

**INSTRUCTION MANUAL**  
**FM-240, FM-640 AND FM-740**



HOW TO GET ON THE AIR IMMEDIATELY!

*after installing the rig in your home or mobile shack... and connecting to power and an antenna... (don't forget the SPEAKER-MICROPHONE) ...*

1. Switch set on using VOLUME knob.
2. Set SQUELCH control.
3. Set VFO-MEMORY-CALL switch to VFO.
4. Tune in frequency using DIAL knob (Knob with FM-240 On it)

Use SPEED button to Speed up tuning rate.  
use SPEED button once more to slow down again.

That's IT! you are in the simplex mode of operation.

IF YOU WANT TO WORK A REPEATER, hit OFST button once for + offset, once more for - offset. If you want to go back to simplex, hit the button again.

IF YOU NEED A TONE TO ACCESS YOUR REPEATER, turn to next page

IF YOU HAVE ANY QUESTIONS, please turn to INDEX on page 1.



1.0 HOW TO GET ON THE AIR IMMEDIATELY  
(CONT'D FROM FRONT COVER)

5. IF YOU NEED A TONE to access your repeater:

A. CTCSS TONES: (See B. below for tone burst)

Hit ENTER button. This puts you in the COMMAND ENTRY SEQUENCE for the VFO. The LCD will prompt you for item to be entered followed by data presently stored in the VFO memory. To skip item, hit ENT again. With the third hit, prompt shows TONE and a frequency (in Hz).

Rotate dial knob to the right slowly. Tone frequency will increase. Turn in reverse direction to lower. Next to lowest tone is OFF which turns tone oscillator off. Tones are standard EIA tones. Now you know how the system works. Keep turning the dial to the right until the desired frequency shows up on the LCD. (Note: Lowest tone is actually 67.0, not 67.7 as shown on the LCD.)

Hit ENT again. This stores your TONE in the VFO memory as well as advancing command entry sequence to next item. Hit ENT two more times and unit will give one long beep to tell you the entry sequence is complete and unit is back in VFO operating mode.

B. 1750Hz TONE BURST: A tone burst oscillator is mounted in the SM-34E type Speaker microphone. Two modes can be selected, a manual tone burst for Continental Europe, and a .5 second automatic burst with every transmission for use in the UK. For details, see page 5, MICROPHONES and SPEECH SYNTHESIZER.

*Now you know how to use your new KDK rig with the User Friendly M-M-I<sup>®</sup> in the VFO mode. You also have a good idea of how the COMMAND ENTRY SYSTEM works. Try out the MEMORY and CALL positions of the function switch. Hit ENT and check to see what items and what data is stored in the command memories for these two functions. Command data can be changed by using the dial knob.*

\* Man-Machine-Interface

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## 1.2 INTRODUCTION

**A. Instruction Manual:** General operating instructions and Command Entry Sequences for all members of the FM-240 family are identical. Differences between models are frequency bands covered, block and schematic diagrams, alignment instructions, etc.

This manual covers operating instructions common to all models. It also includes a schematic diagram with block diagram printed on the reverse side. A separate technical manual will contain a circuit description, alignment instructions, PCB patterns, etc. and are optionally available from dealers and national distributors.

**B. User Friendly M-M-I:** (Man Machine Interface) A combination of rotary switches and push buttons was devised to simplify issuing commands to a CPU. Attention was paid to assigning single jobs only to each button and yet keeping number of buttons at a minimum. A custom LCD was designed for simultaneous display of prompt messages and command data. Operator selection of commands using the dial knob resulted in a simple and easy-to-use control system. Desirable and undesirable inter-action between various controls were carefully reviewed and most logical inter-locking between functions were programmed into the CPU.

**LCD CHARACTER FONTS:** Due to limitations of the LCD character fonts, small D's were used in place of capital D's. Capital D's could not be distinguished from capital O's.

**DIRECT COMMAND OPERATING:** VFO and QSY operations are by a direct command mode using the function switch, DIAL, QSY and OFST buttons.

**COMMAND MEMORIES:** Other operating parameters such as CTCSS tone, band scan limits and modes, etc. are changed by using a command entry sequence which is initiated by depressing the ENTER button. Display prompts operator for item to be entered. If command data displayed by LCD does not need changing, ENT is depressed again and command data stored in command memory remains unchanged.

**COMMAND DATA SELECTION:** Command data is selected by turning dial knob (or using UP-DOWN buttons). When desired data shows up on LCD the ENT button is pushed to advance to the next item. Successive command items can be skipped unchanged by continuing to hit ENT until LCD returns to operating mode. This is announced by the unit sounding out with a long BEEP.

**DIALING WITH UP/DOWN BUTTONS:** All dialing actions are possible using the speaker microphone UP/DOWN buttons including selection of frequencies, selecting memories and selection of command entry data. *Whenever the word dial is used in this manual it should be read to mean using "dial or UP/DOWN buttons."*

## 2.0 HOW TO USE VFO

**2.1 GENERAL DESCRIPTION:** VFO operating mode provides all basic functions required of a transceiver, that is, selecting a frequency and transmitting and receiving on that frequency.

Transmit offset above or below receive frequency is set directly using the OFST button. Selecting CTCSS tones, selecting upper and lower limits for band scan and selecting mode of band scanning is by storing command data in the VFO command memory.

**2.2 VFO MODE SELECTION:** Set function switch to VFO.

**2.3 VFO MODE OFFSET:** + or - offset is selected using button labelled OFST. *This button is active only in VFO and QSY modes.*

**2.4 DIALING SPEED:** Dial step has been set for 5KHz. (12.5Hz in Europe). Using the SPEED button will multiply this by 10 times. Use this feature for dialing up a new frequency widely separated from the start point. Get as close to the desired frequency as possible. Then hit SPEED again and dialing rate will return to the original rate for final zeroing in.

*NOTE: Band scanning occurs at the basic dialing rate, and is not affected by the SPEED button.*

**2.5 COMMAND ENTRY SEQUENCE:** for VFO and QSY. Band scan limits, +, - OFFSET or simplex, TONE, band scanning mode, dial step size and DIAL END mode are selected using the COMMAND ENTRY sequence. This is initiated by hitting the ENTER button. LCD prompts operator for the item to be entered and shows data currently stored in the VFO command memory. If a change is required for VFO (or QSY) operations, initiate command entry sequence by hitting ENT.

**A. SCNL:** Upper and lower limits for band scanning are fully programable. SCNL prompt is for band scan lower limit. If limit shown on LCD is satisfactory, pass on to next item by hitting ENT.

If existing limit shown on LCD needs to be changed, turn dial to right or left until desired limit shows up on LCD. Use SPEED button to speed up dialing as appropriate.

When desired frequency has been selected and displayed on the LCD, hit ENT to store limit, and pass on to next item entry sequence.

**B. SCNH:** Band scanning upper limit. If a change is desired, select using dial, etc. Hit ENT to store and advance to next item.

If no change needed, hit ENT and pass on to next item.

**NOTE:** SCNL lower limit must be lower than the SCNH upper limit frequency. *If relationship*

between SCNL and SCNH is reversed, display will only flicker and unit will not scan.

**C. TONE SELECTION:** Prompt = TONE, followed by OFF, or a frequency. Select tone frequency using dial. When LCD shows desired frequency hit ENT to store TONE and pass on to next item. (NOTE: LCD shows 67.7 for 67.0Hz)

**D. BAND SCAN MODE:** Prompt = SCAN. Modes are:

CARR = Scan controlled by incoming carrier. Scanning stops at busy channel. Scan resumes soon as carrier ceases.

AUTO = Scan will stop at busy channel, then resume scanning after sampling channel for 5 seconds, even if transmission continues.

dELY = Scanning stops at busy channel. Stays on channel for 5 seconds after transmission ceases for monitoring both sides of a QSO.

Select desired mode of scanning by turning dial knob then ENTER and proceed to next item.

**E. dIAL STEP SIZE:** Prompt = STEP. Selects step size per dial click. Also for QSY and band scanning.

Any amount between 2.5 and 40KHz may be selected by using dial. (In multiples of 2.5Khz.)

NOTE: LCD does not have 6th digit for 100Hz display. For example, when using 2.5KHz or 12.5KHz stepping, LCD will show 145.622 for 145.6225 and 145.007 for 145.0075.

**F. DIALING MODE SELECTION:** Prompt = dIAL. Two modes of dialing, WRAP-around and STOP (non-wrap) are selected by using dial knob.

In STOP mode, dialing stops when upper or lower limits are reached. Transceiver beeps with each additional click of the dial.

In WRAP mode, as soon as unit reaches upper or lower frequency limit, the next click will wrap frequency around to the other limit. For example, if LCD is showing a frequency of 149.000, turning the dial one more click to the right will cause frequency to drop down to 142.000. Unit will give one BEEP to signal that wrap-around has occurred.

The WRAP mode is convenient for rapid shifting to frequencies near the opposite end of the band. STOP mode is useful for rapid shifting to band edges (with SPEED function engaged) and so positively zeroing out to a starting point from which dial clicks can be counted. Thus it is possible to set up frequencies without visual reference to LCD while driving. The selected frequency can be confirmed aurally by using the optional speech synthesizer.

**G. ENDING COMMAND ENTRY SEQUENCE:** Dialing mode selection is the last item in the entry

sequence. Hit ENT again and unit will give one long beep to signify entry sequence has been completed.

### 3.0 HOW TO USE QSY FUNCTION

**3.1 General Description:** -- The QSY BUTTON activates a secondary VFO which always starts from frequency presently in use.

**3.2 QSY from VFO, MEMORY or CALL:** -- QSY can be initiated from any position of the function switch, VFO, MEMORY or CALL. Hit QSY and turn dial knob until finding desired new frequency. Hit QSY again to return to previous frequency. Further use of QSY button toggles operation between original and new frequency.

**3.3 Offset Selection:** -- Changing transmitter offset, + and -, or returning to SIMPLEX is controlled directly using the OFST button.

**3.4 TONE Selection:** -- Use command entry sequence for VFO if a different TONE is needed, or TONE is to be turned off, etc. (Para 2.5)

### 4.0 HOW TO USE CALL MEMORY

**4.1 General Description:** The call memory is an extra memory which can be programmed by the user. Separate frequencies are stored for the receive, transmit and CTCSS tone frequencies.

When the PRIority button is activated, the Call receive frequency is checked once every 5 seconds, and the unit will BEEP if the frequency is in use.

**4.2 Command Entry Sequence:** Hit ENT to initiate command entry sequence.

A. CALR = prompt for CALL memory receive frequency. Select frequency by dial, and hit ENT.

B. CALT = prompt for CALL memory TX frequency. Select frequency by dial, and hit ENT.

C. TONE = Select OFF, or a tone, using dial and hit ENT. Unit will emit one long BEEP for end of sequence. (LCD shows 67.7 for 67.0)

NOTE: OFST button is not active for the CALL function and the transmit frequency must be written in to the CALT memory. This provides complete flexibility for choice of frequency and permits use of the CALL function with non-standard splits, such as MARS, CAP and other specialized operations.

### 5.0 HOW TO USE PRIORITY

**5.1 General Description:** PRIORITY button toggles priority function on and off. When engaged, transceiver will sample CALL receive frequency once every 5 seconds.

If frequency is in use, transceiver will emit a

short BEEP. Priority feature is active at all times unit is in reception mode of operation.

## 6.0 HOW TO USE MEMORIES

6.1 General Description: 16 memories are provided. Each memory is capable of storing the operating frequency, tone, scanning mode, and duplex mode.

6.2 Memory Recall: Place function switch in MEMORY position and select memory using dial. LCD will show prompts of "Ch", a memory number and frequency presently stored in memory.

NOTE: Dial end mode specified during VFO command entry sequence determines dial end mode for dialing memories. (See para 2.5, page 2)

6.3 Command Entry Sequence: Select desired memory channel per 6.2 above. Hit ENT to start command entry sequence.

A. FRQ = Frequency. Select desired frequency using dial. Hit ENT to store in memory and advance to next entry item.

B. TONE = CTCSS tone selection. Select OFF, or desired tone frequency using dial. Hit ENT.  
(NOTE: LCD shows 67.7 for 67.0)

C. SCAN = Memory scan mode selection. Rotate dial and select one of four modes available which appear on LCD following SCAN as follows:

SKIP = Channel will be skipped during memory scanning and effectively increase scanning speed. Channel can be re-introduced to scanning sequence by using command entry sequence.

CARR = Carrier control. Scanning will stop at busy channel and resume immediately when carrier ceases.

AUTO = Automatic resume. Scanning will stop at busy channel but will resume after sampling channel for 5 seconds even if carrier is still present.

dELY Delayed resume. Scanning will stop at busy channel. Will stay on channel for 5 seconds after carrier ceases. This permits continuous monitoring of both sides of a QSO.

D. DUPL = Duplex mode (or simplex) selection. Select desired mode using dial as follows:

OFF = Simplex. Transmit on receive frequency.

UP = Transmitter offset above receive frequency by standard offset. (600KHz for 2 meter repeaters)

dOWN = Transmitter offset below receive frequency.

CROS = Transmit on frequency stored in next higher memory. For use with repeaters with non standard offsets. If CROS specified for highest memory, #16, transmits using memory #1. Maximum of 8 such pairs can be designated. Hit ENT and enter desired data using dial.

6.4 Memory scanning: Set function switch to MEMORY position and hit SCAN button.

*Scanning mode for memories are programmed independently for each memory.*

To change scanning mode, select desired memory, then hit ENT until prompt shows SCAN then select desired scan mode using dial. When desired mode shows in LCD hit ENT repeatedly until end of entry sequence.

6.5 MEMORY BACK-UP: A miniature Lithium battery is installed to provide back-up power to CPU and prevent memory loss while power is not applied to transceiver. Under normal conditions battery should be useable for about 5 years.

Avoid accidental shorting of battery terminals as loss of voltage will result not only in loss of memory, but complete loss of computer initialization. In such case CPU must be re-initialized using initialization button located on CONTROL printed circuit board. See para. 8.3, page 5.

## 7.0 HOW TO USE TONE SQUELCH

7.1 General Description: When TNSQL button is engaged, receiver speaker will be disconnected and is activated only when signals modulated with the selected tone frequency are received. The tone decoder frequency is the same tone as that selected for VFO, CALL or MEMORY function, whichever is in use at the time.

*CAUTION: Use of TONE squelch through repeaters may not be possible if repeater filters out the sub-audible tones before re-transmitting.*

When TNSQL is activated, all reception is muted by the tone squelch, including band and memory scanning, VFO, QSY, CALL and Priority.

If different tone frequencies are stored in memory channels, received signals must be modulated with those respective tones in order to be heard from the speaker.

7.2 How to activate tone squelch: Depress TNSQL button. Push again to disengage.

7.3 How to set TONE frequencies: Use command entry sequence for particular function where tone squelch will be used, such as VFO, MEMORY or CALL. If different encoder and decoder frequencies are desired use CROS mode of memory operations. (LCD shows 67.7 for 67.0)

7.4 How to set different tones for Xmt and Rcv. Use CROS mode of memory use and store desired

tones in transmit and receive memories, but same operating frequency in both memories.

## 8.0 IN CASE OF TROUBLE

### 8.1 No sounds heard from receiver:

A. Speaker microphone not connected. Connect speaker microphone. Confirm speaker mike plug is securely screwed in. Or connect a suitable external speaker.

B. Tone squelch button engaged. Confirm LCD TNSQL indicator is not on. If on, depress TNSQL button and disengage.

8.2 Frequency will not stay constant: Check to see scanning is not engaged. Check SCN indicator in LCD. If on, hit SCN button once. Black spot should disappear and frequency should respond correctly to dial.

### 8.3 Transceiver will not respond to DIAL:

A. Scanning activated. See 8.2 above.

B. CPU needs to be re-initialized.

Due loss of backup voltage. Remove cover and locate INIT button. Push INIT button and observe LCD which will show a prompt BASE. Select 140.000 using dial. Hit ENT button. Prompt will now show prompt of LF. Dial up 142.000 (144.000) and hit ENT. Prompt will show RHF. Dial up 149.000 (146.000) and hit ENT. Prompt will show THF. Dial up 149.000 (146.000) and hit ENT. Prompt will show OFST. Dial up 00.600 for 600KHz offset, or other offset frequency as appropriate. Hit ENT. Unit will emit one long beep signifying that initialization sequence has been completed. (Frequencies in parenthesis are for units used in Europe.)

8.4 Will not band scan: (LCD frequency display flickers). SCNH frequency same or lower than SCNL. Reset SCNL or SCNH so upper limit is higher than lower limit. (See 2.5 A/B page 2)

8.5 Will not memory scan: SKIP command stored in all memories. Re-enter other scan modes in at least two memories. (See 6.5 C, page 4)

8.6 DIALING: Will not dial (or BAND SCAN) in 5KHz steps. (Or 12.5KHz, etc.)

A. SPEED button engaged. Disengage.

B. Different DIAL STEP stored in VFO.

8.7 UNABLE DIAL UP 67.0HZ: Select 67.7Hz. LCD shows 67.7 instead of 67.0.

## 9.0 MICROPHONES AND SPEECH SYNTHESIZER

9.1 Microphones: -- Three types of speaker microphones are available for use with the FM-240 family of transceivers. Type supplied depends upon the requirements of country of sale. Please contact your local KDK dealer or National distributor if you wish to purchase a different microphone.

A. SM-34J Speaker Microphone with UP/DOWN buttons.

B. SM-34E Speaker Mike with UP/DOWN buttons and dual purpose 1750Hz tone burst oscillator.

Manual Mode -- When TONE switched on using switch located on rear panel of speaker microphone, DOWN button becomes tone switch and 1750Hz tone is transmitted as long as the button is held down.

Auto Mode -- (For use in U.K.) When TONE switched on a 1750Hz burst of approximately .5 seconds duration is emitted each time P/T switch is pressed so that the burst precedes every transmission.

HOW TO CHANGE MODES: -- Remove three screws in back housing of speaker-microphone case and remove rear cover. Identify 2 groups of jumpers on printed circuit board. Jumper labelled "E" should be connected and jumper labelled "SMC" should be cut for manual mode. For auto mode cut jumper labelled "SMC" and connect cut ends of "E" jumper together with a blob of solder.

C. SM-34A Speaker Microphone with UP/DOWN buttons and 16 button tone encoder keypad.

### TONE CHART

Low Tones (Hz)	High Tones (Hz)			
	1209	1336	1447	1633
697	1	2	3	A
770	4	5	6	B
852	7	8	9	C
941	#	0	*	D

9.2 How To Use Speech Synthesizer: The optional KDK 34SPCH speech synthesizer unit is available from your local dealer or national distributor.

Install unit using instruction sheet supplied with the unit.

When SPCH button is hit, transceiver will announce whatever operating frequency has been selected.

To check duplex transmitting frequencies, engage REVerse button, then hit SPCH button. Push REV again to return unit to normal duplex operation.

## SPECIFICATIONS FM-240

### 1. GENERAL

SEMICONDUCTORS: FET-5, TR-22, IC-17, DIODE-52  
VFO STEPS SIZE: 2.5 - 40KHz, programable (x10 with Speed on)  
MEMORIES: 16 plus CALL. All programable.  
BAND SCAN: Programable limits and modes, SKIP, CARRIER, AUTO & DELAY. Scan steps same as set for VFO steps.  
MEMORY SCAN: Programable modes, SKIP, CARRIER, AUTO & DELAY.  
TYPE OF EMISS.: F-3  
ANT. IMPEDANCE: Unbalanced feed, 50 ohms nominal.  
SUPPLY VOLTAGE: 13.8v, +- 15%, negative ground.  
CONSUMPTION: Transmit: 1.5A @5w, 5.5A @25w  
Receive: .4A @0 sig., .6A @max volume.  
TEMP. RANGE: -10 deg. C to 60 deg. C.  
DIMENSIONS: 40H x 140W x 170D mm (Body only)  
72H x 188W x 320D mm (Shipping carton)  
WEIGHT: 1.0Kg (Body only) 1.65Kg (Shipping weight)

### 2. TRANSMITTER

FREQ. RANGE: 142.000 - 149.000MHz (144.000 - 146.000MHz in Europe)  
OUTPUT: High = 25watts, Low = 5 watts  
MODULATION: Variable reactance frequency modulation  
MAX. DEVIATION: +- 5KHz  
SPUR. EMMIS: Less than 60dB down from carrier  
DUPLEX OFFSET: Programable +-1 to 12.7MHz (set at +- .6KHz ex-factory)  
TONE: Programable 74-250.3 (34 EIA tones)

### 3. RECEIVER

FREQ. RANGE: 142.000 - 149.000MHz (144.000 - 146.000MHz in Europe)  
CIRCUIT TYPE: Double superheterodyne  
INT. FREQ: 1st = 10.7MHz, 2nd = 455KHz  
SENSITIVITY: Better than 35dB S/N ratio @1uV  
Better than 12dB SINAD @.2uV  
SQUELCH SENS: Better than .15uV  
BANDWIDTH: +6KHz @-6dB  
SELECTIVITY: +12.5KHz @-60dB  
IMAGE RATIO: Better than 70dB  
AUDIO OUTPUT: More than 2w, 8 ohms load, 10%THD  
REVERSE DUPLEX: Transmit and receive frequencies reversed.

### 4. STANDARD ACCESSORIES

SPEAKER MICROPHONE: Speaker=8 ohms, Mike=Condenser type.  
One of following three types (by country of sale)  
SM-34J: UP/DOWN buttons only.  
SM-34E: UP/DOWN plus 1750 tone burst.  
SM-34A: UP/DOWN plus tone encoder.  
POWER CABLE: 2 meters, with 7A fuse.  
SPARE FUSE: 1 piece, 7A.  
EXTERNAL SPEAKER PLUG: Miniature phone plug type, 3.5mm.  
MOBILE MOUNTING BRACKET: 1 piece, black.  
SCREWS: 4 pieces, 4x12mm self tapping sheet metal screws.  
4 pieces, plain washers.  
2 pieces, thumbscrews.  
1 piece, microphone hanger.  
2 pieces, microphone hanger mounting screws.  
INSTRUCTION MANUAL: includes wiring diagram.

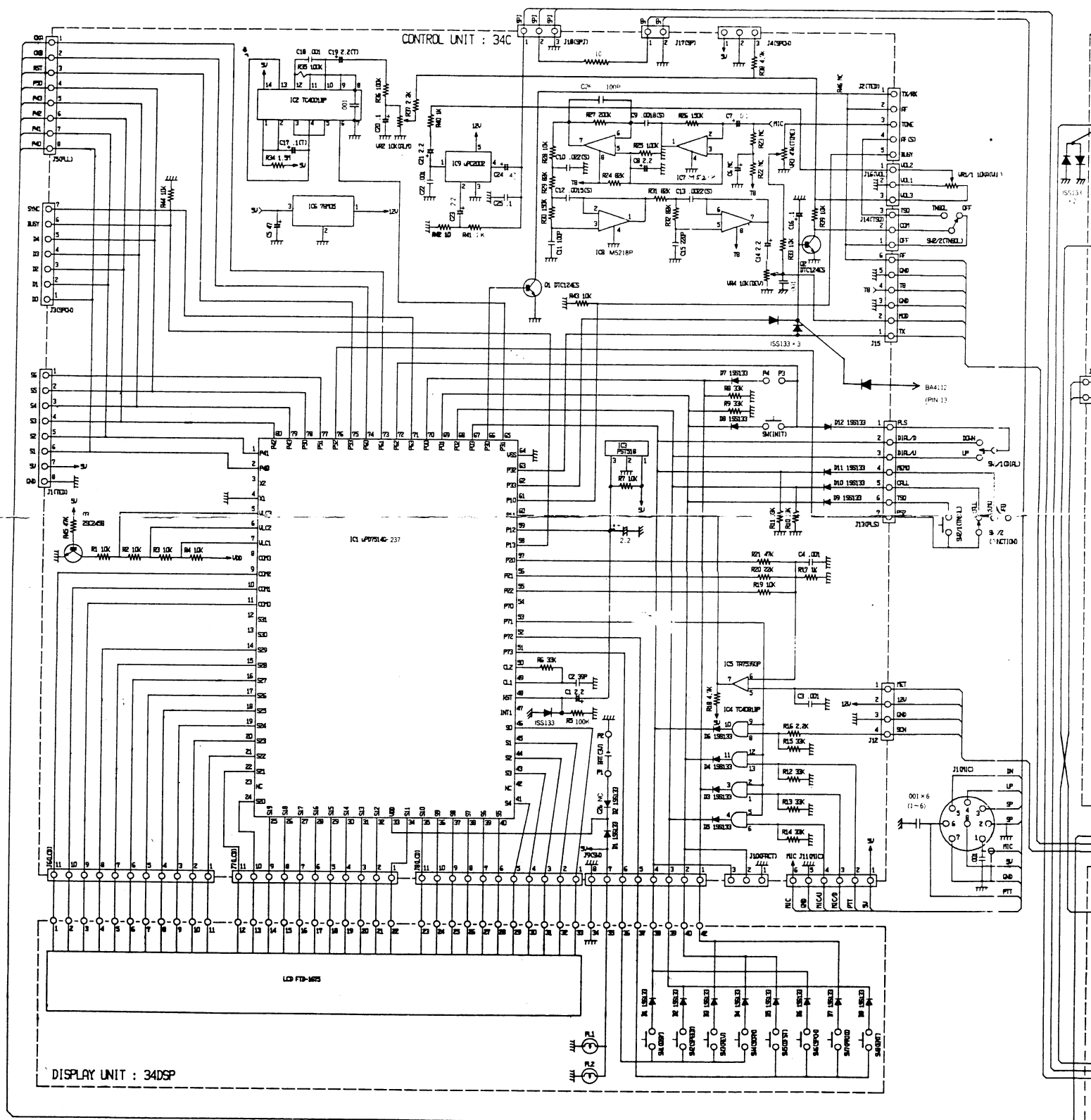
TOYOMURA ELECTRONICS CO., LTD.

2-7-9, SOTO-KANDA, CHIYODA-KU, TOKYO 101, JAPAN TEL.: 03-251-7719

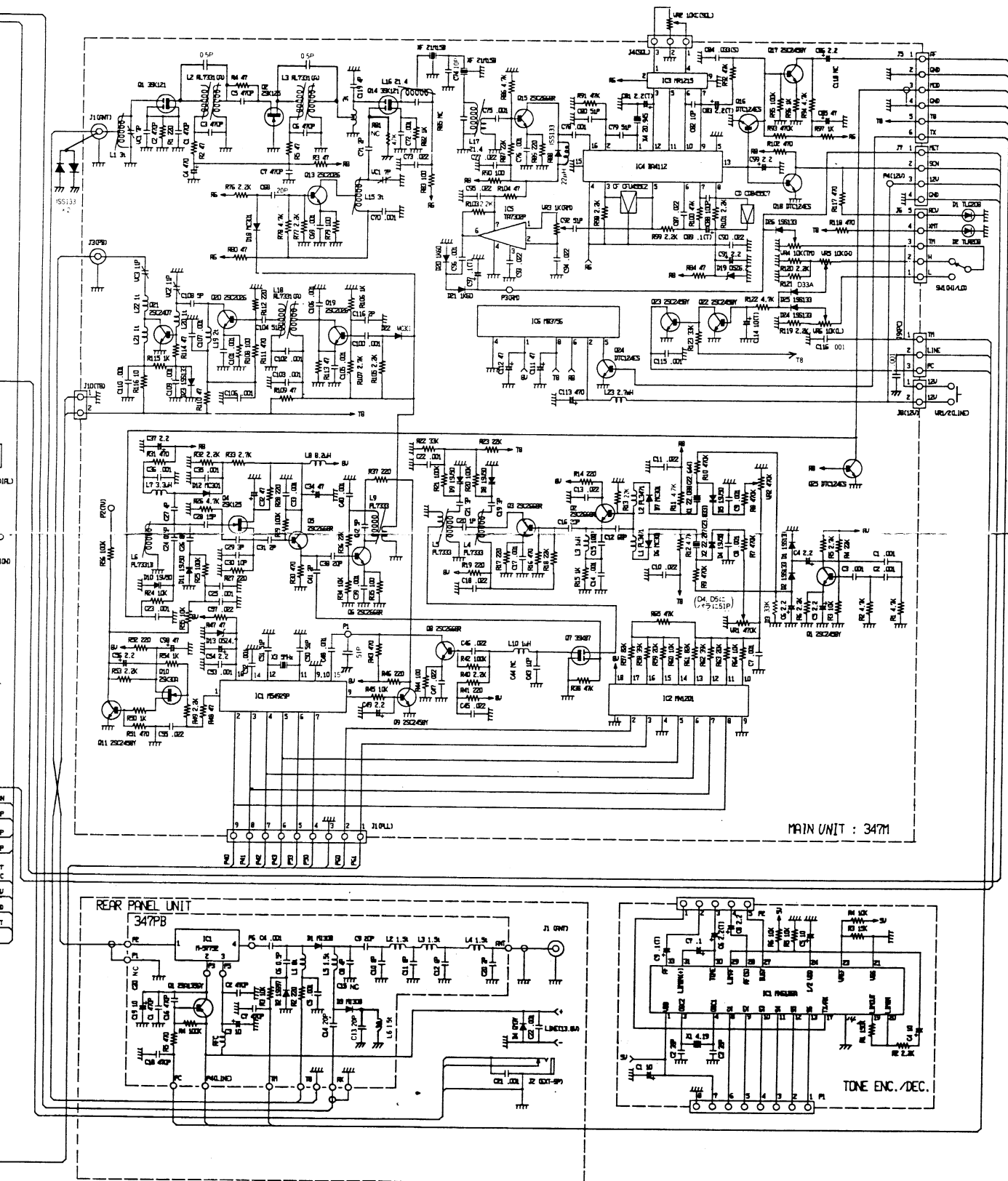
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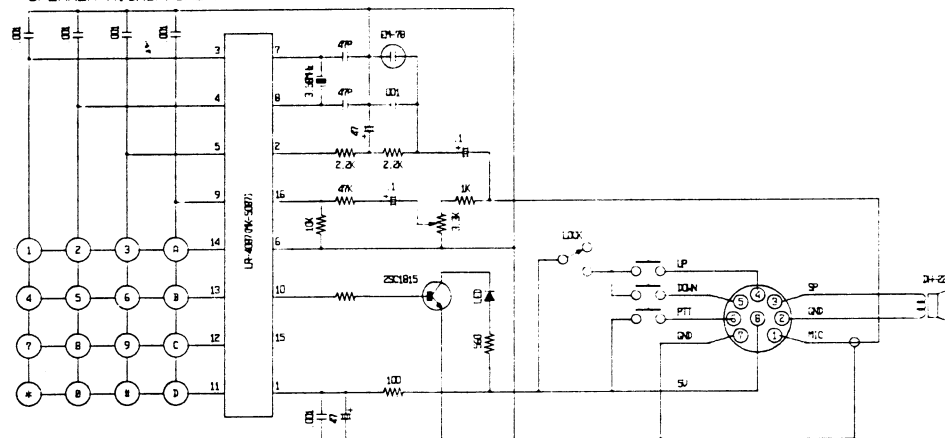
## MODEL FM-740 CIRCUIT DIAGRAM



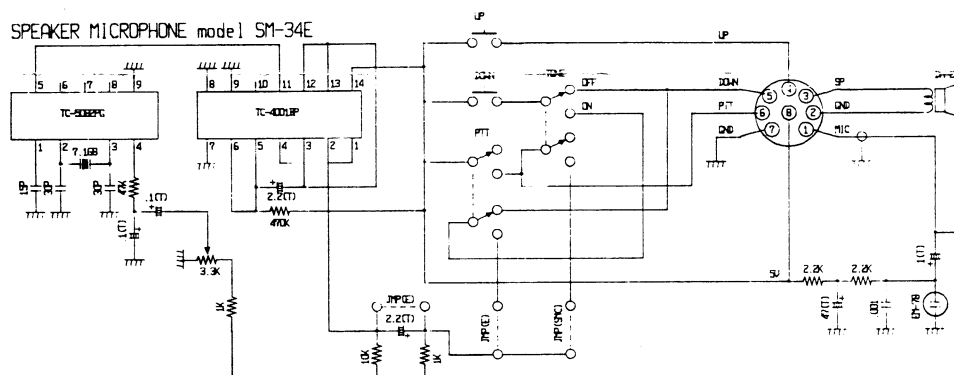
NOTE: UNLESS OTHERWISE INDICATED, VALUES ARE: RESISTANCE IN OHMS AND CAPACITANCE IN MICRO-FARADS. ALL CONNECTOR PINS ARE NUMBERED AS VIEWED FROM OUTSIDE OF THE TRANSCEIVER. CIRCUIT AND VALUES ARE SUBJECT TO CHANGE WITHOUT ADVANCE NOTICE.



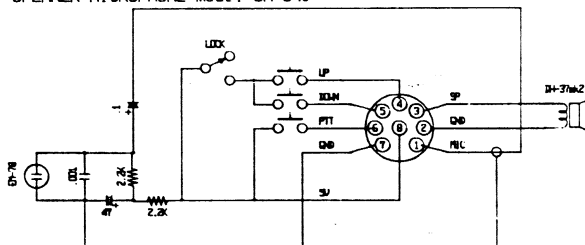
SPEAKER MICROPHONE model SM-34A



SPEAKER MICROPHONE model SM-34E



SPEAKER MICROPHONE model SM-34J



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