG P1-27
	1R	ORN-WHT	2	2	2	PLUG P1-2
	1A	WHT-GRN	3	28	28	PLUG P1-28
	A1	GRN-WHT	4	3	3	PLUG P1-25
	LG	WHT-BRN	5	29	29	PLUG P2-25
	1L	BRN-WHT	6	4	4	PLUG P1-3
	B	WHT-SLT	Block B, Pos 19	30	30	PLUG P4-47
	R	SLT-WHT	20	5	5	PLUG P1-29
2	T2	RED-BLU	Block C, Pos. 27	31	31	PLUG P1-4
	R2	BLU-RED	28	6	6	PLUG P1-30
	2T	RED-ORN	Block A, Pos. 7	32	32	PLUG P1-5
	2R	ORN-RED	8	7	7	PLUG P1-31
	2A	RED-GRN	9	33	33	PLUG P1-6
	A1	GRN-RED	10	8	8	PLUG P1-25
	LG	RED-BRN	11	34	34	PLUG P3-50
	2L	BRN-RED	12	9	9	PLUG P1-32
	B	RED-SLT	Block B, Pos. 21	35	35	PLUG P4-47
	R	SLT-RED	22	10	10	PLUG P1-7
3	T3	BLK-BLU	Block C, Pos. 29	36	36	PLUG P1-33
	R3	BLU-BLK	30	11	11	PLUG P1-8
	3T	BLK-ORN	Block A, Pos. 13	37	37	PLUG P1-34
	3R	ORN-BLK	14	12	12	PLUG P1-9
	3A	BLK-GRN	15	38	38	PLUG P1-35
	A1	GRN-BLK	16	13	13	PLUG P1-25
	LG	BLK-BRN	17	39	39	PLUG P3-25
	3L	BRN-BLK	18	14	14	PLUG P1-10
	B	BLK-SLT	Block B, Pos. 23	40	40	PLUG P4-47
	R	SLT-BLK	24	15	15	PLUG P1-36
4	T4	YEL-BLU	Block C, Pos. 31	41	41	PLUG P1-11
	R4	BLU-YEL	32	16	16	PLUG P1-37
	4T	YEL-ORN	Block A, Pos. 19	42	42	PLUG P1-12
	4R	ORN-YEL	20	17	17	PLUG P1-38
	4A	YEL-GRN	21	43	43	PLUG P1-13
	A1	GRN-YEL	22	18	18	PLUG P1-25
	LG	YEL-BRN	23	44	44	PLUG P4-27
	4L	BRN-YEL	24	19	19	PLUG P1-39
	B	YEL-SLT	Block B, Pos. 25	45	45	PLUG P4-47
	R	SLT-YEL	26	20	20	PLUG P1-14
5	T5	VIO-BLU	Block C, Pos. 33	46	46	PLUG P1-40
	R5	BLU-VIO	34	21	21	PLUG P1-15
	5T	VIO-ORN	Block A, Pos. 25	47	47	PLUG P1-41
	5R	ORN-VIO	26	22	22	PLUG P1-16
	5A	VIO-GRN	27	48	48	PLUG P1-42
	A1	GRN-VIO	28	23	23	PLUG P1-25
	LG	VIO-BRN	29	49	49	PLUG P4-28
	5L	BRN-VIO	30	24	24	PLUG P1-17
	B	VIO-SLT	Block B, Pos. 27	50	50	PLUG P4-47
	R	SLT-VIO	28	25	25	PLUG P1-43

ITT TERRYPHONE CORPORATION
Post Office Box 4038, Harrisburg, PA 17111
Key System Reference v

SI-4200-002
SH 2 OF 2



Key System Reference

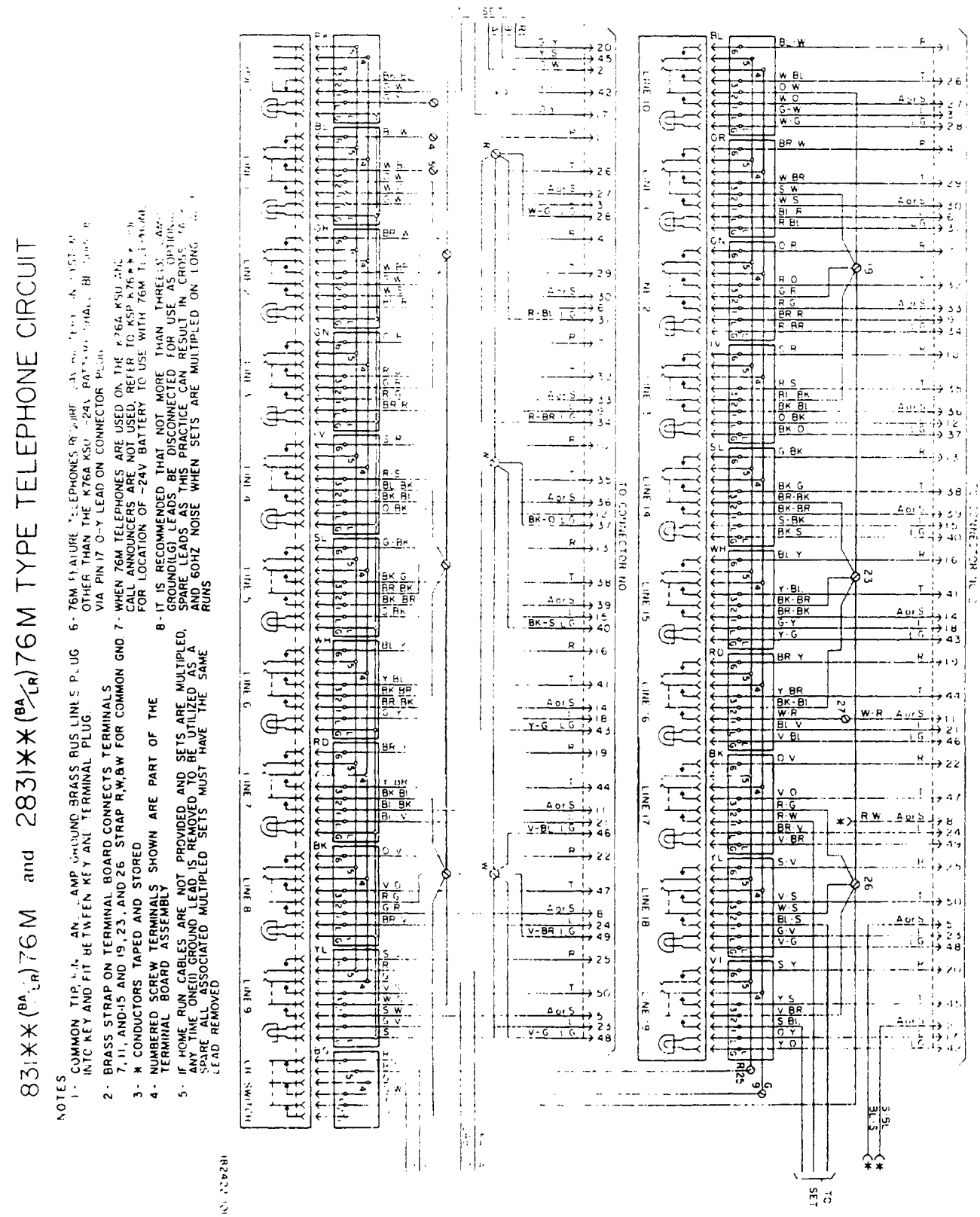


Fig. 13 - Key Wiring, 20 Button Sets K831/76M and K2831/76M

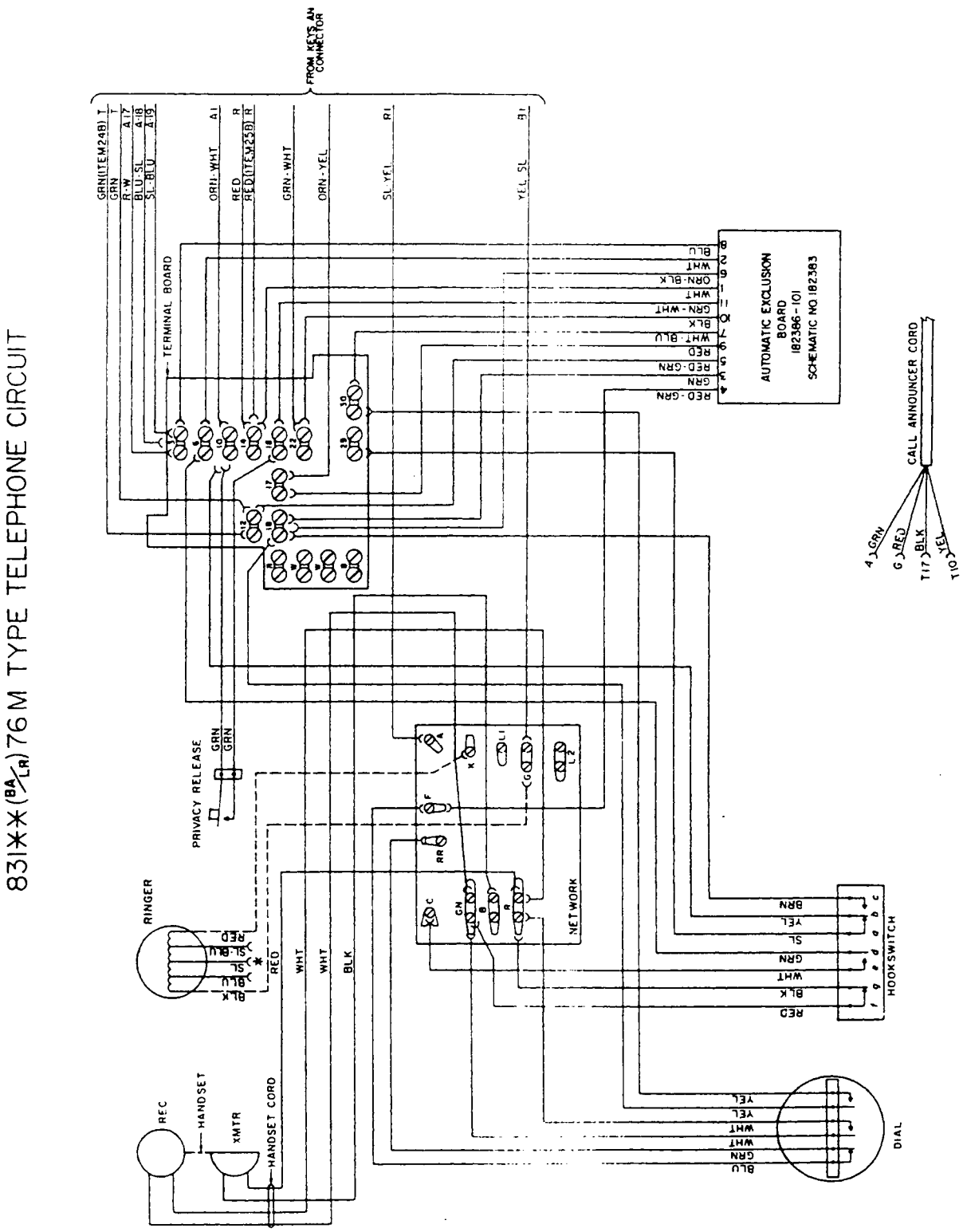


Fig. 14 - Set Wiring, K831/76M Exclusion Sets

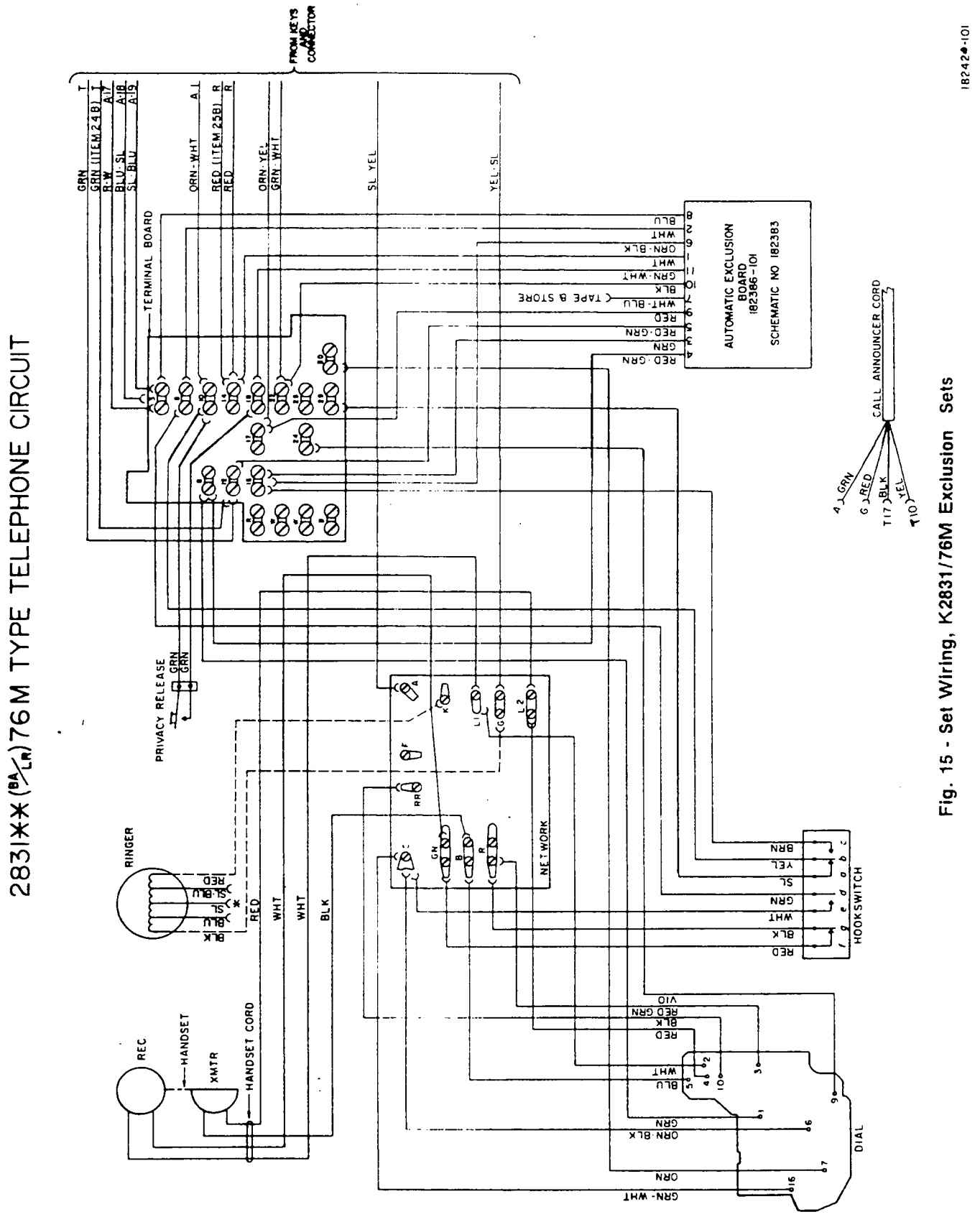


Fig. 15 - Set Wiring, K2831/76M Exclusion Sets

AUTEC POWER SYSTEMS

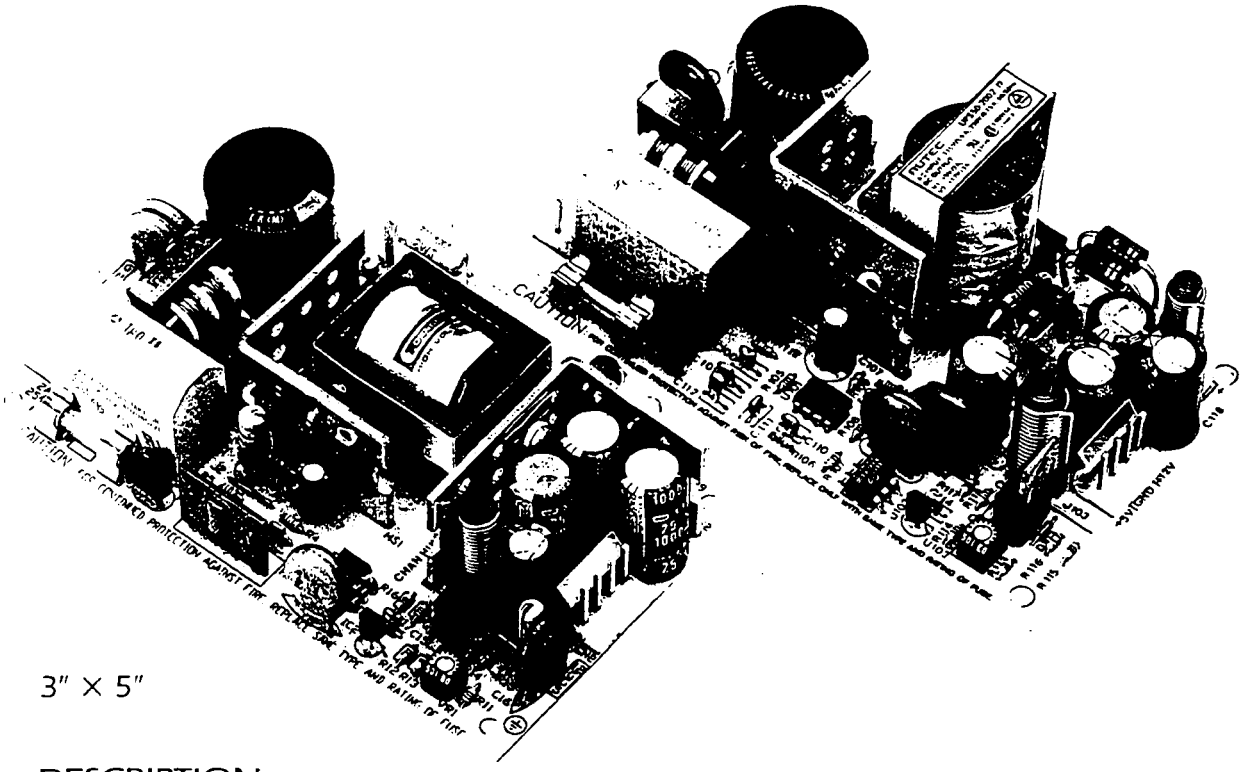
WORLD CLASS POWER HAS NO BOUNDARIES

20, 40 & 50 WATT
SWITCHING POWER SUPPLIES

UPS *VDE* SERIES

Features:

- VDE 0871 LEVEL 'B' and FCC CLASS 'B' COMPLIANCE
- UL 1950 FILE NO. E133148
- CSA 1402C LEVEL 3 FILE NO. LR89164
- TUV APPROVED TO IEC 950 FILE NO. R98290
- 90 - 260 VAC (CONTINUOUS) UNIVERSAL INPUT
- LOW MINIMUM LOAD
- HIGH +12V OUTPUT SURGE CURRENT FOR STARTING HARD DISK DRIVES
- INDUSTRY STANDARD 3" X 5" SIZE



3" X 5"

DESCRIPTION

These UL, CSA and TUV approved dual output switchers are the favorite choice among manufacturers of mass storage sub-systems. Compatible applications are 3½" hard drives, 5¼" Removable Cartridge drives, full height 5¼" hard drives, optical drives, helical scan tape drives and streaming tape drives. On board EMI filtering eases system approval to VDE and FCC class 'B' requirements. Industry standard 3" X 5" size, mounting holes and universal input ensures easy upgrades from units provided by COMPUTER PRODUCTS, POWER GENERAL and SKYNET. Standard AC & DC cables and enclosures are available options.

AUTEC POWER SYSTEMS

69 Moreland Road,
Simi Valley, CA93065

Tel: (805) 522-0888
Fax: (805) 522-8777

GENERAL SPECIFICATIONS

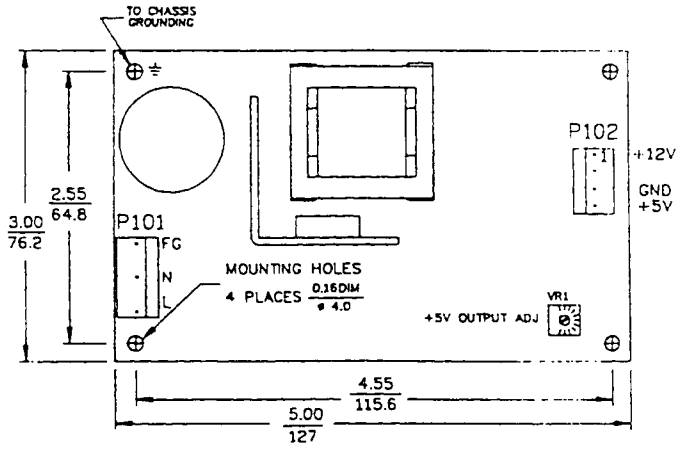
INPUT VOLTAGE	90-260 VAC 47-440 Hz (Universal)
INRUSH CURRENT	70A @ 115 VAC, 40A @ 230 VAC
HOLD-UP TIME	20 mS minimum, see Note 3
DC OUTPUTS	See OUTPUT table below. Output 1 adjustable 5%. All other outputs track output 1
SWITCHING FREQUENCY	40 KHz
EFFICIENCY	70% Minimum
CONDUCTED EMI	VDE 0871 level 'B' & FCC Class 'B'
TEMPERATURE COEFFICIENT	0.02% / degree C
OVERLOAD	Foldback within 150% of total power
HI-POT ISOLATION	3750 VAC input to output for 1 minute
FUSING	2A, STT for 115/230 VAC
OVERVOLTAGE PROTECTION	+5V output, 6.2 VDC ± 0.5V
TEMPERATURE	Operating, 0° to 50° C at full rated power Storage −55° C to 85° C
OUTPUT POWER DERATING	Derate each output linearly to 50% rated output at 70° C
HUMIDITY	5% to 95% RH non-condensing
ALTITUDE	10,000 ft., 40,000 ft. non-operating
WEIGHT	7.5 oz. approximate

OUTPUT TABLE

MODEL WATTAGE	OUTPUT VOLTAGE	LOAD MIN	LOAD RATED	LOAD PEAK[1]	TOLERANCE ±	RIPPLE AND NOISE[4]	REGULATION LINE	REGULATION LOAD[2]
UPS20-2002 20W / 40W Pk	5.0V 12.0V	0.2A 0.1A	1.00A 1.50A	3.00A	3.00% 5.00%	50 mV 100 mV	0.5% 1.0%	3.0% 5.0%
UPS40-2002 40W / 60W Pk.	5.0V 12.0V	0.2A 0.1A	3.00A 2.00A	4.50A	3.00% 5.00%	50 mV 100 mV	0.5% 1.0%	3.0% 5.0%
UPS50-2002 50W / 70W Pk	5.0V 12.0V	0.2A 0.1A	3.00A 3.00A	5.50A	3.00% 5.00%	50 mV 100 mV	0.5% 1.0%	3.0% 5.0%
UPS51-2002 50W / 70W Pk	5.0V 12.0V	0.2A 0.1A	4.00A 3.00A	5.00A 5.50A	1.00% 5.00%	50 mV 100 mV	0.5% 1.0%	1.0% 5.0%

MECHANICAL

inch / mm



P102 PIN ASSIGNMENT

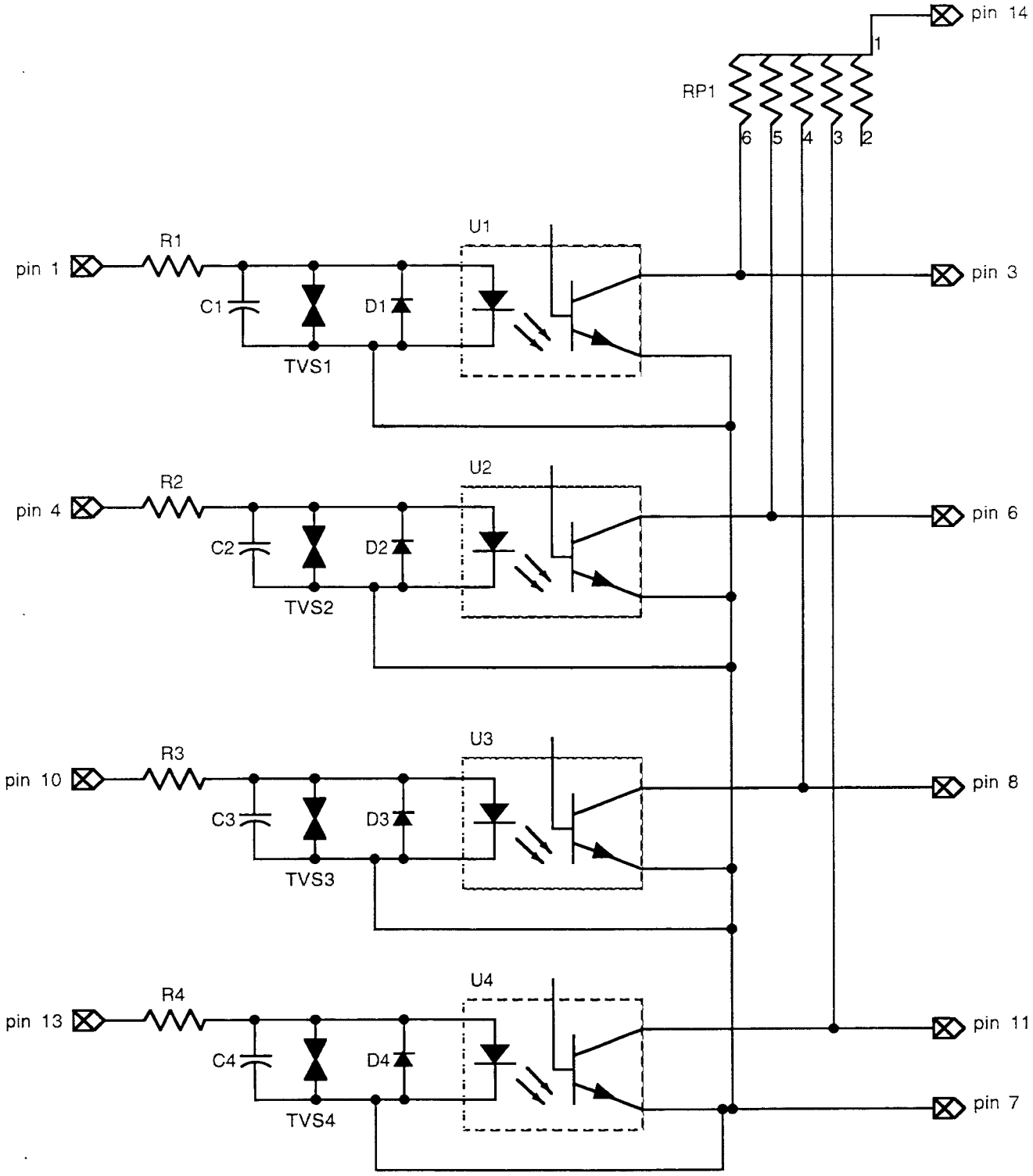
1	2	3	4
+12	COM	COM	+5

Max. Height	inch	mm
UPS20-2002 & UPS40-2002	1.10	27.94
UPS51-2002	1.20	30.48
UPS50-2002	1.70	43.18

CONNECTOR		MATING CONNECTOR
P101 AC INPUT	MOLEX 09-65-2058	MOLEX 09-50-1051
P102 DC OUTPUT	MOLEX 09-65-2048	MOLEX 09-50-1041

Notes:

1. Each output can provide up to its Peak current for 30 seconds. Total Peak wattage must not exceed value indicated with each output not exceeding its Peak rating. Each output can provide up to its total rated output provided the total continuous Wattage does not exceed value indicated above.
2. Load regulation is measured with the output being measured at 100% rated load, with all other outputs at 60% of their rated load. The load on the output being measured is varied from 60% - 100% rated load.
3. Hold-up time is measured at 120 VAC input and 80% of rated load.
4. Ripple & Noise are measured using a 12" twisted pair conductor terminated with a 47 uF capacitor.
5. All specifications are typical at nominal line, full load and 25°C after a 1 minute warm-up period unless otherwise noted.
6. Specifications are subject to change without notice.



PARTS LIST:
TVS1-4 = P6KE20CAGICT-ND
U1-4 = 4N33QT-ND opto-isolator
R1-R4 = 390Ω 1/4 W 5% resistor
D1-4 = 1N4004 diode
RP1 = 1KΩ SIP
C1-4 = 3.3μF 50V mono cap