YAESU LL-2 LANDLINER

AUTOMATIC RADIOTELEPHONE INTERFACE

The LandLiner is a complete, universal two-way radio-to-telephone interface unit designed to provide automatic, transparent linkage between your two-way radio network and the Public Switched Telephone Network (PSTN). When installed in a base station and connected in line with a telephone, the LL-2 allows a remote station to access the telephone system for placing and receiving calls. A base station operator is not required if the remote station is equipped with a simple DTMF keypad.

Additional LandLiner Features

*   Operates simplex, semi-duplex or full duplex (with full duplex radios)
*   Transmit switching controlled by sampling for simplex and semi-duplex
*   Completely controllable from the remote station
*   Automatic DTMF/pulse conversion for use with both dialling systems
*   Allows base operator monitoring and participation, if desired
*   A Remote station without DTMF can place calls through base operator
*   Automatically turns off base transmitter if remote drops out
*   Time-out timer prevents overlong transmissions
*   Automatic Last Number Redial for remote if telephone line busy
*   Simple connection, operation and serviceability for technical personnel: all internal wiring uses push-on connectors for quick on-site service
*   Adjustable for wide variety of telephone systems: factory-customized for your system

This manual is divided into three sections, covering general information, operation, and installation and adjustment. The Operation section should be read carefully and understood by anyone who will have the responsibility of operating or overseeing operation of the LandLiner (the remote operator need only be informed of the procedures indicated in the "Remote Station Operation" subsection). The Installation and Adjustment section is provided for the installing technician: if your LandLiner is not yet installed, or if you need to relocate it, contact your Yaesu dealer for assistance.

SPECIFICATIONS

Power requirements
    11.7 to 16 VDC:
    500mA @ 13.8V with 1.5W Audio output
    250mA @ 13.8V with Monitor Off

Operating temperature range
    -10° to +50°C (+14° to +120°F)

Storage temperature range
    -40° to +70°C (-40 to +158°F)

Dimensions (WHD)
    160 x 65 x 233(mm)

Weight
    1.6 kg

Call Receiving Function
    Ring Signal: 25 VAC
    Line Current (Line On): 60 ±10 mA
    Busy Tone: above -40dBm simplex,
                        above -30dBm duplex

Call Placing Function
    DTMF Input (at AF IN): 0.3 ±0.2V

(3) LINE ON/OFF
Lamp and Switch

POWER LINE
ON/OFF
YAESU

VOLUME MONITOR
LINE/RADIO
LINE ONLY
OFF

UNIVERSAL PATCH LL-2

(1) VOLUME (OFF) Control, (2) MONITOR
and POWER Lamp   LINE/RADIO
                        LINE ONLY Selector
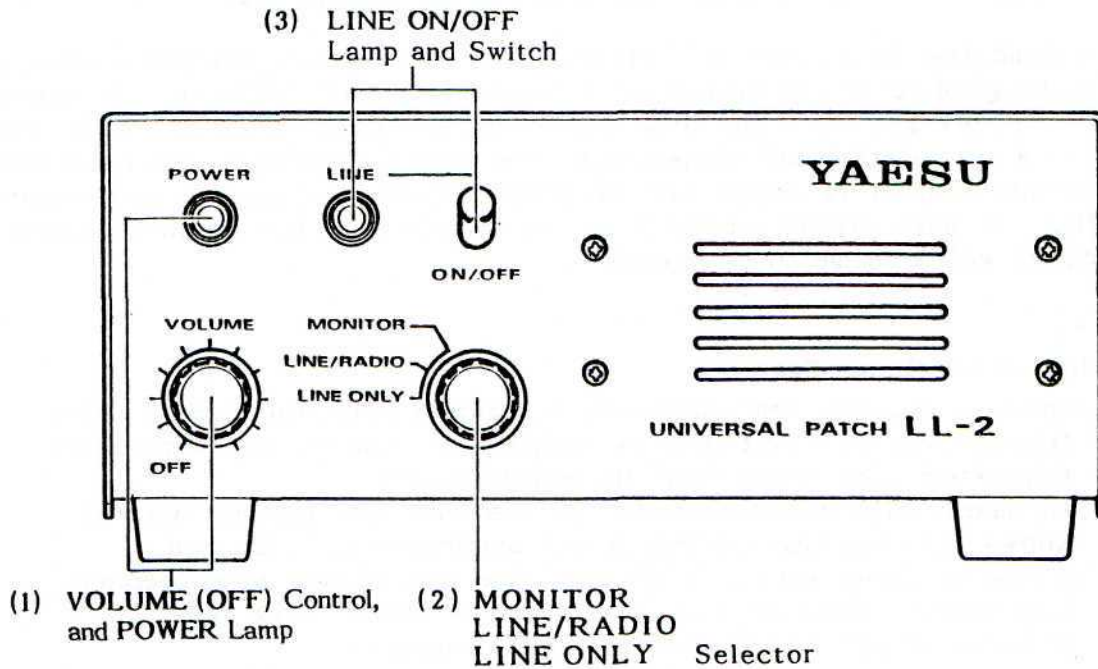
OPERATION

The LandLiner must be installed with the base station transceiver (or repeater) before operation. Because it must be custom-installed and adjusted specifically for your radio and telephone network requirements, the LandLiner should only be installed by a qualified technician. Contact your Yaesu dealer if you need technical assistance.

Throughout this manual, the word "local" refers to the LandLiner-equipped base station, composed of at least the LandLiner, a two-way radio transceiver and a telephone connected to the PSTN or a private telephone network. An operator may or may not be present at the base station, and a special instruction subsection is provided for such a local operator, if present.

Similarly, the word "remote" in this manual refers to any two-way radio station equipped with a transceiver at a remote site operating on the same channel as the base transceiver at the local site. Such remote stations may be mobile, portable or fixed bases, and can even be other Land-Liner equipped bases. The LandLiner is designed for use with one, or at most only a few remote stations, since all calls will be overheard by any remotes.

Remote stations equipped with DTMF tone generator keypads can place and receive calls through the LandLiner unassisted. Remote stations without DTMF require the intervention of a local operator. A special instruction subsection (Part II) covering remote station operation of the LandLiner is also provided in the following pages. Those instructions may be read over the air by the local operator to any new remote stations.

I. Instructions for Local Operator

Before operating the LandLiner, refer to the following descriptions and photograph below to familiarize yourself with the functions of the controls and indicators on the front panel.

(1) VOLUME (OFF) Control, and POWER Lamp

Use this control to turn the LandLiner on and off (fully counterclockwise), and to adjust the volume in the loudspeaker when the LandLiner is set to monitor communications. When on, the POWER Lamp is lit.

(2) MONITOR
LINE/RADIO
LINE ONLY   Selector

This three-position rotary switch selects the operating mode of the LandLiner:

In the MONITOR mode all radio and telephone communications can be monitored via the internal loudspeaker by the LandLiner local operator. All radio transmissions on the channel will be heard, whether or not a telephone call is in progress. The local microphone (connected to the Land-Liner) is disabled. Remote stations (with DTMF) can place and receive calls unassisted in this mode.

In the LINE/RADIO mode the loudspeaker in the LandLiner is disconnected, so communications cannot be monitored by the local operator, except via the local telephone connected to the LandLiner. The local microphone is also disabled in this mode, and remotes can place and receive calls unassisted in this mode.

In the LINE ONLY mode the radio and telephone are always disconnected from one another. The internal loudspeaker and local microphone are connected to the base station radio, and the local telephone is connected to the PSTN, so the operator can place calls or relay for parties calling on on either the radio or telephone line, without direct connection between the two parties. Remotes cannot place or receive calls unassisted in this mode.

(3) LINE ON/OFF Lamp and Switch

The orange LINE lamp indicates when the automatic connection system between the LandLiner and remote stations is active. When the lamp is on the LandLiner is periodically polling the radio channel, alternately sending and receiving so as to detect the presence of a remote station.

This polling is suspended whenever a remote station transmits. Also, in the MONITOR and LINE/RADIO modes, the LINE lamp will blink while a remote station is dialling, and stay lit for the duration of a call.

During a conversation (while the LINE lamp is on) pressing the LINE ON/OFF switch down for about 0.5 seconds cuts the connection to the remote station, effectively terminating the call.

Also, when the local operator is required to manually place calls for remotes unable to dial themselves, after contacting both parties, the LINE ON/OFF switch is used in conjuction with the mode selector to connect the two parties.

Local Operating Procedures

As the local operator, you can place and receive calls by radio, using the local microphone (connected to the LandLiner) and internal loudspeaker; or by telephone via the local telephone connected to the LandLiner. You can also participate as a third party in conversations between a remote and telephone station via the local telephone.

A. Preliminary Control Settings

When the LandLiner station is turned on or when you first come on duty, perform the following steps to ensure that the controls on the base transceiver and Land-Liner are set properly.

(1) Set the mode selector on the Land-Liner to MONITOR.

(2) Set the SQUELCH control on the base station transceiver (connected to the LandLiner) fully counterclockwise.

(3) Set the VOLUME control of the base transceiver to about the 9 o'clock position, and then adjust the VOLUME control on the LandLiner for comfortable volume in the loudspeaker of the LandLiner.

(4) Rotate the SQUELCH control on the transceiver clockwise just to the point where the noise is silenced (when the channel is clear).

(5) You can leave the mode switch set to MONITOR, to be able to hear any calls; or set it to LINE/RADIO if the remotes have DTMF keypads (so they can place calls unassisted) and you do not wish to monitor the calls.

During normal operation when the remotes are equipped with DTMF keypads, there is no need for a local operator to intervene: calls from remotes will be switched automatically, and each remote can place and receive calls using his keypad. When a remote is connected to the telephone line the LINE lamp will be lit, and blink during dialling. If necessary, you can cut off a conversation at any time by pressing the LINE ON/OFF switch until the LINE lamp goes off.

However, when no local operator is present, remote stations without DTMF keypads cannot place or receive calls.

B. Calling from the Local Base

If you need to talk with a remote station set the mode selector on the LandLiner to LINE ONLY, enabling the local microphone and preventing interruptions by incoming telephone calls. Use the local microphone (connected to the LandLiner) to call and talk to remote stations via the radio. Press the PTT (Push-To-Talk) button on the microphone to speak, and release it to listen (unless using a full duplex radio system).

Also, in this (LINE ONLY) mode, you can use the local telephone connected to the LandLiner to place or receive telephone calls independently of the remote stations, which have no access to the telephone network in this mode.

C. Assisting Remote Callers

As mentioned previously, remote stations not equipped with a DTMF tone keypad cannot place or receive telephone calls through the LandLiner without your assistance. The following steps describe the procedures. Note that normally the LandLiner is kept in the MONITOR mode when a local operator is standing by. This permits those who can to place and receive calls unassisted, while those who cannot can still be heard by the local operator when they need assistance.

(1) Receiving Calls for Remotes

(a) If someone calls in on the telephone for a remote station, that station will be unable to respond if he is not equipped with a DTMF keypad. Therefore you should know who does not have such a keypad. Pick up the handset of the local telephone and ask the caller to hold while you page the remote.

(b) Set the LandLiner to the LINE ONLY mode, and use the local microphone to page the remote. When he responds, inform him of the call.

(c) Switch the LandLiner back to MONITOR mode, press the LINE ON/OFF switch so that the LINE lamp lights, and tell the caller (via the local telephone handset) to go ahead.

(2) Remotes Placing Calls

(a) If the remote station does not have a DTMF keypad he will call you, requesting (by voice) that a call be placed. You **must** have the Landliner set to MONITOR or LINE ONLY mode so you can hear their call.

(b) If the Landliner is set to MONITOR, switch to LINE ONLY, and use the local microphone to respond, asking the remote caller to standby while you dial the requested number on the telephone and bring the desired party on the line.

(c) Place the telephone call, and ask the called party to wait a moment while you switch to the remote caller.

(d) Switch the mode selector on the LandLiner to the MONITOR position, and press the LINE ON/OFF switch so that the lamp lights. Then instruct (via the local telephone handset) the parties to go ahead.

(e) The local microphone is disabled in the MONITOR mode, but you can participate in the conversation via the local telephone. If you hang up, the conversation will still be audible in the loudspeaker.

Note: If the radio network is not full duplex (allowing each party to hear the other while talking), it may be necessary to request each party to wait for about a second each time the other finishes speaking, to allow the circuitry to change over to the other party. If both talk at the same time the remote station will not hear the party on the telephone.

II. Remote Station Operation

The SQUELCH control on the remote transceiver should be set normally, as described in the transceiver manual.

In simplex and semi-duplex radio networks, when the LandLiner is active, a pulsing carrier will be heard alternately opening and closing the squelch. This is the polling function of the LandLiner, sampling the channel to detect any transmitted response from a remote station.

Remote stations equipped with DTMF keypads (usually a part of the microphone) can dial and answer calls themselves as described below. Those without DTMF must call the local base station operator if they wish to place a call.

While the PTT (Push-To-Talk) button on the microphone is held to keep the transmitter on, the DTMF keypad functions in the generally the same manner as the keypad on a pushbutton telephone. The [*] key serves a function similar to picking up the handset of a telephone, and the [#] key hangs it up.

If a ringing tone is heard in the receiver, press and hold the PTT switch on the microphone while also pressing the [*] key on the keypad to answer the call. Release the PTT switch to hear the calling party.

When you wish to speak, press the PTT switch and <u>wait</u> for about a half second before you start speaking (otherwise, your first few syllables will not be heard). The wait is not required in full duplex radio systems.

Automatic Dialling with DTMF

Before placing a call, make certain that the channel is not already in use (the BUSY indicator on your transceiver should be off). Hold the PTT switch and press [*] on the keypad, followed by the digits of the number you are calling. Then release the PTT switch and listen for the ringing tone. If you don't hear it after a few seconds, close the PTT and press [#] (to hang up). To redial the same number from the Last Number Redial Memory, just press [*] twice in succession.

Note: If you wait too long after sending the initial [*] tone, the base station will time out. You will loose the connection and have to start again. Also, if you are driving in a "fringe" area, flutter on your signal may interfere with dialling. If you suspect this, stop the vehicle to dial.

When the party answers the phone, press the PTT and remember to wait for a half second before you start speaking. If the other party indicates they are missing some of your words, you may have forgotten to wait after pressing the PTT before speaking. Also, if they speak while you are transmitting you will not hear them, so you might have to ask them to wait until you finish speaking before they answer questions (as the mobile, you are in complete control: they cannot interrupt you).

When finished, you can hang up by pressing [#] while holding the PTT switch. Also, if you hear the squelch of your radio pulsing without conversation, press [#] to shut off the base transmitter.
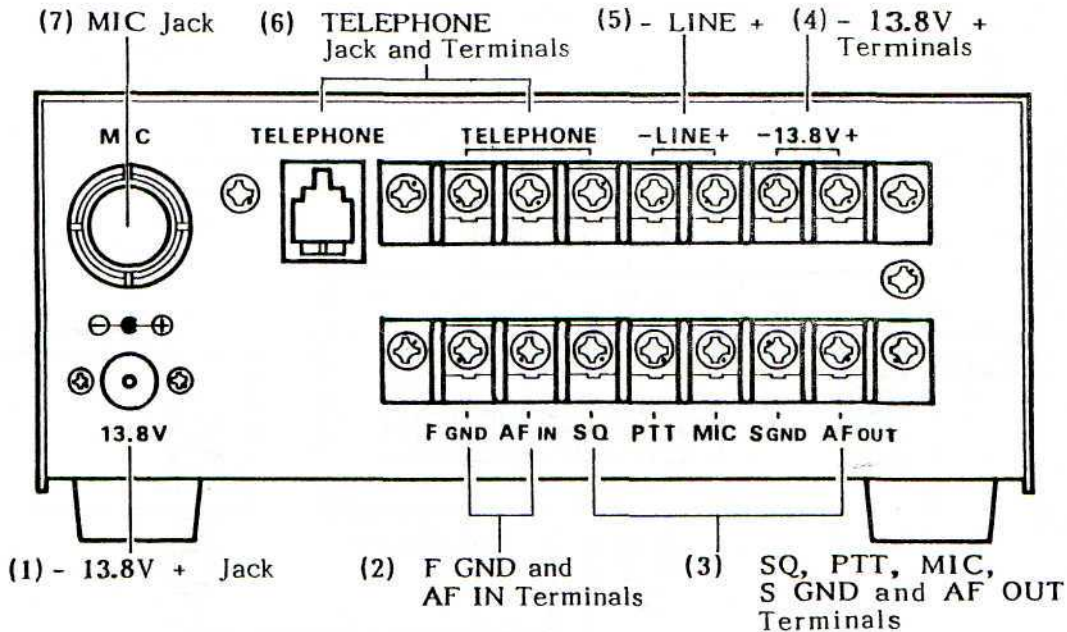
Automatic Last Number Redial

If you hear a busy tone after dialling, you can redial the same number automatically. First hold the PTT and press [#] to hang up. Wait until the channel is clear, and then hold the PTT and press [*] twice in succession.

Operator-Assisted Calling (without DTMF)

Mobiles without DTMF keypads cannot answer or dial calls automatically. However, any station can place a call with assistance of the base station operator, if one is present. Simply call the operator by radio as you would normally call any station, and give the number you wish to call. The operator will then ask you to wait, and then if the call goes through, will tell you to go ahead.

While waiting, and when listening to the other party, you should hear your transceiver's squelch pulse periodically as the base station samples for your transmissions. Remember to press the PTT and wait for half a second each time before you speak, or your first few syllables will not be heard.

(7) MIC Jack　(6) TELEPHONE Jack and Terminals　(5) – LINE +　(4) – 13.8V + Terminals

(1) – 13.8V +　Jack　(2) F GND and AF IN Terminals　(3) SQ, PTT, MIC, S GND and AF OUT Terminals

INSTALLATION AND ADJUSTMENT

The LL-2 should be installed only by a qualified technician familiar with the radio and telephone systems with which the equipment is to be interfaced. Owners should contact their Yaesu dealer for assistance when installing or relocating the LL-2, or if problems are encountered during operation.

(1) & (4) – 13.8V +　Jack and Terminals
Connect an external DC power source either to the terminals (4) or the coaxial jack (1). These are connected in parallel internally. Operating voltage must be between 11.7 and 16 VDC, at 500 mA peak (full speaker volume), 250 mA continuous. Normally, the LL-2 can share the same power supply as the base transceiver if both require the same DC voltage. Otherwise, the Yaesu PA-4B (117V) or PA-4C (220V) AC-to-DC power adapter may be used to power the LL-2 directly from a wall outlet. Pay special attention to polarity when making power supply connections: reversed polarity will seriously damage the equipment. Also, do not attempt to power any other devices by direct connection to these terminals or jack.
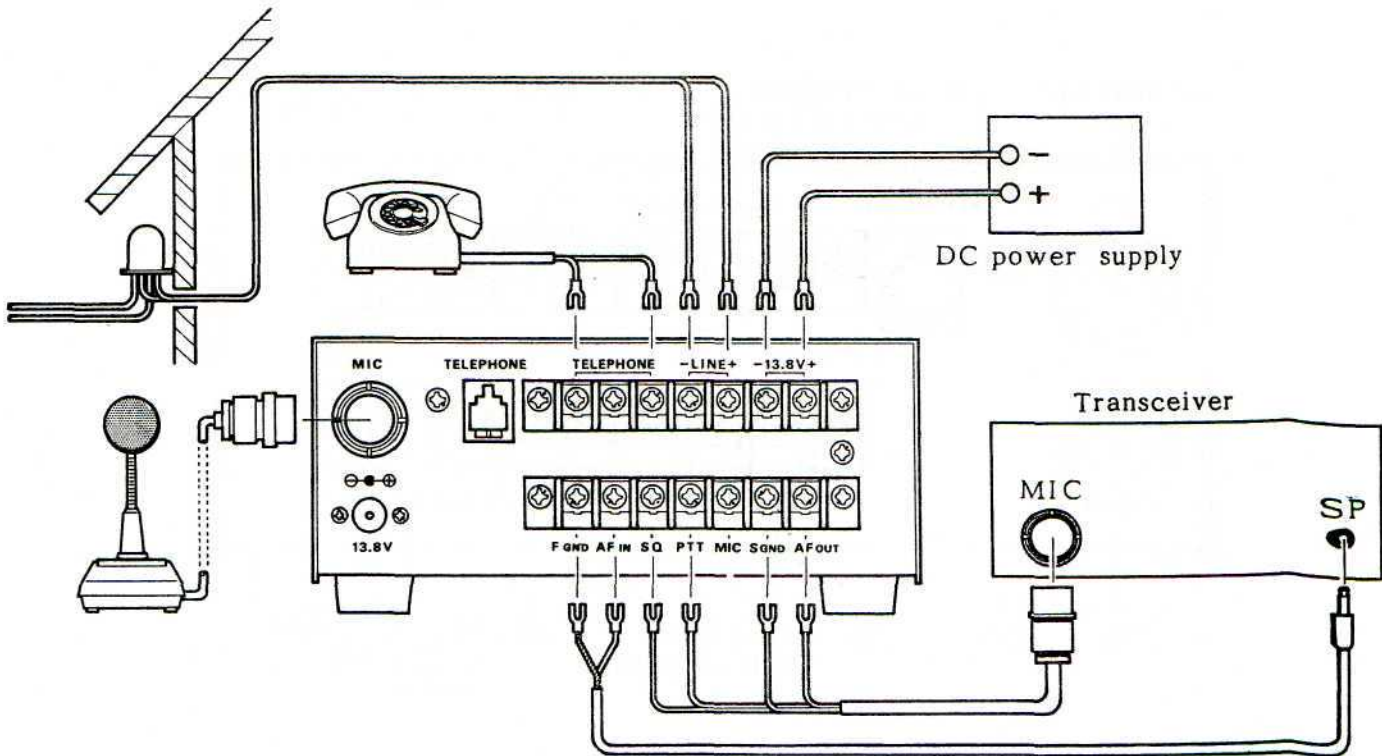
(2)　F GND and AF IN Terminals
These (Frame Ground and Audio Input) terminals are for connection to the EXTernal SPeaker Jack on the base station transceiver with a shielded cable. The shield should connect F GND to the outer contact of the EXT SP jack (transceiver chassis ground). The LL-2 is designed for use with transceivers in which connection to the EXT SP jack disables the speaker in the transceiver.

(3)　SQ, PTT, MIC, S GND and AF OUT Terminals

The SQuelch terminal is an input for squelch control voltage from the transceiver. The control voltage should be fed through a 470- to 100-ohm resistor, and should be near 0V when the squelch is open (receiving a signal), and 5 to 10V DC when the squelch is closed. This terminal can be left unconnected if the transceiver is full duplex.

The PTT terminal is connected internally to a set of relay contacts, for transmitter control of the transceiver. Maximum key down current required by the transceiver should be less than 2A.

DC power supply

Transceiver

MIC   TELEPHONE   TELEPHONE   −LINE+   −13.8V+

MIC   SP

13.8V

F GND   AF IN   SQ   PTT   MIC   S GND   AF OUT

The MIC terminal is a 600-ohm input for audio from a local microphone. This is identical to pin 6 of the LL-2 MIC jack (7) described below, so the terminal should be left unconnected when the MIC jack is used.

The S GND (signal ground) terminal is the grounding point for analog signals, intended here for use as the grounding point for the shield on the MIC wire just mentioned (if used), and the AF OUT line.

The AF OUT terminal is the 600-ohm output providing transmitter audio for the microphone jack of the base transceiver. This signal is derived from either the local microphone or the local telephone, as selected by the mode switch.
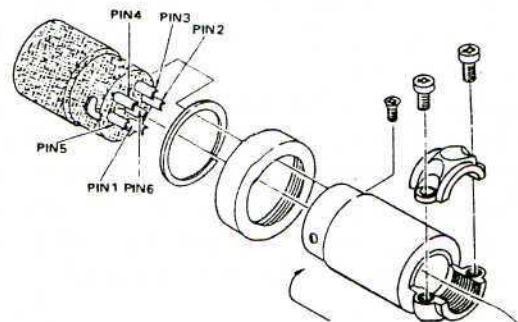
(5) − LINE +
The telephone line connects through the supplied surge suppressor to these terminals, with due attention to polarity. Line polarity should be confirmed with a voltmeter (DC 50V range), with the handset out of the cradle (off-hook) if a telephone is in the line. Connect the positive line lead to "+".
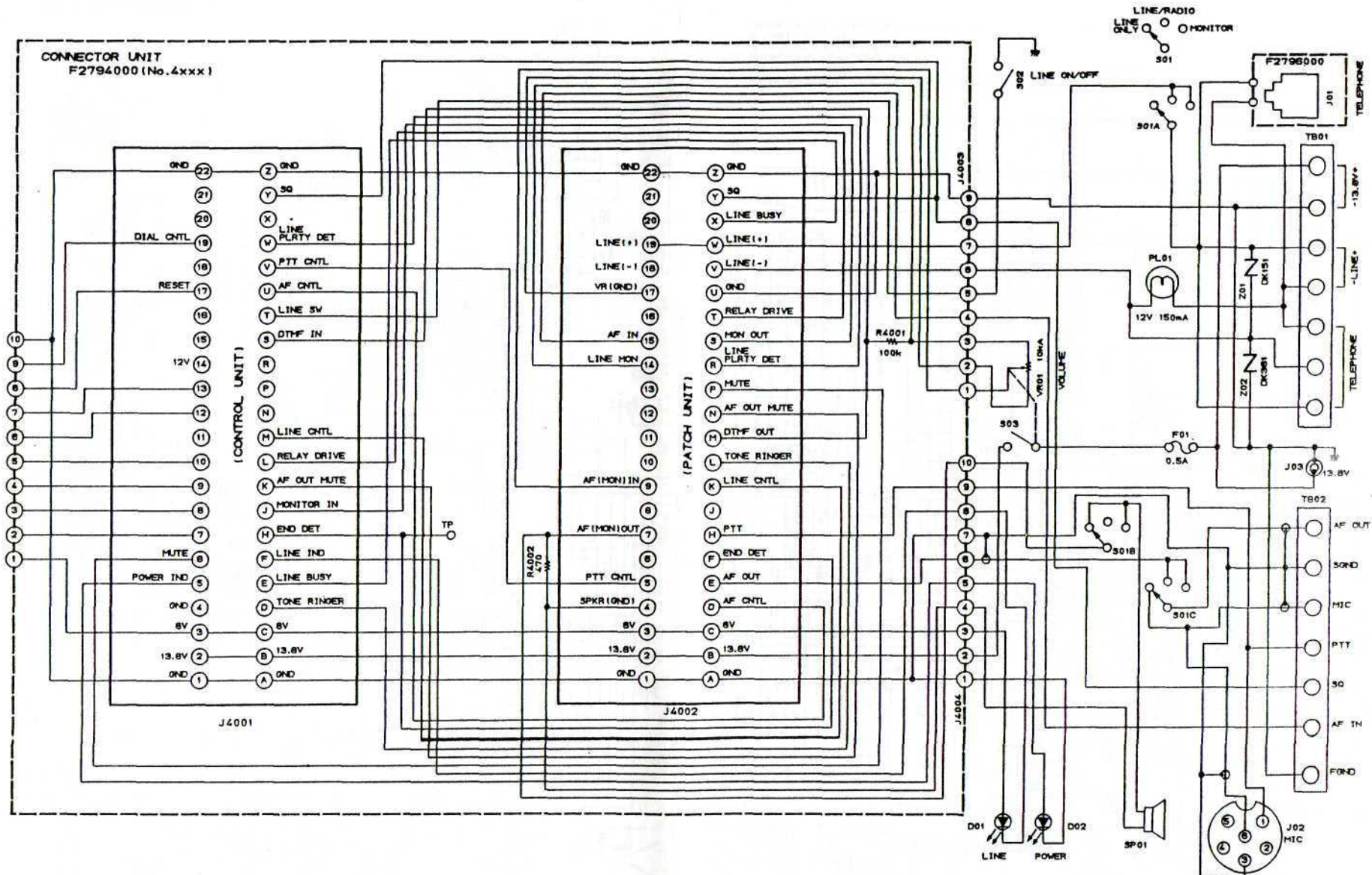
(6) TELEPHONE Jack and Terminals
These are connected in parallel internally, and are for connecting the base station telephone set. If the local phone is not equipped with a modular plastic plug matching the jack, connect the TIP and RING wires to the two terminals indicated (these are separated by a spare, unused terminal). Polarity is not critical here.
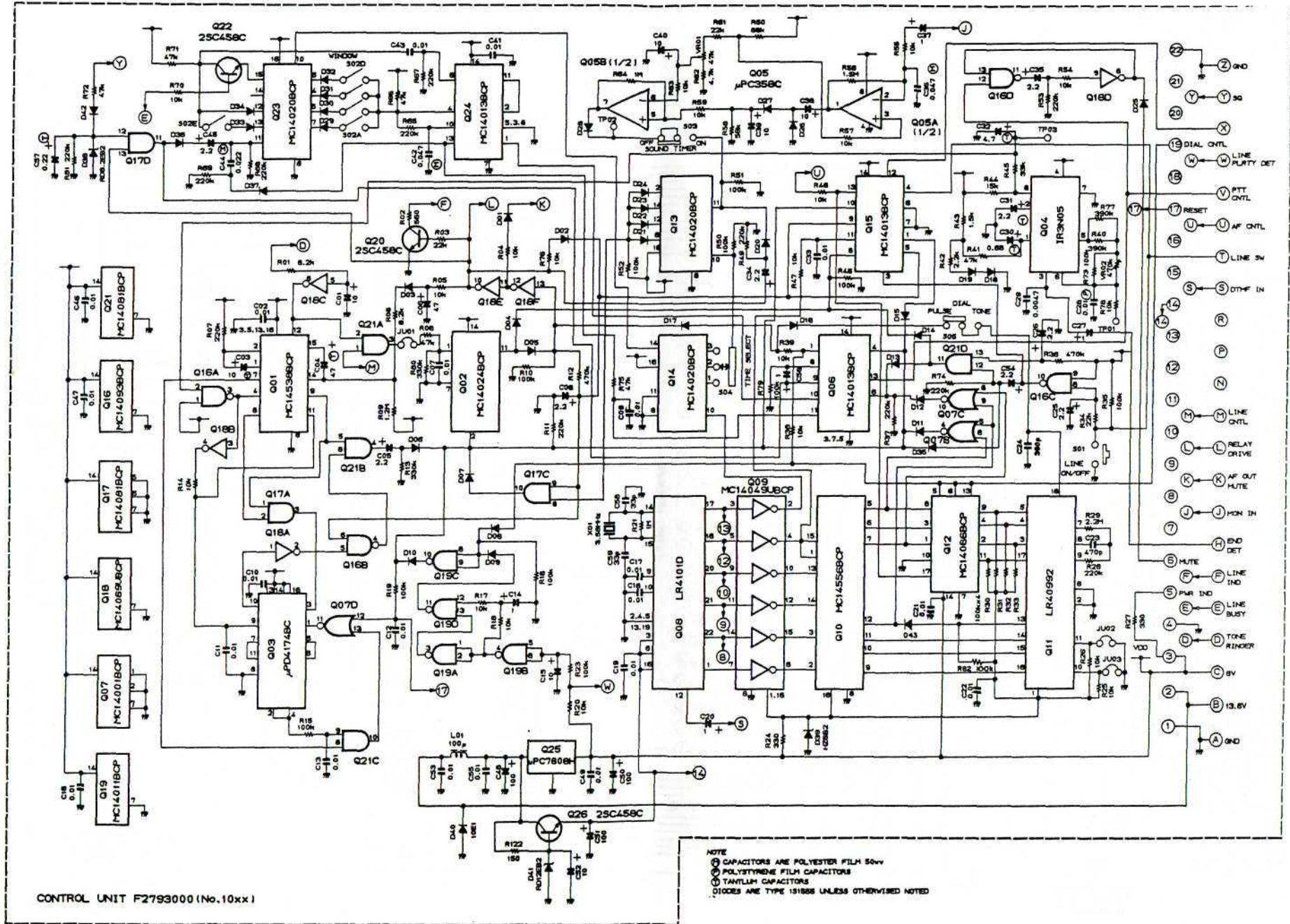
(7) MIC Jack
This six-pin jack is for connection of the local microphone, and matches the Yaesu YM-33 Desktop microphone. Pin 1 is PTT, pin 3 is common, and pin 6 is mic audio.
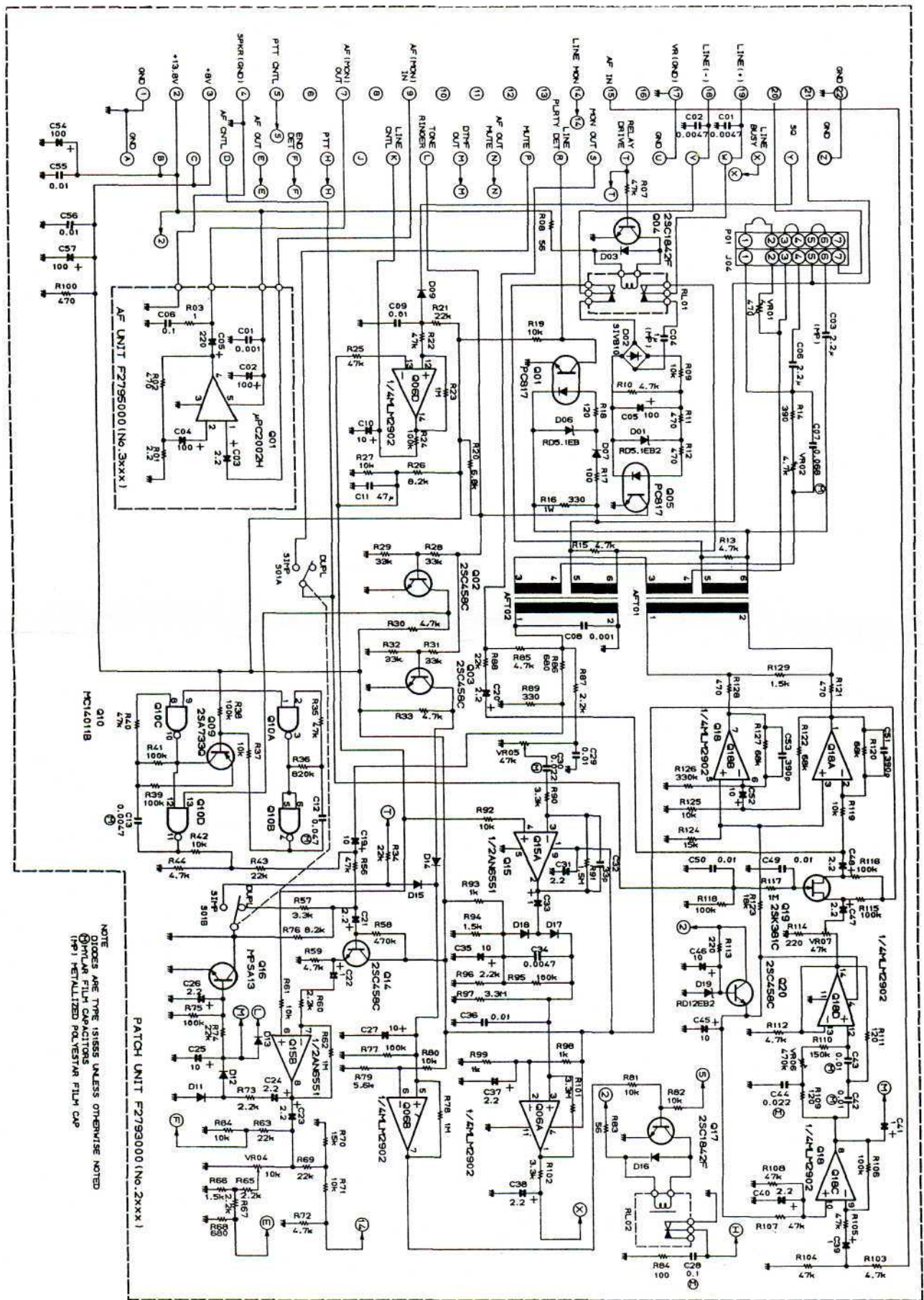

PIN4 PIN3 PIN2
PIN5
PIN1 PIN6

LL-2
CIRCUIT DIAGRAM

CONTROL UNIT F2793000 (No.10xx)

NOTE
- CAPACITORS ARE POLYESTER FILM 50vv
- POLYSTYRENE FILM CAPACITORS
- TANTLUM CAPACITORS
DIODES ARE TYPE 151888 UNLESS OTHERWISED NOTED

-10-

JU1001 —

S1005

JU1003

JU1002

S1003 —
VR1001 —
VR1002 —

S1002

S1001

S1004

CONTROL UNIT

VR2002

VR2001

S2001

VR2006

VR2007

VR2004

VR2005

PATCH UNIT
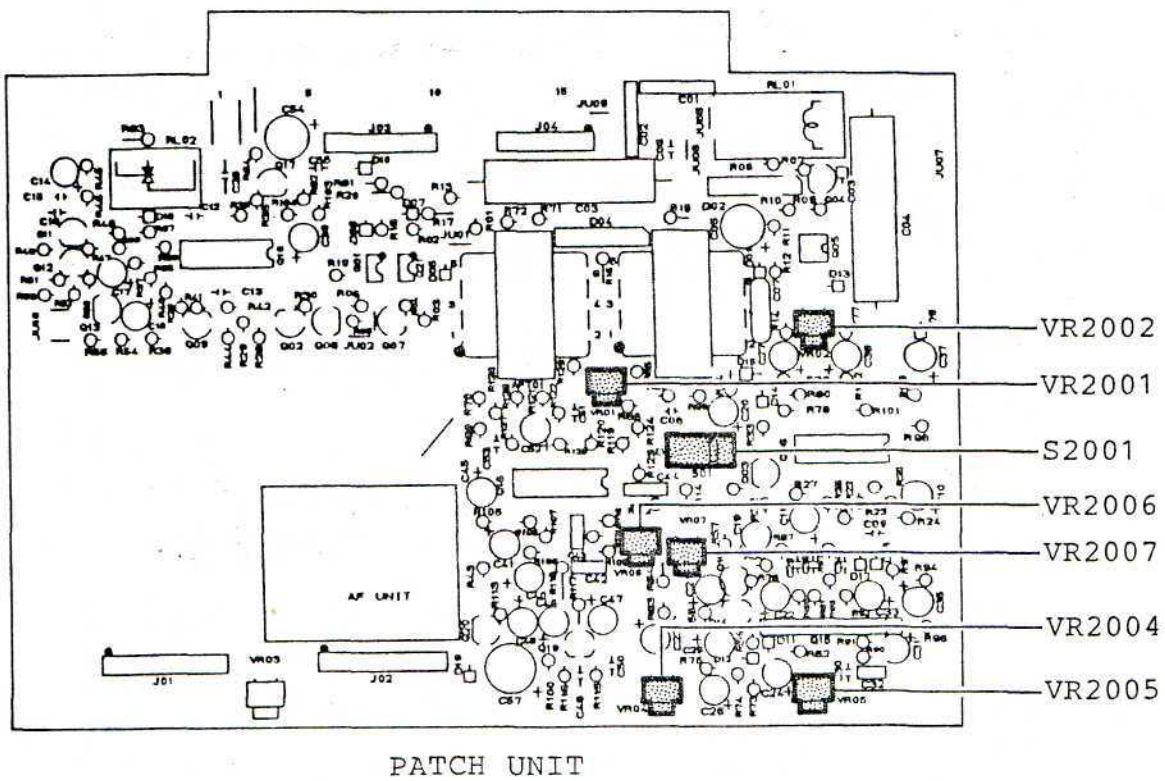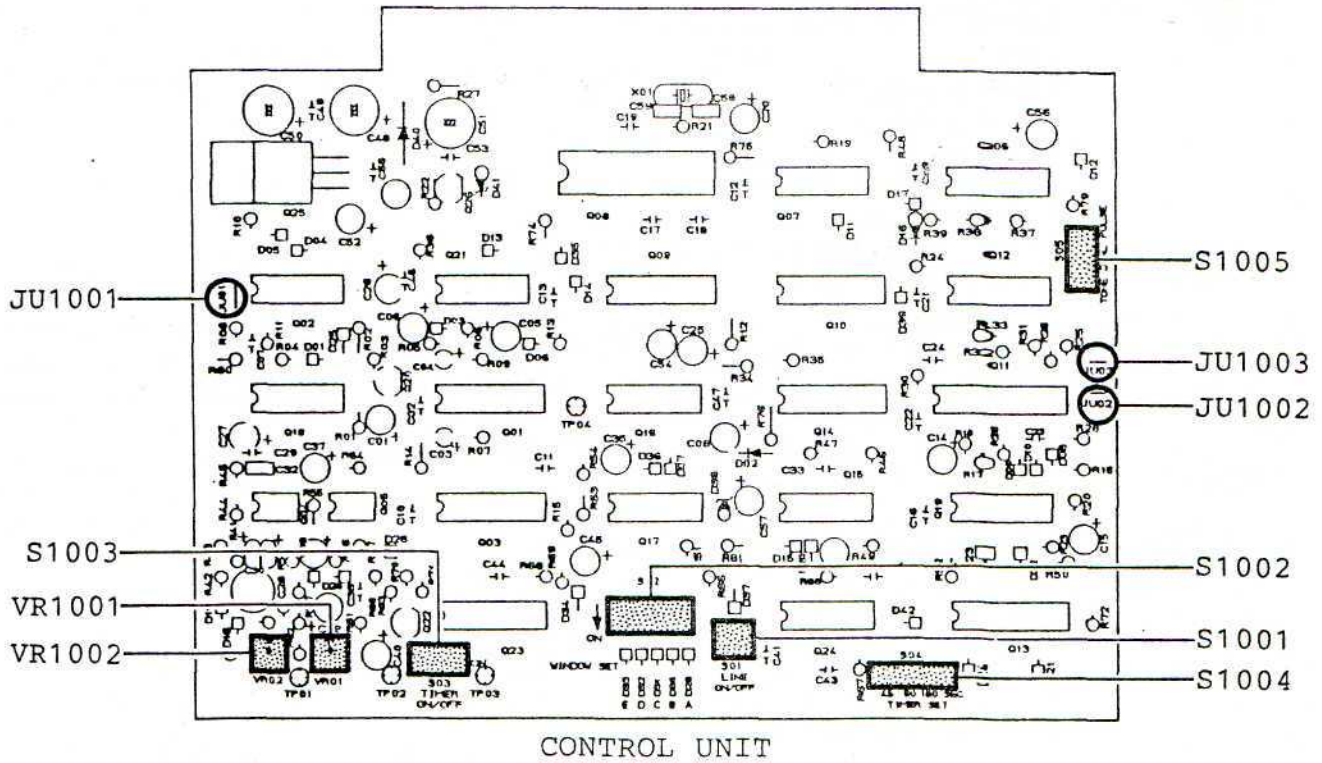
CONTROL UNIT		FACTORY SETTING
S1001	Line Switch	
S1002	Sample Window Duration Selector	
A	ON ⎫ ON ⎫	OFF ⎫
B	OFF ⎬ 18ms ON ⎬ 275ms	ON ⎬ 183ms
C	OFF ⎪(min.) ON ⎪(max.)	OFF ⎪
D	OFF ⎭ ON ⎭	ON ⎭
E	Sample Window Period; ON=1 sec, OFF=0.7 sec	ON
F	Not used (Ref. to chart)	--
S1003	Sampling Time-Out Timer Enable Switch	ON
S1004	TX Time-Out Selector 45-90-180 sec	90 sec
S1005	Dial Format Switch pulse ◄─► tone	Pulse
JU1001	Answering Mode ON=automatic OFF=⊠key code	OFF
JU1002	Dial Pulse Break Ratio ON=60% OFF=66%	ON
JU1003	Dial Pulse Speed Selector ON=10pps OFF=20pps	ON
VR1001	Sample Threshold Level VR max -42dBm, min -34dBm	-36 -38dBm
VR1002	Busy Tone Frequency Set (360—500Hz) 112—256Hz cut R1073 and R1077 500—820Hz add 180kr parallel to R1077	400 Hz

PATCH UNIT		FACTORY SETTING
S2001	Duplex/Simplex Selector	Simplex
VR2001	Hybrid Balance	
VR2002	Hybrid Balance	
VR2004 ○	Microphone Level VR max -24dBm, mid -36dBm at line input -15dBm	-36dBm (simplex)
VR2005 ○	Local Input Level	-40dBm
VR2006 ○	Notch Filter Frequency VR max 3.6kHz, min. 1.8kHz	2500 Hz
VR2007 ○	Local Output Level VR max +3dBm, mid -12dBm at audio input -10dBm, 1kHz	-10dBm

1:ON   A-D:Period   F:Not used
0:OFF   E:Window   (ON=1 sec,OFF=0.7 sec)

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

Sample Window Time t(ms)	S1002						
	A	B	C	D	E	F	
	2^0	2^1	2^2	2^3	—	—	
54.9	1	1	0	0	1	0	FTC-1023. FTC-1043
73.2	0	0	1	0	1	0	FTC-1505. FTC-4005. FTC-2003
91.5	1	0	1	0	1	0	
109.8	0	1	1	0	1	0	FTC-2640. FTC-2203. FTC-5203
128.1	1	1	1	0	1	0	FTC-5340. FTC-1015. FTC-1045
146.4	0	·0	0	1	1	0	
164.7	1	0	0	1	1	0	
183	0	1	0	1	1	0	FT-2700. FT-3800
201.3	1	1	0	1	1	0	
219.6	0	0	1	1	1	0	
237.9	1	0	1	1	1	0	
256.2	0	1	1	1	1	0	
274.5	1	1	1	1	1	0	