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MRTI OPERATOR INSTRUCTIONS

The MRTI (Microprocessor Radio Telephone Interconnect) is capable of operating in four different modes to work with different types of radio systems. Each of these types of systems requires a slightly different set of mobile operating instructions. Therefore, refer to the section that applies to your system.

Signal Search Simplex Mode

In this mode, the MRTI is installed at your base station. To access the telephone line (connect), push the * button on your encoder. In about two seconds you should hear the dial tone, interrupted by short bursts of squelch noise. These short bursts are sample intervals during which the MRTI is searching for your transmitter signal and are heard only by the mobile radio users. When dial tone is heard, you may enter the telephone number, "stretching" the duration of the first digit for about a second to enable the MRTI to detect your transmitter signal. You should follow the telephone number with another *. This second * tells the MRTI that you are finished with telephone line signalling. If you omit this, the MRTI will assume you are finished six seconds after the last digit is entered and will then open the voice path to the telephone line.

When the called party answers, you may converse in the same manner as with the base station operator. You may interrupt the telephone party but they cannot interrupt you and be heard. Each time you push your microphone button, you should pause for about a half second before you begin speaking in order to allow the MRTI to detect your transmitter signal. This will eliminate "lost words" to the telephone line party. When you release your microphone button, the telephone party will hear a short beep to tell him when he may speak and be heard by you. At the end of the conversation, push the # button on your encoder, stretching the duration for about a second. This will disconnect the telephone line and the MRTI will confirm disconnect back to you with a series of short beeps.

This covers the basic operation of the signal search mode. Optional control signalling should be handled in the same manner, always stretching the first control digit in order to be recognized by the MRTI. Many hand-held portable radios are equipped with Touch-Code encoders that will only put out a short burst of Touch-Code signalling. The MRTI will recognize these units with no problem if the transmit button is pressed a second before the Touch-Code signalling commences. Then, signalling may be entered at a normal rate. Now refer to the General Description section for further instructions and discussion of optional equipment.

Enhanced Vox Simplex Mode

In this mode, the MRTI is installed either on your base station or on a wire-line remote control located away from the radio base station. The feature unique to this mode of operation is the cross lock-out between you, the mobile radio party, and the telephone line party. This means that whoever begins speaking first maintains control of the conversation until he is finished speaking. Then, the other party may speak and maintain control of the conversation until he is finished speaking. Then, the other party may speak and maintain control, "locking out" the first party from being heard until speaking is finished. The MRTI recognizes signalling tones to be different than speech and will interrupt such tones as dial tone, busy tone, etc., for mobile control. Typical operation is as follows:

Press the * button on your encoder. After a short delay, you should hear the dial tone for about 2 seconds duration. When it drops out, enter the telephone number. You should follow the telephone number with another *. This second * tells the MRTI that you are finished with telephone line signalling. If you omit this, the MRTI will assume that you are finished six seconds after the last digit has been entered and will then open the voice path to the telephone line.

When the called party answers, you cannot interrupt and be heard until they finish speaking. When they finish speaking, you may then talk to the telephone line party. In order to allow time for you to answer, the MRTI sends an attention-getting ticking sound to the called party which will disappear after you first reply. When you finish speaking he will hear a short beep tone. You should inform the telephone line party not to speak to you until he hears the beep (go-ahead) tone. It is suggested that this be a short, concise statement, such as "when you hear the beep it is your turn to talk". At the end of the conversation, press the # button to release (hang up) the telephone line. The MRTI will confirm release with a series of short beeps.

Network Signalling

When you dial a telephone number that is busy, or make a dialing mistake and get the fast busy signal, the MRTI will determine the repetitive signalling condition and will allow you to hear a few seconds of the telephone network signalling. Then when the MRTI interrupts the signalling you may respond with the # button to release the telephone line. The MRTI will continue to alternate between two seconds of transmitting the repetitive signalling and five seconds of awaiting mobile commands until the telephone is released. Now refer to the General Description section for further instructions and discussion of optional equipment.

Half Duplex Mode

In this mode, the MRTI is installed at your radio repeater site. To access the telephone line (connect),press the * button for about a half second. When dial tone is heard,dial the telephone

number, "stretching" the first digit for about a half second in order to allow the MRTI to detect your transmitter signal. You should follow the telephone number with another *. This second * tells the MRTI that you are finished with telephone number signalling. If you omit this, the MRTI will assume you are finished six seconds after the last digit is entered and will then open the voice path to the telephone line.

When the called party answers, you may talk to them in the same manner as you would to your base station operator or another mobile except that you will be able to interrupt the telephone line party but he cannot interrupt you and be heard. Each time you finish speaking and release your microphone button, the MRTI will send a short beep tone to the telephone party to inform them that you are finished speaking.

At the end of the telephone conversation, press the # button for about a half second to release (hang up) the telephone line. The MRTI will confirm release with a series of short beeps.

Full Duplex Mode

In this mode,the MRTI is installed at your radio repeater site. The outstanding feature of this mode is that telephone conversation may be carried on simultaneously in both directions as with standard home or office telephones. To access (connect) the telephone line, press the * button on your Touch-Code encoder. When dial tone is heard, enter the telephone number. You should follow the telephone number with another *. This second * tells the MRTI that you are finished with telephone number signalling. If you omit this, the MRTI will assume you are finished six seconds after the last digit is entered and then open the voice path to the telephone line.

When the telephone line party answers, you may converse in the usual manner. At the end of the conversation, press the # button to release (hang up) the telephone line. The MRTI will confirm release with a series of short beeps. Now refer to the General Description section for further instructions and discussion of optional equipment.

GENERAL DESCRIPTION
(Common to all modes of operation)

The previous sections have covered the mobile-originated telephone call. The telephone caller originated call proceeds in two different manners, depending on installed options. If special information (security code,selective signalling code, trunking format, etc.) is required to initiate mobile signalling, refer to the applicable option section in this manual for operational details.

Special Instructions Apply Yes No

Refer to Section (s) _____

When the telephone caller dials the MRTI telephone number, the MRTI detects ringing on its line (as indicated by flashing decimal point of display on OTX processor board). After ensuring that the channel is available (carrier detect and PTT sense LED must be off, located on RIMX board or absence of receive audio (or noise) in audio vox mode. Indicated in test 5 by an extinguished decimal point of display on OTX processor board), the MRTI transmits one three-second ring tone. To answer the call, the mobile operator presses * on his encoder after the ring tone ceases. The MRTI will access the telephone line and conversation may proceed as outlined in the previous sections. When the conversation is over, the mobile operator sends a # to release the telephone line. The MRTI will confirm release with a series of short beep tones. This completes instructions on the basic MRTI telephone call originated from a land telephone.

The MRTI has a number of standard convenience features including:

1. Re-dial of the last telephone number dialed. (**).

2. "Flash" signal. (Applicable on certain PBX equipment). (*#*). This allows the mobile user to regain in-house dial tone without releasing and reaccessing the patch. (call transfer, etc.).

3. Answer if called. (*#* before access). Will access the telephone line only if an incoming call is waiting. (Special application).

4. The end of telephone number signalling time is announced by a short beep after which the voice path is enabled to/from the telephone line.

5. The MRTI can share a telephone line with a standard telephone set. This can eliminate the need for a separate telephone line dedicated to the MRTI.

6. MRTI telephone line busy signal. When a mobile user attempts to access the MRTI telephone line and the line is off-hook (in use by a line-sharing telephone set, etc.), the MRTI will

return a busy signal to the mobile user. The line may be accessed in this condition by the busy override code. (***).

There are many standard switch-selectable features including:

7. Ring signalling to mobiles initiated after first or fourth ring fourth ring feature allows an attendant to answer calls on a line sharing telephone set (as discussed in 5 above) before the mobiles are alerted.

8. Attendant control of MRTI: Yes or No. An attendant can initiate or forward calls to the mobile users via a touch-code equipped, line-sharing telephone set by dialing the attendant access code. (#*).

9. Toll (long distance) restriction: Yes or No. MRTI disconnects when 1 or 0 is entered as the first digit of the telephone number.

10. Transmitter private line signal disable: On command only or automatic on access - choose one. In either case, the on/off commands are functional. This feature allows use of the MRTI without disturbing other mobile users in the system. In the latter condition, the private line signal may be commanded back on in order to involve another mobile user in the telephone conversation.

    Tx PL tone on = *1*
    Tx PL tone off = *1#

11. Call origination from mobile users: Yes or No.

12. Call origination from telephone line: Yes or No.

13. Three-minute overall access timer: On or Off.

14. Emergency override of three-minute access timer: Yes or No. Override code = *** (or security code, if applicable, refer to Section D).

15. Access elapsed time coded tones: On or Off.

    1 minute = one short beep.
    2 minutes = two short beeps.

    Also, if the three-minute timer is on: (as in 13).

    2-3/4 minutes = one tick every 2 seconds until 3 minute release.

16. Release after 60 seconds of mobile inactivity: Yes or No. If mobile activity timer is on, "ticks" are sent 15 seconds prior to disconnect. Reception of a mobile signal will reset the mobile inactivity disconnect timer.

Associated with the standard features are Touch-Code command signals utilizing the *, #, and 1 buttons on your encoder. These should be entered in the manner outlined in the MRTI Operator Instruction Section, "stretching" the first digit where applicable. Some examples follows:

*	Access telephone line.
**	Redial last number dialed.
***	Overrides line busy.
***	After access: override 3 minute overall timer.
#	Before access: answer if called (special application).
#	After access: "flash" as applicable.
1	Transmitter PL tone on.
*1#	Transmitter PL tone off.
#*	By attendant, Touch-Code telephone allows attendant to initiate ring signalling to mobile user(s).

NOTICE

This IAI telephone interconnect equipment contains one or more IAI Model RLM-3 telephone interface circuit cards which have been approved by the Federal Communications Commission for connection to the public-switched telephone network under part 68 of the FCC rules and regulations.

The following information is supplied to ensure user compliance with the regulations.

1. The Model RLM-3 telephone interface circuit card may not be used with party lines or coin lines.

2. Customers connecting terminal equipment or protective circuitry to the telephone network shall, before such connection is made, give notice to the telephone company of the particular lines to which such connection is to be made, and shall provide to the telephone company the FCC registration number and ringer equivalence of the registered terminal equipment or registered protective circuitry.

3. The customer shall give notice to the telephone company upon final disconnection of such equipment or circuitry from the particular lines.

4. When telephone line trouble is experienced, the customer shall disconnect the registered equipment from the telephone line to determine if the registered equipment is malfunctioning, and if the registered equipment is malfunctioning, the use of such equipment shall be discontinued until the problem is corrected.

5. The telephone company may make changes in its communications facilities, equipment, operations or procedures, where such

action is reasonably required in the operation of its business and is not inconsistent with FCC rules and regulations. If such changes can be reasonably expected to render any customer's terminal equipment incompatible with telephone company communications facilities, or require modification or alteration of such terminal equipment, or otherwise materially affect its use or performance, the customer shall be given adequate notice, in writing, to allow the customer an opportunity to maintain uninterrupted service.

6. It is required by FCC regulations that repair of the Model RLM-3 shall be accomplished only by the manufacturer or by their authorized agent.

7. All Models RLM-3 shipped in equipment bearing the appropriate FCC registration label are equipped with plugs that mate with USOC type RJ11C interface connectors supplied by the telephone company.

8. The FCC registration number for the IAI Model RLM-3 interface circuit card is BC288J-68921-VP-N. The ringer equivalance is 0.3b.

WARNING

This equipment generates, uses,and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measure may be required to correct the interference.

ABBREVIATED MOBILE COMMAND CHART

Note: All multidigit control functions must be entered with a maximum of 1 second interdigit time.

STANDARD MRTI

* access telephone line
\# release telephone line
** redial last number called
*** overrides line busy
*** after access = 3 minute timer disable
# before access = answer if called (special applications)
# after access = "flash" (momentary on-hook to regain dial tone where applicable)
#* attendant access code
1 TX PL tone on
*1# TX PL tone off

E381/TDN6899 Mobile Control of External Functions Option

N function on where N is one of 7 functions N = 3-9
*N# function off

E377/TDN6895 MULTI-FUNCTION UTILITIES OPTION

n* multidigit access code N = 1-4 digits
#N multidigit release code N = 1-4 digits
*O#N executive override code N = 1-6 digits
overrides a variety of programmed restrictions

E378/TDN6896 OPTION CONTROL (9 NUMBER AUTO-DIAL I)

*1 MRTI dials stored telephone number 1

*9 MRTI dials stored telephone number 9

E379/TDN 6897 OPTION CONTROL (99 NUMBER AUTO-DIAL II)

*01 MRTI dials stored telephone number 01

*99 MRTI dials stored telephone number 99

AUTO DIAL TELEPHONE NUMBER ENTRY FROM MOBILE
(MRTI must not be accessed)

O auto-dial programming command followed by:
L* telephone number memory location (1 = 1 or 2 digits as applicable) - followed by:
N...N telephone number to be stored (N = 1-16 digits) at memory location L (* entered as a telephone number digit causes 1.25 second pause in auto-dialing) - followed by:
*# memory store command: causes telephone number to be stored at memory location L
reset to start over (anywhere in the sequence)

E380/TDN6898 SELECTIVE MOBILE SIGNALLING OPTION

*##N revertive (mobile-to-mobile) call where N is mobile paging code in 1, 2, 3, or 4 digit-format.

INSTALLATION CONSIDERATIONS

MODE DISCUSSION

The MICROPROCESSOR RADIO TELEPHONE INTERCONNECT system provides four basic operational mode options. Half duplex, full duplex, signal search simplex and enhanced vox simplex. Basic operation and interfacing requirements are discussed as follows:

HALF DUPLEX

(Duplex repeater - simplex mobiles and/or portables). This mode is used when the MRTI interfaces the telephone line(s) directly to the repeater in a radio system utilizing standard simplex control station(s), mobiles and/or portables. When the telephone line has been accessed for land line and mobile conversation, the repeater transmitter is keyed continuously for the duration of the telephone conversation. The MRTI automatically adjusts the levels in both the mobile to land-line and land-line to mobile audio paths within a 15 db range.

The radio interface module (RIMX) incorporates receive audio input programming switches to establish "ballpark" input levels. Receive audio input is through a high impedance, balanced differential circuit to eliminate hum and noise pickup and adverse loading affects on the audio source. Repeater receiver audio may be taken from several places as follows:

1. (Preferred) discriminator or quadrature detector output, prior to high frequency rolloff. This method provides audio unaffected by level controls within the repeater. Also, the RIMX squelch circuit provides carrier detect to the MRTI, eliminating model-to-model receiver squelch circuit performance variations.

2. Local speaker audio amp output. The amplifier should be properly loaded to prevent frequency response problems associated with some transformer type output circuits. The amplifier output level and local squelch control setting must be adjusted at installation and the settings maintained. Carrier detection in this method is switch selected for either the RIMX carrier detect logic input, utilizing the repeater receiver squelch circuits or for the receive-audio vox detection by the MRTI audio circuits (not recommended).

3. Other intermediate receive audio source on the repeater receiver utilizing one of the two carrier detect methods described above.

Mobile carrier detect, as mentioned above, is necessary to switch the audio paths within the MRTI during telephone conversation. The RIMX provides switch selectable carrier detect options. The MRTI also examines the repeater receive private line decoder output via the P.L. Detect logic level input. On carrier squelch only systems this input is switch-disabled to provide a continuous P.L. detect condition.

MRTI PTT output connects to "repeater PTT". This PTT signal keys the repeater transmitter without disabling the repeater receiver audio circuits.

MRTI transmit audio output is also balanced to provide hum and noise immunity and connects to the repeater exciter audio input. The output is virtually transparent to circuit impedances of 600 ohms or less allowing connection or disconnection of the MRTI without affecting normal repeater audio levels.

P.L. Stripping, (transmit P.L. disable) a relay closure is provided. This feature is on/off-controllable by a mobile command and may be switch-programmed to operate on access. Release always resets this function.

Monitor, a relay closure is provided to disable receiver P.L. prior to ring signalling in applications where receive audio vox is used to detect mobile activity (as discussed previously, monitor also operates during standard ring signalling to mobiles).

Auxiliary receiver logic level and audio vox input also provided for use in systems requiring a separate monitor receiver to monitor the channel prior to ring or selective signalling.

FULL DUPLEX

(Duplex repeater, duplex mobiles and/or portables). Operation in this mode requires the FDMX module (E376/TDN6894). This mode features simultaneous land-line-to-mobile and mobile-to-land-line conversation. When the telephone line has been accessed for telephone conversation, the repeater transmitter is keyed continuously for the duration of the telephone conversation. The MRTI audio measurement and gain control circuits automatically standardize the mobile-to-land-line audio path, while the FDMX module audio circuits maintain a uniform average land-line-to-mobile audio path. The FDMX also features an electronic hybrid circuit which maintains a high quality audio path.

The radio interface module (RIMX) incorporates receiver audio input programming switches to establish "ballpark" input levels. The MRTI auto-level circuits further adjust audio levels within a 15 db range. The RIMX audio input is through a high impedance, balanced differential circuit to eliminate hum and noise pick up and adverse loading effects on the audio source. Repeater receive audio may be taken from several places as follows:

1. (preferred) discriminator or quadrature detector output, prior to high frequency rolloff. This method provides audio unaffected by level controls within the repeater. Moreover, the RIMX squelch circuit can be utilized, simplifying overall installation.

2. Local speaker audio amp output. The amplifier should be properly loaded to prevent frequency response problems associated with some transformer-type output circuits. The amplifier output level and local squelch control setting must be adjusted at installation and the settings maintained. Carrier detection in this method is switch selected for the RIMX carrier detect logic input, utilizing the repeater receiver squelch circuits or for the receive-audio vox detection by the MRTI audio circuits (not recommended).

3. Other intermediate receive audio source on the repeater receiver utilizing one of the two carrier detect methods described above.

Mobile carrier detect, as mentioned above, is necessary for control and for mobile timer reset and control function recognition. The RIMX provides switch selectable carrier detect options. The MRTI also examines the repeater receiver private line decoder output via the PL detect logic level output.

PL Detect logic level input. On carrier squelch only systems this input is switch-disabled to provide a continuous PL detect condition.

MRTI PTT output connects to "repeater PTT". This PTT signal keys the repeater transmitter without disabling the repeater receiver audio circuits.

MRTI Transmit Audio output is also balanced to provide hum and noise immunity and connects to the repeater exciter audio input. The output is virtually transparent to circuit impedances of 600 ohms or less allowing connection or disconnection of the MRTI without affecting normal repeater audio levels.

PL Stripping, (transmit PL disable) a relay closure is provided. This feature is on/off-controllable by a mobile command and may be switch-programmed to operate on access. Release always resets this function.

Monitor, a relay closure is provided to disable receiver PL prior to ring signalling in applications where receiver audio VOX is used to detect mobile activity. (as discussed previously, monitor also operates during standard ring signalling to mobiles).

Auxiliary Receiver logic level and audio VOX is provided for use in systems requiring a separate monitor receiver to monitor the channel prior to access, ring, or selective signalling.

SIGNAL SEARCH SIMPLEX

(Simplex base station, Simplex mobiles)

This mode is used when the MRTI interfaces the telephone line to a standard Simplex base station. When the telephone line is accessed for land-line and mobile conversation, the base station is keyed and taken down for short mobile-carrier sampling intervals, typically 20 milliseconds in duration every half second. Optional programming can select sample durations from 15 to 100 milliseconds at a sample rate of one every 250 milliseconds to one every 2.5 seconds. When mobile carrier is detected the transmitter is held down for an additional 350 milliseconds for receiver PL detection. If the PL signal is detected, the transmitter is held down until the loss of either carrier detect or PL detect. Upon loss of a valid mobile carrier, the transmitter again begins its previous sampling.

The radio interface module (RIMX) incorporates receive audio input programming switches to establish "ballpark" input levels. The MRTI audio measurement and gain control circuits further "auto level" the mobile to land-line and land-line to mobile audio paths within a 15 db range. Receive audio input is through a high impedance, balanced differential circuit to eliminate hum and noise pickup and adverse loading effects on the audio source.

Receive audio is obtained as follows:

1. Discriminator or quadrature detector output, prior to high frequency rolloff. This method provides audio unaffected by audio level controls. Moreover, the RIMX squelch circuit provides carrier detect, eliminating model-to-model receiver squelch circuit performance variations.

2. Other receive audio interface configurations are possible utilizing the base station squelch circuits for carrier detection but are not recommended.

   Base station transmit-to-receive recovery time must be less than 15 milliseconds for this mode, as is the case in most recent equipment. Optional programming (as previously discussed) is available for station equipment not meeting this requirement.

   PL Detect logic level input connects to the receiver private line decoder output. On carrier squelch systems this input is switch-disabled to provide a continuous PL detect condition.

MRTI PTT to one of the following:

1. (Preferred) Mike PTT. On private line squelch base stations this requires the disabling of reverse burst timing while the MRTI is operating the transmitter. The MONITOR relay closure is operated (closed) during access in this mode of

operation in order to facilitate this function. The monitor relay contacts connect to a point which disables the PTT delayed-off function and yet allows the private line encoder to operate.

2. A PTT point on the base station transmitter that does not activate the delayed-off (reverse burst) function. In some cases the point designated DELAYED PTT satisfies this condition.

   The MRTI PTT sense function, used to detect "station busy," "station ID required", is incorporated into the PTT output. Therefore, the station PTT source chosen should operate when the transmitter is keyed from base mikes, desk sets or other sources.

Transmit audio output is also balanced to provide hum and noise immunity and connects to the base station "mike high and mike lo" inputs. The MRTI output is virtually transparent to circuit impedances of 600 ohms or less. Jumpers that keep the base microphone or desk set handsets "hot" should be cut.

PL stripping,(transmit pl disable) a relay closure is provided. This feature is on/off-controllable by a mobile command and may be switch-programmed to operate on access. Release always resets this function.

Reverse burst disable relay closure. The Monitor relay is operated during access and provides a relay closure for disabling the delayed PTT function on P.L. stations. Also, operates during standard ring signalling.

ENHANCED VOX SIMPLEX

(Simplex base station, Simplex mobiles/portables) used in high interference environments where signal search simplex is not feasible or in applications where mobile carrier is not directly available, i.e., repeater control stations or remote control points. Operation in this mode requires the E375/TDN6893 Enhanced VOX Option. This mode features negative response time VOX operation on land-line audio utilizing digitally delayed transmit audio. This eliminates "lost words" from the telephone party while maintaining apparent instant VOX response time. Featured also are audio processing circuits that automatically adjust the VOX circuits thresholds for background noise and detects the presence of land-line signalling such as dial tone, busy tone, etc.

The mode of operation is standard cross-lockout VOX. Initially, with no audio detected from the mobiles or from the land-line, the MRTI is in the idle condition with the base station in receive. VOX detected audio from either direction will lock out the other direction. Receive audio from the mobile maintains the receive condition. Land-line speech maintains the transmit condition. Land-line signalling is allowed to proceed for a few

seconds in order to alert the mobile. Then the transmitter is taken down to allow mobile response. Landline audio is maintained at a uniform average level and digitally delayed on the OSVX module while the MRTI audio measurement and gain control circuits standardize the mobile-to-land-line audio path.
The radio interface module (RIMX) incorporates receive audio input programming switches to establish "ballpark" input levels. The MRTI audio circuits further adjust audio levels within a 15 db range. The RIMX audio input is through a high impedance balanced differential circuit to eliminate hum and noise pickup and adverse loading effects on the audio source.

Receiver Audio may be obtained from either of the following sources:

1. Discriminator or quadrature detector output. This method provides audio that is unaffected by audio level controls. Moreover, the RIMX internal squelch circuit can provide carrier detect, simplifying installation. This method may be used on repeater control stations where the repeater is set for zero turn-off delay.

2. A source of squelched speaker audio that is unaffected by front panel level controls. Receiver audio VOX is normally used in this method to indicate mobile activity.

   Mobile carrier detect used with method 1, above.
   The preferred source is the RIMX internal squelch circuit. Under special circumstances, the carrier detect logic input may be used in conjunction with the base station squelch circuits.

   PL detect used with method 1, is connected to the base station receiver PL decoder output. In carrier squelch only systems, this input is switch-disabled to provide a continuous PL indication.

   Monitor output relay closure connects to the receiver PL disable input (necessary only when using methods 2 above). This output is used to monitor the channel prior to ring signalling, and operates during standard ring signalling to mobiles.

MRTI PTT CONNECTS TO MIKE PTT.

MRTI transmit audio is balanced to provide hum and noise immunity and connects to the "mike hi" and "mike lo" inputs. The MRTI output is virtually transparent to circuit impedances of 600 ohms or less. Jumpers that keep the microphone or desk-set handsets hot" must be cut.

PL stripping (transmit PL disable). A relay closure is provided. This feature is on/off-controllable by a mobile command and may be switch-programmed to operate on access. Release always resets this function.

MRTI Grounding and Lightning Protection

To provide ground reference for the logic inputs to the MRTI and to enable the extensive lightning and surge protection in the MRTI, the MRTI must be ground bonded to the associated radio equipment through the supplied #12 wire, or larger,by connection to the bolt marked EARTH GROUND on the MRTI rear panel and to the radio equipment frame. The connection to the radio frame should be to bright metal that is a part of the radio proper such as an internal side rail, the connection marked GROUND on the newer series of base stations or by removing one of the antenna connector screws and using a lug of the correct size on products such as MAXAR, MOXIE. This grounding should be extended to the ground utilized by the telephone company's surge protector installed on the phone line(s) used by the MRTI.

General System Lightning Protection Considerations

The damage done by lightning is due to potential differences developed between equipments, between equipment and the power source, between equipment and the outside telephone line and finally between equipment and earth ground. Two things are imperative if we are to minimize lightning damage.

1. All equipment at a site should be bonded frame-to-frame with adequately sized conductor. This common ground should be bonded to the utility entrance ground cable and the telephone entrance ground, if different from the utility entrance ground. Bear in mind that lightning is essentially r.f. and as such does not like long leads and will not tolerate sharp bends, as it "sees" this as a high impedance. If a tower is used it is essential that the common ground system also be bonded to the tower. At a site where these various components are encountered (tower, utility ground, telephone ground) it is suggested that #6 bare copper be used as a minimum.

2. The degree of insurance against lightning, after bonding, is almost directly related to the RESISTANCE of the earth ground (s) used. All grounds connected in parallel contribute to lowering the net ground resistance (tower, utility, telephone, if independent). For "hot" sites (sites where lightning is known to regularly cause damage) it is well to use multiple ground rods spaced several feet apart and bonded together with #6 or better wire. If soil is sandy or rocky the local utility company can usually provide excellent advice if their engineering office is contacted relative to the local methods used to obtain a low resistance ground. Many times these utility engineering departments will measure your site effective ground resistance with their specialized equipment, if approached in the right way. Remember the potential of lightning is what does the damage and the lower the ground resistance, the lower the lightning potential.

Set-up and Interfacing
RIMX (RADIO INTERFACE MODULE)
Switch Settings

All of the MRTI inputs and outputs connected to the radio station equipment are located on the RIMX. The base receiver-related audio and logic input circuits are switch programmable to accommodate the various operating mode requirements. The following is a description of switch functions.

SW1	PL Detect enable	on for private line systems off for carrier squelch systems
SW2	carrier detect select:	on for external squelch circuit off for internal squelch circuit
SW3	carrier detect logic direction (SW2 on)	on for carrier = toward ground off for carrier = toward + supply
SW4	PL detect input logic direction (SW1 on)	on for PL detect = toward ground off for PL detect = toward + supply
SW5	RX audio lvl select: (see below)	on selects low level input off selects high level input
SW6	RX audio de-emphasis select: (see below)	on selects no de-emphasis off selects 6db/octave de-emphasis

Receiver audio level requirements

Receive Audio Source	SW5	SW6	level from receiver: (1000hz tone deviated 4khz)
high level disc./detector	off	off	approx. - 5db (.45 vac)
low level disc./detector	on	off	approx. -20db (.08 vac)
high level speaker audio	off	on	approx. +10db (2.5 vac)
low level speaker audio	on	on	approx. - 5db (.45 vac)

Examples of low level detector audio are MAXAR 80 and FLEXAR base station receivers. High level discriminator/detector audio - from MICOR base/repeater, r1 DISC INPUT or MITREK base, buffered detector audio.

OPTIONAL INPUTS

Auxiliary Receiver Audio
This input is not level-programmable and requires a nominal input level of 0db (.78 vac).

Auxiliary Receiver Carrier Indicator Logic input. Alternate for above. Used in applications requiring monitor receivers. Logic low = carrier.

Patch Inhibit Logic input. A logic-low disables mobile and land-line signalling.

RIMX INPUT/OUTPUT INTERFACE

p12	color	function	I or O
pin 1	brn	TX PL disable (stripping)	relay output
pin 2	red	TX PL disable return	relay output
pin 3	org	monitor (or reverse burst disable)	relay output
pin 4	yel	monitor return	relay output
pin 5	grn	PTT ground (return)	relay output
pin 6	blu	receiver carrier indicator	logic input
pin 7	vio	receiver audio return	linear input
pin 8	gry	receiver audio high	linear input
pin 9	wht	PTT (and PTT sense)	relay output
pin 10	blk	receive PL detect	logic input
pin 11	tan	transmit audio return	linear output
pin 12	pnk	transmit audio high	linear output

P11		optional functions	
pin 1	brn	auxiliary receiver audio low	linear input
pin 2	red	auxiliary receiver audio high	linear input
pin 3	org	patch inhibit	logic input
pin 4	yel	aux. receiver carrier detect	logic input

p13		power supply input
pin 1	black	d.c. negative(-)
pin 2	red/blk	d.c. positive (+), 10.5-16v/a.c. input
pin 3	black	a.c. input, 18 vac nominal

INPUT/OUTPUT SPECIFICATIONS

The RIMX contains the lightning protected logic and linear input/output signal circuits and the power supply for the MRTI. With the exception of the receiver carrier indicator logic input, all logic level inputs are protected 5-volt CMOS Schmitt trigger type and will accept input logic "hi" level of 3.5 volts and a maximum logic "lo" level of 1.5 volts. The carrier indicator logic input has an adjustable switching threshold with a range of +.03 volts to +11.7 volts with a maximum hysteresis of 0.5 volts at the 6-volt threshold level. This input also accepts logic high levels in excess of 100 volts.

The linear audio inputs are in balanced differential configuration to minimize cross-talk and hum. The transmit audio output is in balanced transformer, dc isolated configuration.

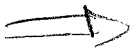
The outputs are 0.5 amp dry relay closures which are protected against burn-out by 10 ohm or 2.7 ohm fusing resistors.

OTX SWITCH SETTINGS

Additional system programming is accomplished by 16 switches on the OTX processor board as follows:

SWITCH	
SW1 - Section 1	Auxiliary receiver channel monitor mode: on = audio VOX (receive audio) off = logic level input
SW1 - Section 2	Channel monitor source: on = main receiver off = aux. receiver
SW1 - Section 3	Main receiver carrier indicator source on = RIMX squelch/logic level input off = audio VOX (receive audio) Note: when in the off position, receive audio is used as the source for carrier indication i.e. (the MRTI detects that the mobile is transmitting by the presence of receive audio). RIMX/logic level (SW1-3 ON) is recommended in all cases even when the Enhanced VOX Option is installed, unless it is not possible to obtain an input from the receiver discriminator or a logic level input from the squelch detector in the receiver,as in installations directly to a remote control console where the actual receiver is inaccessible.
SW1 - Section 4	Toll restriction on = restrict off = no restriction
SW1 - Section 5	Signalling to switched network on = Touch-Code off = rotary
SW1 - Section 6	Mobile call origination on = yes off = no (refer to Page G-3, Parameter 96)
SW1 - Section 7	Switched network (land-to-mobile) call origination on = yes off = no
SW1 - Section 8	Duplex/simplex select on = half duplex, full duplex off = simplex

SW2 - Section 1	Option
SW2 - Section 2	Access time coded tones on = tones off = no tones
SW2 - Section 3	60-second mobile inactivity disconnect on = yes off = no
SW2 - Section 4	Emergency three-minute timer override on = can be overridden off = cannot be overridden
SW2 - Section 5	3-minute access timer: on = automatic release after 3 minutes off = no 3-minute release
SW2 - Section 6	Mobile signalling start. (land-to-mobile calls) on = first ring off = fourth ring
SW2 - Section 7	Transmit PL stripping on = automatic on access off = on command only
SW2 - Section 8	Attendant (line sharing) telephone set control on = yes off = no



Upon completion of switch programming, press the red "reset" button. This causes the MRTI to "read" the switches and change the program appropriately. This must be done every time a switch setting is changed.

LEVEL SETTING

The MRTI should now be connected to the radio station equipment and the RIMX and OTX switches set as appropriate to user specifications.

Transmitter Audio Level The following tests associated with the TX level setting will indicate transmitter modulator - IDC circuit performance and overall quality of the land-line-to-mobile audio.

Before proceeding, disable the private line encoder output (or remove PL reed) so that no PL code/tone is transmitted during the tests.

Now press the gray "test" button once for test 1 as shown on the numeric display of OTX board. After one second the MRTI will output the Touch-Code # signal to the transmitter. Adjust the TX LVL control on the RIMX for 3.0 khz deviation. Press and release the test button, stepping to test 8 as indicated on the display. The purpose of this test is to determine IDC circuit level set and performance. The MRTI will output a sequence of nine tones numbering 0 to 8 on the display. The sequence may be stopped at any tone by pressing the red "reset" button during that tone interval. Pressing the reset button again will resume the sequence. With proper IDC level setting the deviation levels should be as follows (w/o PL).

Tone number 0 approx. 1.3 khz deviation (697 hz)
Tone number 7 approx. 2.5 khz deviation (1633 hz)
Tone number 8 approx. 4.5 khz deviation (2000 hz)
Tone number 8 is 5 db higher in level than the other tones and should put the IDC circuit just into limiting. If these levels are not closely duplicated, it will be necessary to readjust the transmitter IDC level and check the modulator circuit tuning (if any).

After testing is finished, step the "test button" to the off position. (The test condition will "time out" in 15 minutes as a precaution.)

Carrier Detect Adjustments

1. If utilizing the RIMX squelch circuit for carrier detection and not the carrier detect logic input:
   Starting from the maximum level (clockwise) adjust the squelch control on the RIMX so that the desired quieting level (at least 10 db recommended) causes the carrier det. LED to light.

2. If utilizing the carrier detect logic input and not the squelch circuit for carrier detection:
   Adjust the threshold control on the RIMX so that the carrier det. LED lights when the receiver is "unsquelched" and goes off in the "squelched" condition.

Receiver Levels

1. If utilizing the discriminator/detector output:
   No level setting necessary apart from RIMX switch settings.

2. If utilizing speaker audio source:
   Adjust the internal volume control (where applicable, such as wire-line remote consoles) for a level of +10 db (2.5 vac) or alternately -5 db (0.45 vac) (see RIMX Set-up and Interfacing section) with a 1000 hz tone, deviated 4 khz into the receiver.

   Level setting complete.

INSTALLATION CHECKLIST

1. Connect MRTI to radio station.

2. Check for proper grounding and lightning protection.

3. Set switches on RIMX board.
   (refer to RIMX Switch Settings)

4. Set switches on OTX board.
   (refer to OTX Switch Settings)

5. Installation level checklist
   a. Punch up test 1. set TX deviation to
      3 khz (no PL tone)

   b. Punch up test 8-tone 8. Insure 4.5 khz deviation.

   c. Carrier detect/squelch adjustment.

   d. Receiver Audio:
      Discriminator/detector source; no level
      setting necessary. Check setting of SW5
      and SW6 on RIMX.
      Speaker audio source; set volume control
      for +10db (2.5 vac) or -5db (0.45 vac)
      while receiving 1000 hz @ 4 khz deviation
      (SW5 and SW6 on RIMX set accordingly).

6. Enter option parameter data where applicable
   (refer to Options section of this manual).

SYSTEM SELF-TESTS

The self-contained tests are invoked and controlled by the test and reset buttons on the OTX processor board. Each time the test button is depressed,the next test is selected. The test number is displayed for 1 second upon entry into test before the test is started. This allows entry into any test without activating other tests. Each time the test or reset buttons are depressed, the test timer is reset. If and when the test timer reaches 15 minutes, the MRTI will revert to the normal idle condition, ready to handle communications.

1. Level Set/Check to Transmitter and Switched Network. Touch code "#" is generated and sent to the transmitter and switched network amplifiers at the reference level. The transmitter is keyed and the SN is accessed. This test is used to adjust and/or check the level to the associated transmitter. The transmitter is adjusted to +-3 kc deviation (in a 5 kc system). If the switched network line is 600 ohms, the level to the SN will be -10 dbm +- 1.5db. The decimal point on the LED display indicates the state of the patch inhibit input, lighting when at logic low.

2. Transmitter and SN Linearity/Touch-Code Decoder Test. This test effectively tests most of the linear circuits in the MRTI. The transmitter is keyed, the sn is accessed and TX PL disable is activated. The tone generators generate touch-code "1" to "0", "*", and "#" at 8 levels from -18 db to +5 db, 3 db steps (with respect to reference in test 1). The tones are sent to the phone line and the transmitter. The Touch-Code decoder is fed from the phone line (effectively) and its output displayed on the LED display. The display decimal point displays "data valid". Therefore, with the phone line unterminated, the display should show all 8 levels of all tones except "*" and "#" which cannot be displayed (although the decimal point will indicate "data valid"). The reset button will slow the test. The second reset will freeze the test, and the next reset will resume the test.

3. Receiver to SN Test. This test may be used to test mobile Touch-Code encoders, distortion, etc. The SN is accessed and the monitor function is activated. The audio path from the receiver through the variable gain stage, to the switched network is established. The Touch-Code decoder is fed from the receiver, and its output displayed on the LED display. When the decimal point is on, Touch-Code data valid is indicated. The audio path is autoleveled by the processor to test the firmware.

4. Switched Network to Transmitter Test. This test tests SN autoleveling. The transmitter is keyed, the SN accessed and the audio path from the sn through the variable gain stage to the transmitter is established. The Touch-Code decoder is driven from the sn and displayed on the display. SN VOX (processor determined) is indicated by the decimal point.

5. Receiver to SN Signalling Test. Tests audio paths from the receiver to the SN and Touch-Code decoder. The sn is accessed and the audio path from the receiver, through the variable gain stage, to the sn is enabled (when not receiving telephone number signalling). The Touch-Code decoder is driven from the receiver and displayed on the display. The decimal point is on when RX VOX (processor determine) is detected.

6. Auxiliary Receiver Tests. Tests the audio and logic inputs from an auxiliary receiver. The sn is accessed, the audio path is established from the auxiliary receiver through the variable gain stage to the sn (Multiline L1158A only). The decimal point indicates auxiliary receiver logic low input if SW1, Section 1 is off or auxiliary receiver VOX if SW1, Section 1 is on. Also tests contacts of switches 1 and 2 of the OTX board. With all switches on, A "1" should be displayed. Afterward, each switch may be exercised to test for proper operation, observing that the displayed "1" extinguishes only when an individual switch is turned completely off.

7. Non-accessed Switched Network Test. Tests the MRTI ability to monitor activity on its telephone line when not accessed. The transmitter is keyed and the audio path is established from the non-accessed telephone line through the variable gain stage to the transmitter when "off hook" is detected by the MRTI. The decimal point "on" indicates off hook. The Touch-Code decoder is driven from the non-accessed SN and displayed on the display. Ringing on the non-accessed SN is indicated by the flashing of the decimal point.

8. Single Tones to the Transmitter and SN. Single tones are sent to the transmitter and switched network at 0 db (with respect to reference in test 1) except for tone #8 (+5 db). The sn is accessed and the transmitter keyed; each tone is .5 seconds. Reset freezes the test and a second reset resumes the test. The tone number is displayed on the display. The decimal point on indicates PL/DPL logic input or carrier indicate.

   0 = 697
   1 = 770
   2 = 852
   3 = 942
   4 = 1209
   5 = 1336
   6 = 1477
   7 = 1633
   8 = 2000 at +5 db

9. This test position is used to modify parameters in the optional NVRAM. Refer to the section "Parameter Modification Procedure" in the Option E155/TDN6908, Section A, for details.

CIRCUIT DESCRIPTION / THEORY of OPERATION

RLM-3 Registered Line Module

The RLM-3 interfaces the public switched telephone network to the MRTI control module. It is registered with the FCC under part 68 of the FCC regulations. It provides a very high degree of isolation from lightning type impulse voltages on the telephone lines when properly installed and grounded in the radio system as detailed in this manual under "lightning protection." The RLM-3 also provided the time averaged signal power limiting circuitry as well as the out-of-band signal limiting chracteristics required by FCC regulation for registration under the most demanding device category regulation ("VP").

The LIM-1 module on the RLM-3 monitors dc and ac voltages on the telephone line, converting them to levels and signals usable by the OTX control module. Pin 4 of the RLM-3 outputs switched network audio (accessed or not accessed) at the same level as seen on the telephone line. Additionally, the dc level is logic high when the PSTN voltage is below approximately 17 volts and logic low when the PSTN voltage is above approximately 17 volts. This indicates to the OTX control module when the line is in use by another party (or defective). Pin 3 of the RLM-3 outputs logic high when the voltage on the PSTN exceeds approximately 65 volts and logic low below 65 volts. The OTX module uses this information to detect ringing on the PSTN (after checking the period of several transitions to insure the signal being received is ring and not dial pulses).

The OTX module accesses and pulse dials the telephone line (if applicable) by putting logic low on pin 5 of the RLM-3.

RIMX Radio Interface Module

The RIMX interfaces the radio system (remote, microwave channel, etc.) to the OTX control module. Additionally, the input power is converted to the voltages required by the system. A very high degree of immunity to lightning type impulses is achieved in the design and layout of the RIMX.

Power for the MRTI is supplied through a transformer that is plugged into a receptacle external to the MRTI. This transformer inherently provides a large amount of protection from impulses and surges. Also powered by external D.C. thru P11, pin 1 and 2. A.C. input 18v nominal. D.C. 10.5-16v.

Additional thyristor protection is provided on the RIMX and is very effective when the MRTI is installed and grounded in the radio system as detailed in this manual under "Lightning Protection.

IC1 is the constant frequency, pulse-width controlled switching regulator control element for the 5-volt supply. D21 provides failure mode protection for the system. IC2 is the switching regulator for the -6 supply.

Logic outputs to the radio are through relay closures, and logic inputs from external sources are through high impedance (200k) inputs. Audio output to the radio transmitter is through an isolation transformer, driven by a variable gain amplifier stage. Audio inputs from the receiver and optionally an auxiliary channel monitor receiver, are via high impedance, balanced, differential inputs.

PL detect input from radio (if applicable) can be set to respond to positive or negative inputs, or disabled for carrier squelch or audio VOX applications.

If a logic level input is required for receiver carrier indication, switches can select either polarity, and a threshold control adjusted to respond to small or asymmetrical swing signals. Indicator LEDs are included to monitor input and output logic states, considerably simplifying installation and subsequent trouble shooting.

SW5 compensates for high level/low level audio sources (discriminator, quadrature detector, etc.) and SW6 selects flat response (from audio output circuits) or 6 db/octave rolloff (taken from radio detector). The internal squelch control is set for 10-20 db of quieting, when used.

OTX System Processor Board

The OTX control board can be broken down into functional blocks as follows:

1. Digitally controlled audio gain stage consisting of ICs 36, 35, 34 and 33. The processor can select the gain stage input via IC36 and route the gain stage output to various locations via IC33. Processor control of IC34 controls the gain of the function block. IC35A , and IC35B comprise a high pass filter to eliminate hum, pl, etc. IC35 converts the CMOS ladder network in IC35 to a variable gain function.

2. Tone Generator 1 and 2
   The programmable timer module (PTM) IC11 produces square waves at the required frequency under firmware control. These square waves are converted to triangle waves by transconductance amp IC22. Ground reference is guaranteed by inverters F and E of IC24, and IC25. Peak value is determined by IC24D, IC25A, C49 and IC26D. This peak value is applied to step comparator IC27. The digital output at the step comparator is converted to a 20 step sine wave by the associated resistor network. Processor controlled amplitude is provided by IC30C, IC30D and IC29C. Low pass filter IC29C removes the steps in the sine wave and IC31 distributes the resultant output to various circuits. Tone generator 2 is the same except its low pass filter rolls off at a higher (-3db at 2500 hz) frequency.

3. Peak Reading Voltmeter Circuit
Processor controlled input to the voltmeter is via IC38. Range select is controlled by IC39 and amplifier IC42C. This signal is rectified by the precision rectifier circuit of IC42D and IC42A. This dc level is compared with the voltage generated by counter IC40 and associated 1R-2R resistor network, in comparator IC42B. The comparator output controls clock generator IC43C. The processor selects an input, sets the range, and resets the counter. When an ac signal is detected, the counter counts up to the peak value of the signal. The processor will then read the counter output and respond as required.

4. Switches Network Amplifiers

IC41A mixes the various signal sources in a summing amplifier configuration. This summed signal drives the switched network line through driver IC4C. Signals from the switched network are amplified by IC4B and distributed as necessary. IC41D amplifies the signal from the nonaccessed switch network, and IC21E detects the associated logic level.

5. Transmitter Summing Amplifier
Signals from the various sources are summed in amplifier IC41D and sent to the RIMX.

6. Touch-Code Decoder
Touch-code decoder IC20 is time shared on the various inputs. The processor selects an input for the decoder via IC37 and reads the results.

7. Mic. non-buss related circuits
   A. Display decoder
   IC18 decodes and drives the LED display in response to processor commands.

   B. Programming Switches
   Switch bank SW1 is continuously available to the processor for reading while switch bank SW2 is multiplexed with display information and tone generator amplitude signals. Therefore, to read SW2, the processor reconfigures the associated lines as inputs, reads the switches, and restores the line as outputs.

   C. Reset and test switches.
   These switches cause interrupts to the processor and the processor responds as required. System reset is not generated by the reset button.

8. System Reset Circuitry
Power up (C6 being discharged) causes processor IC10 to be initially reset. Upon charging, the reset is removed. IF the unregulated supply on the RIMX drops below 15 volts, (power fail), IC43A and IC43D cause NMI (non-maskable interrupt) to occur first, causing the processor to go into a

non-volatile RAM protection routine. Then system reset is exerted. When the system is operating normally, interrupts are generated every 5 milliseconds on the IRQ line (short, negative pulses every 5 milliseconds). It has been established that anything that upsets normal processor operation (such as inadvertently shorting data lines, induced pulses from external sources, etc.) will cause the IRQ pulses to change drastically in frequency. IC3C and associated parts keep reset from occurring as long as IRQ pulses are present. When lost, the system will automatically reset and attempt restarts until successful.

9. Processor Bus Related Functions

A. Chip select decoder
IC2 decodes the addresses generated by the processor and enables the appropriate ROM, RAM, PIA or PTM.

B. NVRAM (optional)

IC1 provides 256 four-bit bytes of shadow - type nonvolatile random access memory.

C. Processor
IC10 is the microprocessor which controls the MRTI System. The 3.58 mhz clock signal is derived from the Touch-Code decoder IC20 which is crystal controlled.

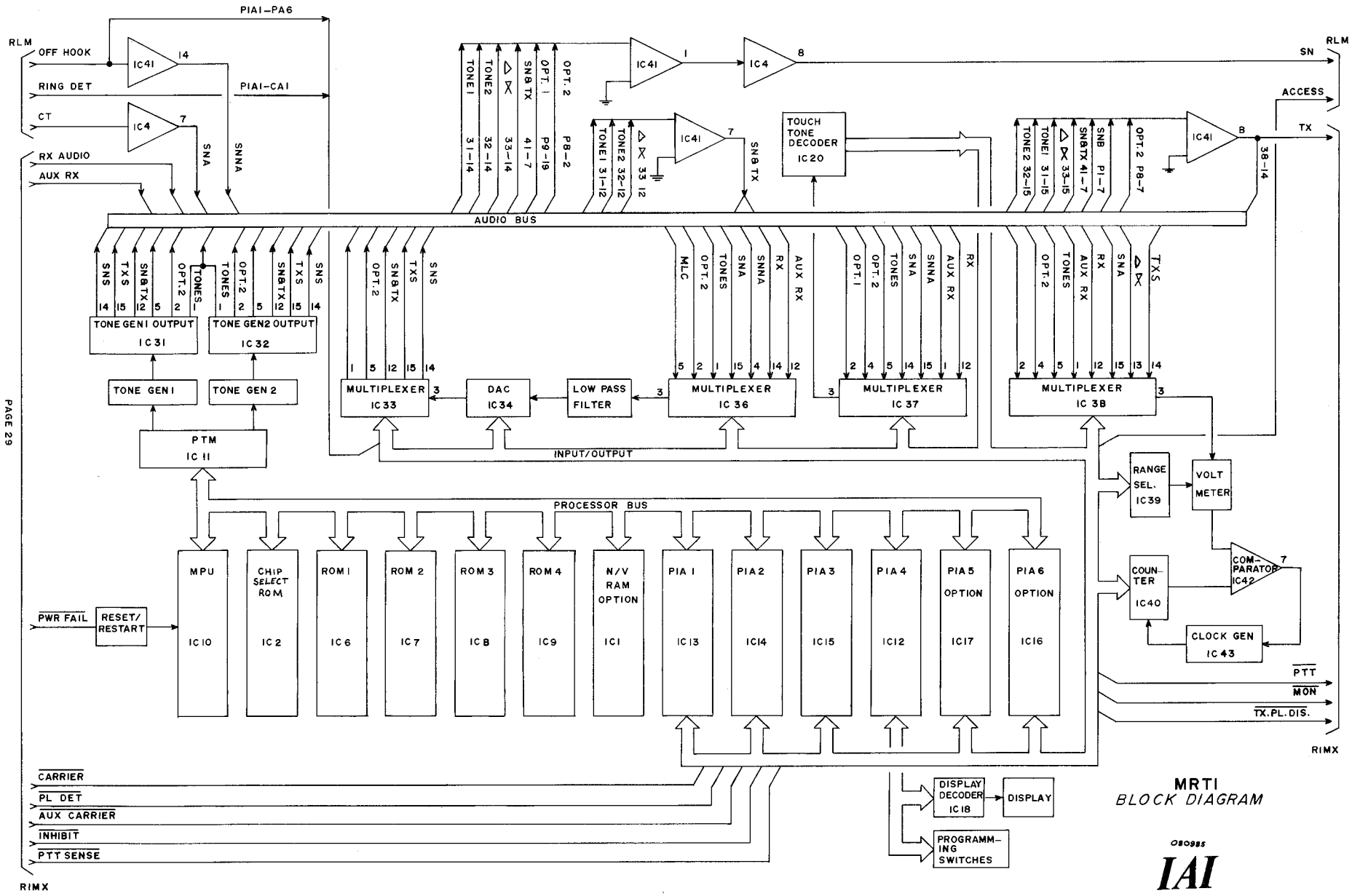
D. Parallel Interface Adaptors
PIAs, IC12, 13, 14, 15 and optionally 16, 17 are 20-line devices which can be programmed by the processor such that each line can be an input readable by the processor or a latched output. Most of the inputs and outputs of the processor are through these PIAs.

E. Programmable timer module
IC11 is a three-section timer module that times the 5 millisecond interrupts, and generates the square waves for tone generators 1 and 2.

F. Read Only Memories

The MRTI processor program is contained in read only memory (ROMs) and is field replaceable (socketed) as necessary. Basic firmware is contained in one or more ROMs so marked, and optional firmware, (autodial, multi-function utilities or selective signalling) is contained in other ROM(s) also designated. A 2-letter designation indicates the supplied firmware as follows:

BSC - Basic MRTI firmware, required for all MRTI functions
UT - Multifunction Utilities - Option E377/TDN6895
AD - Autodial 1 - Option E378/TDN6896
SS - Selective Signalling - Option E380/TDN6893

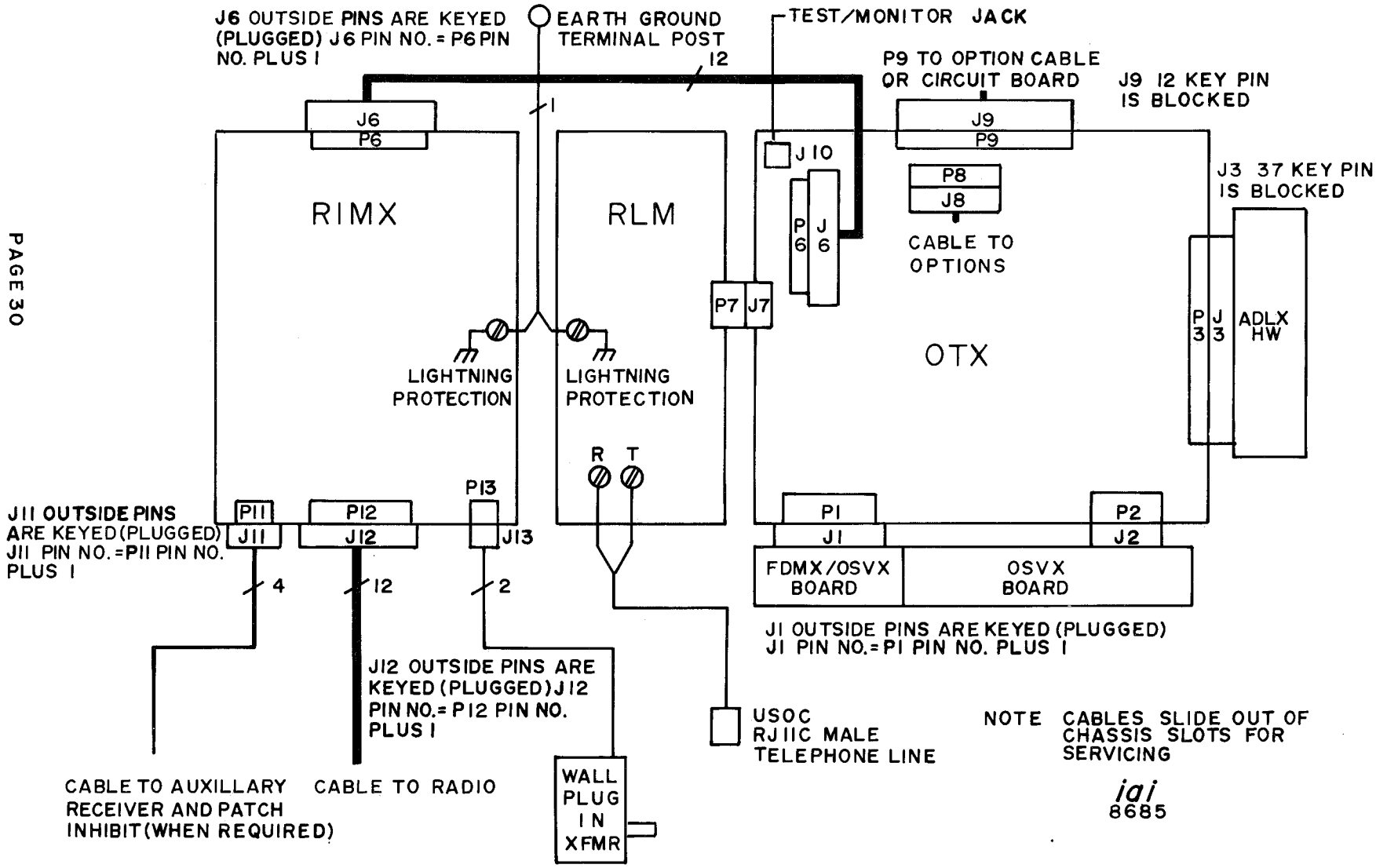


MRTI
BLOCK DIAGRAM

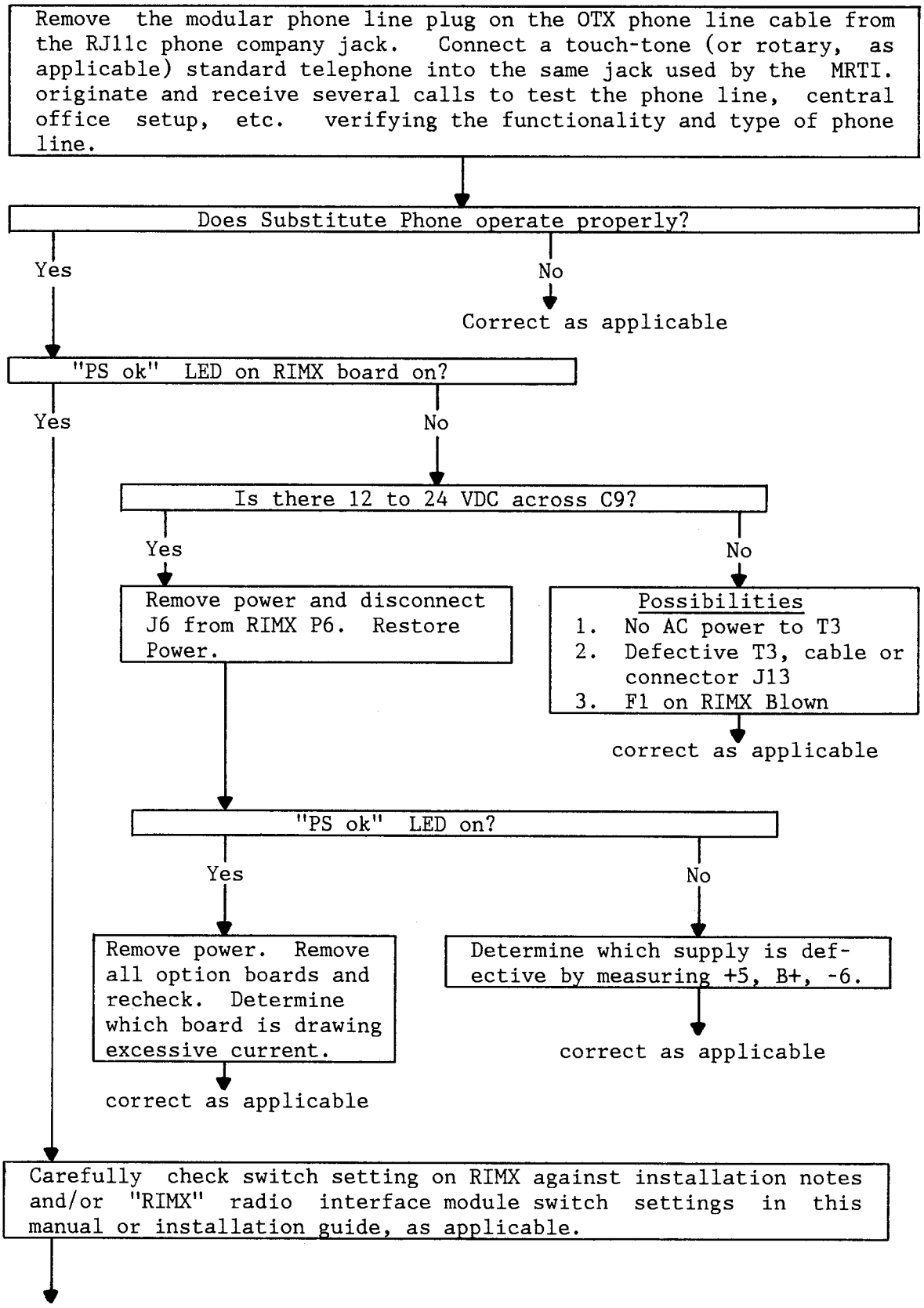
080985

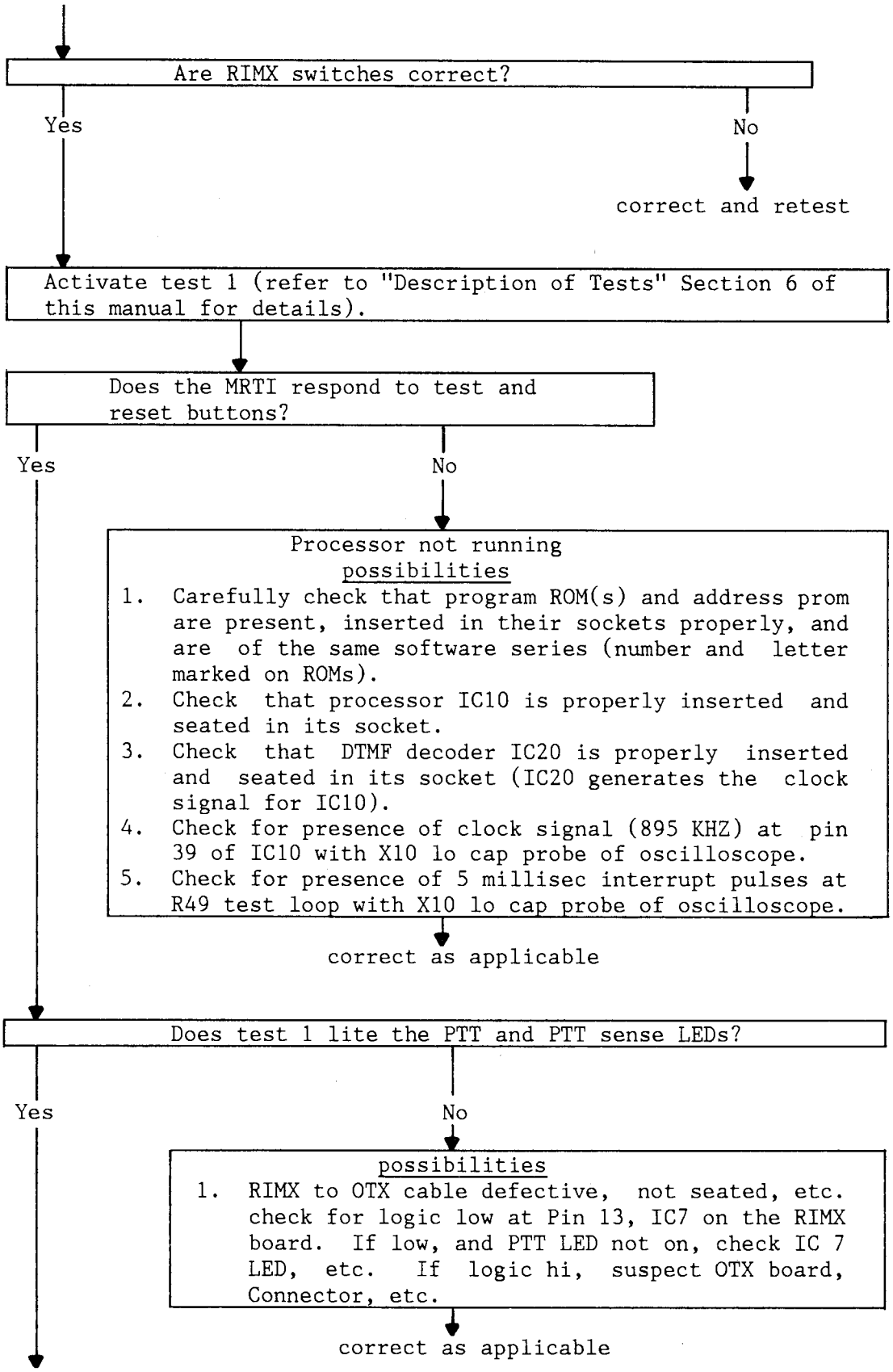
IAI

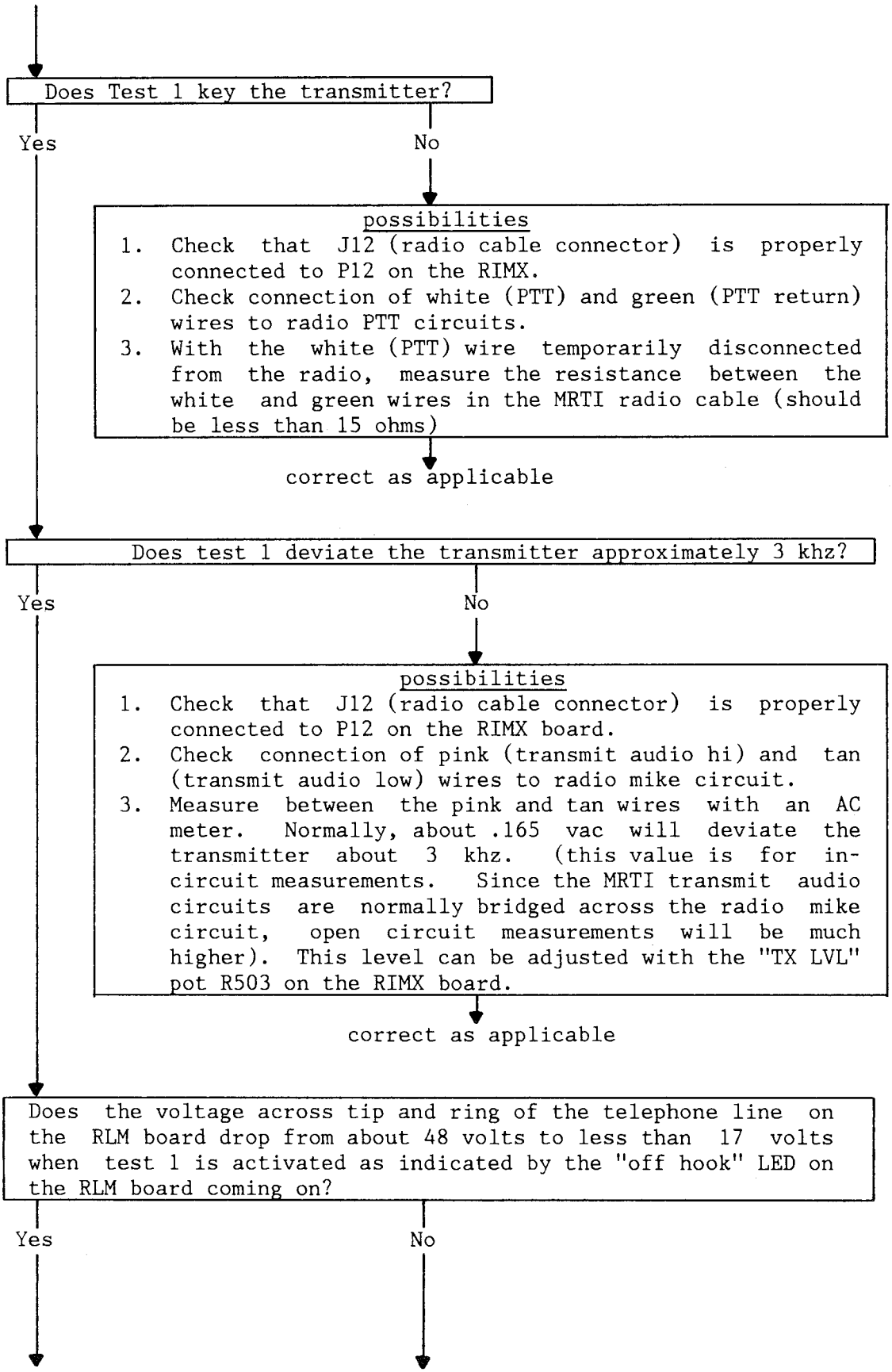
MRTI INTERCONNECT DIAGRAM

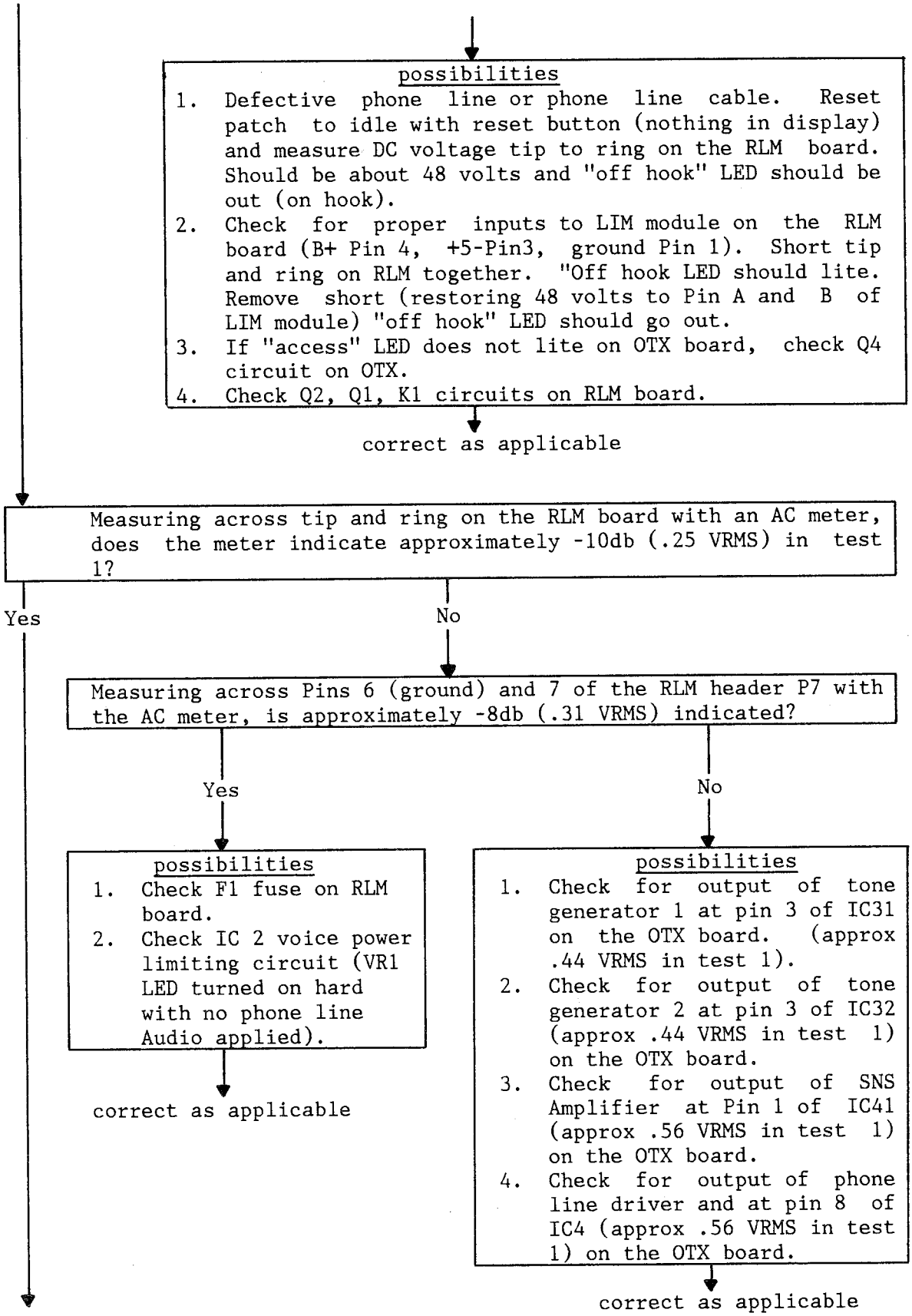


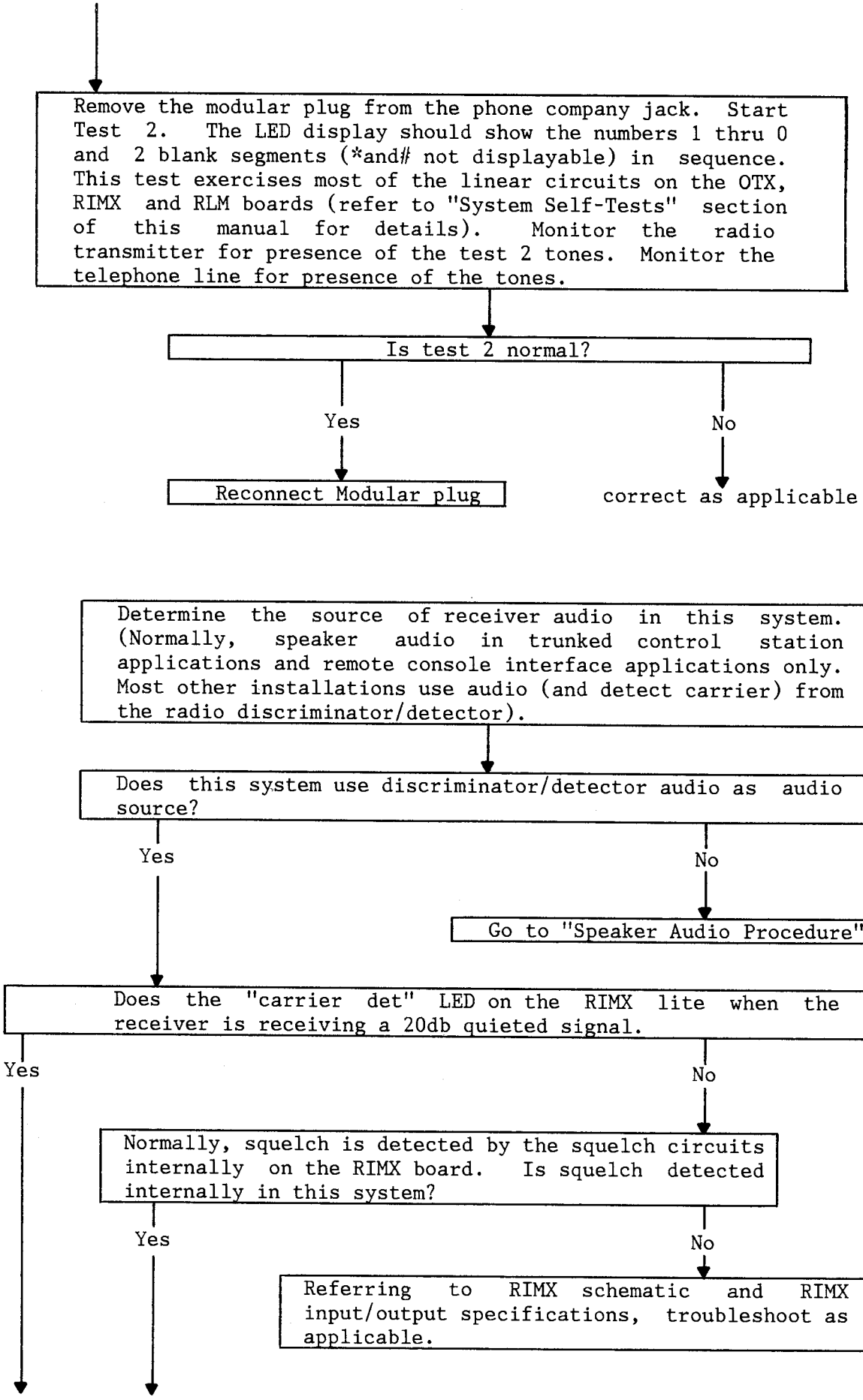
SYSTEM TROUBLESHOOTING-FLOW CHART




Are RIMX switches correct?
Yes
No
correct and retest
Activate test 1 (refer to "Description of Tests" Section 6 of this manual for details).
Does the MRTI respond to test and reset buttons?
Yes
No
Processor not running
possibilities
1. Carefully check that program ROM(s) and address prom are present, inserted in their sockets properly, and are of the same software series (number and letter marked on ROMs).
2. Check that processor IC10 is properly inserted and seated in its socket.
3. Check that DTMF decoder IC20 is properly inserted and seated in its socket (IC20 generates the clock signal for IC10).
4. Check for presence of clock signal (895 KHZ) at pin 39 of IC10 with X10 lo cap probe of oscilloscope.
5. Check for presence of 5 millisec interrupt pulses at R49 test loop with X10 lo cap probe of oscilloscope.
correct as applicable
Does test 1 lite the PTT and PTT sense LEDs?
Yes
No
possibilities
1. RIMX to OTX cable defective, not seated, etc. check for logic low at Pin 13, IC7 on the RIMX board. If low, and PTT LED not on, check IC 7 LED, etc. If logic hi, suspect OTX board, Connector, etc.
correct as applicable


Does Test 1 key the transmitter?
Yes
No
possibilities
1. Check that J12 (radio cable connector) is properly connected to P12 on the RIMX.
2. Check connection of white (PTT) and green (PTT return) wires to radio PTT circuits.
3. With the white (PTT) wire temporarily disconnected from the radio, measure the resistance between the white and green wires in the MRTI radio cable (should be less than 15 ohms)
correct as applicable
Does test 1 deviate the transmitter approximately 3 khz?
Yes
No
possibilities
1. Check that J12 (radio cable connector) is properly connected to P12 on the RIMX board.
2. Check connection of pink (transmit audio hi) and tan (transmit audio low) wires to radio mike circuit.
3. Measure between the pink and tan wires with an AC meter. Normally, about .165 vac will deviate the transmitter about 3 khz. (this value is for in-circuit measurements. Since the MRTI transmit audio circuits are normally bridged across the radio mike circuit, open circuit measurements will be much higher). This level can be adjusted with the "TX LVL" pot R503 on the RIMX board.
correct as applicable
Does the voltage across tip and ring of the telephone line on the RLM board drop from about 48 volts to less than 17 volts when test 1 is activated as indicated by the "off hook" LED on the RLM board coming on?
Yes
No


possibilities
1. Defective phone line or phone line cable. Reset patch to idle with reset button (nothing in display) and measure DC voltage tip to ring on the RLM board. Should be about 48 volts and "off hook" LED should be out (on hook).
2. Check for proper inputs to LIM module on the RLM board (B+ Pin 4, +5-Pin3, ground Pin 1). Short tip and ring on RLM together. "Off hook LED should lite. Remove short (restoring 48 volts to Pin A and B of LIM module) "off hook" LED should go out.
3. If "access" LED does not lite on OTX board, check Q4 circuit on OTX.
4. Check Q2, Q1, K1 circuits on RLM board.
correct as applicable
Measuring across tip and ring on the RLM board with an AC meter, does the meter indicate approximately -10db (.25 VRMS) in test 1?
Yes
No
Measuring across Pins 6 (ground) and 7 of the RLM header P7 with the AC meter, is approximately -8db (.31 VRMS) indicated?
Yes
No
possibilities
1. Check F1 fuse on RLM board.
2. Check IC 2 voice power limiting circuit (VR1 LED turned on hard with no phone line Audio applied).
correct as applicable
possibilities
1. Check for output of tone generator 1 at pin 3 of IC31 on the OTX board. (approx .44 VRMS in test 1).
2. Check for output of tone generator 2 at pin 3 of IC32 (approx .44 VRMS in test 1) on the OTX board.
3. Check for output of SNS Amplifier at Pin 1 of IC41 (approx .56 VRMS in test 1) on the OTX board.
4. Check for output of phone line driver and at pin 8 of IC4 (approx .56 VRMS in test 1) on the OTX board.
correct as applicable


Remove the modular plug from the phone company jack. Start Test 2. The LED display should show the numbers 1 thru 0 and 2 blank segments (*and# not displayable) in sequence. This test exercises most of the linear circuits on the OTX, RIMX and RLM boards (refer to "System Self-Tests" section of this manual for details). Monitor the radio transmitter for presence of the test 2 tones. Monitor the telephone line for presence of the tones.
Is test 2 normal?
Yes
No
Reconnect Modular plug
correct as applicable
Determine the source of receiver audio in this system. (Normally, speaker audio in trunked control station applications and remote console interface applications only. Most other installations use audio (and detect carrier) from the radio discriminator/detector).
Does this system use discriminator/detector audio as audio source?
Yes
No
Go to "Speaker Audio Procedure"
Does the "carrier det" LED on the RIMX lite when the receiver is receiving a 20db quieted signal.
Yes
No
Normally, squelch is detected by the squelch circuits internally on the RIMX board. Is squelch detected internally in this system?
Yes
No
Referring to RIMX schematic and RIMX input/output specifications, troubleshoot as applicable.

1. Measure across the gray (RX audio hi) and violet (RX audio lo) wires from the radio cable where they are attached to the radio with a high impedance AC voltmeter or oscilloscope. With no RJ signal into the receiver (measuring squelch noise), the meter should read about .45 VAC (high level discriminator output) or about 80 millivolts AC (low level detector output). Check the RIMX switch settings to ensure proper settings for this installation (refer to the "RIMX radio interface module switch settings" in this manual).

2. With a 10db quieted signal injected into the receiver, set the control T502 on the RIMX to just illuminate the "carrier det" LED (refer to "Level Setting" in this manual).
3. Check IC5, IC6, IC4, IC8, IC9 circuits for proper operation.

correct as applicable

With radio receiving a system mobile, is the "PL det" LED on? (in non-PL systems, PL LED is on all the time).

Yes

No

<u>possibilities</u>

1. Check setting of RIMX switches.
2. Ensure system ground between MRTI and radio is in place.
3. Measure where the black (RX PL detect) wire from the radio cable is connected to the radio with a DC voltmeter or oscilloscope (PL systems only). When PL is being received, the opposite logic level should be seen from that of not receiving PL (logic thresholds - greater than 3.5v = high, less than 1.5 volts = lo).

correct as applicable

Speaker Audio Procedure

Activate Test 3. Transmit Touch Codes from a system mobile (or equivalent). Does the LED display show the decoded digits from the mobile, and the display decimal point indicate digit valid when receiving modulation from the mobile? Also, advance to Test 5, does display decimal point indicate RX VOX when receiving modulation from the mobile?

Yes

No

possibilities

1. Referring to "Level setting" in this manual, ensure that the proper speaker level is being sent to the MRTI while receiving a system mobile (or equivalent).

2. Measure Pin 8 of IC6 on the RIMX board with an AC voltmeter while receiving a system mobile. This level should be between .45 VRMS and 1.4 VRMS (processor autoleveling will compensate over this range).

correct as applicable

Activate Test 3. With a system mobile (or equivalent) transmit Touch Codes to the MRTI. Does the LED display indicate the digits being sent by the mobile?

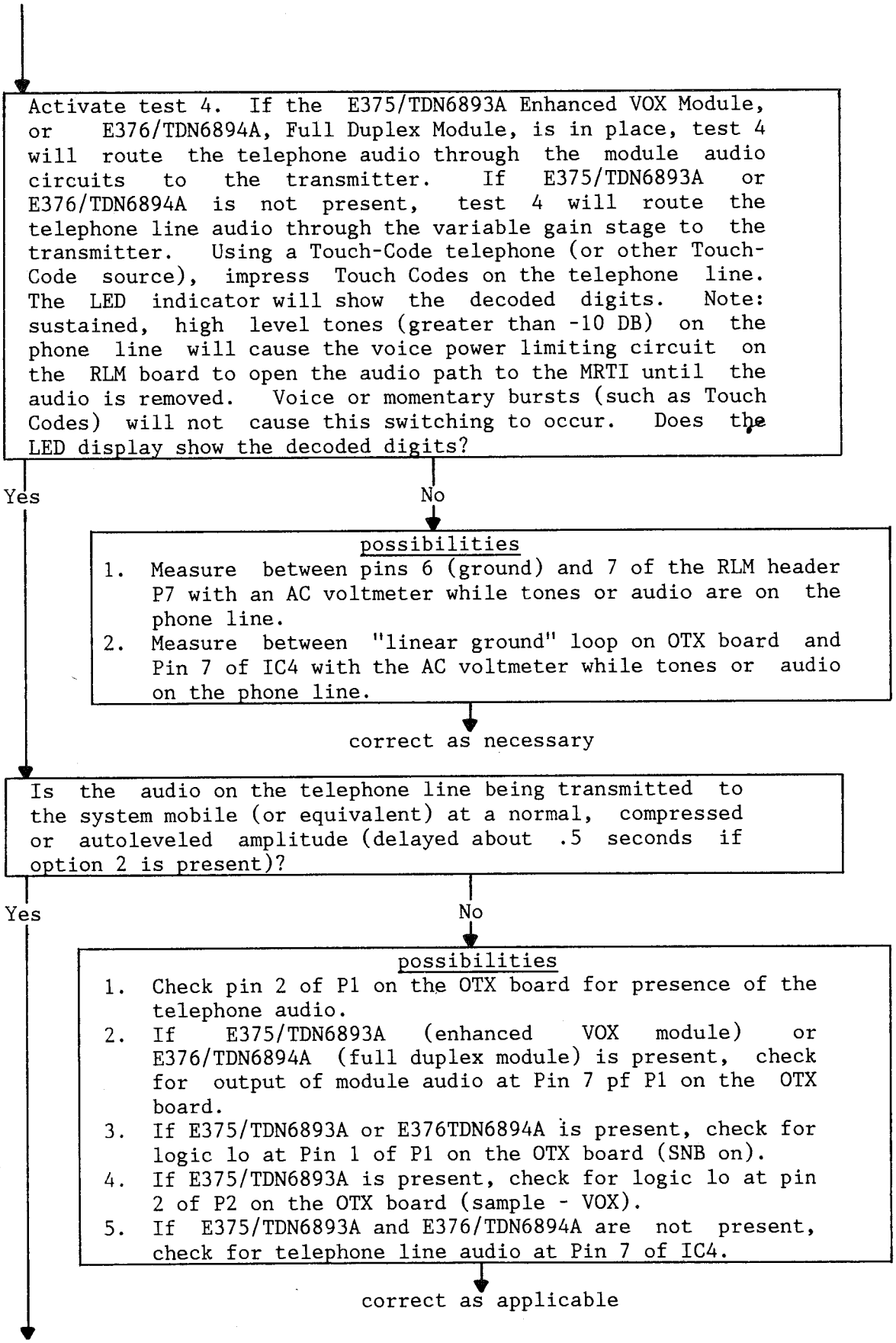
Yes

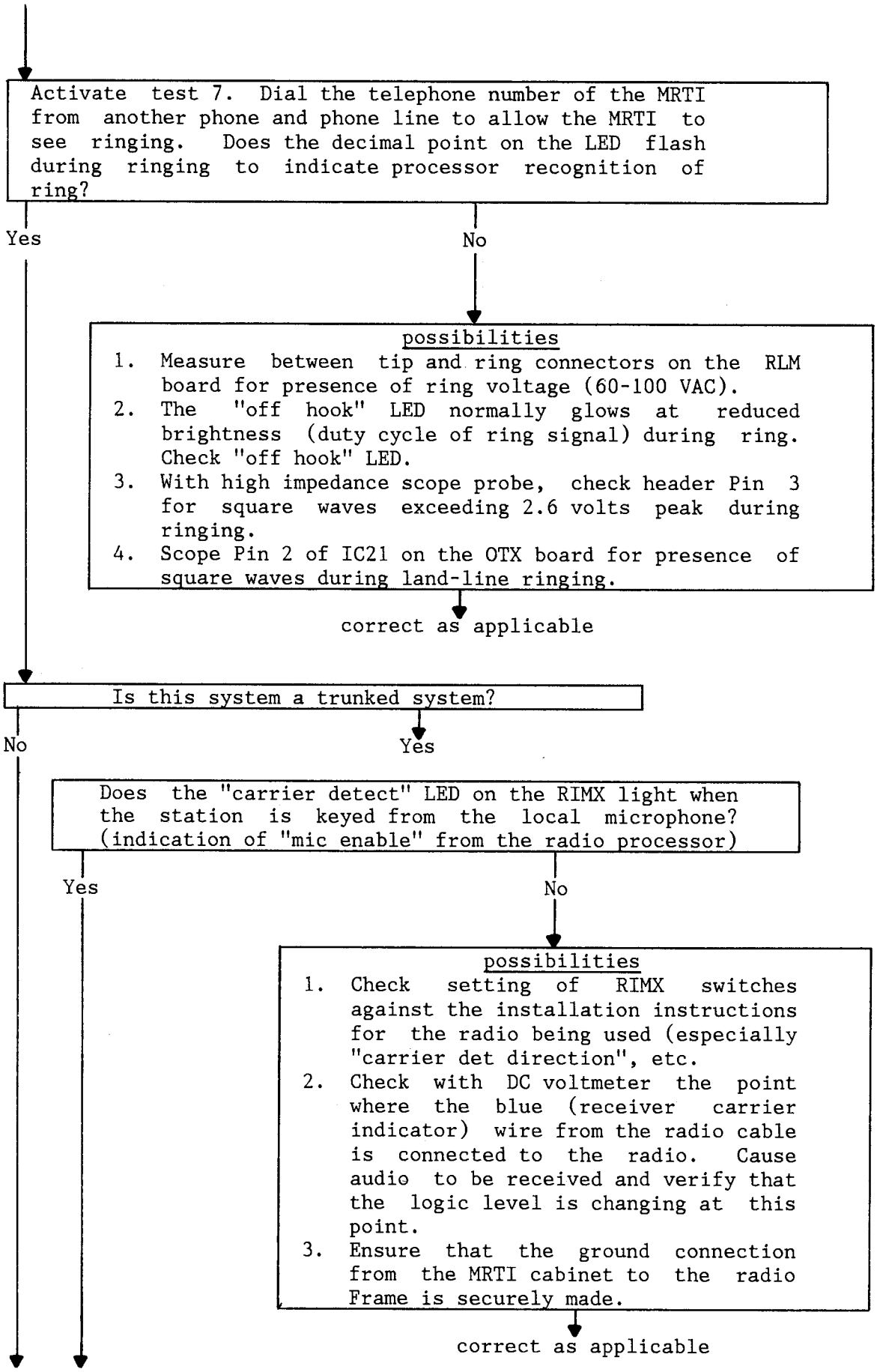
No

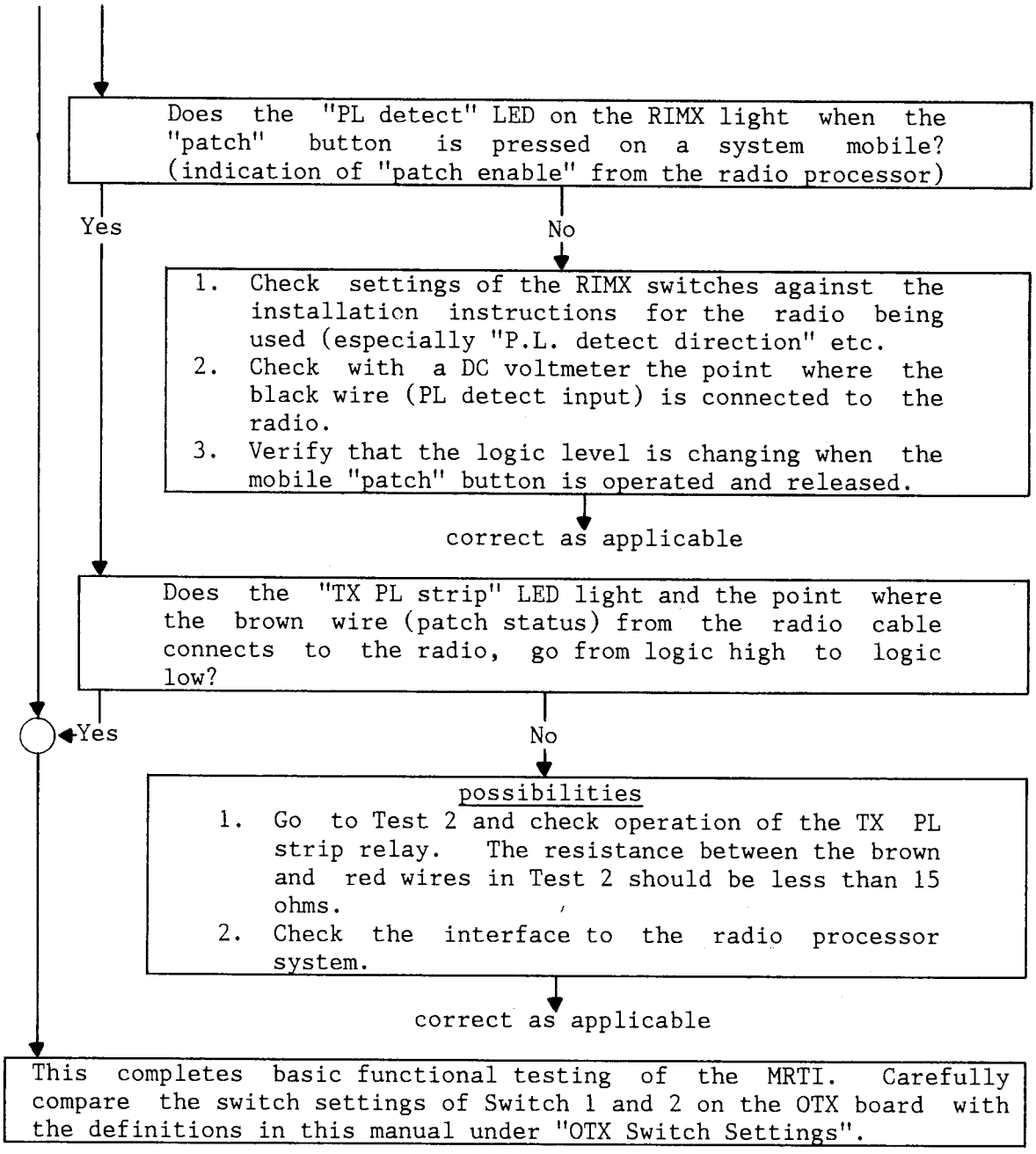
possibilities

1. Carefully check system mobile deviation (set max IDC to approximately 4.8 khz with overdrive signal, and set Touch Code encoder digit #5 to 3 khz with no PL/DPL. Check mobile twist, with encoders that can send single tones, proceed as follows: disable mobile TX PL. Transmit 697 (1 & 2 buttons both down). Deviation should be about ± 1 khz. Now transmit 1477 (3 & 6 buttons both down). Deviation should be about ± 2.2 khz (6 db/octave TX pre-emphasis, 1477/697 times 1 khz).
   "#" should deviate about ± 3.5 khz.
   "1" should deviate about ± 2.7 khz.
2. Check for presence of Touch Codes at Pin 14 of IC4 on RIMX board.
3. Note: testing for presence of touch codes on the touch-tone decoder can be very deceiving since the decoder is time-share driven by the processor. With this in mind, examining Pin 9 of IC20 with an oscilloscope will show bursts of Touch Codes with steady Touch Code being received from the system mobile.

correct as applicable

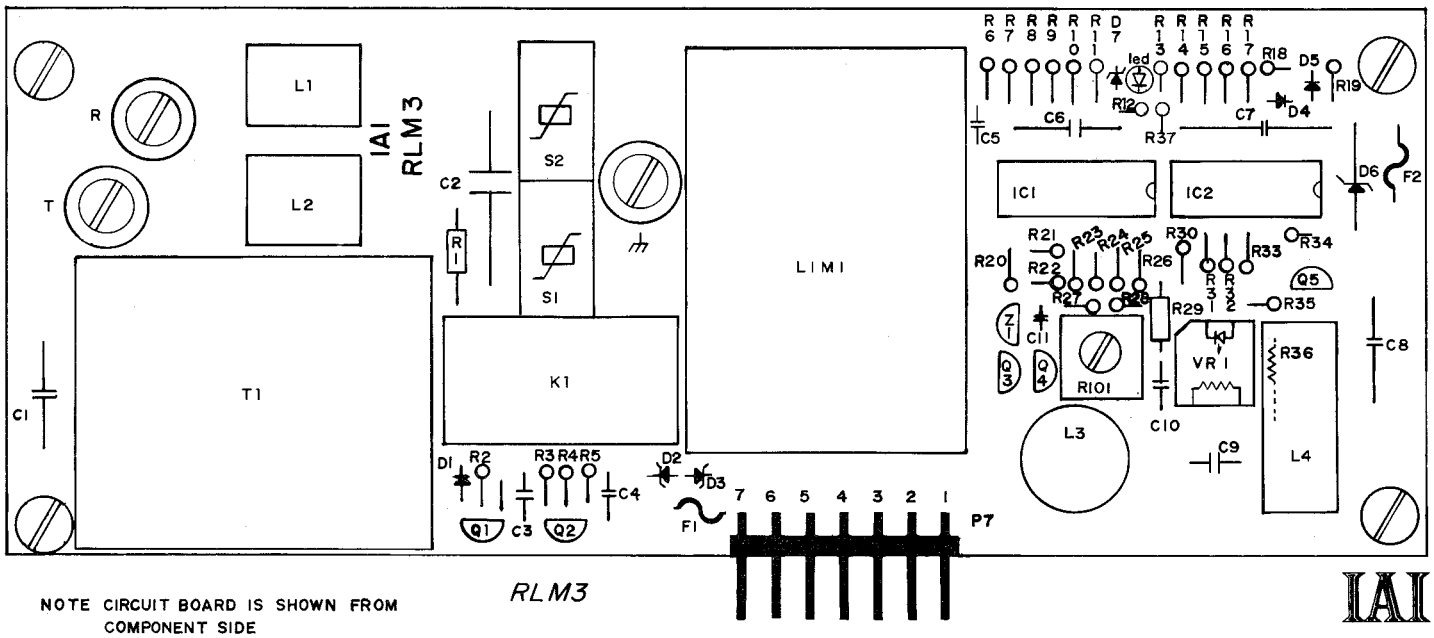

Activate test 4. If the E375/TDN6893A Enhanced VOX Module, or E376/TDN6894A, Full Duplex Module, is in place, test 4 will route the telephone audio through the module audio circuits to the transmitter. If E375/TDN6893A or E376/TDN6894A is not present, test 4 will route the telephone line audio through the variable gain stage to the transmitter. Using a Touch-Code telephone (or other Touch-Code source), impress Touch Codes on the telephone line. The LED indicator will show the decoded digits. Note: sustained, high level tones (greater than -10 DB) on the phone line will cause the voice power limiting circuit on the RLM board to open the audio path to the MRTI until the audio is removed. Voice or momentary bursts (such as Touch Codes) will not cause this switching to occur. Does the LED display show the decoded digits?
Yes
No
possibilities
1. Measure between pins 6 (ground) and 7 of the RLM header P7 with an AC voltmeter while tones or audio are on the phone line.
2. Measure between "linear ground" loop on OTX board and Pin 7 of IC4 with the AC voltmeter while tones or audio on the phone line.
correct as necessary
Is the audio on the telephone line being transmitted to the system mobile (or equivalent) at a normal, compressed or autoleveled amplitude (delayed about .5 seconds if option 2 is present)?
Yes
No
possibilities
1. Check pin 2 of P1 on the OTX board for presence of the telephone audio.
2. If E375/TDN6893A (enhanced VOX module) or E376/TDN6894A (full duplex module) is present, check for output of module audio at Pin 7 pf P1 on the OTX board.
3. If E375/TDN6893A or E376TDN6894A is present, check for logic lo at Pin 1 of P1 on the OTX board (SNB on).
4. If E375/TDN6893A is present, check for logic lo at pin 2 of P2 on the OTX board (sample - VOX).
5. If E375/TDN6893A and E376/TDN6894A are not present, check for telephone line audio at Pin 7 of IC4.
correct as applicable


Activate test 7. Dial the telephone number of the MRTI from another phone and phone line to allow the MRTI to see ringing. Does the decimal point on the LED flash during ringing to indicate processor recognition of ring?
Yes
No
possibilities
1. Measure between tip and ring connectors on the RLM board for presence of ring voltage (60-100 VAC).
2. The "off hook" LED normally glows at reduced brightness (duty cycle of ring signal) during ring. Check "off hook" LED.
3. With high impedance scope probe, check header Pin 3 for square waves exceeding 2.6 volts peak during ringing.
4. Scope Pin 2 of IC21 on the OTX board for presence of square waves during land-line ringing.
correct as applicable
Is this system a trunked system?
No
Yes
Does the "carrier detect" LED on the RIMX light when the station is keyed from the local microphone? (indication of "mic enable" from the radio processor)
Yes
No
possibilities
1. Check setting of RIMX switches against the installation instructions for the radio being used (especially "carrier det direction", etc.
2. Check with DC voltmeter the point where the blue (receiver carrier indicator) wire from the radio cable is connected to the radio. Cause audio to be received and verify that the logic level is changing at this point.
3. Ensure that the ground connection from the MRTI cabinet to the radio Frame is securely made.
correct as applicable

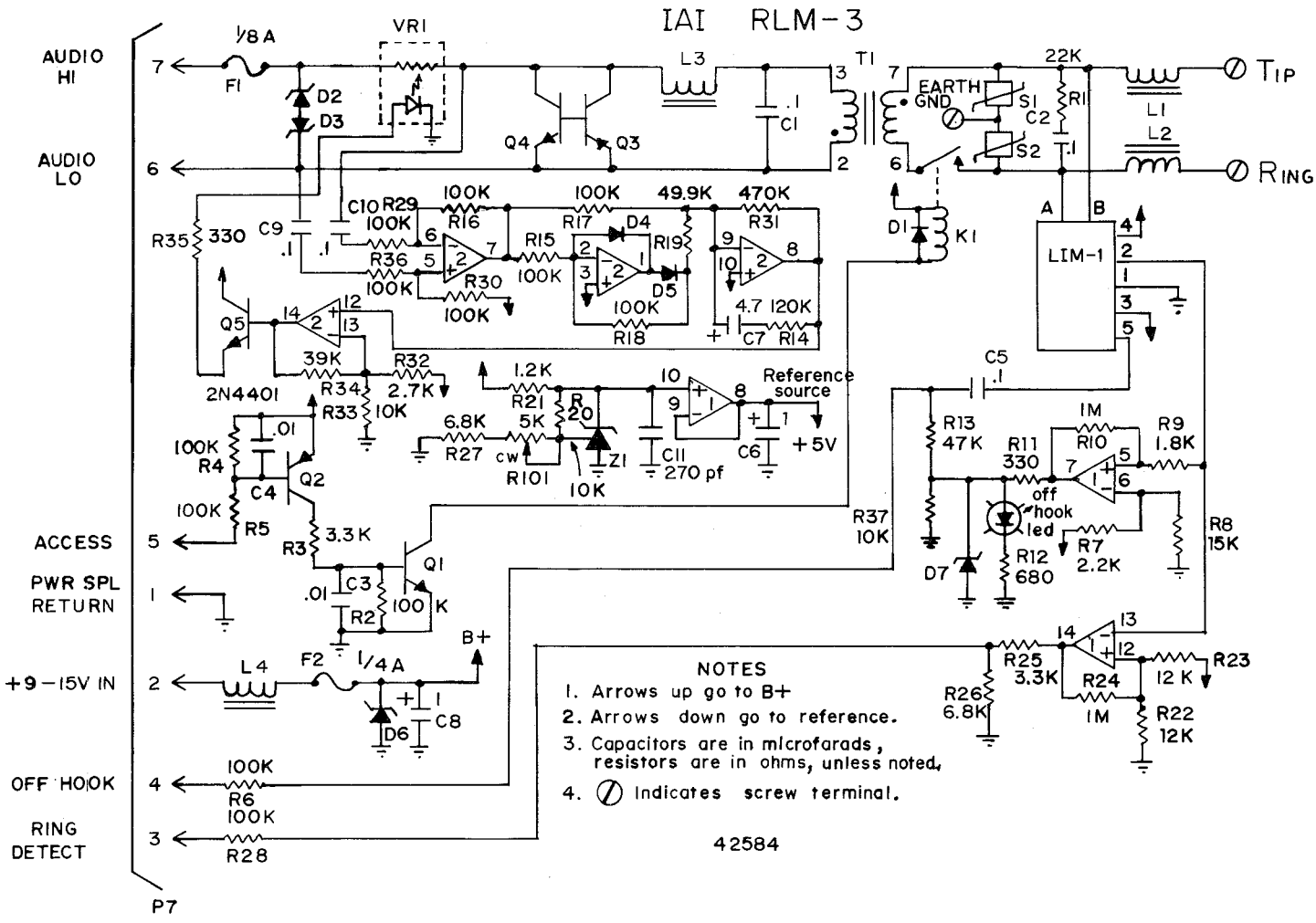

Does the "PL detect" LED on the RIMX light when the "patch" button is pressed on a system mobile? (indication of "patch enable" from the radio processor)
Yes
No
1. Check settings of the RIMX switches against the installation instructions for the radio being used (especially "P.L. detect direction" etc.
2. Check with a DC voltmeter the point where the black wire (PL detect input) is connected to the radio.
3. Verify that the logic level is changing when the mobile "patch" button is operated and released.
correct as applicable
Does the "TX PL strip" LED light and the point where the brown wire (patch status) from the radio cable connects to the radio, go from logic high to logic low?
Yes
No
possibilities
1. Go to Test 2 and check operation of the TX PL strip relay. The resistance between the brown and red wires in Test 2 should be less than 15 ohms.
2. Check the interface to the radio processor system.
correct as applicable
This completes basic functional testing of the MRTI. Carefully compare the switch settings of Switch 1 and 2 on the OTX board with the definitions in this manual under "OTX Switch Settings".

Other Possibilities

1. If your unable to resolve the problem by following the preceding flow chart, then refer to the "System Self-Tests" section of this manual. Every input and output can be tested using these procedures.
2. Ensure that the orange "inhibit" lead is not accidentally grounded, inhibiting the MRTI (see test 1).
3. Ensure that the ground lead from the MRTI to the radio is in place and electrically sound.
4. To ensure that option programming (multi-digit access, multi digit release, selective signalling, etc.) is not causing seemingly defective performance, disconnect power and remove all option ROM(s),(labeled with one or more of the following 2-letter designation; UT, AD, SS.) leaving only basic ROM(s) (Labeled with the following 3-letter designation; BSC.) Retest. If correct performance is obtained, reinstall ROMs and check NVRAM programming (see "variables (parameter) modification procedure" under E155/TDN6908A and other applicable option sections.



NOTE CIRCUIT BOARD IS SHOWN FROM COMPONENT SIDE
103183

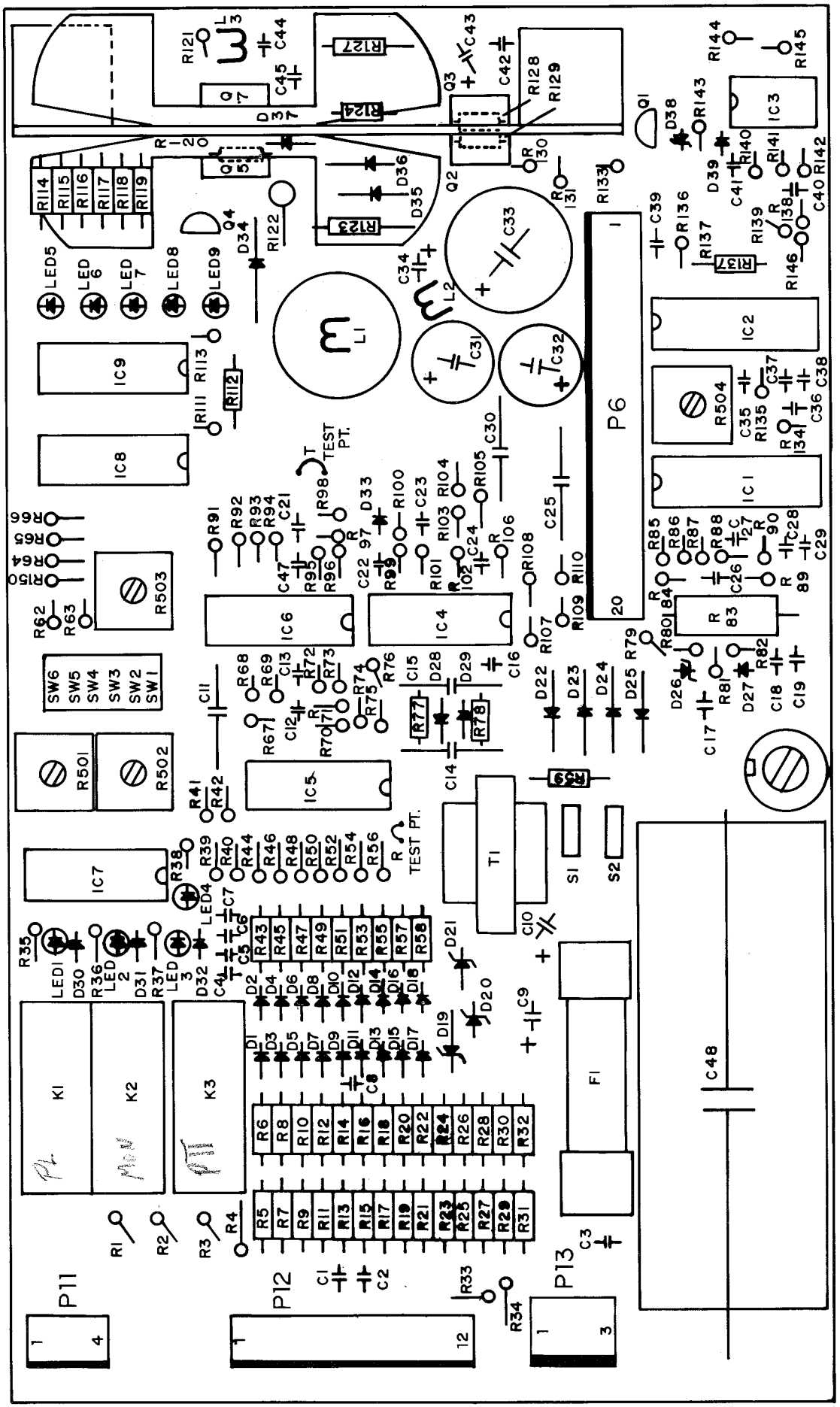


RLM-3 LINE INTERFACE MODULE

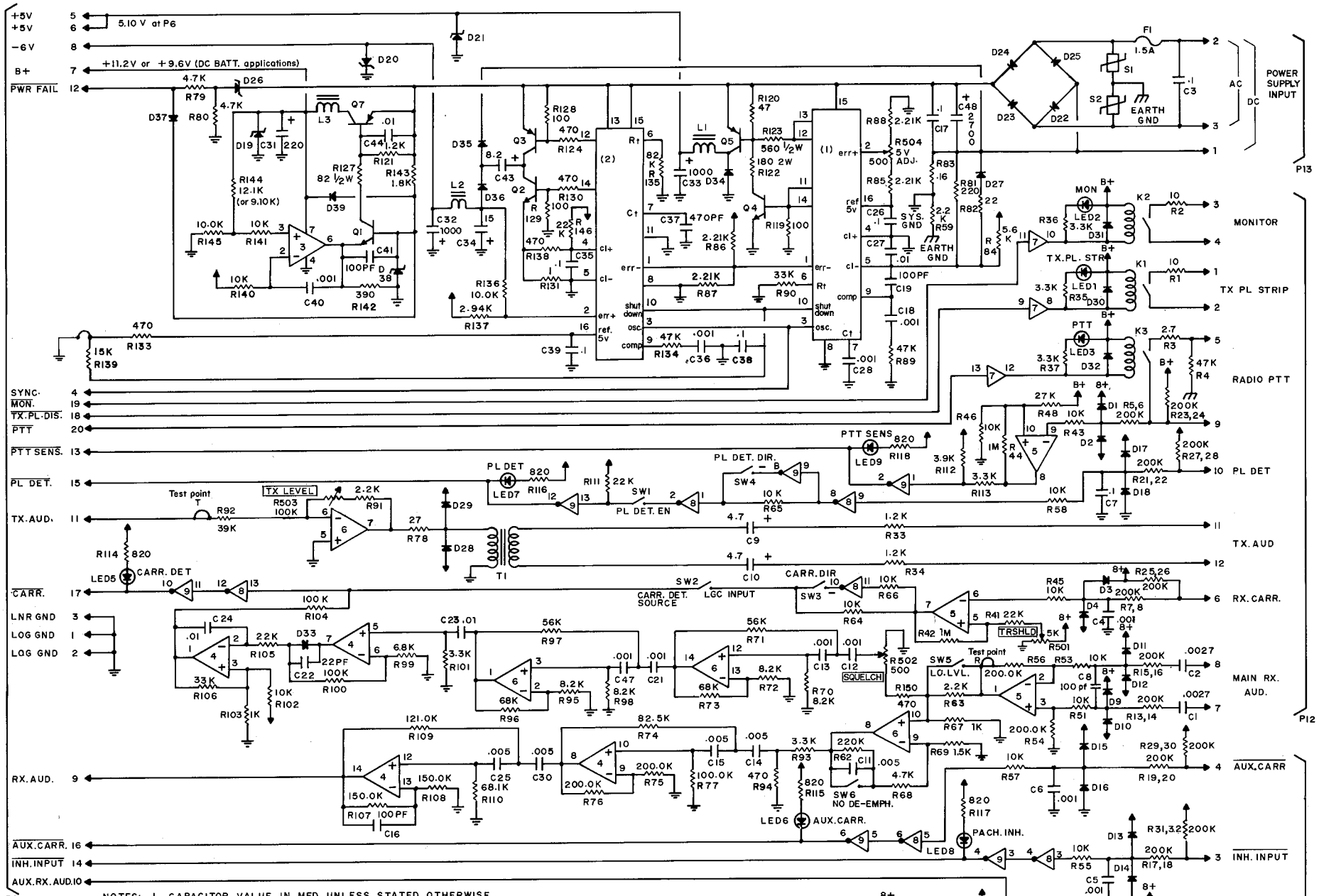
REFERENCE SYMBOL	IAI PART NUMBER	DESCRIPTION
	INTERGRATED CIRCUITS	
IC1	3301-10055-00	QUAD OPERATIONAL AMPLIFIER
IC2	3301-10006-00	QUAD FET INPUT OPERATIONAL AMPLIFIER
Z1	3301-10044-00	PROGRAMMABLE ZENER DIODE
	DIODES	
D4,D5	3302-20008-00	SILICON DIODE
D2,D3	3302-20003-00	4.7 VOLT ZENER DIODE
D6	3302-20005-00	18 VOLT ZENER DIODE
D1	3302-20001-00	SILICON DIODE
D7	3302-20014-00	ZENER
	RESISTORS	
R35	3303-03300-10	330 1/4W 5%
R11	3303-06800-10	680 1/4W 5%
R12	3303-01001-10	1K 1/4W 5%
R21	3303-01201-10	1.2K 1/4W 5%
R9	3303-01801-10	1.8K 1/4W 5%
R7	3303-02201-10	2.2K 1/4W 5%
R3,25	3303-03301-10	3.3K 1/4W 5%
R26,R27	3303-06801-10	6.8K 1/4W 5%
R20,33	3303-01002-10	10K 1/4W 5%
R22,R23	3303-01202-10	12K 1/4W 5%
R8	3303-01502-10	15K 1/4W 5%
R1	3303-02202-10	22K 1/4W 5%
R34	3303-03902-10	39K 1/4W 5%
R13	3303-04702-10	47K 1/4W 5%
R2,4,5,6,15,16	3303-01003-10	100K 1/4W 5%
R17,18,28,29,30,36	3303-01003-10	100K 1/4W 5%
R14	3303-01203-10	120K 1/4W 5%
R31	3303-04703-10	470K 1/4W 5%
R10,R24	3303-01004-10	1MEG 1/4W 5%
R19	3304-04992-10	49.9K 1/4W 1%
R32	3303-02701-10	2.7K 1/4W 5%
	CAPACITORS	
C1,C2	3306-35900-00	.1MFD TUBULAR
C3,C4	3306-11030-00	.01MFD DISC
C5,C9,C10	3306-01003-00	.1MFD CERAMIC
C7	3306-44704-00	4.7MFD/20 VDC TANTALUM
C8	3306-41004-00	1MFD/35 VDC TANTALUM
C11	3306-02700-00	270 PF CERAMIC
LED 1	3306-00750-00	LED
C6	3306-41505-00	15MFD/20V TANTALUM

RLM-3 LINE INTERFACE MODULE

REFERENCE SYMBOL	IAI PART NUMBER	DESCRIPTION
	COILS	
L1,L2,L4	3307-00010-30	1.2MH CHOKE (DC RESISTENCE 15)
L3	3307-10000-00	CHOKE ASSEMBLY (DC RESISTENCE APPROX 5)
	TRANSISTORS	
Q1,Q4,Q5	3309-44010-00	NPN TRANSISTOR
Q2,Q3	3309-44030-00	PNP TRANSISTOR
	MISCELLANEOUS	
LIM1	3312-10000-00	LINE INTERFACE MODULE
S1,S2	3312-20000-10	TRANSIENT SUPPRESSOR
VR1	3312-42000-00	OPTO-ISOLATOR
F1	3312-10125-00	1/8 A FUSE
F2	3312-12500-00	1/4 A FUSE
R101	3305-05001-00	5K POT
T1	3308-03873-00	AUDIO COUPLING TRANSFORMER
K1	3310-00008-00	RELAY
P7	3311-10007-20	7 POS HEADER



RADIO INTERFACE MODULE MODEL RIMX-B



NOTES:
1. CAPACITOR VALUE IN MFD UNLESS STATED OTHERWISE
2. RESISTOR " " OHMS " " "
3. ↑ INDICATE CONNECTION TO +5V " " "
4. ↓ " " " -6V " " "
5. C29, C42, C45 (DECOUPLING CAPACITORS) ARE NOT SHOWN
6. FUNCTION SWITCHES

		ON	OFF
SW1	PL.DET. ENABLE	PL. SQUELCH	CARR. SQUELCH
SW2	CARR. DETECT	CARR. INDICATOR TOWARD GND	RIMX SQUELCH TOWARD SUPPLY
SW3	CARR. IND. DIR.	"	"
SW4	PL. DET. DIR.	"	"
SW5	RX. AUD. LVL.	LO. LVL. INPUT	HI. LVL. INPUT
SW6	RX. AUD. DE-EMPHASIS	FLAT RESPONSE	DE-EMPH. ENABLE

RIMX-B RADIO INTERFACE MODULE

SYMBOL	IAI PART NUMBER	DESCRIPTION
	INTERGRATED CIRCUITS	
IC1,2	3301-10008-00	VOLTAGE REGULATOR
IC3	3301-10058-00	OPERATIONAL AMPLIFIER
IC4,5,6	3301-10006-00	OPERATIONAL AMPLIFIER
IC7	3301-10037-00	HEX BUFFER
IC8	3301-10028-00	HEX SCHMITT INVERTER
IC9	3301-10039-00	HEX INVERTER
	DIODES	
D1,2,3,4,5,6,7,8,9,	3302-20008-00	SILICON DIODE
10,11,12,13,14,15,	3302-20008-00	SILICON DIODE
16,17,18,27,28,29,	3302-30008-00	SILICON DIODE
30,31,32,33,37,39	3302-20008-00	SILICON DIODE
D22,23,25	3302-20006-00	SILICON DIODE, 2A
D34,35,36	3302-20002-00	SILICON DIODE, HIGH SPEED
D19,20	3302-20004-00	PROTECTION ZENER
D21	3302-20009-00	PROTECTION ZENER
D26,38	3302-20010-00	ZENER DIODE
D24	3302-20015-00	SILICON DIODE, SCHOTKY
	RESISTORS	
R131	3303-00010-10	1 1/4W 5%
R3	3303-00027-10	2.7 1/4W 5%
R1,2	3303-00100-10	10 1/4W 5%
R82	3303-00220-10	22 1/4W 5%
R78	3303-00270-10	27 1/4W 5%
R120	3303-00470-10	47 1/4W 5%
R119,128,129	3303-01000-10	100 1/4W 5%
R81	3303-02200-10	220 1/4W 5%
R142	3303-03900-10	390 1/4W 5%
R94,124,130,	3303-04700-10	470 1/4W 5%
133,138,150	3303-04700-10	470 1/4W 5%
R114,115,116,117,118	3303-08200-10	820 1/4W 5%
R103,67	3303-01001-10	1K 1/4W 5%
R33,34,121	3303-01201-10	1.2K 1/4W 5%
R69	3303-01501-10	1.5K 1/4W 5%
R143	3303-01801-10	1.8K 1/4W 5%
R40,59,63,91,	3303-02201-10	2.2K 1/4W 5%
R35,36,37,38,93	3303-03301-10	3.3K 1/4W 5%
101,113	3303-03301-10	3.3K 1/4W 5%
R112	3303-03901-10	3.9K 1/4W 5%
R39,68,79,80,	3303-04701-10	4.7K 1/4W 5%
R84	3303-05601-10	5.6K 1/4W 5%
R99	3303-06801-10	6.8K 1/4W 5%
R43,45,46,47,49,	3303-01002-10	10K 1/4W 5%
51,53,55,57,58	3303-01002-10	10K 1/4W 5%
64,65,66,102,	3303-01002-10	10K 1/4W 5%
126,140,141	3303-01002-10	10K 1/4W 5%
R70,72,95,98	3303-08201-10	8.2K 1/4W 5%

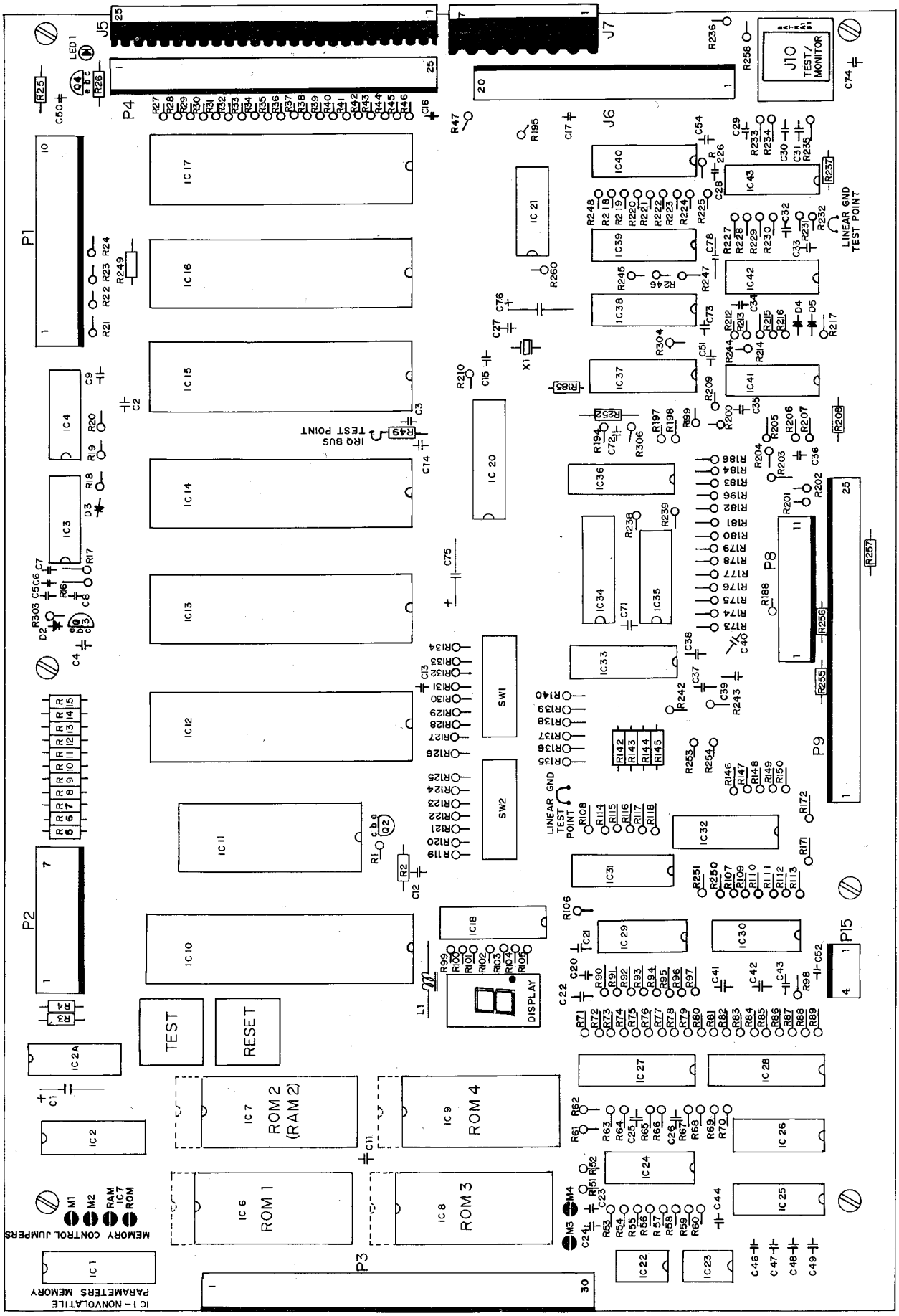
RIMX-B RADIO INTERFACE MODULE

REFERENCE SYMBOL	IAI PART NUMBER	DESCRIPTION
	RESISTORS	
R139	3303-01502-10	15K 1/4W 5%
R41,111,105	3303-02202-10	22K 1/4W 5%
R48	3303-02702-10	27K 1/4W 5%
R90,106	3303-03302-10	33K 1/4W 5%
R92	3303-03902-10	39K 1/4W 5%
R4,89,134	3303-04702-10	47K 1/4W 5%
R71,97,	3303-05602-10	56K 1/4W 5%
R73,96	3303-06802-10	68K 1/4W 5%
R135	3303-08202-10	82K 1/4W 5%
R5,6,7,8,17,18,19,	3303-01003-10	100K 1/4W 5%
20,21,22,23,24,25,	3303-01003-10	100K 1/4W 5%
26,27,28,29,30,31,	3303-01003-10	100K 1/4W 5%
32,100,104	3303-01003-10	100K 1/4W 5%
R62	3303-02203-10	220K 1/4W 5%
R42,44	3303-01004-10	1M 1/4W 5%
R127	3303-00820-20	82 1/2W 5%
R123	3303-05600-20	560 1/2W 5%
R83	3303-00016-40	.16 2W 5%
R122	3303-01800-40	180 2W 5%
R85,86,87,88	3304-02211-10	2.21K 1/4W 1%
R137	3304-02941-10	2.94K 1/4W 1%
R136,145	3304-01002-10	10K 1/4W 1%
R144	3304-09091-10	9.09K 1/4W 1%
R110	3304-06812-10	68.1K 1/4W 1%
R74	3304-08252-10	82.5K 1/4W 1%
R9,10,11,12,13,	3304-01003-10	100K 1/4W 1%
14,15,16,77	3304-01003-10	100K 1/4W 1%
R109	3304-01213-10	121K 1/4W 1%
R107,108	3304-01503-10	150K 1/4W 1%
R50,52,54,56	3304-02003-10	200K 1/4W 1%
75,76	3304-02003-10	200K 1/4W 1%
	POTS	
R501	3305-05001-00	5K
R502,504	3305-05000-00	500
R503	3305-01004-00	100K
	CAPACITORS	
LED 1,2,3,4,5,6,7,8,9	3306-00750-00	LED
C22	3306-00220-00	22PF CERAMIC
C16,19,41,8	3306-01000-00	100PF CERAMIC
C37	3306-04710-00	470PF CERAMIC
C12,13,18,21,5,6	3306-01001-10	.001MF CERAMIC
28,36,40,47,	3306-01001-10	.001MF CERAMIC
C23,24,27,44	3306-01002-00	.01MF CERAMIC
C1,2,3,7,17,26,	3306-01003-00	.1MF CERAMIC
29,35,38,39,42,45	3306-01003-00	.1MF CERAMIC

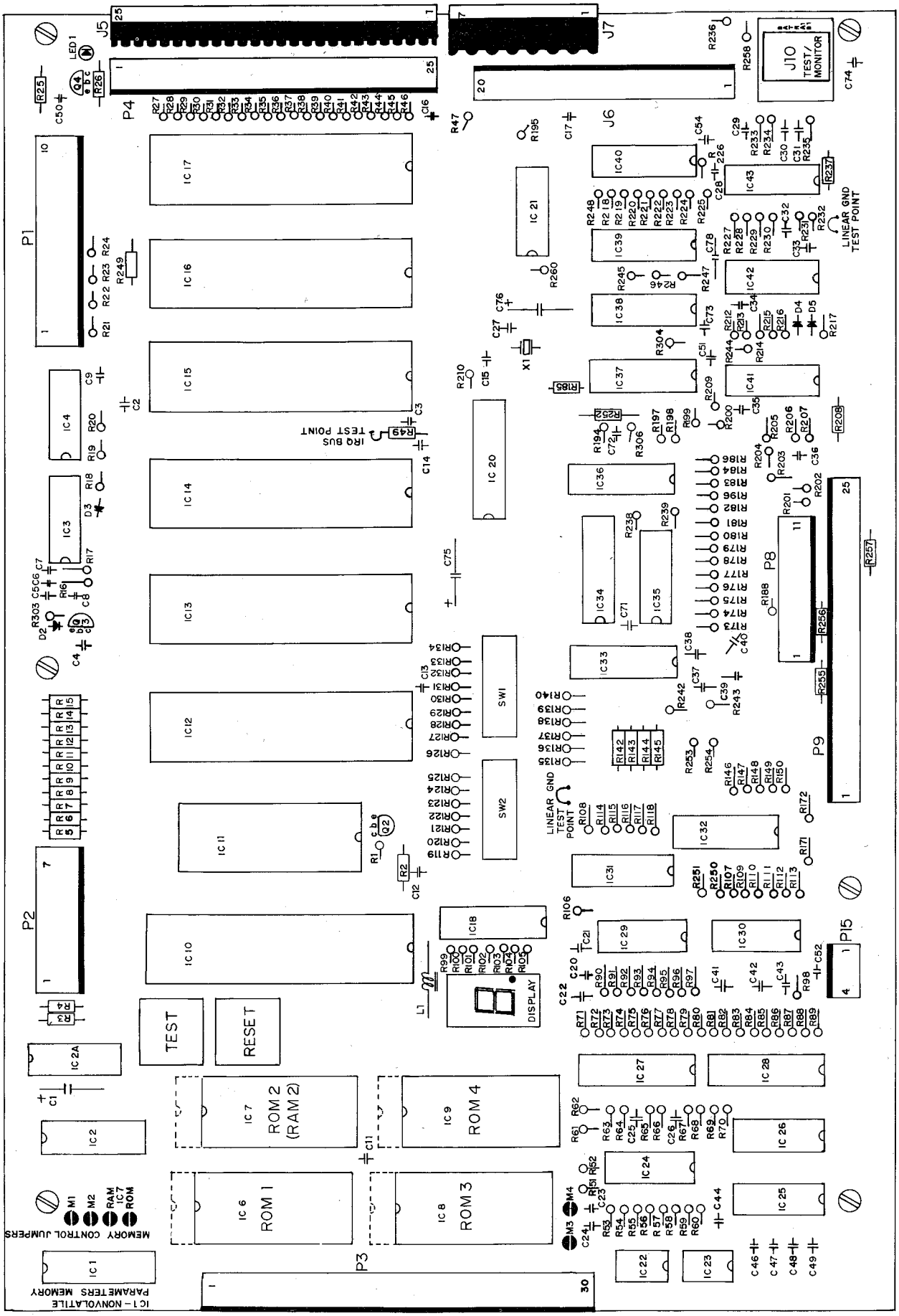
RIMX-B RADIO INTERFACE MODULE

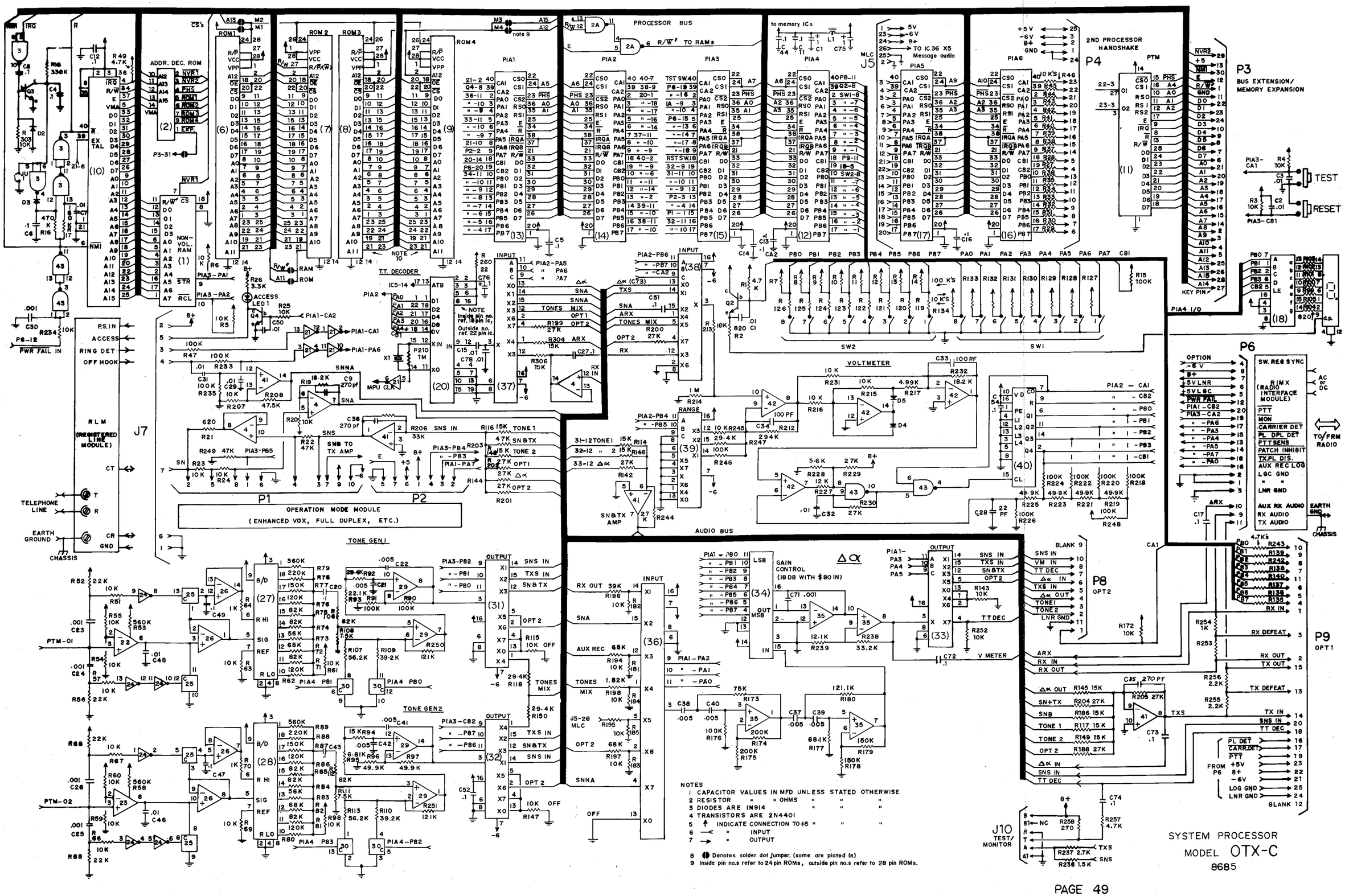
REFERENCE SYMBOL	IAI PART NUMBER	DESCRIPTION
	CAPACITORS	
C11,14,15,25,30	3306-26110-00	.005MF POLYSTYRENE
C9,10	3306-44704-00	4.7MFD/20VDC
C43	3306-48204-00	8.2MFD/35VDC
C31	3306-52206-10	220MFD/16VDC
C33	3306-51007-00	1000MFD/16VDC
C48	3306-42707-00	2700MFD/30VDC
C32	3306-51007-10	1000MFD/6.3VDC
C34	3306-41505-00	15MFD/20VDC
	CONNECTORS	
P6	3311-10020-00	20 CIRCUIT HEADER
P12	3311-10012-00	12 CIRCUIT HEADER
P11	3311-10004-00	4 CIRCUIT HEADER
P13	3311-10003-10	3 CIRCUIT HEADER
	MISCELLANEOUS	
L1	3307-00010-20	SWITCHING CHOKE ASSEMBLY
L2,3	3307-00099-40	CHOKE BEAD
T1	3308-03974-00	TRANSFORMER
Q1,4	3309-44010-00	NPN TRANSISTOR
Q2	3309-41820-00	NPN TRANSISTOR
Q3,5,7	3309-41720-00	PNP TRANSISTOR
K1,2,3	3310-00191-00	REED RELAY
S1,2	3312-10000-10	TRANSIENT SUPPRESSOR
SW1	3312-01006-00	6 PST DIP SWITCH
F1	3312-11500-00	1.5A FUSE

Model OTX-C


P1
P2
P3
P4
J5
J6
J7
J10
TEST/ MONITOR
P8
P9
P15
IC 1
IC 2
IC 2A
IC 3
IC 4
IC 6
ROM 1
IC 7
ROM 2 (RAM 2)
IC 8
ROM 3
IC 9
ROM 4
IC 10
IC 11
IC 12
IC 13
IC 14
IC 15
IC 16
IC 17
IC 18
IC 20
IC 21
IC 22
IC 23
IC 24
IC 25
IC 26
IC 27
IC 28
IC 29
IC 30
IC 31
IC 32
IC 33
IC 34
IC 35
IC 36
IC 37
IC 38
IC 39
IC 40
IC 41
IC 42
IC 43
SW1
SW2
DISPLAY
TEST
RESET
IRQ BUS TEST POINT
LINEAR GND TEST POINT
LINEAR GND TEST POINT
MEMORY CONTROL JUMPERS
M1
M2
M3
M4
RAM IC7
ROM
IC 1 – NONVOLATILE PARAMETERS MEMORY

Model OTX-C


P1
P2
P3
P4
J5
J6
J7
J10
TEST/ MONITOR
P8
P9
P15
IC 1
IC 2
IC 2A
IC 3
IC 4
IC 6
ROM 1
IC 7
ROM 2 (RAM 2)
IC 8
ROM 3
IC 9
ROM 4
IC 10
IC 11
IC 12
IC 13
IC 14
IC 15
IC 16
IC 17
IC 18
IC 20
IC 21
IC 22
IC 23
IC 24
IC 25
IC 26
IC 27
IC 28
IC 29
IC 30
IC 31
IC 32
IC 33
IC 34
IC 35
IC 36
IC 37
IC 38
IC 39
IC 40
IC 41
IC 42
IC 43
SW1
SW2
TEST
RESET
DISPLAY
LED 1
X1
L1
IRQ BUS TEST POINT
LINEAR GND TEST POINT
LINEAR GND TEST POINT
MEMORY CONTROL JUMPERS
M1
M2
RAM IC7
ROM
M3
M4
IC 1 – NONVOLATILE PARAMETERS MEMORY


PROCESSOR BUS
R/W TO RAMs
to memory ICs
2ND PROCESSOR HANDSHAKE
PTM
P3
BUS EXTENSION/ MEMORY EXPANSION
P4
P6
P8
OPT2
P9
OPT1
ADDR. DEC. ROM
NON-VOL. RAM
PIA1
PIA2
PIA3
PIA4
PIA5
PIA6
ROM 1
ROM 2
ROM 3
ROM 4
RAM
ROM
INPUT
OUTPUT
T.T. DECODER
TONE GEN1
TONE GEN2
GAIN CONTROL (18 DB WITH $80 IN)
VOLTMETER
V METER
KEY PIN
PIA4 I/O
P.S.IN
ACCESS
RING DET
OFF HOOK
PWR FAIL IN
RLM (REGISTERED LINE MODULE)
J7
CT
T
R
CR
GND
TELEPHONE LINE
EARTH GROUND
CHASSIS
OPERATION MODE MODULE
(ENHANCED VOX, FULL DUPLEX, ETC.)
P1
P2
SNB TO TX AMP
AUDIO BUS
SYSTEM PROCESSOR
MODEL OTX-C
8685
J10
TEST/ MONITOR
SW. REG SYNC
RIMX (RADIO INTERFACE MODULE)
TO/FRM RADIO
AC or DC
EARTH GND
CHASSIS
OPTION
PTT
MON
CARRIER DET
PL DPL DET
PTT SENS
PATCH INHIBIT
TXPL DIS.
AUX REC LOG
LGC GND
LNR GND
AUX RX AUDIO
RX AUDIO
TX AUDIO
TEST
RESET
ACCESS LED1
NOTES
1 CAPACITOR VALUES IN MFD UNLESS STATED OTHERWISE
2 RESISTOR " " OHMS " " "
3 DIODES ARE IN914 " " "
4 TRANSISTORS ARE 2N4401
5 INDICATE CONNECTION TO +5 " " "
6 " INPUT
7 " OUTPUT
8 Denotes solder dot jumper. (some are plated in)
9 Inside pin no.s refer to 24 pin ROMs, outside pin no.s refer to 28 pin ROMs.

IAI
PARTS LIST

OTX-C SYSTEMS PROCESSOR BOARD

REFERENCE SYMBOL	IAI PART NUMBER	DESCRIPTION
	INTERGRATED CIRCUITS	
IC1	3301-10003-00	NON-VOLATILE RAM
IC2	3301-10062-**	READ ONLY MEMORY
**WHEN ORDERING REPLACEMENT PART INCLUDE		SUFFIX NO. MARKED ON ORIGINAL PART
IC3,43	3301-10022-00	QUAD SCHMITT NAND GATE
IC4,29,35,41	3301-10029-00	QUAD OPERATIONAL AMPLIFIER
IC6,7,8,9	3301-10004-00	READ ONLY MEMORY
IC10	3301-10034-00	MICROPROCESSOR
IC11	3301-10036-00	PROGRAMMABLE TIMER
IC12,13,14,15,17	3301-10035-00	PARALLEL INTERFACE ADAPTOR
IC18	3301-10024-00	DISPLAY LATCH AND DECODER
IC24	3301-10028-00	HEX SCHMITT INVERTER
IC20	3301-10061-00	DTMF DECODER
IC22,23	3301-10005-00	TRANSCONDUCTANCE AMPLIFIER
IC25,30	3301-10013-00	QUAD ANALOG GATE
IC26,42	3301-10006-00	QUAD FET INPUT OPERATIONAL AMPLIFIER
IC27,28	3301-10009-00	ANALOG TO DIGITAL CONVERTER
IC31,32,33,36,37,38,39	3301-10020-00	ANALOG MULTIPLEXER
IC34	3301-10001-00	DIGITAL TO ANALOG CONVERTER
IC40	3301-10025-00	4 BIT BINARY COUNTER
IC2A	4601-10113-00	HEX QUAD NAND
IC21	4601-10112-00	HEX SCHMITT TRIGGER
	RESISTORS	
R260	3303-00220-10	22 1/4W 5%
R258	3303-02700-10	270 1/4W 5%
R21	3303-06200-10	620 1/4W 5%
R2,99,100,101,102,	3303-08200-10	820 1/4W 5%
R103,104,105	3303-08200-10	820 1/4W 5%
R64,70,253,254	3303-01001-10	1K 1/4W 5%
R236	3303-01501-10	1.5K 1/4W 5%
R255,256	3303-02201-10	2.2K 1/4W 5%
R237	3303-02701-10	2.7K 1/4W 5%
R26	3303-03301-10	3.3K 1/4W 5%
R1,49,135,136,137,257	3303-04701-10	4.7K 1/4W 5%
R138,139,140,172	3303-04701-10	4.7K 1/4W 5%
R242,243	3303-04701-10	4.7K 1/4W 5%
R228	3303-05601-10	5.6K 1/4W 5%
R108,111	3303-07501-10	7.5K 1/4W 5%
R3,4,5,6,23,24,25,27	3303-01002-10	10K 1/4W 5%
R28,29,30,31,32,33,34	3303-01002-10	10K 1/4W 5%
R35,36,37,38,39,40,41	3303-01002-10	10K 1/4W 5%
R42,43,44,45,46	3303-01002-10	10K 1/4W 5%
R51,54,55,57,59,60,61	3303-01002-10	10K 1/4W 5%
R63,66,67,69,98,115	3303-01002-10	10K 1/4W 5%
R119,120,121,122,123,	3303-01002-10	10K 1/4W 5%
R124,125,126,127,128	3303-01002-10	10K 1/4W 5%

OTX-C SYSTEMS PROCESSOR BOARD

REFERENCE SYMBOL	IAI PART NUMBER	DESCRIPTION
	RESISTORS	
R129,130,131,132,133	3303-01002-10	10K 1/4W 5%
R134,143,147,181,	3303-01002-10	10K 1/4W 5%
R182,183	3303-01002-10	10K 1/4W 5%
R234	3303-01002-10	10K 1/4W 5%
R303,252	3303-01002-10	10K 1/4W 5%
R227	3303-01202-10	12K 1/4W 5%
R114,116,117,145	3303-01502-10	15K 1/4W 5%
R146,148,149,186,	3303-01502-10	15K 1/4W 5%
R304,306	3303-01502-10	15K 1/4W 5%
R52,56,65,68,	3303-02202-10	22K 1/4W 5%
R142,144,188,199,	3303-02702-10	27K 1/4W 5%
R200,201,202,204,205,	3303-02702-10	27K 1/4W 5%
R209,229,230	3303-02702-10	27K 1/4W 5%
R244	3303-02702-10	27K 1/4W 5%
R206	3303-03302-10	33K 1/4W 5%
R196	3303-03902-10	39K 1/4W 5%
R22,203,249	3303-04702-10	47K 1/4W 5%
R73,83	3303-05602-10	56K 1/4W 5%
R72,82,194,197	3303-06802-10	68K 1/4W 5%
R71,74,75,81,84,85,	3303-08202-10	82K 1/4W 5%
R106,112	3303-08202-10	82K 1/4W 5%
R7,8,9,10,11,12,13,14,	3303-01003-10	100K 1/4W 5%
R15,171,233,235,47	3303-01003-10	100K 1/4W 5%
R62,76,80,86	3303-01203-10	120K 1/4W 5%
R77,87	3303-01503-10	150K 1/4W 5%
R17	3303-01803-10	180K 1/4W 5%
R78,88	3303-02203-10	220K 1/4W 5%
R16	3303-04703-10	470K 1/4W 5%
R53,58,79,89	3303-05603-10	560K 1/4W 5%
R18	3303-03303-10	330K 1/4W 5%
R210	3303-01004-10	1MEG 1/4W 5%
R198	3304-01821-10	1.82K 1/4W 1%
R217	3304-04991-10	4.99K 1/4W 1%
R95	3304-06811-10	6.81K 1/4W 1%
R20,184,207,213,215,	3304-01002-10	10.0K 1/4W 1%
R216,231,245	3304-01002-10	10.0K 1/4W 1%
R239	3304-01212-10	12.1K 1/4W 1%
R94	3304-01502-10	15.0K 1/4W 1%
R19,232	3304-01822-10	18.2K 1/4W 1%
R93,	3304-02212-10	22.1K 1/4W 1%
R92,118,150,247	3304-02942-10	29.4K 1/4W 1%
R238	3304-03322-10	33.2K 1/4W 1%
R109,110	3304-03922-10	39.2K 1/4W 1%
R96,97,219,221,223,225	3304-04992-10	49.9K 1/4W 1%
R208	3304-04752-10	47.5K 1/4W 1%

IAI
PARTS LIST

OTX-C SYSTEMS PROCESSOR BOARD

REFERENCE SYMBOL	IAI PART NUMBER	DESCRIPTION
	RESISTORS	
R107,113	3304-05622-10	56.2K 1/4W 1%
R177	3304-06812-10	68.1K 1/4W 1%
R173	3304-07502-10	75.0K 1/4W 1%
R90,91,176,218,	3304-01003-10	100K 1/4W 1%
R220,222,224,226,246,	3304-01003-10	100K 1/4W 1%
R248	3304-01003-10	100K 1/4W 1%
R180,250,251	3304-01213-10	121K 1/4W 1%
R178,179	3304-01503-10	150K 1/4W 1%
R174,175	3304-02003-10	200K 1/4W 1%
R212	3304-02943-10	294K 1/4W 1%
R214	3304-01004-10	1M 1/4W 1%
	CAPACITORS	
DISPLAY	3306-00740-00	7 SEGMENT LED DISPLAY
LED1	3306-00750-00	LIGHT EMITTING DIODE
C28	3306-00220-00	22PF CERAMIC
C33,34	3306-01000-00	100PF CERAMIC
C9,35,36	3306-02700-00	270PF CERAMIC
C23,24,25,26,30,71	3306-01001-00	.001MF CERAMIC
C21,22,37,38,39,40,	3306-26110-00	.005MF POLYSTYRENE
C41,42	3306-26110-00	.005MF POLYSTYRENE
C2,3,7,15,77	3306-01002-00	.01MF CERAMIC
C29,31,32,46,48,50	3306-01002-00	.01MF CERAMIC
C4,5,6,8,11,12,13	3306-01003-00	.1MF CERAMIC
C14,16,17,20,27,43,44,	3306-01003-00	.1MF CERAMIC
C47,49,51,52,54,	3306-01003-00	.1MF CERAMIC
C72,73,74	3306-01003-00	.1MF CERAMIC
C1,75,76	3306-41004-00	1MF TANTALUM
C77	4606-01002-20	.01MF POLYESTER
	CONNECTORS	
IC1,20 SOCKET	3311-30018-00	18 PIN IC SOCKET
IC2 SOCKET	3311-30016-00	16 PIN IC SOCKET
IC6-9 SOCKETS	3311-30024-00	24 PIN IC SOCKET
IC10 SOCKET	3311-30040-00	40 PIN IC SOCKET
P1	3311-10010-00	10 CIRCUIT HEADER
P2	3311-10007-00	7 CIRCUIT HEADER
P3A,P3B OPT	3311-10015-00	15 CIRCUIT HEADER
P4,9 OPT	3311-10025-00	25 CIRCUIT HEADER
J5 OPT	3311-20025-00	25 CIRCUIT BOARD CONNECTOR
P6	3311-10020-00	20 CIRCUIT HEADER
J7	3311-20007-00	7 CIRCUIT BOARD CONNECTOR
P8 OPT	3311-10011-00	11 CIRCUIT HEADER
J10	3311-60000-00	4 CIRCUIT MODULAR FEMALE CONNECTOR
MLC,IC6,8,9 SOCKET	3311-30028-00	28 PIN IC SOCKET

OTX-C SYSTEMS PROCESSOR BOARD

MISCELLANEOUS

D2,3,4,5	3302-20008-00	SILICON DIODE
Q,2,3,4	3309-44010-00	NPN TRANSISTOR
X1	3312-00100-00	3.58MHZ CRYSTAL
SW1,2	3312-01008-00	8 PST DIP SWITCH
PUSH BUTTON, TEST	3312-71000-00	SPST P.B. SWITCH, GRAY
PUSH BUTTON, RESET	3312-72000-00	SPST P.B. SWITCH, RED
L1	3307-00099-00	CHOKE, BEAD

Option E155/TDN6908
Programmable Variables Memory
Non-Volatile RAM (NVRAM)

Variables (parameters) modification procedure.
All MRTI options that use the NVRAM as parameter storage are enabled,disabled, and/or programmed using the following parameter modification procedure:

1. (preferred method) A standard Touch-Code telephone equipped with a modular-type plug inserted into J10, the test jack located in the lower right-hand corner of the OTX processor board. (The MRTI should be viewed from the rear of the chassis.) Power for the telephone is supplied by the MRTI. The installer should ascertain proper Touch-Code operation of the phone by a simple listen test before proceeding.

2. A mobile or portable radio equipped with a DTMF pad or encoder can also be used to load parameters. This method requires that the MRTI be first installed and basically operational before the options can be programmed.

3. The MRTI can also be programmed from an external telephone, two telephone lines are required, one for the MRTI and a second line from the test telephone that will be used for parameter storage and modification.

   After connecting the MRTI to the first telephone line, dial into that line from another DTMF (Touch-Code) telephone from the second line. If you are programming an L1158 multiline MRTI, the line "1" should be the one connected to the phone line in order to do the parameters modification. After the telephone number of the MRTI is dialed, but before ring begins, depress the gray test button located on the OTX processor board repeatedly until test 9 is indicated, allowing the MRTI to access the line, completing the audio path from the test phone through the switched network (local PBX or PSTN) to the MRTI. It requires one second of time after test 9 is selected before the telephone line is actually seized.

Any one of the above three mentioned sources will work. As soon as the MRTI detects the first Touch-Code digit, it will disable the other input ports.

Depress the gray test button located on the OTX processor board repeatedly until "9" is indicated on the LED display. This will set the MRTI to receive Touch-Code digits from one of three possible programming ports.

Next, dial "1490," the parameter access code. If you should misdial the code, the MRTI will revert to test "1". If this occurs, restart the test using the above procedure. After dialing the access code, any parameter may be examined and changed. To "open" a parameter location, dial the parameter

number followed by a *. The number stored at that location will be displayed on the LED display. To change the displayed parameter, dial the number you wish to store in that location or, to display the next parameter without changing the displayed parameter, dial another *. To "close" a parameter location, dial a # which will blank the display. At this time, another location may be opened as described above or, you may exit the routine by dialing a second #. This will cause any new parameters to be stored in the shadow memory. If the reset (red) button is pushed while in this routine, any parameter changes made while in the routine will be cancelled, with the old values being restored. A couple of examples follows:

To change parameter 08 from 3 to 7:

1. Push test button until "9" is displayed.

2. Dial "1490" on Touch-Code encoder.

3. Dial "08*" on Touch-Code encoder. The old parameter "3" will be displayed.

4. Dial "7". The next parameter (parameter 9) will be displayed.

5. To examine parameter 10, dial *.

6. To close these locations, dial #.

7. To check parameter 8, dial 08*. "7" is displayed.

8. To close and store the new parameter, dial ##.

To change parameters 23 through 29 to "9876543":

1 Using the test button on the OTX board, select test 9.

2. Dial "1490" on the Touch-Code encoder.

3. Dial "23*" on the Touch-Code encoder (the old parameter in 23 will be displayed).

4. Dial "9876543". After each digit is entered, the old parameter at the next location will be displayed.

5. Dial "#" to close these locations. Display will blank.

6. Dial "23*" to open and check the numbers just input. "9" will be displayed.

7. Dial " * * * * * * * ". The numbers entered will be displayed.

8. Dial " # # " to close and store the new parameters.

In certain special cases it is necessary to store * or # (and in some cases, 4th column digits) in a parameter location; i.e. as a digit of a Touch-Code selective signalling unit code number. The procedure is as follows:

1. In the parameter entry routine, obtain the closed parameter condition indicated by a blank display.

2. Dial " * ", then the parameter location number.

3. Now dial either the * or # to be stored in that location. The display will step to and display the next parameter location.

4. Dial "#" to "close" the location. The display will blank.

5. To check the location in which the * or # was entered, dial the parameter location number, then dial *. The display will be blank if * was entered into that location or a blank and a decimal point if # was entered into that location.

6. Dial "##" to close and store the information in the non-volatile shadow memory (NVRAM).

Recap: To enter * in a parameter location:
Dial "*NN". (NN = 1 or 2 digit parameter location number).

To enter # in a parameter location, dial *NN#, (NN = 1 or 2 digit parameter location number).

Installation

If an IC socket is not present in the IC1 position on the OTX processor board, install the socket supplied with the field install kit. Carefully insert the NVRAM IC in the IC1 socket.

Option E375/TDN6893
Enhanced VOX Module Model OSVX

Installation

To install the OSVX, remove the power and remove the top. Push the OSVX onto the mating board connectors P1 and P2 on the OTX board until the connectors lock together. Install the two "Peel and Stick" rubber bumpers on the inside front panel to align with the 2 blank spots over each connector on the OSVX. Power up the MRTI and test for operation. Reassemble the cabinet. No adjustments to the OSVX are required.

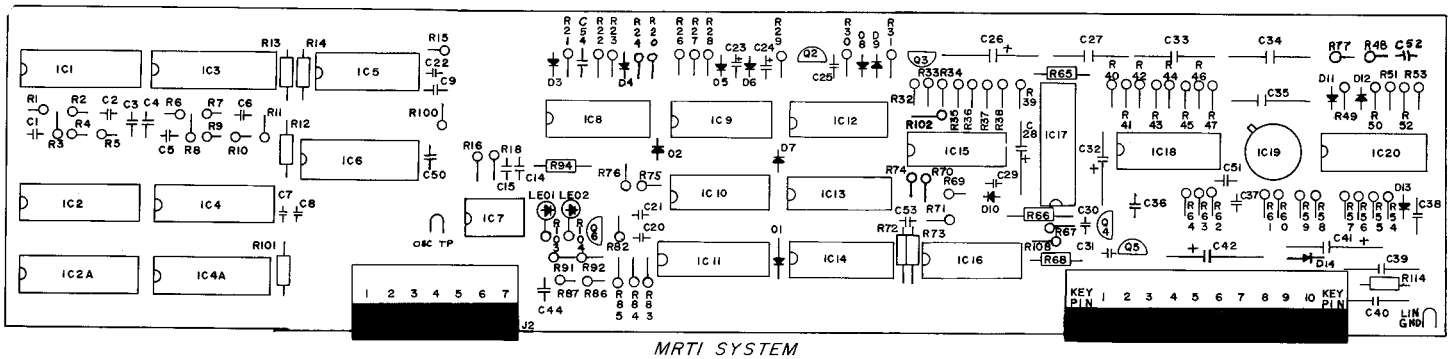
Circuit Description

Phone line audio enters the OSVX on pin 2 of J1. IC28 C and D make up a high pass filter to eliminate hum, rumble, etc. The output of this filter is sent to MRTI for decoding etc. Through IC8A to J1-8. This filtered signal is also sent through a processor controlled gate (IC17D) to the compressor circuit consisting of IC20 and 19.

The compressor control voltage generated by IC20D and C is peak sampled by IC20B and applied to storage circuit C41. It is also valley sampled by IC15 B and C. The output of IC15C is a voltage representation of the lowest signal level (background). The differential between this background level and peak level is used as the VOX signal. With little or no differential, a steady state, non-voiced signal is indicated and the VOX drops out. VOX decay is established by timer IC16.

Repetitive signals (busy, fast busy, line off hook, etc.) are detected by comparing the voltages on C23 and C24. These capacitors are alternately charged by a constant current from Q2 with the charge period being the length of time the signal is present. If the voltages are within the design limits, it indicates that the signal durations were the same. This voltage match clocks counter IC 11. When 5 occurrences of matches signal duration occur, repetition is asserted (J2-4).

Filtered, compressed audio is also sent to the audio delay circuit. IC 1 is a continuously variable slope delta modulator which digitizes the input audio into a serial bit stream. The clock, IC7 generates about 128 khz, the bit rate. The digital signal stream is delayed for .5 seconds by being stored in Dynamic Random Access Memory IC 6 organized as 64K, 1 bit words. Counters IC 2 and 2A are cascaded to give the 16 bit count required and multiplexers IC 4 and 4A provide the address multiplexing necessary. The output bit stream is sent to CVSD demodulator IC 3 which reconstitutes the delayed audio. This method provides excellent audio fidelity which is non-temperature sensitive. The delayed audio is routed through processor controlled gate IC 17B to J1-7.

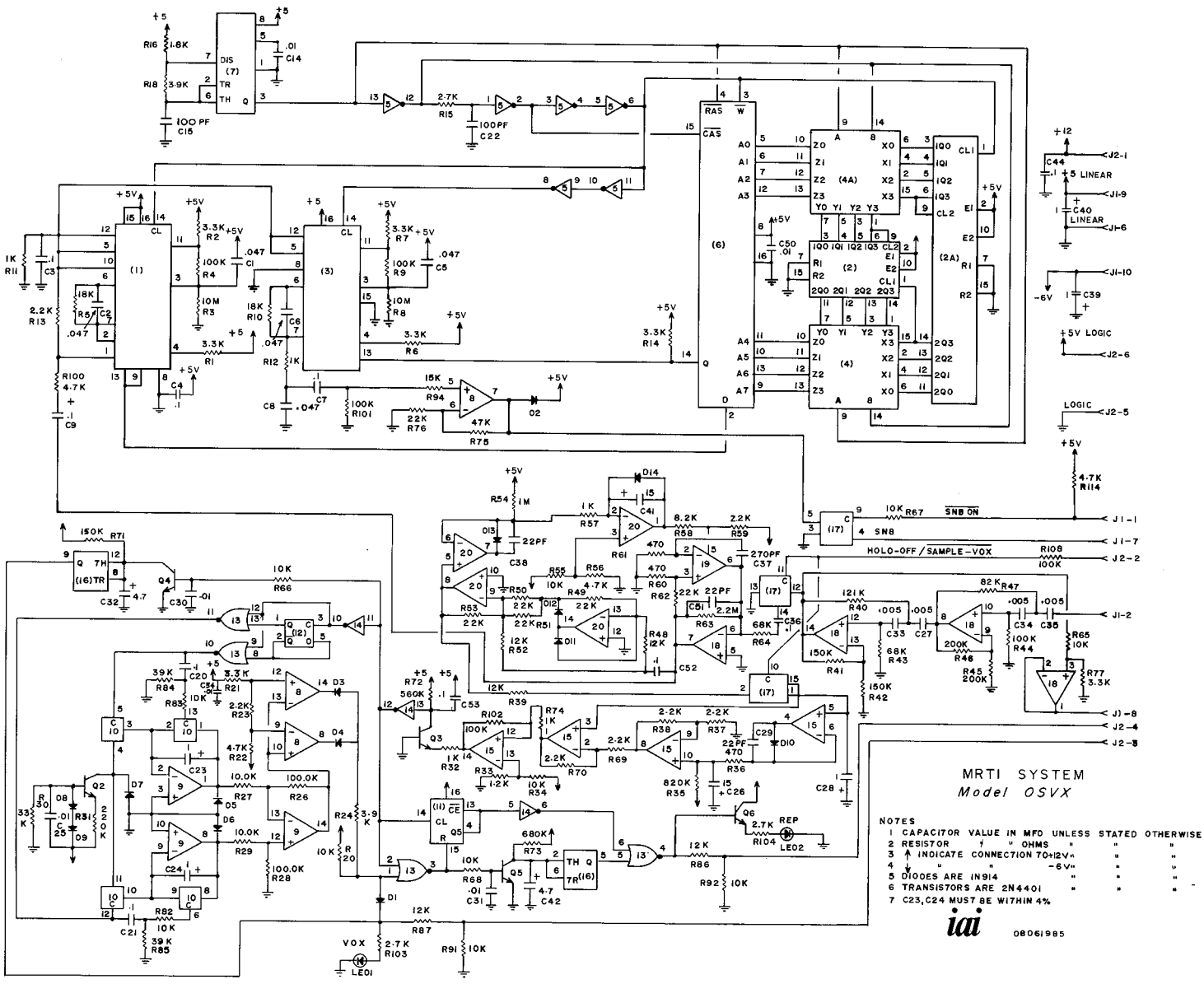


MRTI SYSTEM
MODEL OSVX

iai

NOTE CIRCUIT BOARD IS SHOWN FROM COMPONENT SIDE

08061985



MRTI SYSTEM
Model OSVX

NOTES
1 CAPACITOR VALUE IN MFD UNLESS STATED OTHERWISE
2 RESISTOR " " OHMS " " "
3 ↑ INDICATE CONNECTION TO +12V " " "
4 " " " -6V " " "
5 DIODES ARE IN914 " " "
6 TRANSISTORS ARE 2N4401 " " "
7 C23, C24 MUST BE WITHIN 4%

iai 08061985

IAI
PARTS LIST

OSVX - ENHANCED VOX MODULE

REFERENCE SYMBOL	IAI PART NUMBER	DESCRIPTION
	INTERGRATED CIRCUITS	
IC1,3	3301-10007-00	SLOPE DELTA A TO D CONVERTER
IC2,2A	3301-10027-00	DUAL BINARY COUNTER
IC4,4A	3301-10026-00	MULTIPLEXER
IC5	3301-10028-00	HEX SCHMITT INVERTER
IC6	3301-10033-00	64 K BIT MEMORY
IC7	3301-10030-00	TIMER
IC8	3301-10029-00	QUAD OPERATIONAL AMPLIFIER
IC9,15,18,20	3301-10006-00	QUAD FET INPUT OPERATIONAL AMPLIFIER
IC10	3301-10013-00	QUAD ANALOG GATE
IC11	3301-10014-00	DECODED COUNTER
IC12	3301-10012-00	DUAL D FLIP FLOP
IC13	3301-10010-00	QUAD NOR GATE
IC14	3301-10017-00	HEX INVERTER
IC16	3301-10031-00	DUAL TIMER
IC17	3301-10021-00	ANALOG MULTIPLEXER
IC19	3301-10005-00	TRANSCONDUCTANCE AMPLIFIER
	DIODES	
D1,2,3,4,5,6,7,8,9,	3302-20008-00	SILICON DIODE
D10,11,12,13,14	3302-20008-00	SILICON DIODE
	RESISTORS	
R36,60,61	3303-04700-10	470 1/4W 5%
R58	3303-08200-10	820 1/4W 5%
R11,12	3303-01001-10	1K 1/4W 5%
R23,57,70,90	3303-01001-10	1K 1/4W 5%
R33	3303-01201-10	1.2K 1/4W 5%
R13,23,37,38,59,69,74	3303-02201-10	2.2K 1/4W 5%
R15,103,104	3303-02701-10	2.7K 1/4W 5%
R1,2,6,7,14,77	3303-03301-10	3.3K 1/4W 5%
R18,24	3303-03901-10	3.9K 1/4W 5%
R22,56,100,114	3303-04701-10	4.7K 1/4W 5%
R58	3303-08201-10	8.2K 1/4W 5%
R20,21	3303-01002-10	10K 1/4W 5%
R32,34,55	3303-01002-10	10K 1/4W 5%
R58,65,66,67,68,82,	3303-01002-10	10K 1/4W 5%
R83,91,92	3303-01002-10	10K 1/4W 5%
R16	3303-01801-10	1.8K 1/4W 5%
R39,48,86,87,52	3303-01202-10	12K 1/4W 5%
R94	3303-01502-10	15K 1/4W 5%
R5,10	3303-01802-10	18K 1/4W 5%
R49,50,51	3303-02202-10	22K 1/4W 5%
R53,62,76	3303-02202-10	22K 1/4W 5%
R30	3303-03302-10	33K 1/4W 5%
R84,85	3303-03902-10	39K 1/4W 5%

OSVX - ENHANCED VOX MODULE

REFERENCE SYMBOL	IAI PART NUMBER	DESCRIPTION
	RESISTORS	
R72	3303-04702-10	47K 1/4W 5%
R64	3303-06802-10	68K 1/4W 5%
R4,9	3303-01003-10	100K 1/4W 5%
R101	3303-01003-10	100K 1/4W 5%
R102,108	3303-01003-10	100K 1/4W 5%
R71	3303-01503-10	150K 1/4W 5%
R31	3303-02203-10	220K 1/4W 5%
R73	3303-06803-10	680K 1/4W 5%
R35	3303-08203-10	820K 1/4W 5%
R54	3303-01004-10	1M 1/4W 5%
R63	3303-02204-10	2.2M 1/4W 5%
R3,8	3303-01005-10	10M 1/4W 5%
R75	3303-05602-10	56K 1/4W 5%
R27,29	3304-01002-10	10.0K 1/4W 1%
R47	3304-08252-10	82.5K 1/4W 1%
R26,28,44	3304-01003-10	100K 1/4W 1%
R40	3304-01213-10	121K 1/4W 1%
R41,42	3304-01503-10	150K 1/4W 1%
R45,46	3304-02003-10	200K 1/4W 1%
R43	3304-06812-10	68.1K 1/4W 1%
	CAPACITORS	
LED 1, LED 2	3306-00740-00	LIGHT EMITTING DIODE
C29,38,51	3306-00220-00	22PF CERAMIC
C22	3306-01000-00	100PF CERAMIC
C37	3306-02700-00	270PF CERAMIC
C15	3306-01001-00	.001MF CERAMIC
C27,33,34,35	3306-26110-00	.005MF POLYSTYRENE
C25,30,31	3306-01002-00	.01MF CERAMIC
C1,2,5,6,8	3306-04702-00	.047MF CERAMIC
C3,4,7,9	3306-01003-00	.1MF CERAMIC
C20,21	3306-01003-00	.1MF CERAMIC
C36,44,50,52	3306-01003-00	.1MF CERAMIC
C14	3306-01003-00	.1MF CERAMIC
C23,24,28,32,39,40	3306-41004-00	1MF/35V TANTALUM
C42	3306-44704-00	4.7MF/20V TANTALUM
C26,41	3306-41505-00	15MF/20V TANTALUM
	MISCELLANEOUS	
Q2,3,4,5,6	3309-44010-00	NPN TRANSISTOR
J1	3311-20012-00	12 CIRCUIT BOARD CONNECTOR
J2	3311-20007-00	7 CIRCUIT BOARD CONNECTOR

Option E376/TDN6894
Full Duplex Module Model FDMX

Installation

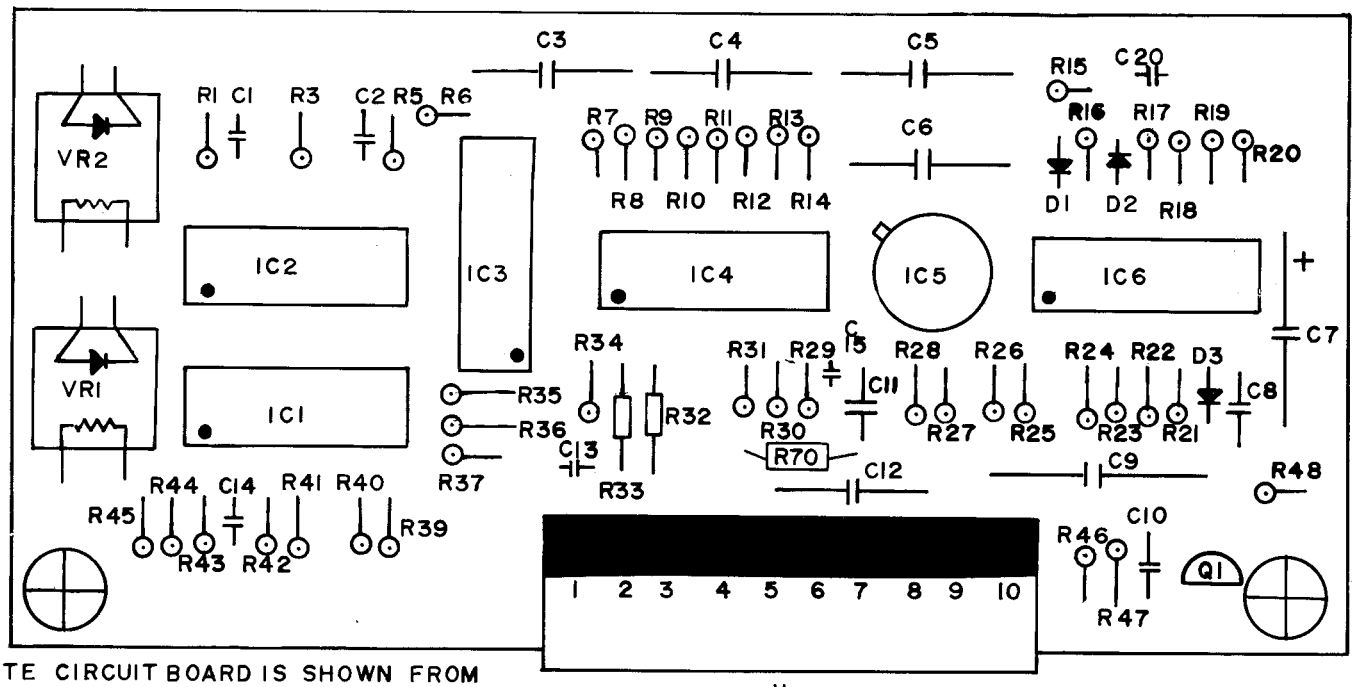
Remove power and remove top cover. Push the FDMX board J1 onto the OTX P1 until the connectors lock together. Install the "Peel and Stick" rubber bumper on the inside front panel to align with the blank space over the J1 connector. Power up the MRTI and check for proper operation.

Circuit Description

Audio from the switched network is input to the FDMX via pin 2 of J1. This audio is buffered and sent to the compression circuit and the electronic balance circuit through summing amp IC4A. The other input to the balance circuit is the audio from the MRTI driving the switched network. This audio is phase shifted about 90 degrees by C14 and fed to comparator IC2A. When the amplitude from the MRTI is adequate, IC2A gates audio from summing amp IC4A in a synchronous rectifier fashion, driving optical isolator VR1 in the direction to cancel the audio that has been phase shifted by the reactance of the switched network appearing at IC4A.

Audio from the MRTI is also fed to buffer IC1-B which drives comparator IC2B. IC2B drives audio gate IC3C in synchronous rectifier fashion when the amplitude of audio from the MRTI is adequate. This voltage drives VR2 which varies the amplitude of the signal driving the switched network in a direction to cause cancellation of the signal at IC4 pin 1. The result is a high degree of transhybrid isolation of the signal at J1 pin 8. This resultant signal is high pass filtered to eliminate hum and rumble and compressed by IC6, 5 and 4. The processor gates this audio path on and off via Q1.

FDMX
LAYOUT



NOTE CIRCUIT BOARD IS SHOWN FROM COMPONENT SIDE

iai
10011982

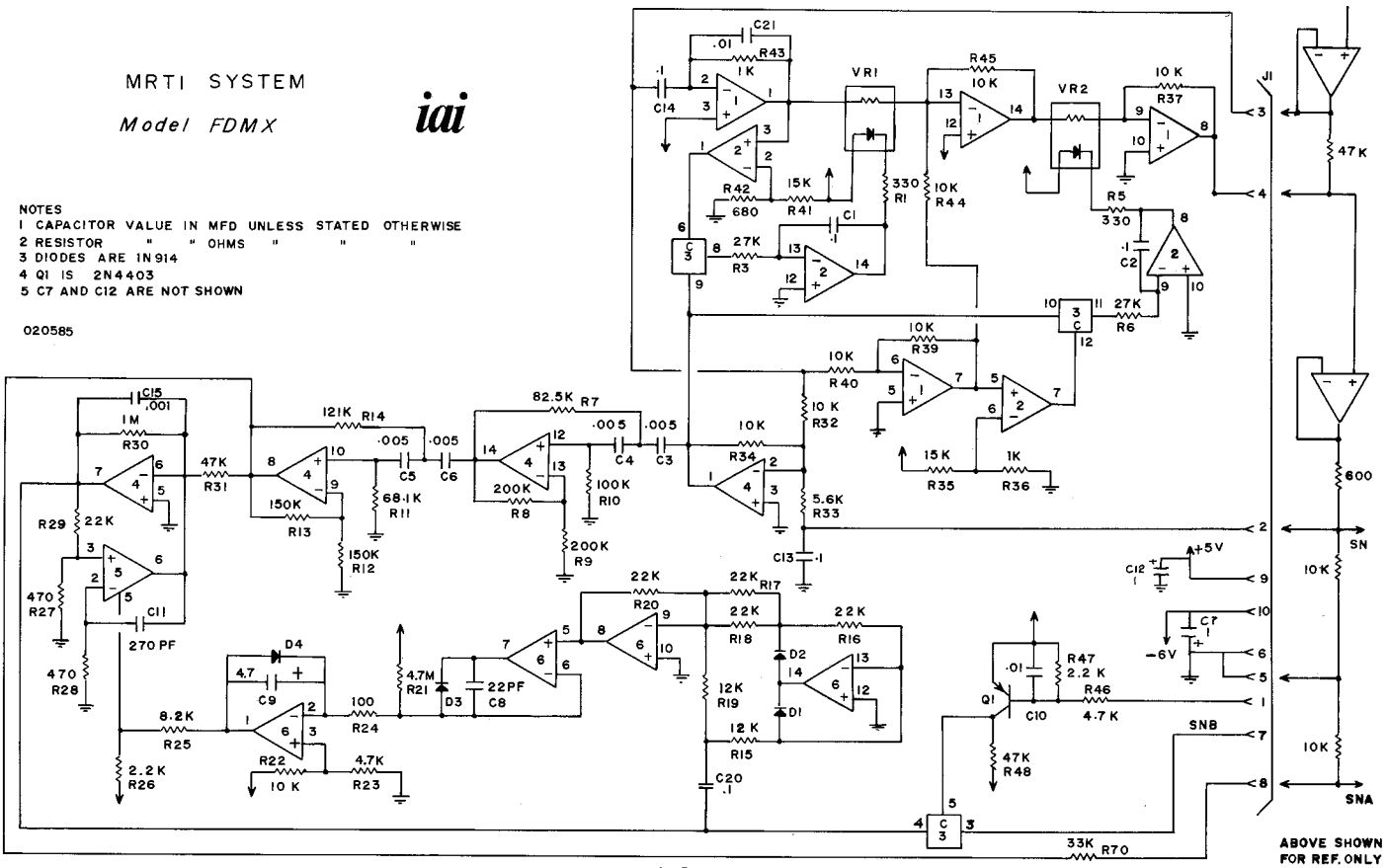
MRTI SYSTEM

Model FDMX

iai

NOTES
1 CAPACITOR VALUE IN MFD UNLESS STATED OTHERWISE
2 RESISTOR " " OHMS " " "
3 DIODES ARE IN914
4 Q1 IS 2N4403
5 C7 AND C12 ARE NOT SHOWN

020585



ABOVE SHOWN FOR REF. ONLY

IAI
PARTS LIST

FDMX - FULL DUPLEX MODULE

REFERENCE SYMBOL	IAI PARTS NUMBER	DESCRIPTION
	INTERGRATED CIRCUITS	
IC1,4	3301-10029-00	QUAD OPERATIONAL AMPLIFIER
IC2,6	3301-10006-00	QUAD FET INPUT OPERATIONAL AMP
IC3	3301-10013-00	QUAD ANALOG GATE
IC5	3301-10005-00	TRANSCONDUCTANCE AMPLIFIER
	RESISTORS	
R36	3303-01000-10	100 1/4W 5%
R1,5	3303-03300-10	330 1/4W 5%
R27,28	3303-04700-10	470 1/4W 5%
R42	3303-06800-10	680 1/4W 5%
R24,43	3303-01001-10	1K 1/4W 5%
R26,47	3303-01201-10	1.2K 1/4W 5%
R23,46	3303-04701-10	4.7K 1/4W 5%
R25	3303-08201-10	8.2K 1/4W 5%
R22	3303-01002-10	10K 1/4W 5%
R32,33,34,37,39,40	3303-01002-10	10K 1/4W 5%
R44,45	3303-01002-10	10K 1/4W 5%
R15,19	3303-01202-10	12K 1/4W 5%
R35,41	3303-01502-10	15K 1/4W 5%
R16,17,18,20,29	3303-02202-10	22K 1/4W 5%
R3,6	3303-02702-10	27K 1/4W 5%
R70	3303-03302-10	33K 1/4W 5%
R31,48	3303-04702-10	47K 1/4W 5%
R21,30	3303-01004-10	1M 1/4W 5%
R12,13	3304-04752-10	47.5K 1/4W 1%
R11	3304-06812-10	68.1K 1/4W 1%
R7	3304-08252-10	82.5K 1/4W 1%
R8,9,10	3304-01003-10	100K 1/4W 1%
R14	3304-01213-10	121K 1/4W 1%
	CAPACITORS	
C8	3306-00220-00	22PF CERAMIC
C15	3306-01000-00	100PF CERAMIC
C11	3306-02700-00	270PF CERAMIC
C3,4,5,6	3306-26110-00	.005MF POLYSTYRENE
C10,21	3306-01002-00	.01UF CERAMIC
C1,2,13,14,20	3306-01003-00	.1MF CERAMIC
C7,12	3306-41004-00	1MF/35V TANTALUM
C9	3306-44704-00	4.7MF/20V TANTALUM
	MISCELLANEOUS	
D1,2,3,4	3302-20008-00	SILICON DIODE
Q1	3309-44030-00	PNP TRANSISTOR
J1	3311-20012-00	12 CIRCUIT BOARD CONNECTOR
VR1,2	3312-41000-00	OPTO ISOLATOR

Option E377/TDN6895
Multi-Function Utilities

The MRTI multi-function utilities is a collection of firmware routines, which in connection with the required E155/TDN6908, provide the following functions:

I. Automatic station identifier

II. Security/executive override code maintenance

III. Multidigit MRTI access and/or release

IV. Adjustable "signal search" frequency and duration times

V. Comprehensive toll restrictions

VI. Mobile signalling start

VII. Control of external devices using the security code

VIII. Land-line priority with selective signalling

IX. Variable length Touch-Codes to land-line

X. Emergency call direct access

XI. Inhibiting pseudo Touch-Code regeneration during mobile dialogue

XII. Special mobile signalling control

A. High frequency ringing to mobiles
B. Loud ring to mobiles
C. Multiple ringing to mobiles

XIII. Variable mobile inactivity timer

XIV. Attendant connect control

XV. Land-line caller connect control

XVI. Land line message/hailing timer

XVII. Variable overall access timer

I. Automatic Station Identifier

Description

Up to ten digits of any combination of letters and numbers can be field programmed using the parameter modification routine described under option E155/TDN6908 in this manual. The identifier can be enabled or disabled, set to identify every 15 or 30 minutes (if a station PTT has occurred in that time) and at the end of each phone patch (on release), or every 15 or 30 minutes only.

Installation:
If field installed, the ROM containing the utilities software should be carefully installed into its designated socket, being sure that the notched end is as shown on the OTX board layout in this manual.

The following chart will be used to convert SID characters to numbers to store in the NVRAM.

1 = 01	a = 11	k = 21	u = 31
2 = 02	b = 12	l = 22	v = 32
3 = 03	c = 13	m = 23	w = 33
4 = 04	d = 14	n = 24	x = 34
5 = 05	e = 15	o = 25	y = 35
6 = 06	f = 16	p = 26	z = 36
7 = 07	g = 17	q = 27	
8 = 08	h = 18	r = 28	end-of-word pause = 37
9 = 09	i = 19	s = 29	end of ID = 00
0 = 10	j = 20	t = 30	

Using the table above, establish the number pairs for the ID you wish to install. Install these numbers starting at parameter 01, one number per parameter location, using each successive location until finished with "end of ID" (00). (The processor will ignore anything left in unused parameter locations up through 20).

Parameter	
01-20	Station identification code as determined above
21	SID control digit determined as follows: Starting with 0: If SID is turned on add 1, else add 0 (SID off) If SID every 15 minutes add 2, else add 0 (30 minutes) If SID also after every phone patch add 4, else add 0 (no SID after patch) The resultant control digit will be between 0 and 7

When properly stored, check for proper operation

Example: to install "DE (pause) ABC12" SID on, every 15 minutes (if station ptt occurred in that time) and after every phone patch, the parameters would be set as follows:

01 = 1	07 = 1	13 = 0	19 = don't care
02 = 4	08 = 1	14 = 1	20 = don't care
03 = 1	09 = 1	15 = 0	21 = 7
04 = 5	10 = 2	16 = 2	
05 = 3	11 = 1	17 = 0	
06 = 7	12 = 3	18 = 0	

II. Security/Executive Override Code

The security code may be used to:

1. Access patch from a mobile even though SW1 Section 6 on the OTX board is set for no mobile access.

2. Override 3 min. timer with *** even if SW2 Section 4 is off.

3. Override toll restrictions.

4. If so programmed, selective mobile signalling from an attendant and/or land-line caller can require the security code as a prefix (requires Selective Signalling option, E380/TDN6898).

5. If so programmed, attendant and/or land-line caller direct access can require the security code as a prefix. Refer to Section D, XIV and XV.

6. Operate external devices (for example, enabling a repeater) whenever the security code flag is set (the monitor relay is used as the control relay). Refer to Section D, VII, (Control of External Devices using the Security Code).

The security code reception flag is reset during every disconnect. The normal procedure for the priviledged mobile is to dial the security code prior to accessing the patch (*0#N where N is the stored security code). This will set the "security code received" flag which will remain up until the MRTI is next disconnected. The security code may also be entered after the MRTI accesses the telephone line.

Installation:

The security code is entered into the NVRAM using the procedure detailed under Option E155/TDN6908 parameter modification procedure.

The following defines the applicable locations.

Parameter	Function
22	Number of digits in security code (0-6)
23-28	The security code

III. Multi-Digit Mobile Access and/or Release Description

Multi-digit access and/or release codes are useful primarily in systems where more than one MRTI can be simultaneously accessed by a mobile. Also, multi-digit access and release can help prevent non-system mobile access to the MRTI (note that the security/executive override code, described elsewhere is used primarily to override restrictions placed on system users and land-line callers).

Installation:
The parameter modification procedure as described under Option E155/TDN6908 (Non-Volatile RAM) in this manual, is used to install the applicable parameters.

Parameter	
42	Number of digits in the multi-digit access prefix. This number may be from 1 to 4 (0 disables the multi-digit access prefix) Note: it may be desirable to allow a * sent by a mobile to bypass the multi-digit access prefix if a land-line call is waiting (ring signalling heard by mobile). If this function is desired, add 4 to the number of digits in the multi-digit access prefix. The resultant number to be entered in Parameter 42 will be from 5 to 8 (corresponding to 1 to 4 digits respectively, in the multi-digit access prefix)

Parameter	
43-46	Multi-digit access prefix (the processor ignores unused parameters)
47	Number of digits in the multi-digit release suffix
48-51	Multi-digit release suffix (the processor ignores unused parameters)

Examples:

1. If Parameter 42=3, 43=1, 44=2, 45=3, 47=2, 48=4, and 49=5, then the MRTI would respond to system mobiles as follows:

   123* would be used to originate a call or answer a waiting land-line caller. #45 would be used to release the telephone line.

2. If Parameter 42=7, 43=1, 44=2, and 45=3, then the MRTI would respond to system mobiles as follows:

   123* would be used to originate a call.
   123* could be used to answer a waiting land-line caller or * could be used to answer a waiting land-line caller in response to ring signalling from the MRTI. Note that if ring signalling had not been sent or the processor determined that the land-line party was no longer waiting, the MRTI will not respond to a *.

IV. Adjustable "Signal Search" Frequency and Duration Times

Description:
The standard signal search frequency is 2 per second or every 1/2 second. The standard signal search duration is 20 mnilliseconds. If these times are not adequate (slower transmitter relays, etc., they may be adjusted to suit the individual requirements in the following ranges:

Frequency - 4 per second to every 2.5 seconds.
Duration - 15 milliseconds to 100 milliseconds.

Installation:
The frequency is stored as a two- digit number at locations 54-55. Determine the number of 25-millisecond periods in the required frequency. For example, if a frequency of 1 second is desired, the numbers would be 40. Install them at locations 54-55 as described under Option E155/TDN6908 "Parameter Modification Procedure".

The duration is stored as a two-digit number at locations 52-53. Determine the number of 5-millisecond periods in the required duration. For example, if a duration of 40 milliseconds was required, the numbers would be 08.

Install them at locations 52-53 as described under Option E155/TDN6908 "Parameter Modification Procedure".

Parameter	
52-53	Two digit number of 5 millisecond periods in the signal search sample duration
54-55	Two digit number of 25 millisecond periods in the signal search frequency

When properly stored, check for proper operation.

V. Comprehensive Toll Restrictions

Description:
Up to 4 different prefixes of up to 4 digits may be restricted. Additionally up to 2 numbers or prefixes of up to 9 digits may specifically be allowed even though they contain a restricted prefix (such as 1411 for information, etc.). When a number is determined to be restricted and not stored as an allowed number, the MRTI disconnects the phone line.

Installation:
The control digits and numbers are entered as described under Option E155/TDN6908 "Parameter Modification Procedure". The following chart shows locations and definitions:

Parameter	
56	Number of digits in restrict prefix 1 (0-4) (0 disables this restrict prefix)
57-60	Restrict prefix 1
61	Number of digits in restrict prefix 2 (0-4)
62-65	Restrict prefix 2
66	Number of digits in restrict prefix 3 (0-4)
67-70	Restrict prefix 3
71	Number of digits in restrict prefix 4 (0-4)
72-75	Restrict prefix 4
76	Number of digits in allowable No 1 (0-9) (0 disables this allowable slot)
77-85	Allowable Number 1 or Prefix 1
86	Number of digits in allowable No 2 (0-9)
87-95	Allowable Number 2 or Prefix 2

After installing and storing the numbers in the shadow memory, test all functions for normal operation.

VI. Mobile Signalling Start

Description:
This feature is used when standard 1st or 4th ring signalling start is not adequate for system requirements. Land-line originated calls will ring from 1-9 times as programmed, before mobile signalling is initiated.

Installation:
The parameter modification routine as described under Option E155/ TDN6908 in this manual is used to install the control digit.

Parameter	
99	Number of rings before start of mobile signalling. (1-9) if 0, OTX SW2-Section 6 determines number of rings.

VII. Control of External Devices using the Security Code

In some installations, it is desirable to operate external devices, whenever the security code has been entered by the mobile user.

One example of such an application would be enabling or disabling a repeater in multiple repeater site systems.

(VII. cont'd.)

Provision has been made in the MRTI through control of the monitor relay in systems where the monitor relay is not necessary for normal MRTI operation. This function should not be used in installations where receive audio is used as the mobile carrier indicator, that is SW1 Section 3 is off. (See OTX Switch Settings)

Installation: Refer to VIII, Parameter 100.

Note 1: The security code flag is set whenever the security code has been entered by the mobile user either prior or after accessing the MRTI. (See Security/Executive Override Code in this section of this manual.) The security code flag is reset after every disconnect.

VIII. Land-line Priority with Selective Signalling

(Applicable with single line Model L1159A only. With Selective Signalling Option installed)

Certain telephone and PBX systems generate only a short, fixed-length D.T.M.F. burst. In order to reduce the burst length required from the caller telephone, provision has been made to give the land-line port priority, example - ignore the other input ports and "look" at only the land-line port during entry of selective signalling digits, rather than time-sharing the DTMF decoder in the MRTI. Enabling this feature allows the MRTI to respond to DTMF bursts as low as 50ms from the land-line port during entry of selective signalling digits.

Installation:
The parameter modification routine as described under Option E155/TDN6908 in this manual is used to install the control digit.

Note: Parameter 100 is also used with two other functions. They are:

1. Alteration of auto dial pause length (see Section G of this manual)
2. Control of External Devices using the Security Code. Refer to Section D, VII.

Whenever control of the monitor relay with the security code is needed, in addition to any of the other two functions, the control parameter digit entered for each function should be added together,and the resultant digit is entered in Parameter 100 as the control digit.

Parameter

100 Add 0 - No control of external function with the monitor relay when the security code flag is set. Normal 1.25 second pause length (refer to Auto-Dial Option Section G). No land-line priority when selective call digits are being entered.

Add 1 - Operate monitor relay when security code flag is set.

Add 2 - Increase Auto-Dial pause length to 8 seconds (refer to Section G)

Add 4 - Land-line priority when entering selective call digits (currently available only on Model L1159A- contact enginnering for specifics) (refer to Section H)

The resultant of the preceding operations is the Parameter 100 control digit and will be from 0 to 7.

IX. Variable Length Touch-Code Tones to Land-Line

Description:
This function allows the length of the Touch-Code tones sent to the land-line during land-line signalling (dialing a phone number) to be varied to compensate for slow tone receivers in the central office. This function is only operable when Touch-Code tones are being sent (not applicable during rotary signalling). The default value of 0 will cause standard land-line signalling; the first tone 250 milliseconds and successive tones 100 milliseconds. All tone off times are 100 milliseconds.

Installation:
The parameter modification routine, as described under Option E155/ TDN6908 in this manual, is used to install this parameter.

Parameter

127 Variable length Touch-Code tones to land-line. The number of 50 millisecond periods in each Touch-Code tone, range, 1-9 = 50 milliseconds to 450 milliseconds tone on time (tone off time always 100 milliseconds).

X. Emergency Call Direct Access

Description:
When this feature is enabled, a caller or attendant that has dialed into the MRTI (and been answered by the MRTI) and is waiting, (channel busy, another call, no mobile answer, etc.), can declare an emergency and be immediately connected to the radio by sending a full three second *. The MRTI will recognize the long *, say "Connecting (or "conferencing", as applicable) emergency call on line (x)", and gate on conversational audio. (This will occur even if the channel is busy. Therefore, a mobile user talking may not hear the connect message.) This feature is available only on L1158 multiline. Refer to XI for installation.

XI. Inhibiting Pseudo Touch-code Regeneration During Mobile Dialogue

The enabling of this feature prevents the regeneration of Touch-Code tones (or possible pseudo Touch-Codes) and consequently the muting of the audio path from the receiver to land-line for 6 seconds following a received Touch-Code digit.

The use of this function requires the mobile user to depress a second * immediately following the entry of the telephone number dialed (normal procedure).

Precautionary note: The use of this function excludes the regeneration of Touch-Codes to the land-line when mixed mode revert to Touch-Code is utilized with the auto-dial Option E378/TDN6896 or E379/TDN6897. However, Touch-Codes from the mobile are passed to the switched network and should not present any problem when the receiver is receiving a fully quieted signal. Operation under weak signal conditions may prove unreliable. See Section G Controlling Land Line Signalling Mode, of this manual.

Installation:
The parameters are entered into the NVRAM as described under Option E155/TDN6908 in this manual.

Parameter
143 Starting with 0;
a. To enable emergency call direct access, add 1, else add 0 (emergency call access disabled). (Refer to X for description)
b. To prevent the regeneration of Touch-Code tone or possible pseudo Touch-Codes) and consequently the muting of the audio path from the receiver to land-line for 6 seconds following a valid Touch-Code digit, add 4. The resultant parameter will be 0 to 5.

XII. Special Mobile Signalling Control

Description:
This feature is used when standard ring signalling (ring once for 3 seconds standard 390hz/430hz ring tone at reference level) is inadequate for system requirements. The ring frequencies may be changed to 800hz/840hz in situations where standard ringing signals are difficult to hear. Additionally, the ring tone may also be increased about 6 db if desired. In radio services that allow multiple rings to the mobile, this parameter can be programmed to cause ring or selective signalling to be repeated every 8 seconds (if the rf channel is clear)

NOTE:

In many applications below 800mhz, the maximum allowable mobile signalling, as prescribed by FCC regulations, is one time for no more than 3 seconds. Therefore, be sure that regulations applying to this system are not violated before programming this parameter to allow multiple signalling sequences.

Installation:
The parameter modification routine as described under Option E155/TDN6908 in this manual, is used to install the control digit.

Parameter	Function
159	Mobile Signalling Control Digit

Control digit determination starting with 0,

a. To change standard ringing tone (390hz/430hz) to a high frequency tone (800hz/840hz), add 1, else add 0.
b. To increase the amplitude of the ringing tone, add 2, else add 0 (does not affect selective signalling tones).
c. To cause ring (or selective) signalling to be repeated every 8 seconds, add 4, else add 0.

The resultant control digit will be from 0 to 7.

XIII. Variable Mobile Inactivity Timer

Description:
The standard mobile inactivity timer is set to 60 seconds (SW2, Section 3 on the OTX board on). This parameter can set the mobile inactivity timer from 32 seconds to 4 minutes 48 seconds in 32-second increments. When SW2, Section 3 on the OTX board is off, the mobile inactivity timer is completely disabled.

Installation:
The parameter modification procedure detailed under Option E155/TDN6809 is used to install this parameter.

Parameter

191	Mobile inactivity timer - the number of 32 second periods of mobile inactivity allowed before disconnect. If set to 0, the standard 1 minute mobile inactivity is used.

NOTE:

The following direct access control parameters 239 and 255 provide access control to attendants and/or land-line callers. FCC regulations concerning this kind of operation vary depending on type of service, accessability, etc. Therefore, be sure that regulations applying to this system are not violated before programming these parameters to value that would allow direct access to attendants and/or land-line callers.

XIV. Attendant Connect Control

The attendant connect control adds attendant control of the MRTI to the standard mobile control in all non-trunking systems. Mobile users may be addressed verbally, following mobile signalling in an attendant originated call. The attendant also has the ability to release the telephone line with "#" command. See XV for installation.

XV. Land-Line Caller Connect Control

Description:
The land-line caller connect control adds caller control of the MRTI to the standard mobile control and attendant control in all nontrunking systems. Like attendant control above, mobile users may be addressed verbally, following mobile signalling (ring or selective signalling, as appropriate), in a land-line caller originated call. The land-line caller also can cause the MRTI to release by sending the "#" command (if his phone is Touch-Code equipped. IF not, the MRTI can be released by a mobile or will time out, depending on how the timers are set).

Installation:
The parameter modification routine, as described under Option E155/TDN6908 in this manual, is used to install the control digit.

Parameter

239	Attendant direct access control parameter 0 = no attendant access control 1 = automatic connect after mobile signalling 2 = requires * from attendant to connect after mobile signalling

Parameter
239 (cont'd.)

3 = requires an "A" (fourth column Touch-Code digit) from attendant to connect after mobile signalling.

If the security code is required from the attendant before direct access is possible, add 4 to one of the above numbers.

The resultant parameter will be from 0 to 7

Parameter
255

Land-line caller direct access control parameter
0 = no land-line caller access control
1 = automatic connect after mobile signalling
2 = requires * from land-line caller to connect after mobile signalling
3 = requires an "A" (fourth column Touch-Code digit) from land-line caller to connect after mobile signalling

If the security code is required from the land-line caller before direct access is possible, add 4 to one of the above numbers.

The resultant parameter will be from 0 to 7

In MRTI systems that have been programmed for direct access as described above, it may be desirable to place additional timing restrictions on these land to mobile calls that have been initiated without supervision by mobiles or control points. These restrictions have been designed to conserve air time and are controlled by parameters 207 and 223.

XVI. Land-Line Message Hailing Timer

Description:
Provides a timed interval for paging or addressing a mobile of up to 45 seconds.

Parameter
207

Land-line message/hailing timer - the number of 5 second periods allowed from direct access (immediately following mobile signalling) until disconnect occurs (or a system mobile carrier is detected, as described below) range 1-9 = 5 sec - 45 sec.
0 disables this timer

XVII. Variable Overall Access Timer

Description:
Adds extended timed call length to standard MRTI overall access timer of up to 9 minutes in systems that allow it.

Parameter

223 Overall access timer - the number of minutes allowed for total access time. This parameter is also used in conjunction with parameter 207 to provide special direct access timing restrictions as described below.
Range, 1-9 = 1 minute to 9 minutes
0 disables this timer

Timer Function Table:

	OTX SW2-5	Message/ Hailing timer (207)	Alternate over-all timer (223)	Functional Description
1.	off	don't care	don't care	When SW2-5 on the OTX board (3 minute timer) is off, parameters 207 and 223 have no effect. This removes any overall timing restriction, but does allow mobile inactivity timing as determined by SW2-3 on the OTX board.
2.	on	0	0	This setting also defeats the special timers but does provide the standard 3 minute overall timer.
3.	on	0	1-9	This setting overrides the 3 minute overall timer and provides 1 to 9 minutes of overall access time.
4.	on	1-9	0	This setting allows direct access calls only the amount of time set by parameter 207 (5 to 45 seconds). Non-direct access calls will have 3 minutes of overall access time. This setting can be used to configure the MRTI as a paging system where the direct access caller would have only 5 to 45 seconds to give a voice message before disconnect.

OTX SW2-5	Message/ Hailing timer (207)	Alternate over-all timer (223)	Functional Description
			This function can be used alone or in conjunction with the non-direct access features of the MRTI. Mobile originated calls can be allowed by OTX switch settings. If parameters 255 and 239 are set to require a * or "A" for direct access calls, normal land to mobile calls can be allowed.
5. on	1-9	1-9	This setting allows direct access calls the amount of time set by Parameter 207 (5 to 45 seconds) unless a system mobile transmission is detected. If no transmissions are detected in the time set by Parameter 207, disconnect will occur. However, if a system transmission is detected (such as a mobile response to the land-line caller), this message/hailing timer is disabled and the alternate overall timer (Parameter 223) is enabled, allowing an overall time of 1 to 9 minutes.) This function can be used to help conserve air time on direct access calls. If the land -line caller originating a direct access call does not reach the desired mobile and either neglects to send a "#" to release the MRTI, or does not have a Touch-Code phone, the MRTI would remain accessed until one of the standard timers timed out. With this function set, that time can be limited from 5 to 45 seconds.

The *** command from a system mobile (if enabled by SW2-4 on the OTX board being on) has the effect of turning SW2-5 off only for the duration of the current access.

Option E378/TDN6896A - Auto Dial I (9 number storage) and
Option E379/TDN6897A - Auto Dial II (99 number storage)

AUTO DIAL OPTIONS

Auto-Dial Description

The MRTI Auto-Dial options allow storage of often used telephone numbers. E378/TDN6896A allows storage of up to 9, 15-digit numbers. Option E379/TDN6897A includes an expansion memory board (ADLX) and allows storage of an additional 90, 16-digit numbers. The numbers are stored in nonvolatile memory, that is, the numbers are remembered even during power outages. Auto-Dial number entry by mobiles may or may not be allowed as programmed by the installing technician. Also a security code may be required prior to auto-dial use if so programmed by the installing technician. Additionally, the auto-dial options allow a mobile operator to control the mode of land-line signalling (Touch-Code or rotary). A special "mixed" mode set by the mobile operator can allow a mixture of rotary and Touch-Code as described below.

OPERATOR INSTRUCTIONS

1. Using Auto-Dial

To use the MRTI Auto-dial feature, simply dial * and the auto-dial location number (1 to 9 for Option E378/TDN6896A and 01 to 99 for Option E379/TDN6897A). This auto-dial command may be issued while the MRTI is idle, or after the MRTI has been accessed. In either case, if a number is stored in that location, the MRTI will automatically dial the number, pausing, if necessary, between numbers (to allow for specific equipment requirements).

EXAMPLES:

*01 will cause the number stored in location 1 to be dialed.

* 1 will cause the same number in location 1 to be dialed.

*28 will cause the number stored in location 28 to be dialed (if E379/TDN6897A is included in this MRTI).

If commanding auto-dial from a location that is empty or the appropriate option has not been included for the location requested, you will receive no response from the MRTI.

2. Storing Numbers in the Auto-Dial Memory

To store auto-dial numbers, proceed as follows:
MRTI must be idle (not accessed)

a. Dial *0* puts MRTI in auto-dial entry mode
b. Dial the location number,
   (1-9 Option E378/TDN6897A)
   (1-99 Option E379/TDN6897A)
   followed by a * (end of location number)
c. Dial the number to store (up to 16 digits)
d. Dial *# (store command)

EXAMPLES:

1. *0* 2* 9 4 8 1 4 9 0 *#
   will store the number 948-1490 in Location 2.
2. *0* 34* 1 8 0 0 5 5 5 1 2 1 2 *#
   will store the number 1-800-555-1212 in location 34.

To cause a 1.25 second pause between numbers being auto-dialed, enter a * where the pause is desired (it is counted as one of the 16 digits).

Note: Refer also to Parameter 100, this section for increased paused length

EXAMPLE:

0 9* 9* 1 9 0 1 5 2 6 5 2 6 1 *#

would store in location 9, and when auto-dialed, would dial 9 (possibly outside line), pause 1.25 seconds (allowing equipment to respond), and then dial 1-901-526-5261.

To cause a revert-to-touch code, enter ** where the revert is desired (the revert-to-Touch-Code mode must be in effect when entering a revert code. See "controlling land-line signalling mode" below. After a revert command, additional *s only cause additional pauses.

EXAMPLE:

0 7* 87**1901**5551212 *#

would store in location 7 and, when autodialed, would pulse dial 87 (possible accessing a Touch-Code responsive line), pause 1.25 seconds, then Touch-Code dial 1-901, pause 2.5 seconds, then Touch-Code dial 555-1212.

When the mixed mode is in effect, revert to Touch-Code can also be used when manual dialing numbers. The revert is caused by a * and 2 second pause followed by the required Touch-Code digits.

Manual Entry Example:

1. dial * (accesses MRTI)
2. dial 87* (pulse dials 87, then reverts)
3. pause 2 seconds or more (defines revert command)
4. dial 5551212 (Touch-Code dials 5551212)

The redial command will redial the last sequence, including the revert.

Any time while in the auto-dial entry mode, you may reset to start over by dialing a # as long as it is not preceded by a * (*# is the store command). After the initial *0* command, 1 minute is allowed to complete the auto-dial entry. If the entry does not conform to the proper format, disconnect beeps will be heard when the mobile unkeys.

3. Clearing an Auto-Dial Location

Entering a new auto-dial number at a location will automatically clear the old number. To empty a location, proceed as follows:

dial *0* (location number) * *#

EXAMPLES

1. *0* 4* *# will clear location 4
2. *0* 73* *# will clear location 73

4. Controlling Land-Line Signalling Mode

a. Programming to default mode (mode determined by Switch 1 Section 5 on the OTX board. Units are shipped with this mode set)
   1. dial *0* (put MRTI in Auto-Dial entry Mode)
   2. dial 0* (specifies signalling mode entry)
   3. dial 0 (specifies default mode)
   4. dial *# (store command)

b. Programming to Touch-Code signalling mode
   1. dial *0*
   2. dial 0*
   3. dial 1 (specifies Touch-Code mode)
   4. dial *#

c. Programming to Rotary with revert-to-Touch-Code mode (mixed mode)
   1. dial *0*
   2. dial 0*
   3. dial 2 (specifies rotary with revert-to-Touch-Code)
   4. dial *#

Note: This dialing mode parameter is stored in Parameter 175, bits 2 and 3 and can be accessed via the standard parameter modification routine. The following defines Parameter 175, if direct modification is desired.

starting with 0

1. If existing parameter is odd, add 1,else add 0 (multiline terminology parameter)
2. If Touch-Code mode add 2, else add 0
3. If mixed mode, add 4, else add 0
4. If steps 2 and 3 are 0 then default mode is the result)

INSTALLATION

(If the ROM containing the Auto-Dial firmware is being field installed, it may be necessary to install the supplied socket in its designated position. Carefully install the ROM in its designated socket ensuring that the notch is oriented as shown on the OTX board layout).

If the ADLX board is supplied (Option E379/TDN6897) it may be necessary to install the supplied Header(s) at the p3 location on the OTX board. Ensure that the locking Ramp is as shown on the OTX board layout and the key pin 27 is missing.

The Auto-Dial control parameter in the NVRAM controls access on/off etc. The procedure to modify this parameter to change the option is described in the "Parameter Modification Procedure"

PARAMETER	
96	AUTO DIAL CONTROL DIGIT: If disabled add 1, if enabled add 0 (allows auto-dialing even if mobile access is disabled) If mobiles not allowed to enter/delete auto-dial numbers, add 2 else add 0 If security code required to use auto-dial, add 4. Else add 0. For Example: Parameter 96 = 0 Auto-dial enabled, mobiles can store auto-dial numbers, no security code required. Parameter 96 = 6 Auto-dial enabled,mobiles cannot change auto-dial numbers, security code required prior to each use of auto-dial (utilities option E155/TDN6895 required to support security code).

Variable Auto Dial Pause Length

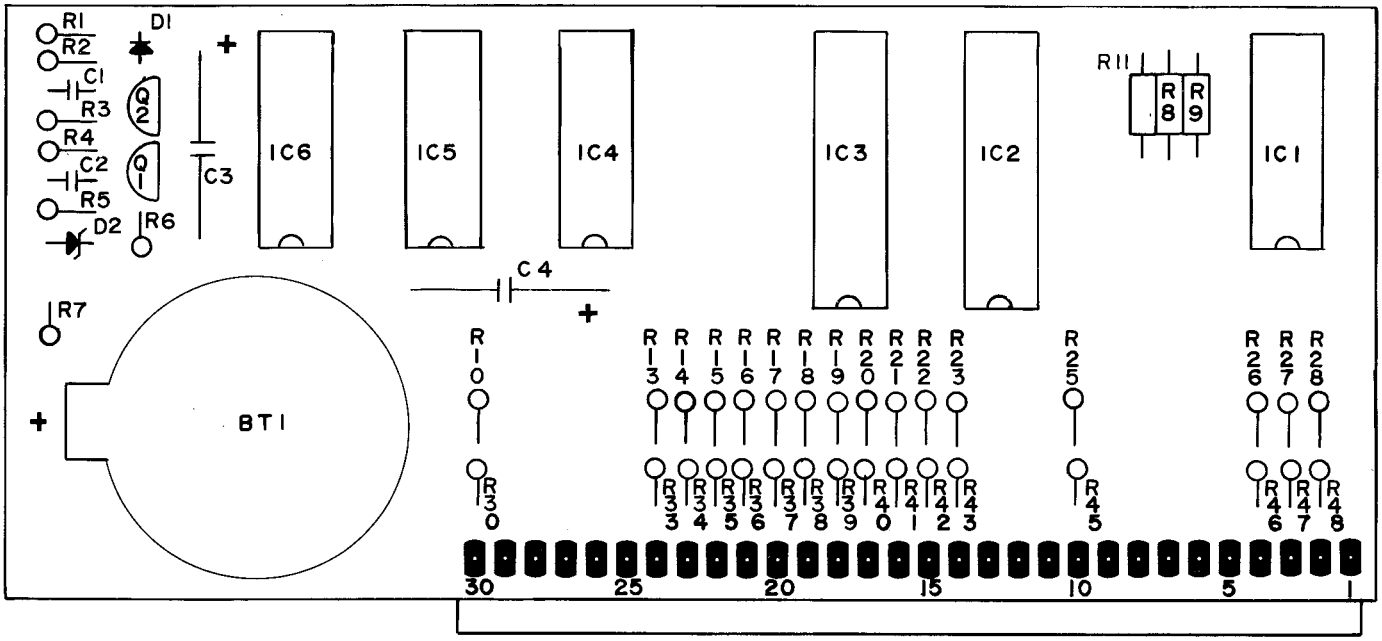
Occasionally, it is necessary to lengthen the normal pause between numbers being auto-dialed when using some long distance services such as MCI, SPRINT, etc. to allow for system response. In such cases, provision has been made to alter the pause length to 8 seconds.

Parameter	Auto Dial Control Digit
100	Add 0 - normal 1.25 sec. auto dial pause length
	Add 2 - increase auto dial pause length to 8 seconds

Note: Parameter 100 is also in the multi-function and selective signalling options (see sections D and H of this manual). In such cases, the control digit should be added with any other parameter 100 functions.

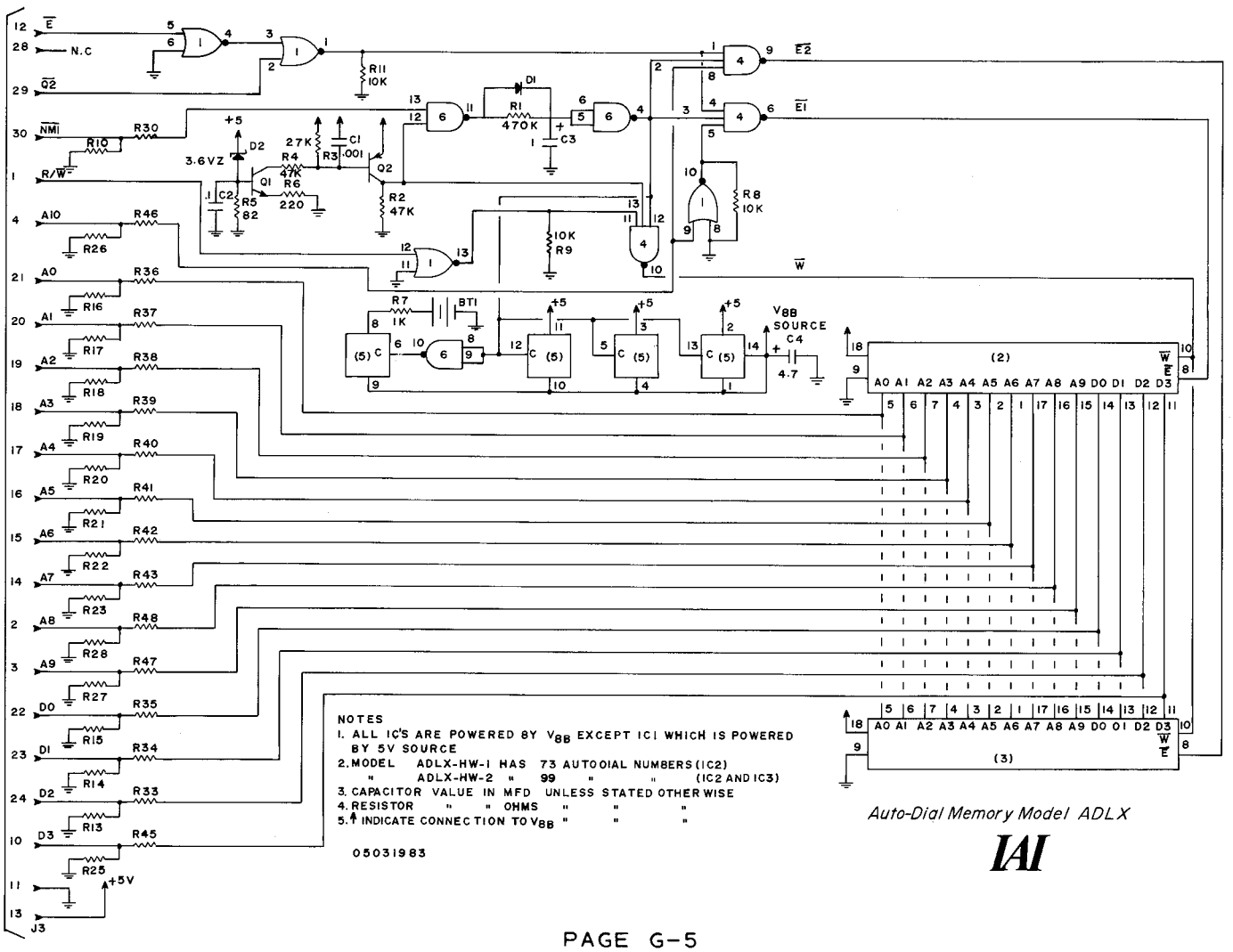
For example: If selective signalling is installed and Parameter 100 has been loaded with a 4 (land line priority when selective call digits are entered) and it is also necessary that the auto dial pause length be increased to 8 seconds, the resulting control digit to be installed in Parameter 100 would be 6.

AUTO DIAL MEMORY Model ADLX (P/O TDN6897A)



NOTE CIRCUIT BOARD IS SHOWN FROM COMPONENT SIDE

05031983



Auto-Dial Memory Model ADLX

IAI

Option E380/TDN6898
Selective Signalling of Mobiles in Touch-Code or Two-tone Sequential

Operator Instructions

The selective signalling feature may be operated by; 1. A land-line caller that has a Touch-Code telephone (or other means to generate Touch-Code tones). 2. An in-plant caller that has a Touch-Code phone (or other means to generate Touch-Code tones) on the same telephone line as the MRTI. A Touch-Code equipped mobile (revertive signalling). Parameter modification will determine which of these are allowed (any, all, or none).

1. Land-line caller. The caller dials the MRTI number. The MRTI will answer (1st or 4th ring as determined by SW2 Section 6) and acknowledge with a short beep. The caller has 6 seconds to begin entering selective signalling numbers after hearing the first short beep tone. When the proper number of digits are received, prefaced by the security code, if so programmed (requires option E377/TDN6895A) a second acknowledge beep will be heard. If the six seconds has expired and the proper number of digits have not been entered, one of two things will occur, depending on parameter programming (Parameter32).
   (a.) The caller will be disconnected or
   (b.) The MRTI will send a simulated ring signal for any mobile to answer. If the caller is not disconnected and ring signalling is sent, the time allowed a mobile to respond before the MRTI disconnects from the telephone line is determined by Parameter 29.

2. An in-plant caller attendant. After a telephone conversation is established on the same telephone line used by the MRTI, the attendant dials #* on his Touch-Code telephone or encoder. The MRTI will access the line and respond with a beep. The attendant then sends the appropriate numbers for selective signalling. After monitoring the channel, the MRTI sends the selective tones and then leaves the telephone line (disconnects). When the signalled mobile responds by accessing the MRTI, the conversation can begin.

3. Mobile Caller (Revertive)
   A mobile can selectively signal another mobile using the revertive feature of the MRTI. The mobile dials the code *## and the appropriate numbers of the desired unit. After testing for channel activity, the MRTI will send the Selective Signalling Sequence.

Installation

If the ROM containing the selective signalling firmware is being field installed, carefully insert the ROM in its designated socket ensuring that the notch is oriented as shown on the OTX board layout. The ROM containing selective signalling will be marked on the gummed label with the letters "SS". It may also be

combined with other firmware options and in such cases there will be the appropriate additional markings on the label. (The Multi-function Utilities Option will be designated with the letters UT, and the Auto-Dial Option will be designated with the letters AD.)

PARAMETER	FUNCTION
29	Time allowed for mobile to answer land-line caller before disconnect. Parameter is the number (1-9) of 16-second periods in the answer time. Range: 16 seconds to 2 minutes, 24 seconds. (Minimum of 16 seconds must be used.)
	In the following three parameters, different numbers of input digits may be required in each of the three selective call initiation methods (land-line call, mobile to mobile, and attendant).
30	Number of digits required from land-line caller (0-4) (if 0, the same code will be sent every time without any digits from caller).
97	Number of digits required from a mobile in mobile revertive (0-4) (if 0, the same number as in parameter 30)
98	Number of digits required from an attendant (0 to 4) (if 0, the same number as is in parameter 30)
31	Number of times to signal (1-3) (does not apply to attendant or revertive calls. If set to 0, selective signalling will be turned off). If TX PL stripping is desired during signalling, add 4, else add 0. The resultant signalling control digit will be 1-7.
32	Revert/Security Control Digit The revert/security control digit is established by the following procedure: Starting with 0: A. If revert to ring signalling after 6 seconds without receiving proper numbers, add 1, else add 0 (disconnect after the 6 seconds). B. If security code required from land-line callers, add 2,else add 0 (no code required.) C. If security code required from attendant, add 4, else add 0 (no code required). The resultant of the preceding three operations is the revert/security control digit and will be from 0 to 7.

33 Access control digit
The access control digit is established by the following procedure:
Starting with 0:
A. If accessible by land-line ring, add 1, else add 0.
B. If accessible by attendant, add 2, else add 0.
C. If accessible by mobile, add 4, else add 0.

The resultant of the preceding three operations is the access control digit and will be from 0 to 7.

34 Type of selective signalling
1 = Touch-Code (DTMF) signalling
2 = two-tone sequential signalling

The following parameter definitions apply only to Touch-Code (DTMF) signalling:

PARAMETER FUNCTION

35 Touch-code outpulse timing: This parameter is the number (1-9) of 50-millisecond periods in the touch-code digit and interdigit time.
Range: 50 ms on, off to 450 ms on, off.

NOTE: The maximum allowable mobile signalling time as prescribed by FCC regulations is three (3) seconds except in certain emergency service applications. Since it is possible to configure Touch-Code selective signalling so as to exceed the three-second requirement, it is recommended that the number of digits and digit timing parameters be established to conform to this regulation.

36 Number of digits in the preamble: (0 - 5)

37-41 Touch-code preamble:
For example, if the parameters were set up as follows:

29 = 6, 30 = 3, 31 = 6, 32 = 3, 33 = 7, 34 = 1,
35 = 2, 36 = 5, 37 = 9, 38 = 8, 39 = 7, 40 = 6,
41 = 5

The following conditions would be established:

1. The mobile used would have approximately 1-1/2 minutes (96 seconds) to respond to a land-line call before the landline caller was dumped.

2. The MRTI would accept three digits from the land-line caller. If the caller does not enter the digits within 6 seconds the MRTI will send simulated ring signalling instead of selective signalling.

3. Signalling will occur twice for land-line and mobile (revertive) calls and the TX PL stripping relay will operate during signalling.
4. Land-line callers must preface the selective signalling digits with the security code (part of utilities Option, E377/ TDN 6895). Upon receipt of the security code an additional 6 seconds is allotted for receipt of the selective signalling digits.

5. Land-line, attendants and mobile-to-mobile selective signalling is allowed.

6. Touch code (DTMF) signalling will occur.

7. The selective signalling preamble will contain 5 Touch-Code digits.

8. The preamble digits will be "98765".

   Therefore, if a caller sends selective signalling digits of "321", (prefaced by the security code, if necessary) the MRTI will check for channel activity and when clear, key the transmitter with no tones for .375 seconds and then send the DTMF tones, "98765321" formatted 100 milliseconds of tone, 100 milliseconds of no modulation. If dialed by a land-line caller or mobile, if no response is heard after 15 seconds, the code will be repeated. A land-line caller will hear "ringing" between signalling sequences, and will hear the signalling sequences.

The following parameter definitions apply only to two-tone sequential signalling;

PARAMETER	FUNCTION
35-36	2-digit number of desired code plan from the following table;

General Encode Plan	00	Code Plan M	= 12
modified gen. enc. plan	= 01	" " N	= 13
code plan B	= 02	" " P	= 14
code plan C	= 03	" " Q	= 15
code plan D	= 04	" " R	= 16
code plan E	= 05	" " S	= 17
code plan F	= 06	" " T	= 18
code plan G	= 07	" " U	= 19
code plan H	= 08	" " V	= 20
code plan J	= 09	" " W	= 21
code plan K	= 10	" " Y	= 22
code plan L	= 11	GE Code Plan	= 23

PARAMETER	FUNCTION
37	1st (MSD) digit of 2-tone prefix (if parameter 30 is less than 3)

PARAMETER	FUNCTION
38	2nd (NSD) digit of 2-tone prefix (if parameter 30 is less than 2)
39	3rd (LSD) digit of 2-tone prefix (If parameter 30 is 0 which will cause the same 2-tone code to be sent every time.)
40	Group Call Timing Control Digit (Group call timing is defined as follows; when tone a = tone b then the signalling tone is sent 8 seconds.) The group call timing control digit is established as follows: starting with 0 A. to enable group call timing for land-line originated calls add 1, else add 0. B. to enable group call timing for attendant originated calls add 2, else add 0. C. to enable group call timing for mobile originated (revertive) calls add 4, else add 0. The resultant control digit will be from 0-7.
41	B tone length. Varies the length of the B tone from 1 second to 9 seconds as follows: 0 = standard 2-second B tone 1-9 = length, in seconds, of the B tone

For example if parameters were set as follows:
30 = 2, 34 = 2, 35 - 1, 36 = 2, 37 = 4, 38, 39 don't care, 40 = 4, and 41 = 3

The conditions set would be as follows:
1. 2 digits accepted from caller
2. 2 tone sequential signalling
3. code plan M selected
4. 4 would be the 1st (hundreds) digit of cap codes

(continued)

(conditions cont'd.)

5. group call timing would be enabled on mobile-to-mobile revertive calls
6. A tone = 1 second, B tone = 3 seconds

Therefore, if a caller dialed "79" as the selective signalling digits, the MRTI would send the two-tone sequence (1 second A tone, 3 second B tone) corresponding to cap code 479 of code plan M (A tone = 470.5hz, B tone = 524.6 hz).

If a mobile wishing to dial a group of other mobiles entered 55 as the selective signalling digits the MRTI would send 8 seconds of B tone (422.1 hz).

NOTE:

In many applications below 800 MHZ, the maximum allowable mobile signalling time, as prescribed by FCC regulations, is three (3) seconds. Therefore, be sure that regulations applying to this system are not violated before programming parameters 40 and/or 41 to values that would cause the MRTI to signal mobiles for more than the allowed time.

MRTI Two Tone Selective Signalling Code To Frequency Charts

Tone Group Frequency Chart (Chart A)

Tone Group #	Tone Number 0	1	2	3	4	5	6	7	8	9	Chart A Group #
1	330.5	349.0	368.5	389.0	410.8	433.7	457.9	483.5	510.5	539.0	1
2	569.1	600.9	634.5	669.9	707.3	746.8	788.5	832.5	879.0	928.1	2
3	1092.4	288.5	296.5	304.7	313.0	953.7	979.9	1006.9	1034.7	1063.2	3
4	321.7	339.6	358.6	378.6	399.8	422.1	445.7	470.5	496.8	524.6	4
5	553.9	584.8	617.4	651.9	688.3	726.8	767.4	810.2	855.5	903.2	5
6	1122.5	1153.4	1185.2	1217.8	1251.4	1285.8	1321.2	1357.6	1395.0	1433.4	6
A	358.9	398.1	441.6	489.8	543.3	602.6	668.3	741.3	822.2	912.Ø	7
B	371.5	412.1	457.1	507.0	562.3	623.7	691.8	767.4	851.1	944.1	8
Z	346.7	384.6	426.6	473.2	524.8	582.1	645.7	716.1	794.3	881.Ø	9
GE (A)	682.5	592.5	757.5	802.5	847.5	892.5	937.5	547.5	727.5	637.5	A
GE (B)	652.5	607.5	787.5	832.5	877.5	922.5	967.5	517.5	562.5	697.5	B
GE (C)	667.5	712.5	772.5	817.5	862.5	907.5	952.5	532.5	577.5	622.5	C

Code Plans (Chart B)

(1st digit indicates Chart A Group # source for A tone,
2nd digit indicates Chart A Group # source for B tone)

Code Plan	1st digit of 3 digit CAP code 0	1	2	3	4	5	6	7	8	9	Parameter 35-36
Gen Enc	42	11	22	12	44	55	21	45	54	24	00
Mod Gen Enc	42	11	22	33	44	55	66	45	54	24	01
B	N/A	11	22	33	12	13	21	31	23	32	02
C	N/A	11	22	12	44	14	21	41	24	42	03
D	N/A	11	22	12	15	55	21	51	25	52	04
E	N/A	11	22	12	21	16	66	61	26	62	05
F	N/A	11	13	33	44	31	14	41	34	43	06
G	N/A	11	13	33	31	55	15	51	35	53	07
H	N/A	11	13	33	31	16	66	61	36	63	08
J	N/A	11	14	41	44	55	15	45	54	51	09
K	N/A	11	14	41	44	16	66	61	46	64	10
L	N/A	11	15	51	16	55	66	61	56	65	11

Code Plan	1st digit of 3 digit CAP code 0	1	2	3	4	5	6	7	8	9	Parameter 35-36
M	N/A	23	22	33	44	32	24	42	34	43	12
N	N/A	23	22	33	32	55	25	52	35	53	13
P	N/A	23	22	33	32	26	66	62	36	63	14
Q	N/A	24	22	42	44	55	25	45	54	52	15
R	N/A	24	22	42	44	26	66	62	46	64	16
S	N/A	25	22	52	26	55	66	62	56	65	17
T	N/A	34	43	33	44	55	35	45	54	53	18
U	N/A	34	43	33	44	36	66	63	46	64	19
V	N/A	35	53	33	36	55	66	63	56	65	20
W	N/A	46	64	56	44	55	66	45	54	65	21
Y	N/A	77	88	99	78	79	87	97	89	98	22
GE	AA	BA	BB	AB	CC	CA	CB	AC	BC	N/A	23

Option E381/TDN6899
Mobile Control of External Functions
Module Model ORCTX-1

Operator Instructions

The E381/TDN6899 remote control option allows up to seven (7) independent control functions, on-off controllable from the mobile. The mobile operator may open and close gates or doors, or turn lights on and off etc. For instance, entering a *4* control command from your mobile or portable causes function 2 to "turn on". Enter A *4# and function 2 "turns off". The table below describes the control function commands.

3	function 1	turns on
*3#	function 1	turns off
#	function 1	turns off at every patch disconnect
4	function 2	turns on
*4#	function 2	turns off
5	function 3	turns on
*5#	function 3	turns off
.		
.		
.		
9	function 7	turns on
*9#	function 7	turns off

Functional Description

The ORCTX-1 features seven (7) independent 1/2 amp (resistive) relay closures controllable by the *n* commands described above. The first relay features a revertive function that opens the relay automatically on every patch disconnect. The relays 2 to 7 remain in the last state commanded. AC power interruption to the patch resets all relays to open.

Installation

The ORCTX-1 module plugs into P9 on the OTX board. P9 is repeated on the ORCTX-1 board to allow access to the P9 functions by other options. The relay closure cable connecting to P121 on the ORCTX-1 board leaves the patch chassis through the large "option" slot on the chassis rear panel. The snub-bushing provided on the cable slides into the slot, affording strain relief. The cable conductor functions are as follows:

P121 PIN	Cable color	FUNCTION
1	black	relay closure 1
2	white	relay closure return 1
3	red	relay closure 2
4	green	relay closure return 2
5	orange	relay closure 3
6	blue	relay closure return 3
7	white/black	relay closure 4
8	red/black	relay closure return 4
9	green/black	no connection
10	orange/black	relay closure 5
11	blue/black	relay closure return 5
12	black/white	relay closure 6
13	red/white	relay closure return 6
14	green/white	relay closure 7
15	blue/white	relay closure return 7

Option E382/TDN6900
Consolette Subfleet Control from Mobile
Module Model ORCTX-2
(Binary Switch Format)

Operators Instructions

The ORCTX-2 module allows the mobile operator to remotely control the fleet/subfleet switch selection on the base station. For example, by entering the *3* control sequence, you may effectively select "subfleet 1" on the radio front panel switch. You now have control of the radio fleet/subfleet switch and may select one of seven (7) sequential switch selections from your mobile by entering the Touch-Code commands as described at the bottom of this page. Control is returned to the base station switch only after you enter either *N# or # (patch disconnect) command.

Functional Description

The E382/TDN6900 option provides mobile selection of seven (7) sequential fleet/subfleet selections on trunked base stations via 4 bit binary format. Relays on the ORCTX board simulate the base station front panel (sub)fleet switching only and do not alter the code plug options within the trunking micro-computer system. This option features a jumper programmable binary adder function that allows the seven *N* command selections to be "moved" anywhere in the 16 fleet/subfleet selection scheme. The ORCTX takes control of the base station (sub)fleet selection upon entry of a *N* command (n = 3-9) and reverts control back to the base station front panel switch when the patch disconnect signal is received. The revert function also occurs when the *N# command is received, allowing the revert function to occur without dropping the telephone line party.

The command functions are:

3	(sub)fleet selection 1
4	" " " 2
5	" " " 3
6	" " " 4
7	" " " 5
8	" " " 6
9	" " " 7
*N#	returns control to base station switch where N = 3-9.
#	returns control to base station switch and disconnects telephone party.

Installation

The ORCTX-2 module plugs into P9 on the OTX board. P9 is repeated on the ORCTX board to allow access to the P9 functions by other options. The fleet/subfleet control cable connecting to P122 on the ORCTX board leaves the patch chassis through the large "option" slot on the rear of the patch chassis. The snub-bushing provided on the cable slides into the slot affording strain relief. Refer to the INSTALLATION MANUAL for specific base station interface details.

Option E383/TDN6901
Motrar Fleet or Subfleet Control from Mobile
Module Model ORCTX-3
(1 of 4 Format)

Operators Instructions

The ORCTX-3 module allows the mobile operator to remotely control the fleet/subfleet switches on the base station. For example, by entering the *3* control sequence you effectively press the "A" button on the radio front panel. You now have control of the radio fleet/subfleet buttons and may effectively "press any button" remotely from your mobile by entering the Touch-Code commands as described in the table at the bottom of this page. Control is returned to the base station buttons only after you enter either *N# or # (patch disconnect) command.

Functional Description

The E383/TDN6901 option provides mobile selection of up to four (4) trunked control station fleet/subfleet selections via 1 of 4 unique format. Relays on the ORCTX-3 board simulate the base station front panel (sub)fleet switching only and do not alter the code plug options within the trunking micro-computer system. The ORCTX-3 takes control of the base station (sub)fleet selection upon entry of a *N* command (n= 3-9) and reverts control back to the front panel switches when the disconnect signal is received from the mobile. The revert function also occurs when the *N# command is received from the mobile, allowing the revert function to occur without dropping the telephone line party.

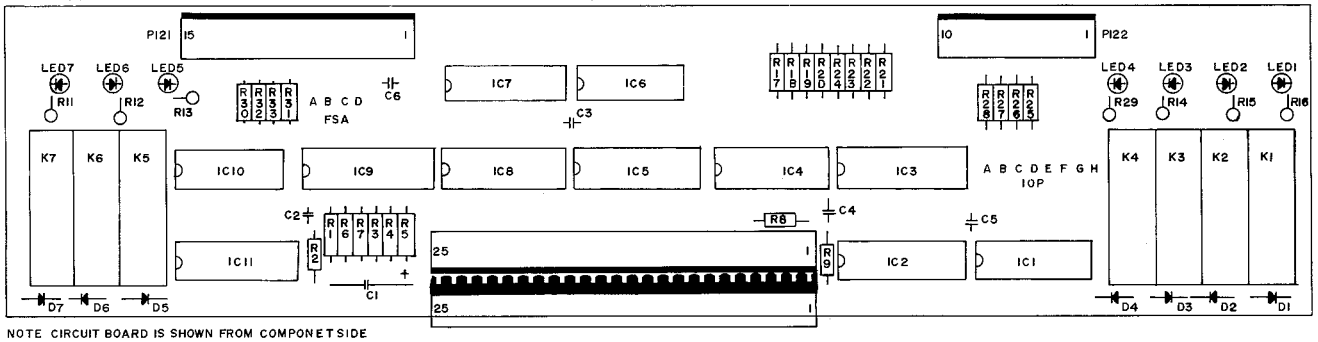
The command functions are:

3	(sub)fleet A	
4	" " B	
5	" " C	
6	" " D	
7 to *9*	" " A	(all switch lines open)

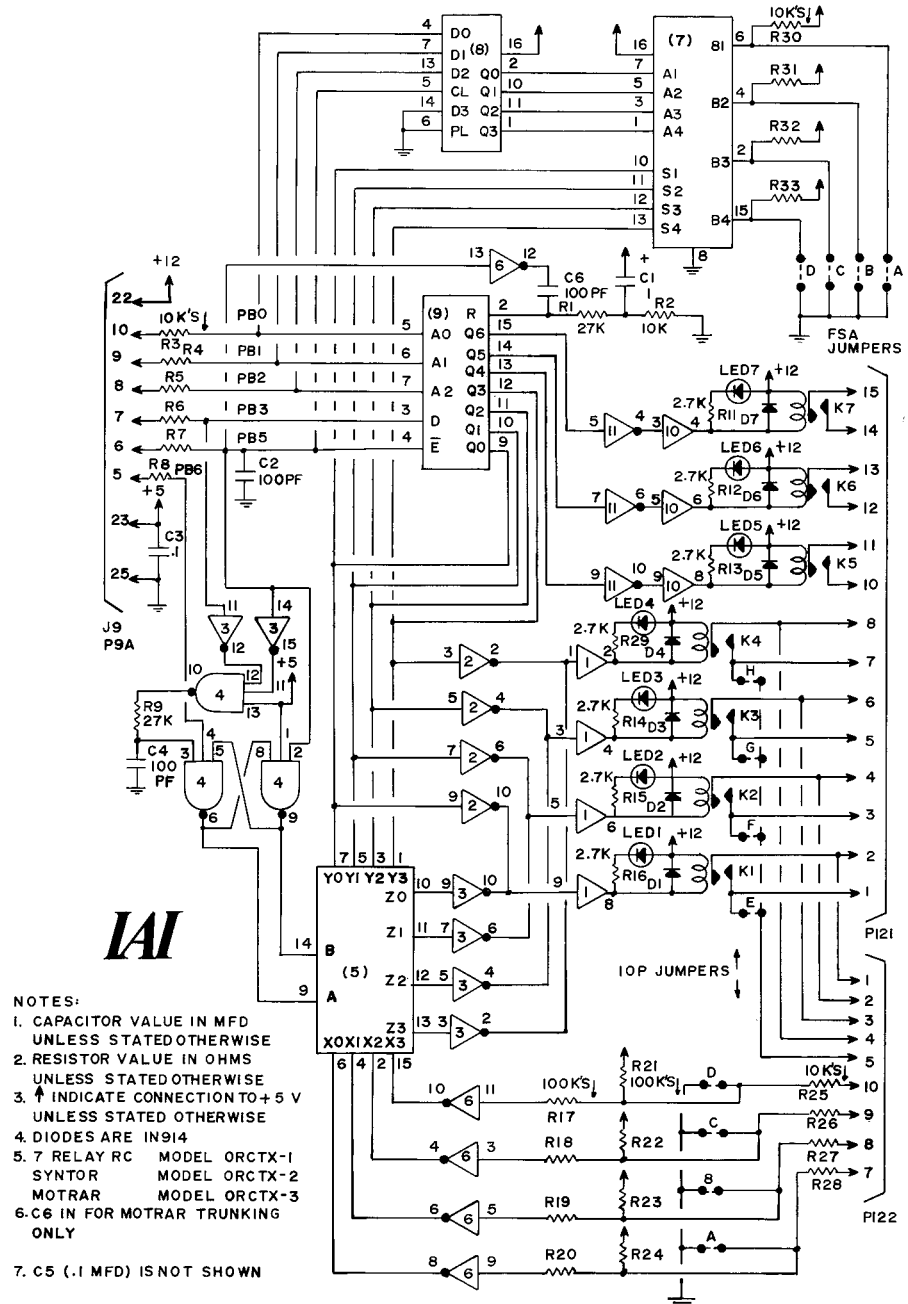
*N# returns control to switches where n = 3-9.
returns control to switches and disconnects telephone party.

Installation

The ORCTX-3 module plugs into P9 on the OTX board. P9 is repeated on the ORCTX-3 board to allow access to the P9 functions by other options. The fleet/subfleet control cable connecting to P122 on the ORCTX-3 board leaves the patch chassis through the large "option" slot on the rear of the patch chassis. The snub-bushing provided on the cable slides into the slot affording strain relief. Refer to the INSTALLATION MANUAL for specific base station interface details.



NOTE CIRCUIT BOARD IS SHOWN FROM COMPONET SIDE
03171983



NOTES:
1. CAPACITOR VALUE IN MFD UNLESS STATED OTHERWISE
2. RESISTOR VALUE IN OHMS UNLESS STATED OTHERWISE
3. ↑ INDICATE CONNECTION TO +5 V UNLESS STATED OTHERWISE
4. DIODES ARE IN914
5. 7 RELAY RC MODEL ORCTX-1
   SYNTOR MODEL ORCTX-2
   MOTRAR MODEL ORCTX-3
6. C6 IN FOR MOTRAR TRUNKING ONLY
7. C5 (.1 MFD) IS NOT SHOWN
8.

	IC1	IC2	IC3	IC4	IC5	IC6	IC7	IC8	IC9	IC10	IC11
ORCTX-1	●	●							●	●	●
ORCTX-3	●		●	●	●	●			●		
ORCTX-2	●		●	●	●	●	●	●			

9. 10P (INPUT/OUTPUT PROG.) JUMPERS ARE FOR SP APPLICATIONS: FIXED FREQ. REVERT, ETC.

REMOTE CONTROL/ TRUNKING
Model ORCTX
03171983

ORCTX-1 REMOTE CONTROL MODULE

REFERENCE SYMBOL	IAI PART NUMBER	DESCRIPTION
	INTERGRATED CIRCUITS	
IC1,10	3301-10037-00	HEX BUFFER
IC2,11	3301-10017-00	HEX INVERTER
IC9	3301-10023-00	8 BIT LATCH
	RESISTORS	
R9	3303-01001-10	1K 1/4W 5%
R11,12,13,14,15,16,29	3303-02701-10	2.7K 1/4W 5%
R2,3,4,5,6,7,8,25,26,	3303-01002-10	10K 1/4W 5%
R27,28	3303-01002-10	10K 1/4W 5%
R1	3303-02702-10	27K 1/4W 5%
R17,18,19,20,21,22,	3303-01003-10	100K 1/4W 5%
R23,24	3303-01003-10	100K 1/4W 5%
	CAPACITORS	
LED 1,2,3,4,5,6,7	3306-00750-00	LIGHT EMITTING DIODE
C2,4	3306-01000-00	100PF CERAMIC
C3,5	3306-01003-00	.1MF CERAMIC
C1	3306-41004-00	1MF/35V TANTALUM
	CONNECTORS	
P121	3311-10015-00	15 CIRCUIT HEADER
P9A	3311-10025-00	25 CIRCUIT HEADER
J9	3311-20025-00	25 CIRCUIT BOARD CONNECTOR
	MISCELLANEOUS	
D1,2,3,4,5,6,7	3302-20008-00	SILICON DIODE
K1,2,3,4,5,6,7	3310-00191-00	REED RELAY

ORCTX-2 REMOTE CONTROL MODULE (BINARY FORMAT)

REFERENCE SYMBOL	IAI PART NUMBER	DESCRIPTION
	INTERGRATED CIRCUITS	
IC1	3301-10037-00	HEX BUFFER
IC3	3301-10017-00	HEX INVERTER
IC4	3301-10015-00	TRIPLE 3 INPUT GATE
IC5	3301-10026-00	MULTIPLEXER
IC6	3301-10028-00	HEX SCHMILT INVERTER
IC7	3301-10011-00	FULL ADDER
IC8	3301-10045-00	QUAD LATCH
	RESISTORS	
R9	3303-02702-10	27K 1/4W 5%
R14,15,16,29	3303-02701-10	2.7K 1/4W 5%
R3,4,5,6,7,8,25,26,	3303-01002-10	10K 1/4W 5%
R27,28	3303-01002-10	10K 1/4W 5%
R17,18,19,20,21,22,	3303-01003-10	100K 1/4W 5%
R23,24	3303-01003-10	100K 1/4W 5%
	CAPACITORS	
LED 1,2,3,4	3306-00750-00	LIGHT EMITTING DIODE
C4	3306-01000-00	100PF CERAMIC
C3,5	3306-01003-00	.1MF CERAMIC
	CONNECTORS	
P122	3311-10010-00	10 CIRCUIT HEADER
P9A	3311-10025-00	25 CIRCUIT HEADER
J9	3311-20025-00	25 CIRCUIT BOARD CONNECTOR
	MISCELLANEOUS	
D1,2,3,4	3302-20008-00	SILICON DIODE
K1,2,3,4	3310-00191-00	REED RELAY

ORCTX-3 - 1 OF 4 FORMAT

REFERENCE SYMBOL	IAI PARTS NUMBER	DESCRIPTION
	INTERGRATED CIRCUITS	
IC1	3301-10037-00	HEX BUFFER
IC3	3301-10017-00	HEX INVERTER
IC4	3301-10015-00	TRIPLE 3 INPUT NAND GATE
IC5	3301-10026-00	MULTIPLEXER
IC6	3301-10028-00	HEX SCHMITT INVERTER
IC9	3301-10023-00	8 BIT LATCH
	RESISTORS	
R14,15,16,29	3303-02701-10	2.7K 1/4W 5%
R2,3,4,5,6,7,8,25,26,	3303-01002-10	10K 1/4W 5%
R27,28	3303-01002-10	10K 1/4W 5%
R1,9	3303-02702-10	27K 1/4W 5%
R17,18,19,20,21,22,	3303-01003-10	100K 1/4W 5%
R23,24	3303-01003-10	100K 1/4W 5%
	CAPACITORS	
LED 1,2,3,4	3306-00750-00	LIGHT EMITTING DIODE
C2,4,6	3306-01000-00	100PF CERAMIC
C3,5	3306-01003-00	.1MF CERAMIC
C1	3306-41004-00	1MF/35V TANTALUM
	CONNECTORS	
P122	3311-10010-00	10 CIRCUIT HEADER
P9A	3311-10025-00	25 CIRCUIT HEADER
J9	3311-20025-00	25 CIRCUIT BOARD CONNECTOR
	MISCELLANEOUS	
D1,2,3,4	3302-20008-00	SILICON DIODE
K1,2,3,4	3310-00191-00	REED RELAY

Option 384/TDN6902
Key Telephone System In-use Annunciator
Module Model KSAX

Description

The KSAX key system annunciator module provides a line-busy indication for certain standard key telephone systems. A relay closure via the standard USOC RJ12C telephone interconnect lights up the button associated with the phone patch telephone line. This gives the users of accompanying telephone sets the indications that the phone patch has accessed the telephone line.

Installation

The KSAX module plugs directly into J9 on the OTX board. On systems with other J9 options, the P159 cable plugs into the P9a extension plug on the other option. (Example: P9A on the ORCTX board) In this case, the KSAX module mounts on the #4-40 standoffs on the top cover-inside, directly above and parallel to the RLM-3 board, with the earth ground and telephone cables leaving the board toward the rear panel. Connections are as follows:

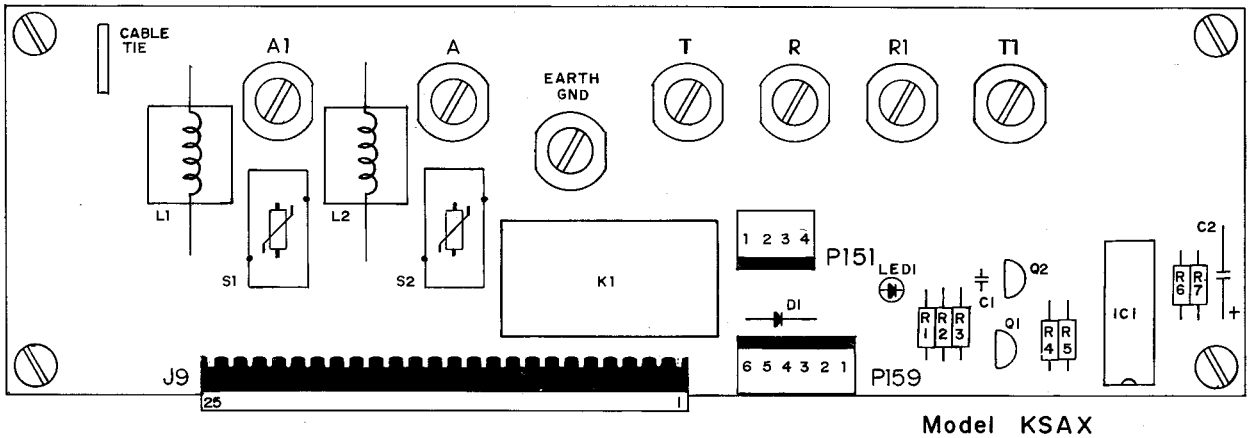
Screw Terminal	Connects To
earth ground	earth ground lug inside rear panel
A	black lead on RJ12C cable
A1	yellow lead on RJ12C cable
T	green lead on RJ12C cable
R	red lead on RJ12C cable
T1	T (tip) on RLM-3
R1	R (ring) on RLM-3

The earth ground and telephone connections, should be routed away from all other cables and circuit boards. The T1, R1 cord should be tie-wrapped to the RLM-RIMX earth ground wire.

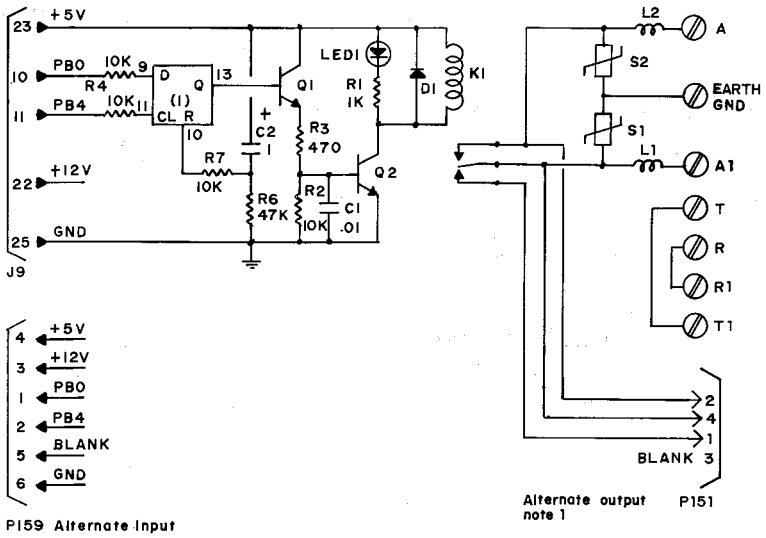
P151 -Connections provide 2 amp dry relay contacts for non-telephone applications where the KSAX module provides an isolated, multi-purpose relay operation on phone patch access.

P151 Pin #	Relay Contact
1	normally closed
2	normally open
3	keyed blank
4	common

MRTI KEY TELEPHONE SYSTEM ANNUNCIATOR



Model KSAX
06211983



NOTES.
1. L1, L2, S1, S2, are deleted when P151 is installed.
2. Capacitors are in mfd., resistors are in ohms. 06201983
3. ⊘ Indicates screw terminal connection.

IAI
PARTS LIST

KSAX KEY SYSTEM ANNUNCIATOR

REFERENCE SYMBOL	IAI PARTS NUMBER	DESCRIPTION
	RESISTORS	
R1	3303-01001-10	1K 1/4W 5%
R3	3303-00470-10	470 OHM 1/4W 5%
R2,7,9,11	3303-01002-10	10K 1/4W 5%
R6	3303-04702-10	47K 1/4W 5%
	CAPACITORS	
C1	3306-01002-00	.01 CERAMIC
LED 1	3306-00750-00	LIGHT EMITTING DIODE
C2	3306-41004-00	1MF CERAMIC
	TRANSISTORS	
Q1,2	3309-44010-00	NPN TRANSISTOR
	CONNECTORS	
J9	3311-20025-00	25 CIRCUIT BOARD CONNECTOR
P151	3311-10004-00	4 CIRCUIT HEADER
P159	3311-10006-00	6 CIRCUIT HEADER
S151	3311-40004-10	4 POSITION CONNECTOR
S159	3311-40006-00	6 POSITION CONNECTOR
	MISCELLANEOUS	
IC 1	3301-10012-00	DUAL D FLIP FLOP
D1	3302-20001-00	SILICON DIODE
L1,2	3307-00010-30	PROTECTION CHOKE
K1	3310-00215-00	RELAY
S1,2	3312-20000-10	SURGE SUPPRESSOR

Read This First !

INSTALLATION MANUAL FOR

MICPROCESSOR RADIO TELEPHONE INTERCONNECT

L1158 and L1159

This manual contains installation information for the following Radio Equipment:

Mitrek Consolette

Maxar and Moxy

Maxar 80 Base

Micor RCB Repeater

Flexar Repeater

T1600 Series Remote

MSR 2000 Series Base

MSF 5000 Series Base

INSTRUMENT ASSOCIATES, INC.

CONTENTS

INSTRUMENT ASSOCIATES, INC.

Last Revised AUG 1985

Revision B

These instructions are categorized by operational mode as discussed in the detailed "Installation Considerations: section of the MRTI Instruction Manual and reflect the normal, recommended, method of connection to the base station. IT is recommended that you read the "Installation Considerations" section to familiarize yourself with MRTI operation and to answer any questions regarding the short form procedures.

General installation procedures for installation in any radio equipment are covered in detail in the accompanying MRTI Instruction Manual.

Note: If any of the following options are included in this MRTI, parameter modification (described in Section A of the instruction manual) may be necessary to enable/disable a particular function.

1. E377AA/TDN6895A Multifunction Utilities (contained in ROM firmware marked "UT") Shipped with all optional functions turned off. Refer to Section D of the instruction manual.

2. E378AA/TDN6896A E379/TDN6897A Auto-dial (contained in ROM firmware marked "AD") Shipped with all Auto-dial functions enabled. Refer to Section G of the instruction manual.

3. E380AA/TDN6898A Selective Signalling (contained in ROM firmware marked "SS") Shipped with all Selective Signalling Options disabled. Refer to Section H of the instruction manual.

IMPORTANT: The importance of proper grounding for logic reference and lightning protection cannot be over-emphasized. Therefore, a copy of "MRTI Grounding and Lightning Protection" is included as the first page of these instructions. When installed utilizing the methods outlined, a very high degree of surge and lightning protection is provided both to the MRTI and companion equipment.

MRTI Grounding and Lightning Protection

To provide ground reference for the logic inputs to the MRTI and to enable the extensive lightning and surge protection in the MRTI, the MRTI must be ground bonded to the associated radio equipment through the supplied #12 wire, or larger, by connection to the bolt marked EARTH GROUND on the MRTI rear panel and to the radio equipment frame. The connection to the radio frame should be to bright metal that is a part of the radio proper such as an internal side rail, the connection marked GROUND on the newer series of base stations or by removing one of the antenna connector screws and using a lug of the correct size on products such as MAXAR, MOXIE. This grounding should be extended to the ground utilized by the telephone company's surge protector installed on the phone line(s) used by the MRTI.

General System Lightning Protection Considerations

The damage done by lightning is due to potential differences developed between equipments, between equipment and the power source, between equipment and the outside telephone line and finally between equipment and earth ground. Two things are imperative if we are to minimize lightning damage.

1. All equipment at a site should be bonded frame to frame with adequately sized conductor. This common ground should be bonded to the utility entrance ground cable and the telephone entrance ground, if different from the utility entrance ground. Bear in mind that lightning is essentially R.F. and as such does not like long leads and will not tolerate sharp bends, as it "sees" this as a high impedance. If a tower is used it is essential that the common ground system also be bonded to the tower. At a site where these various components are encountered (tower, utility ground, telephone ground) it is suggested that #6 bare copper be used as a minimum.

2. The degree of insurance against lightning, after bonding, is almost directly related to the RESISTANCE of the earth ground(s) used. All grounds connected in parallel contribute to lowering the net ground resistance (tower, utility, telephone, if independent). For "hot" sites (sites where lightning is known to regularly cause damage) it is well to use multiple ground rods spaced several feet apart and bonded together with $6 or better wire. If soil is sandy or rocky the local utility company can usually provide excellent advice if their engineering office is contacted relative to the local methods used to obtain a low resistance ground. Many times these utility engineering departments will measure your site effective ground resistance with their specialized equipment, if approached in the right way. Remember the potential of lightning is what does the damage and the lower the ground resistance, the lower the lightning potential.

MITREK CONSOLETTE

MRTI Signal Search Simplex Mode

Interconnection between the MRTI and the base station can be made via the accessory terminal strips TB1 and TB2 on the rear of the chassis. In most applications, there are several spare terminals available for special interfacing in addition to the standard functions provided.

MRTI Signal Search Simplex Mode

Install the following modifications/additions to the base station utilizing spare screw terminals on TB1 and TB2.

1. RX Detected Audio — Run a wire to DETECTED AUDIO available at solder strip TB4-5,6.

2. P.L. Detect — Run a wire to SQUELCH DISABLE on the MITREK transmitter-receiver board. Set up the P.L. detect circuit output for "or squelch" operation. (JU1, JU2 out on the P.L. deck). If the busy light kit is NOT present, add a 5.6k, 1/4w. resistor from SQUELCH DISABLE to ground.

3. P.L. Stripping — Run a wire to the CD (code disable) stake pin on the P.L. deck.

4. Reverse Burst Inhibit — Run a wire to the P.L. deck as follows: digital P.L. deck: to E3 stake pin. Tone P.L.deck: to junction of R18 + R22.

Now connect the MRTI P12 interconnect cable to TB1 and TB2 as follows:

P12 Cable Color	To	Function
brown	designated spare	TX P.L. stripping
red	TB2-4	ground
orange	designated spare	reverse burst inhibit
yellow	TB2-4	ground
green	TB2-4	ground
violet	TB2-4	ground
gray	designated spare	RX detected audio
white	TB2-5	PTT
black	designated spare	P.L. detect
tan	TB2-6	mike low
pink	TB2-7	mike high

Earth Ground — Run the supplied #12 (or larger) wire from the EARTH GROUND terminal on the MRTI to the base station chassis ground. This wire must be as short as practical, not coiled, and fastened securely to the base station chassis.

Connection complete.

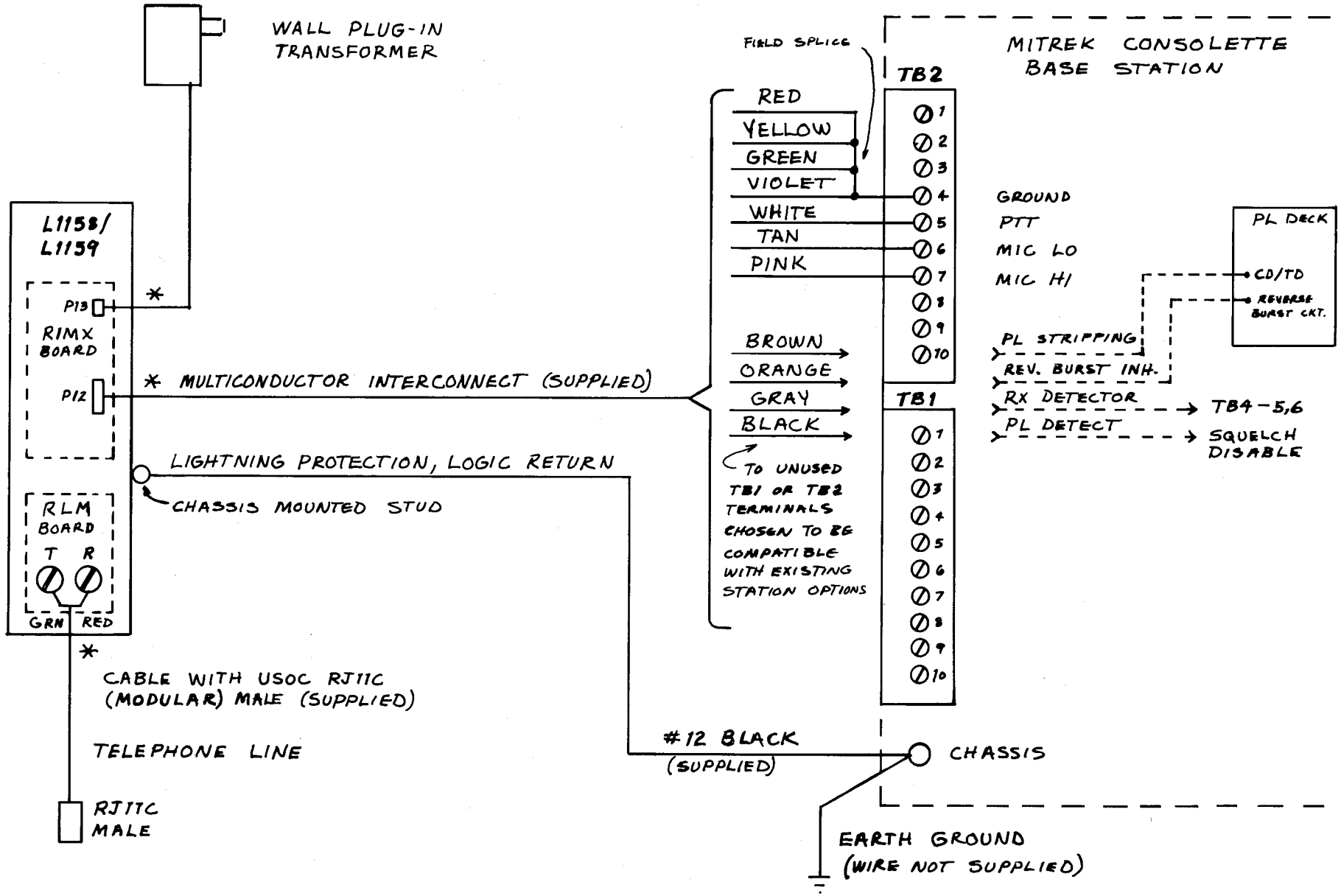
RIMX Switch Settings: Set the switches as follows:

SW1 on (private line system, off for carrier squelch)
SW2 off
SW3 don't care
SW4 off
SW5 off
SW6 off

OTX Switch Settings: Set the OTX switches as follows:

SW1 section 2 on
SW1 section 3 on
SW2 section 1 off

All other switches are programmed as applicable to system requirements. Refer to the OTX Switch Settings section in the MRTI Instruction Manual, then go to the Level Setting section.



* NOTE CABLES SLIDE OUT OF MRTI CHASSIS SLOTS FOR SERVICING

INTERCABLING DIAGRAM
FOR SIGNAL SEARCH SIMPLEX MODE
MITREK CONSOLETTE BASE STATION TO L1158/L1159

MITREK CONSOLETTE

Enhanced VOX Simplex Mode

Install the following modifications/additions to the base station utilizing spare screw terminals on TB1 and TB2.

1. RX Detected Audio — Run a wire to DETECTED AUDIO available at solder strip TB4-5,6.

2. P.L. Detect — Run a wire to SQUELCH DISABLE on the MITREK transmitter-receiver board. Set up the P.L. detect circuit output for "or squelch" operation. (JU1 in, JU2 out on the P.L. deck). If the busy light kit is NOT present, add a 5.6k, 1/4w, resistor from SQUELCH DISABLE to ground.

3. P.L. Stripping — Run a wire to the CD (code disable) stake pin on the P.L. deck.

Now connect the MRTI P12 interconnect cable to TB1 and TB2 as follows:

P12 Cable Color	To	Function
brown	designated spare	TX P.L. stripping
red	TB2-4	ground
green	TB2-4	ground
violet	TB2-4	ground
gray	designated spare	RX detected audio
white	TB2-5	PTT
black	designated spare	P.L. detect
tan	TB2-6	mike low
pink	TB2-7	mike high

Earth Ground — Run the supplied #12 (or larger) wire from the EARTH GROUND terminal on the MRTI to the base station chassis ground. This wire must be as short as practical, not coiled, and fastened securely to the base station chassis.

If this is a control station in a repeater system, that transmits PL/DPL during transmit turn off delay, it is necessary that the repeater be set for zero turn-off delay. (See note 1 below.)

RIMX Switch Settings: Set the switches as follows:

SW1 on (private line system, off for carrier squelch)
SW2 off
SW3 don't care
SW4 off
SW5 off
SW6 off

OTX Switch Settings: Set the OTX switches as follows:

SW1	section 2	on
SW1	section 3	on
SW2	section 1	off

All other switches are programmed as applicable to system requirements. Refer to the OTX Switch Settings section in the MRTI Instruction Manual, then go to the Level Setting section.

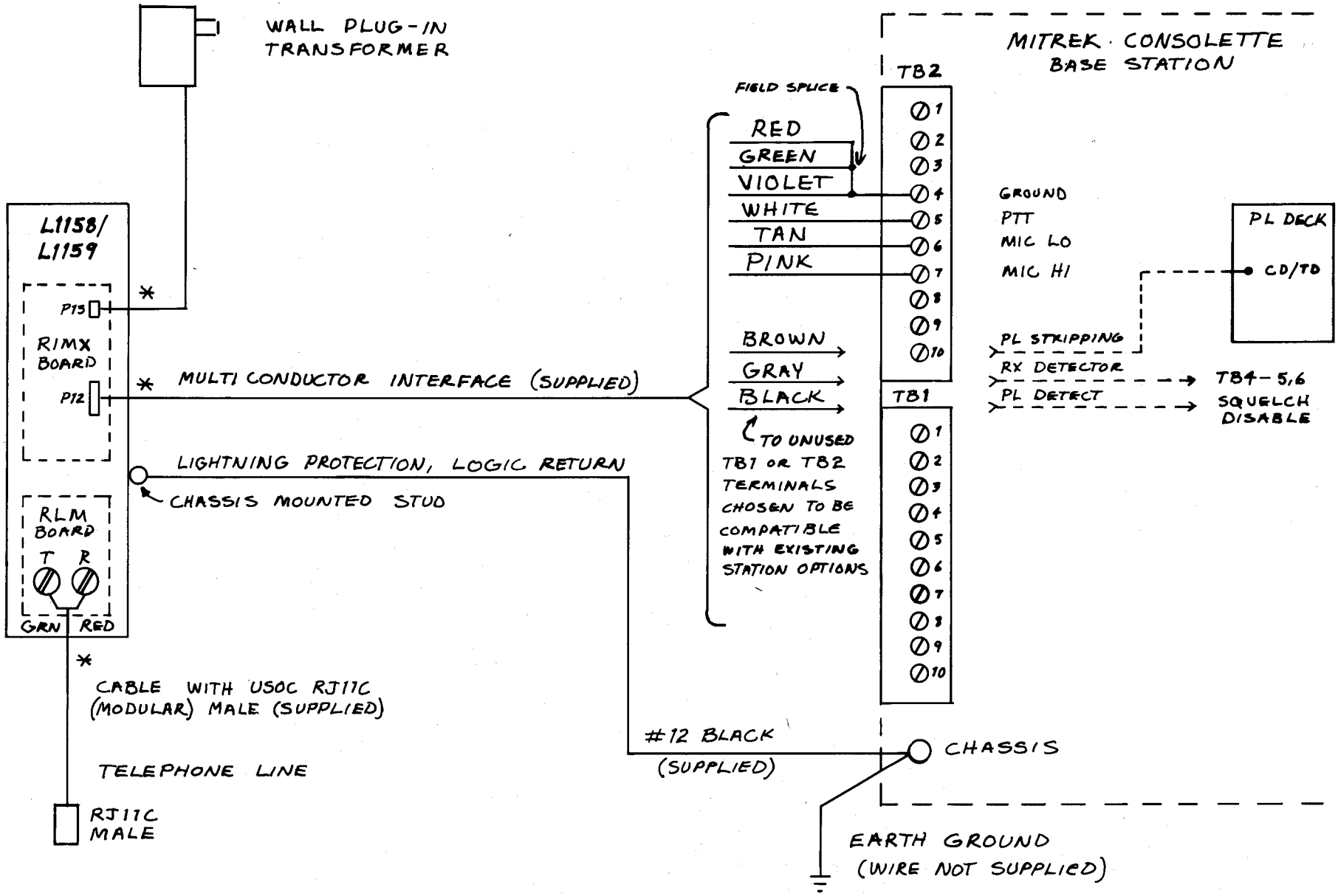
Notes:

1. Repeater transmit turn-off delay in repeater control station installations.

   When the MRTI is being installed in a control station controlling a repeater, it is necessary to ensure that the repeater does not stay on the air after the control station unkeys. If the MRTI detects carrier (and PL/DPL, if applicable) after unkeying the control station, it will erroneously be seen as a mobile transmission. In systems that require PL/DPL and retransmit (not generate) the PL/DPL signal (such as most community repeaters), no problem will be encountered since carrier only will not be seen as a system mobile. Some repeater stations have a jumper for turn-off delay but many of them will delay turnoff more than a second even though the "0" position is selected. In these cases, reducing the timing capacitor to a much smaller value will produce the required results (for example, changing C11 on a MICOR repeater TLN4662A squelch gate module from 68UFD to 4.7UFD).

2. 60-Second Mobile Inactivity Timer.

   In the Enhanced VOX Simplex Mode, the land-line caller cannot be interrupted by the mobile (until the 30-second timeout). Therefore, it is possible for the mobile to hear the warning ticks and not be able to reset the inactivity timer because the land-line party is talking. Therefore, it is recommended that the mobile inactivity timer be disabled (SW2-Section 3 on the OTX board turned off) in Enhanced VOX Simplex systems. If the mobile drives out of range, the three-minute access timer will prevent the MRTI from staying accessed indefinitely (SW2-Section 5 on the OTX board turned on).



* NOTE **CABLES SLIDE** OUT OF MRTI CHASSIS SLOTS FOR SERVICING

INTERCABLING DIAGRAM
FOR ENHANCED VOX SIMPLEX MODE
MITREK CONSOLETTE BASE STATION TO L1158/L1159

(characterized by all pins in the cable connector being the same size)

Install the following modifications/additions to the base station utilizing the supplied female connector pins where necessary.

1. RX Detector Audio — Run a wire from U10, Pin 6, to J601-13 (wire for meter 2 may be in Pin 13 of J601 and possibly could be rerouted and used for this function).

2. TX PL Disable — Run a wire from the PL/DPL code disable - Pin CD or TD on the PL/DPL deck to J601-3.

3. PL Detect

   tone PL (reed type) (TRN6177C and similar) — Locate and remove the soldered-in JU401 and install a 100k 1/4w resistor in its place (NOTE: there are two JU401s shown on the board pictorial. The correct one for this function is the one in series between U401 Pin 13 and Q409 base. This resistor allows Pin 13 of U401 to swing between detectable logic levels). Remove C428 and replace it with a 1 MFD capacitor, observing polarity. Run a wire from U401 Pin 13 to J601, Pin 10 (wire for meter 1 may be in Pin 10 of J601 and possibly can be rerouted and used for this function).

   tone PL (reedless type (TRN4237A and similar) — Run a wire from U401, Pin 28, on the PL deck to J601, Pin 10 (wire for meter 1 may be in Pin 10 of J601 and possibly can be rerouted and used for this function).

   digital PL: (TRN6207A and similar) — Run a wire from U301, Pin 7, on the DPL deck to J601, Pin 10, (wire for meter 1 may be in Pin 10 of J601 and possibly can be rerouted and used for this function).

4. reverse burst disable — (Necessary for signal search mode only.)

   tone PL (reed type) (TRN6177C and similar) — Remove the lead on the PL deck that comes from J601, Pin 1 (PL on-off from hang-up box) and solder it to Q406 base. Solder the supplied .01 MFD RF decoupling capacitor between base and emitter of Q406. Connect JU401 to HD (note: there are two JU401s shown on the board pictorial. The correct one for this function is the one that grounds the emitter of Q409 when connected to Pin HD.)

tone PL (reedless type) (TRN4237A and similar)	Remove the lead on the PL deck that comes from J601, Pin 1 (PL on-off from hang-up box) and solder it to U401, Pin 36. Remove the lead on the PL deck that comes from J601, Pin 2 (hang-up box ground) and solder it to the junction of C414 and R408 on the PL deck. Remove R421 on the PL deck (between U401, Pin 7, and Pin 26). Solder the supplied diode into the JU102 holes on the main circuit board, (close to squelch control) with the cathode toward mic PTT.
digital PL: (TRN6207A and similar	Remove the lead on the PL deck that comes from J601, Pin 1 (on-off from hang-up box) and solder it to Q312 base. Connect JU302 to Pin D.

The monitor function is now via the front panel and/or desk mike monitor switch.

Now connect the MRTI J12 radio cable to the base station P601 connector as follows, utilizing the supplied male connector pins, as applicable.

Pin 601 Pin #	Color	Function
6	red	TX PL disable return
6	green	PTT return
6	violet	RX detector return
6	tan	TX audio return

Twist the above listed leads together and solder to a short wire lead. Then strip a small section on the black power lead close to the connector. Neatly, solder the short lead from the returns to the stripped section of the black power lead.

5	pink	TX audio (mic hi)
13	gray	RX detector audio
3	brown	TX PL disable
10	black	RX PL detect
8	white	push to talk
1	orange	reverse burst inhibit
2	yellow	reverse burst inhibit return

Note: The orange and yellow lead (reverse burst inhibit and return) need be connected only in the signal search mode.

Earth Ground — Run the supplied #12 black ground wire from the MRTI EARTH GROUND terminal to the base station chassis. This wire must be as short as practical, not coiled, and connected securely to the base station chassis.

If this is a control station in a repeater system, that transmits PL/DPL during transmit turn-off delay, it is necessary that the repeater be set for zero turn off delay. (See note 2 below.)

Connection complete.

RIMX Switch Settings: Set the switches as follows:

SW1 on (private line system, off for carrier squelch)
SW2 off
SW3 don't care
SW4 on-tone (reed), off-tone (reedless) off - DPL
SW5 on
SW6 off

OTX Switch Settings: Set the OTX switches as follows:

SW1	section 2	on
SW1	section 3	on
SW1	section 8	off
SW2	section 1	off

All other switches are set as applicable to system requirements. Refer to the OTX Switch Settings section in the MRTI Instruction Manual and then go to the Level Setting section.

Notes:

1. MAXAR Quadrature Detector Adjustment can cause receiver response time problems, especially in DPL systems. This can adversely affect MRTI operation, especially in the Signal Search mode. The following procedure will ensure the shortest possible receiver PL/DPL response time and is the procedure currently being used on all MAXAR, MOXY and MAXAR 80 radios being shipped from the factory.

   a. Transmit into a 50-ohm load at 13.8v
   b. Note meter 2 (Quadrature output)using a high impedance DVM (may be necessary to measure on the radio circuit board if the meter 2 wire was used in the MRTI installation).
   c. Dekey the radio.
   d. Inject a 10.7000mhz signal into the I.F. of the MAXAR radio.
   e. Adjust the Quadrature coil (L18 or L23) for a meter 2 reading as measured in step 2 plus or minus 0.1 volts DC.

This procedure reduces or eliminates the pulse to the PL/DPL deck caused by the difference of Quadrature voltage between transmitting and receiving an on-frequency signal. Note that a mobile transmitting off frequency can cause the same problem.

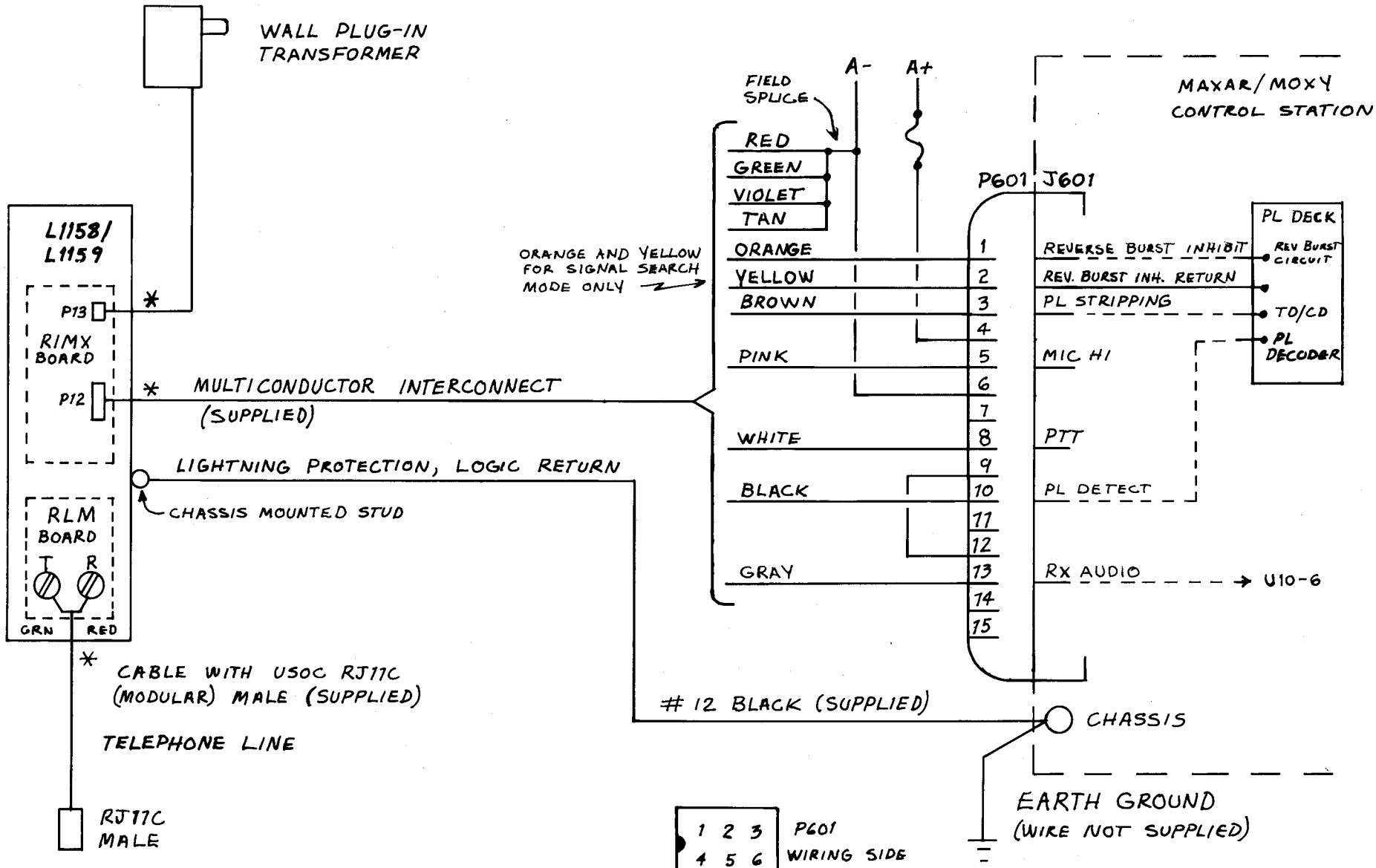
2. Repeater transmit turn-off delay in repeater control station installations.

   When the MRTI Is being installed in a control station controlling a repeater, it is necessary to ensure that the repeater does not stay on the air after the control station unkeys. If the MRTI detects carrier (and PL/DPL, if applicable) after unkeying the control station, it will erroneously be seen as a mobile transmission. In systems that require PL/DPL and retransmit (not generate) the PL/DPL signal (such as most community repeaters), no problem will be encountered since carrier only will not be seen as a system mobile. Some repeater stations have a jumper for turn-off delay but many of them will delay turn off more

than a second even though the "0" position is selected. In these cases, reducing the timing capacitor to a much smaller value will produce the required results (for example, changing C11 on a MICOR repeater TLN4662A squelch gate module from 68UFD to 4.7UFD).

3. 60-Second Mobile Inactivity Timer.

In the Enhanced VOX Simplex Mode, the land-line caller cannot be interrupted by the mobile (until the 30-second timeout). Therefore, it is possible for the mobile to hear the warning ticks and not be able to reset the inactivity timer because the land-line party is talking. Therefore, it is recommended that the mobile inactivity timer be disabled (SW2-Section 3 on the OTX board turned off) in Enhanced VOX Simplex systems. If the mobile drives out of range, the three-minute access timer will prevent the MRTI from staying accessed indefinitely (SW2-Section 5 on the OTX board turned on).



* NOTE CABLES SLIDE OUT OF MRTI CHASSIS SLOTS FOR SERVICING

INTERCABLING DIAGRAM

MAXAR/MOXY CONTROL STATION TO L1158/L1159

(characterized by 2 large power pins in the cable connector, pins A and B).

Install the following modifications/additions to the base station utilizing the supplied female connector pins where necessary.

1. RX Detector Audio — Run a wire from U10, Pin 6, to J601-6 (wire for meter 2 may be in Pin 13 of J601 and possibly could be rerouted and used for this function).

2. TX PL Disable — Run a wire from the PL/DPL code disable - Pin CD or TD on the PL/DPL deck to J601-3.

3. PL Detect

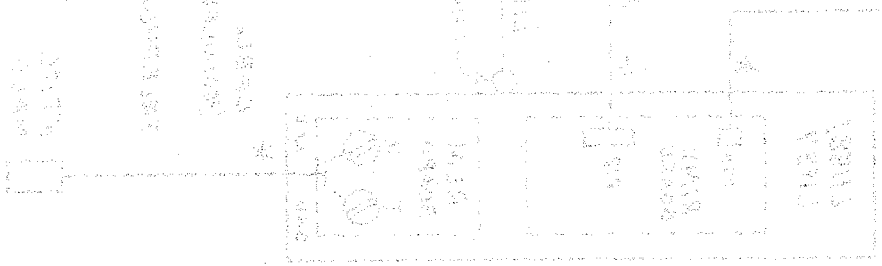
   tone PL (reed type) (TRN6177C and similar) — Locate and remove the soldered-in JU401 and tone PL (reed type) install a 100k 1/4w resistor in its place (Note: there are two JU401s shown on the board pictorial. The correct one for this function is the one in series between U401, Pin 13, and Q409 base. This resistor allows Pin 13 of U401 to swing between detectable logic levels). Remove C428 and replace it with a 1 MFD capacitor, observing polarity. Run a wire from U401 Pin 13 to J601, Pin 4.

   tone PL (reedless type) (TRN6207A and similar) — Run a wire from U401, Pin 28, on the PL deck to type J601, Pin 4.

   digital PL: (TRN6207A and similar) — Run a wire from U301, Pin 7, on the DPL deck to J601, Pin 4.

4. reverse burst disable — (Necessary for signal search mode only.)

   tone PL (reed type) (TRN6177C and similar) — Remove the lead on the PL deck that comes from J601, Pin 1 (PL on-off from hang-up box) and solder it to Q406 base. Solder the supplied .01 MFD RF decoupling capacitor between base and emitter of Q406. Connect JU401 to HD (note: there are two JU401s shown on the board pictorial. The correct one for this function is the one that grounds the emitter of Q409 when connect to pin HD).



tone PL (reedless type) (TRN4237A and similar)	Remove the lead on the PL deck that comes from J601, Pin 1 (PL on-off from hang-up box) and solder it to U401, Pin 36. Remove the lead on the PL deck that comes from J601, Pin 2 (hang-up box ground) and solder it to the junction of C414 and R408 on the PL deck. Remove R421 on the PL deck (between U401, Pin 7, and Pin 26). Solder the supplied diode into the JU102 holes on the main circuit board, (close to squelch control) with the cathode toward mic PTT.
digital PL: (TRN6207A and similar)	Remove the lead on the PL deck that comes from J601, Pin 1 (on-off from hang-up box) and solder it to Q312 base. Connect JU302 to Pin D.

The monitor function is now via the front panel and/or desk mike monitor switch.

Now connect the MRTI J12 radio cable to the base station P601 connector as follows, utilizing the supplied male connector pins, as applicable.

Pin 601 Pin #	Color	Function
B	red	TX PL disable return
B	green	PTT return
B	violet	RX detector return
B	tan	TX audio return

Twist the above listed leads together and solder to a short wire lead. Then strip a small section on the black power lead close to the connector. Neatly, solder the short lead from the returns to the stripped section of the black power lead.

5	pink	TX audio (mic hi)
6	gray	RX detector audio
3	brown	TX PL disable
4	black	RX PL detect
8	white	push to talk
1	orange	reverse burst inhibit
2	yellow	reverse burst inhibit return

Note: the orange and yellow leads (reverse burst inhibit and return) need be connected only in the signal search mode.

Earth Ground — Run the supplied #12 black ground wire from the MRTI EARTH GROUND terminal to the base station chassis. This wire must be as short as practical, not coiled, and connected securely to the base station chassis.

If this is a control station in a repeater system, that transmits PL/DPL during transmit turn-off delay, it is necessary that the repeater be set for zero turn off delay. (See note 2 below.)

Connection complete.

RIMX Switch Settings: Set the switches as follows:

SW1 on (private line systems, off for carrier squelch)
SW2 off
SW3 don't care
SW4 on-tone (reed), off-tone (reedless) off - DPL
SW5 on
SW6 off

OTX Switch Settings: Set the OTX switches as follows:

SW1 section 3 on
SW1 section 8 off
SW2 section 1 off

All other switches are set as applicable to system requirements. Refer to the OTX Switch Settings section in the MRTI Instruction Manual and then go to the Level Setting section.

Notes:

1. MAXAR Quadrature Detector Adjustment can cause receiver response time problems, especially in DPL systems. This can adversely affect MRTI operation, especially in the Signal Search mode. The following procedure will ensure the shortest possible receiver PL/DPL response time and is the procedure currently being used on all MAXAR, MOXY and MAXAR 80 radios being shipped from the factory.

   a. Transmit into a 50-ohm load at 13.8v
   b. Note meter 2 (Quadrature output)using a high impedance DVM (may be necessary to measure on the radio circuit board if the meter 2 wire was used in the MRTI installation).
   c. Dekey the radio.
   d. Inject a 10.7000mhz signal into the I.F. of the MAXAR radio.
   e. Adjust the Quadrature coil (L18 or L23) for a meter 2 reading as measured in step 2 plus or minus 0.1 volts DC.

This procedure reduces or eliminates the pulse to the PL/DPL deck caused by the difference of Quadrature voltage between transmitting and receiving an on-frequency signal. Note that a mobile transmitting off frequency can cause the same problem.

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   When the MRTI Is being installed in a control station controlling a repeater, it is necessary to ensure that the repeater does not stay on the air after the control station unkeys. If the MRTI detects carrier

(and PL/DPL, if applicable) after unkeying the control station, it will erroneously be seen as a mobile transmission. In systems that require PL/DPL and retransmit (not generate) the PL/DPL signal (such as most community repeaters), no problem will be encountered since carrier only will not be seen as a system mobile. Some repeater stations have a jumper for turn-off delay but many of them will delay turn off more than a second even though the "0" position is selected. In these cases, reducing the timing capacitor to a much smaller value will produce the required results (for example, changing C11 on a MICOR repeater TLN4662A squelch gate module from 68UFD to 4.7UFD).

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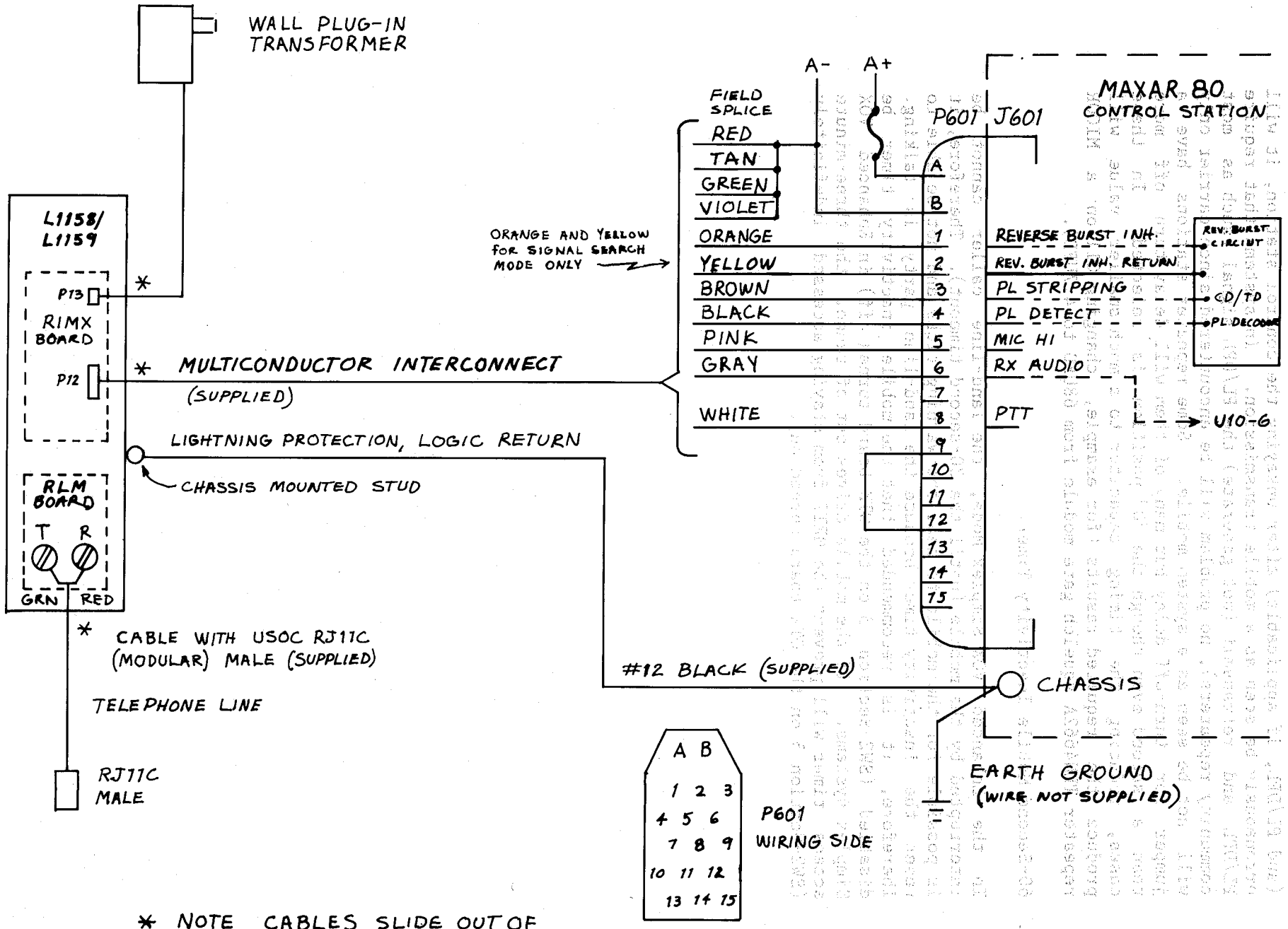
In the Enhanced VOX Simplex Mode, the land-line caller cannot be interrupted by the mobile (until the 30-second timeout). Therefore, it is possible for the mobile to hear the warning ticks and not be able to reset the inactivity timer because the land-line party is talking. Therefore, it is recommended that the mobile inactivity timer be disabled (SW2-Section 3 on the OTX board turned off) in Enhanced VOX Simplex systems. If the mobile drives out of range, the three-minute access timer will prevent the MRTI from staying accessed indefinitely (SW2-Section 5 on the OTX board turned on).



* NOTE CABLES SLIDE OUT OF MRTI CHASSIS SLOTS FOR SERVICING

INTERCABLING DIAGRAM

MAXAR 80 CONTROL STATION TO L1158/L1159

MRTI Duplex and-Half-duplex Modes

To facilitate easier installation and servicing, the screw terminals (TB3) should be utilized for connection of the MRTI P12 interface cable. It is suggested that the following jumper wires should be soldered into the holes adjacent to the screw terminals rather than wrapping the jumper ends around the terminals. Install the following jumpers:

	From	To	function
1.	screw terminal #9	J5 pin 9	PL stripping
2.	screw terminal #13	sta cont Pin 21	R1 disc.
3.	screw terminal #15	F1-PL Pin 22	exciter input
4.	screw terminal #17	J2-10	P.L. indicator

(In order to use the P.L. stripping function, a jumper must also be installed from P701 on the P.L. encoder board to P964 on the transmitter interconnect board. This jumper is also used with the paging P.L. defeat option.)

Installation of P12 Interface Cable

Cable Color	To	Function
Red	screw terminal #1	P.L. stripping return
green	screw terminal #1	PTT return
violet	screw terminal #1	RX audio return
tan	screw terminal #1	TX audio return
brown	screw terminal #9	P.L. stripping
gray	screw terminal #13	RX disc audio
white	screw terminal #14	Repeater PTT
pink	screw terminal #15	TX audio
black	screw terminal #17	P.L. indicator

Earth Ground Run the supplied #12 (or larger) wire from the EARTH GROUND terminal on the MRTI to the base station chassis ground. This wire must be as short as practical, not coiled, and fastened securely to the base station chassis.

Connection complete.

(continued)

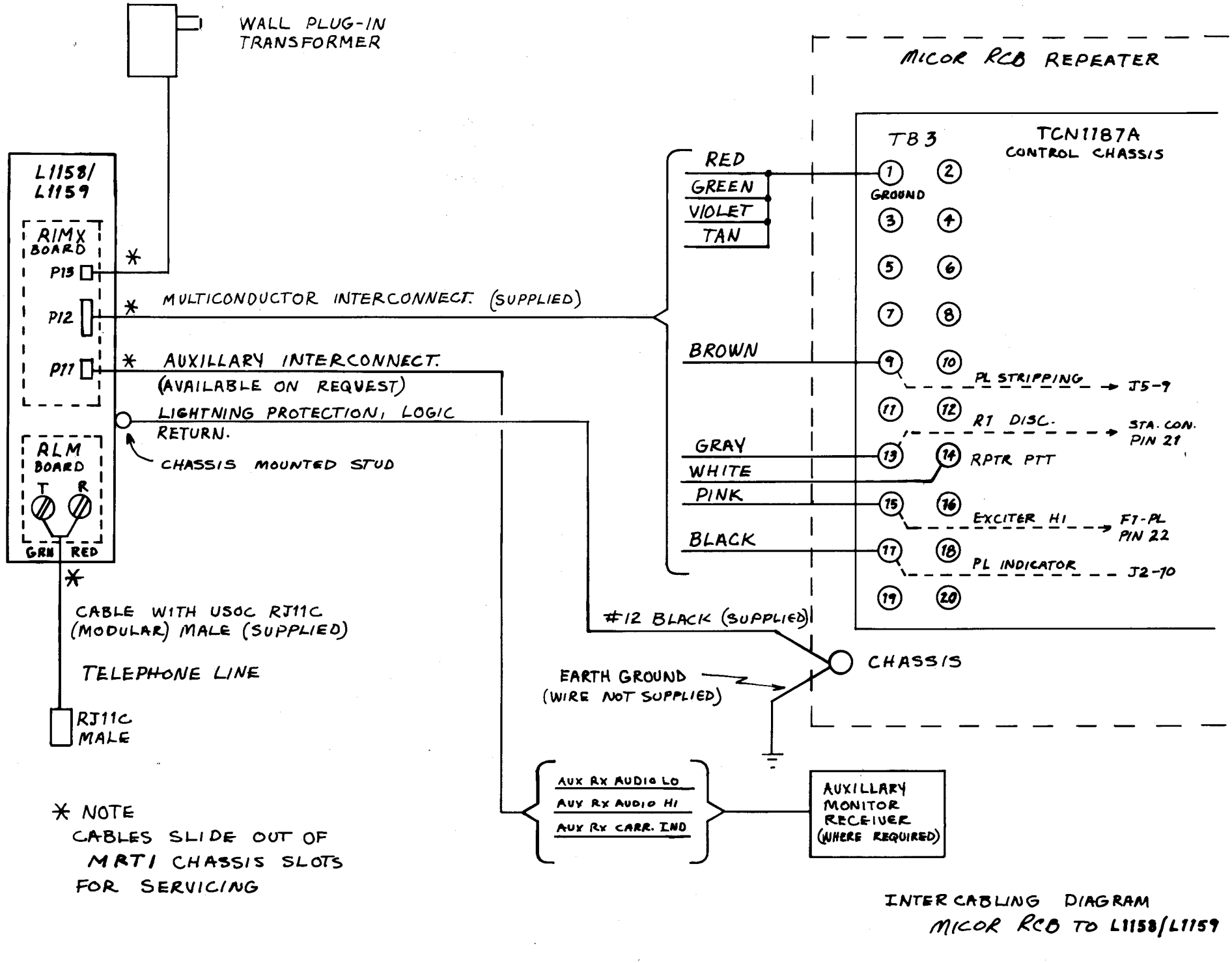
RIMX Switch Settings: Set the switches as follows:

SW1 on (private line systems, off for carrier squelch)
SW2 off
SW3 don't care
SW4 off
SW5 off
SW6 off

OTX Switch Settings: Set the OTX switches as follows:

SW1	section 3	on
SW1	section 8	on
SW2	section 1	off

All other switches are set as applicable to system requirements. Refer to the OTX Switch Settings section in the MRTI Instruction Manual and then go to the Level Setting section.



INTERCABLING DIAGRAM
MICOR RCB TO L1158/L1159

Install the following modifications/additions to the Flexar repeater utilizing the supplied connector pins. Female pins are used on J801. Wire colors specified match MRTI cable wire colors,and if followed may assist in any future service.

1. RX Detector Audio — Run a gray wire from J801 (metering socket) Pin 1 to P901 (receiver chassis plug) Pin 1 (male pin). Run another gray wire from J901 Pin 1 (female pin) on the receiver chassis to U10 Pin 6 (detector audio output).

2. PL Detect — Run a black wire from J801 Pin 9 position to P901 Pin 2 (male pin).

   tone PL (reed type TRN6177 and similar) — Run another black wire from J901 Pin 2 (female pin) on the receiver chassis to U401 Pin 13 on the PL deck. Locate and remove the soldered in JU401 and install a 100k, 1/4w resistor in its place. (Note: there are two JU401s shown on the board pictorial. The correct one for this function is the one in series between U401 Pin 13 and Q409 base.) This resistor allows Pin 13 of U401 to swing between detectable logic levels. Remove C428 and replace it with a 1 MFD capacitor, observing polarity.

   tone PL (reedless type TRN4273A and similar) — Run another black wire from J901 Pin 2 (female pin) on the receiver chassis to U401 Pin 28 on the PL deck.

   digital PL (TRN6207A and similar) — Run another black wire from J901 Pin 2 (female pin) on the receiver chassis to U301 Pin 7 on the PL deck.

3. TX PL Strip — Locate the yellow wire running from J701 Pin 10 the filter bracket terminal 10. Cut this wire off at the filter bracket and install a male pin on the free end. Insert the pin into J801 Pin 2 position. This is a spare wire that terminates at J601 on the transmitter chassis in the Flexar housing. Run another yellow wire from J601 Pin 10 position (may already be present) to the cathode side of CR120 on the exciter chassis (schematic reference point 57).

4. TX Audio — Run a pink wire from J801 Pin 4 position to the previously vacated filter bracket terminal 10. On the REPEATER CONTROL BOARD, connect a pink lead in series with a 1 meg resistor: from J20 Pin 10, clipping the resistor leads to 1/2 inch and soldering the resistor to U2 Pin 9. Use heat shrink or other "spaghetti" to insulate the wire-end of the resistor.

5. PTT — Run a white wire from J801 Pin 5 position to terminal 8 of the filter bracket.

6. Install male pins on the MRTI J12 radio cable and insert them into a plug body (Motorola p/n 15-80315A40) as follows:

Color	Function	Plug Pin Number
Gray	Rec. audio	1
Black	PL detect	9
Pink	transmit audio	4
White	PTT	5
Brown	TX PL strip	2
Yellow, Green,	ground	6
Violet, Tan, Red	ground	6

This plug mates with J801.

7. Earth ground (and logic return) — Run the supplied #12 black ground wire from the MRTI EARTH GROUND TERMINAL to the repeater chassis frame. This wire must be as short as practical, not coiled, and connected securely to the chassis.

Connection complete.

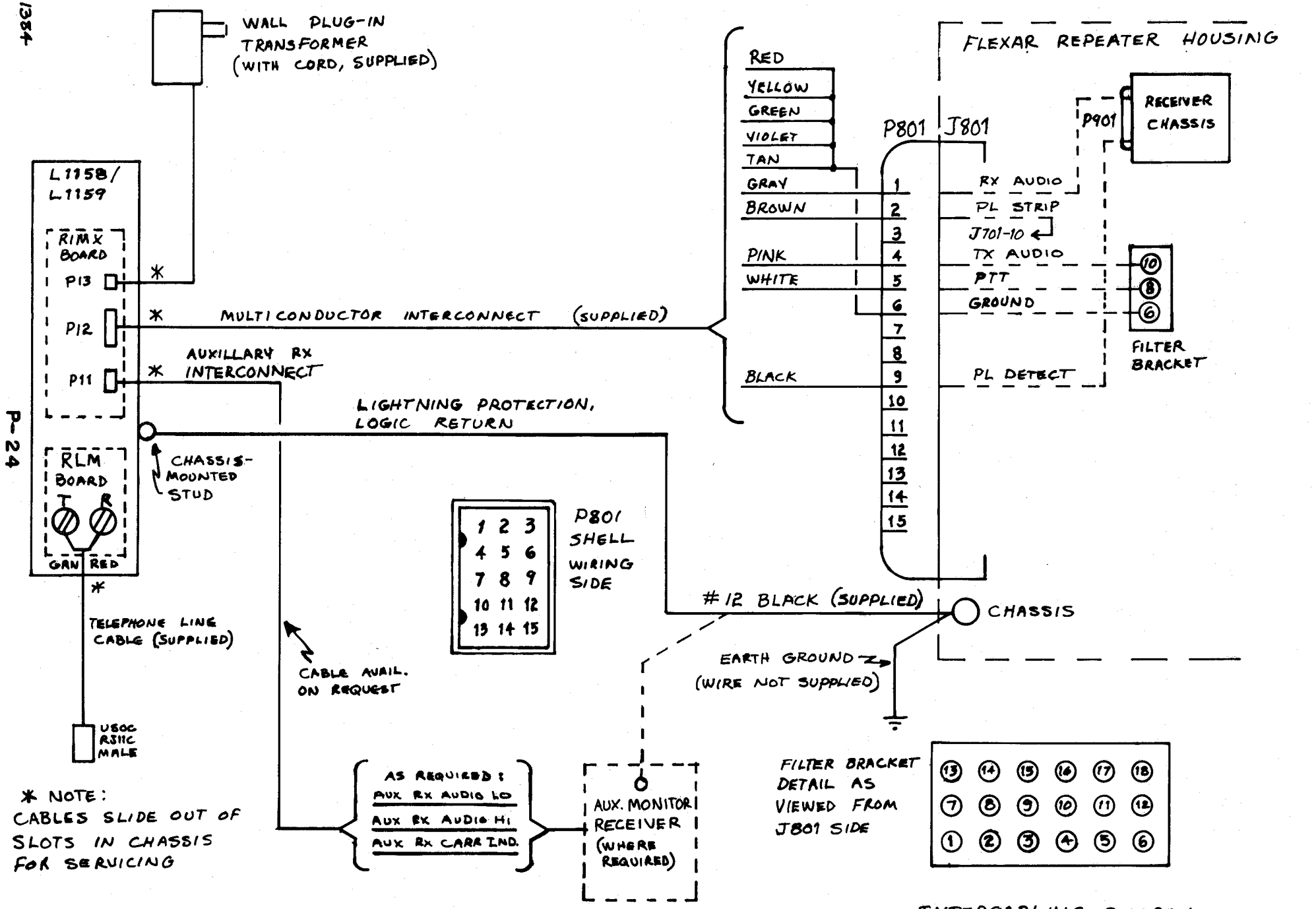
RIMX Switch Settings: Set the switches as follows:

SW1 on (private line systems, off for carrier squelch)
SW2 off
SW3 don't care
SW4 on-tone, reed. off-tone, reedless. off-DPL
SW5 on
SW6 off

OTX Switch Swettings: Set the OTX switches as follows:

SW1 section 2 on
SW1 section 3 on
SW1 section 8 on

All other switches are set as applicable to system requirements. Refer to the OTX Switch Settings section in the MRTI Instruction Manual and then go to the Level Setting section.



* NOTE:
CABLES SLIDE OUT OF SLOTS IN CHASSIS FOR SERVICING

INTERCABLING DIAGRAM
FLEXAR REPEATER TO L1158/L1159

In this mode of operation, the MRTI normally operates in the Enhanced VOX Simplex Mode. The MRTI must be equipped with the E375/TDN6893 Enhanced VOX Option. Receiver audio is used as the receiver carrier source. The exception is in full duplex applications when the 4-wire audio kit is installed on the remote. In such installations the MRTI would require the E376/TDN6894 Full Duplex Option.

Connect the MRTI radio cable to the remote as follows:

Radio Cable Interfacing

Color	Function	Terminal
Grey	Receive audio hi	13
Violet	Receive audio lo	12
Pink	Transmit audio hi	28
Tan	Transmit audio lo	27
White	Push to talk	15
Green	Push to talk return	1
Orange	Monitor (rec. PL disable)	19
Yellow	Monitor return	1
Blue	Receive carrier indicate	n.c
Brown	Transmit PL disable	n.c
Red	Transmit PL disable return	n.c
#12 black ground	Logic/lightning ground	1

RIMX Switches

SW1 off (carrier squelch)
SW2 don't care
SW3 don't care
SW4 don't care
SW5 off (hi level speaker audio)
SW6 on (no de-emphasis)

OTX Switches

SW1-1 don't care
SW1-2 on
SW1-3 off
SW1-4 user determined
SW1-5 as required
SW1-6 normally on
SW1-7 normally on
SW1-8 off

SW2-1 n.a.
SW2-2 as required
SW2-3 normally on
SW2-4 as required
SW2-5 normally on
SW2-6 as required
SW2-7 n.a.
SW2-8 as required

Level Setting:
The remote should be set to provide +10dbm output measured at the 8ohm hot output with any Touch-Code digit from a properly adjusted mobile. Also, refer to LEVEL SETTING in the MRTI Instruction Manual.

Important Note: The line input level to the remote should be adjusted to the minimum level that will provide satisfactory receive volume. (at the knee of compression and no more)

Excessive input sensitivity or too high an adjustment of the receive line input level potentiometor will result in an increase in effective line noise and/or hum, possibly causing improper operation of the MRTI cross lock-out VOX feature.

During final tests, a check should be made by setting up the MRTI for Test 5 (refer to System Self-Tests section of MRTI Manual) and ascertain the decimal point is extinguished when not receiving a mobile signal and is illuminated with the presence of receive audio.

MSR 2000 Series

Installation to these model stations require the use of the Motorola supplied phone patch interface option kits.

Model # C719AC-SP (for Repeater Installation)
Model # C719AD-SP (for Base Station Installation)

Installation instructions are supplied with the kits.

MSF 5000 Series
Base/Repeater Stations

Installation to these model stations require the use of the Motorola supplied Model C719-AB-SP phone patch interface option kit. Installation instructions are supplied with the kits.

ABBREVIATED MOBILE COMMAND CHART

Note: All multidigit control functions must be entered with a maximum of 1 second interdigit time.

STANDARD MRTI

*	access telephone line
#	release telephone line
**	redial last number called
***	overrides line busy
***	after access = 3 minute timer disable
#	before access = answer if called (special applications)
#	after access = "flash" (momentary on-hook to regain dial tone where applicable)
#*	attendant access code
1	TX PL tone on
*1#	TX PL tone off

E381/TDN6899 Mobile Control of External Functions Option

N	function on where N is one of 7 functions N = 3-9
*N#	function off

E377/TDN6895 MULTI-FUNCTION UTILITIES OPTION

n*	multidigit access code N = 1-4 digits
#N	multidigit release code N = 1-4 digits
*O#N	executive override code N = 1-6 digits overrides a variety of programmed restrictions

E378/TDN6896 OPTION CONTROL (9 NUMBER AUTO-DIAL I)

*1	MRTI dials stored telephone number 1
*9	MRTI dials stored telephone number 9

E379/TDN 6897 OPTION CONTROL (99 NUMBER AUTO-DIAL II)

*01	MRTI dials stored telephone number 01
*99	MRTI dials stored telephone number 99

AUTO DIAL TELEPHONE NUMBER ENTRY FROM MOBILE
(MRTI must not be accessed)

O	auto-dial programming command followed by:
L*	telephone number memory location (1 = 1 or 2 digits as applicable) - followed by:
N...N	telephone number to be stored (N = 1-16 digits) at memory location L (* entered as a telephone number digit causes 1.25 second pause in auto-dialing) - followed by:
*#	memory store command: causes telephone number to be stored at memory location L
#	reset to start over (anywhere in the sequence)

E380/TDN6898 SELECTIVE MOBILE SIGNALLING OPTION

*##N	revertive (mobile-to-mobile) call where N is mobile paging code in 1, 2, 3, or 4 digit-format.

Ville de Beaufort

Radio interface

SW - 1 OFF
SW - 2 ON
SW - 3 OFF
SW - 4 OFF
SW - 5 OFF
SW - 6 OFF

OTX switch setting

SW 1 - 1 OFF
2 ON
3 OFF
4 OFF
5 ON
6 ON
7 ON
8 ON

SW 2 - 1 ON
2 ON
3 OFF
4 ON
5 ON
6 ON
7 ON
8 OFF

Beaufré

Parametre

01	3
02	4
03	2
04	0
05	1
06	6
07	3
08	7
09	0
10	8
11	0
12	9
13	0
14	4
15	0
16	0
17	0
18	0
19	0
20	0
21	0

Automatic station identifier

END	00		
1	01	I	19
2	02	J	20
3	03	K	21
4	04	L	22
5	05	M	23
6	06	N	24
7	07	O	25
8	08	P	26
9	09	Q	27
O	10	R	28
A	11	S	29
B	12	T	30
C	13	U	31
D	14	V	32
E	15	W	33
F	16	X	34
G	17	Y	35
H	18	Z	36
		Pause	37

0	OFF
1	ON 30min
3	15 min
5	30 min + each Patch
7	15min + each Patch

Beeper

Parametre

security code II

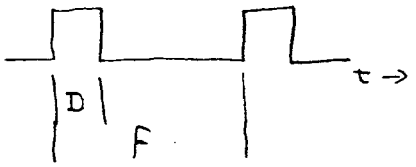
22	4	Nombre de digits 1 à 6 0=disable
23	2	security code
24	7	
25	2	
26	7	
27	0	
28	0	

multi-digits access prefix III

42	0	Nombre de digits 1 a 4 0=disable
43		access code
44		
45		
46		
47	0	Nombre de digits 1 a 4 0=disable
48		Release code
49		
50		
51		

Beaufré

Parametre		
		ajustable signal search IV
52	0	Duration x 5mS
53	0	
54	0	Frequence x 5mS
55	0	

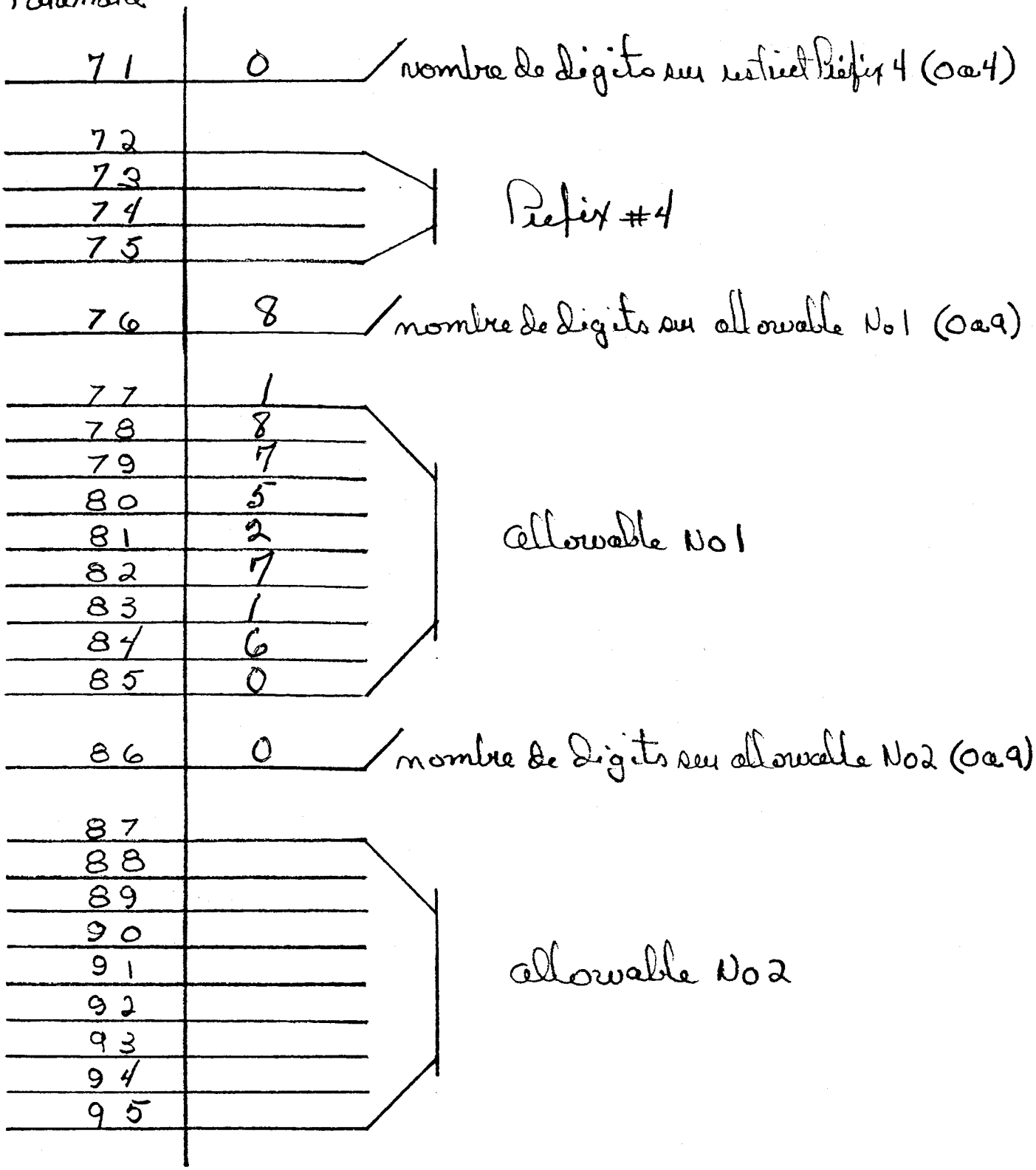


Duration = D 15 à 100mS
Frequence = F

Toll restriction V

56	1	nombre de digits non restrict Prefix 1 (0 à 4)
57	1	Prefix #1
58	0	
59	0	
60	0	
61	0	nombre de digits non restrict Prefix 2 (0 à 4)
62		Prefix #2
63		
64		
65		
66	0	nombre de digits non restrict Prefix 3 (0 à 4)
67		Prefix #3
68		
69		
70		

Beaufié


Paramètre
71
0
nombre de digits sur restrict Préfix 4 (0 à 4)
72
73
74
75
Préfix #4
76
8
nombre de digits sur allowable No1 (0 à 9)
77
1
78
8
79
7
80
5
81
2
82
7
83
1
84
6
85
0
allowable No1
86
0
nombre de digits sur allowable No2 (0 à 9)
87
88
89
90
91
92
93
94
95
allowable No2

Beaufei

Parametre		
99	1	Nombre de rings avant de répondre 1 à 9 0 = SW2-6 1 ou 4
100	2	Contrôle d'appareil Devices VII Land-Line Priority Paging VIII 0 = No control + 1.25 sec auto dial Pause add 1 = operate monitor relay add 2 = increase auto dial To 8 sec. add 4 = land-line Priority on Paging
127	0	Variable length Touch-Code tones IX 0 = 250 ms 1° Tone 100 ms next 100 ms inter tones 1 à 9 = X 50 ms. length of tones 100 ms inter Tones Emergency call Direct access X Inhibiting Pseudo Touch code XI
143	0	0 = Disable emergency call add 1 = Enable " " add 4 = mute receiver for 6 sec. voir XI D-9

Beaupré

Parametre	
159	6
191	1
239	0
255	2

XII Special mobile signalling control

state 0
add 0 - standard Ring 340/430 Hz
add 1 - Ring 800/840 Hz
add 2 - increase volume Ring
add 4 - signaling repeated every 8 sec.

XIII Variable Mobile inactivity timer

SW2-3 on

0 = 1 min
1 a 9 = n x 32 sec

attendant connect control XIV
Land-line Caller connect control XV

attendant control

0 = No attendant control
1 = auto. connect. after mobile signal
2 = requires * from attendant
To connect after mobile signaling

line caller direct access control

0 = NO control
1 = auto. connect after mobile signal
2 = requires * From mobile

Beaufort

Parameter	
207	4
223	3
96	0
175	2

Paging length message XVI

SW2-5 ON
0 = disable timer
1 & 9 = n x 5sec.

Variable overall timer XVII

SW2-5 ON

0 = disable timer
1 à 9 = n x 1 min.

Auto dial control Digits

start 0

add 0 = enabled
add 1 = Disable
add 2 = Mobile Not allowed
add 4 = Security code requires

Ton Dial

Beaupré

Selective Call

Parametre	
29	6
30	3
97	3
98	3
31	0
32	1
33	4
34	2

Temps alloué au mobile pour répon
1 à 9 = n x 16 sec
0 = 16 sec

Nombre de digits from land-calle
0 à 4
Nombre de digits from mobile
0 a 4 0 = ñ que 30
nombre de digits from attendant
0 à 4 0 = ñ que 30

0 = Pageing disable
add 1 a 3 = Notre de fois Pageing
add 4 = PL desable on T1

stait 0
add 1 = retour de la sonnerie obtenu
0 = disconnect
add 2 = security code land-lin
add 4 = " " attendant

accès confid digits
add 1 = accessible by land
2 = attend
4 = mobile

Selective call
1 = DTMF
2 = Two-Tone

Beneficiel

Parametre

35	0
36	5
37	0
38	5
39	0
40	4
41	0

Code Plan

Gen	00	M	12
GenM	01	N	13
B	02	P	14
C	03	Q	15
D	04	R	16
E	05	S	17
F	06	T	18
G	07	U	19
H	08	V	20
I	09	W	21
K	10	Y	22
L	11	GE	23

TWO-TON Prefix

MSD 1° prefix Parametre 30<3

NSD 2° prefix Parametre 30<2

LSD 3° prefix Parametre 30=1

Group Call

start 0

add 1 = G.C available by land calls

add 2 = G.C available by attendant

add 4 = G.C available by Mobile

length of Tone B

0 = 2 sec

1 a 9 = N x 1 sec.