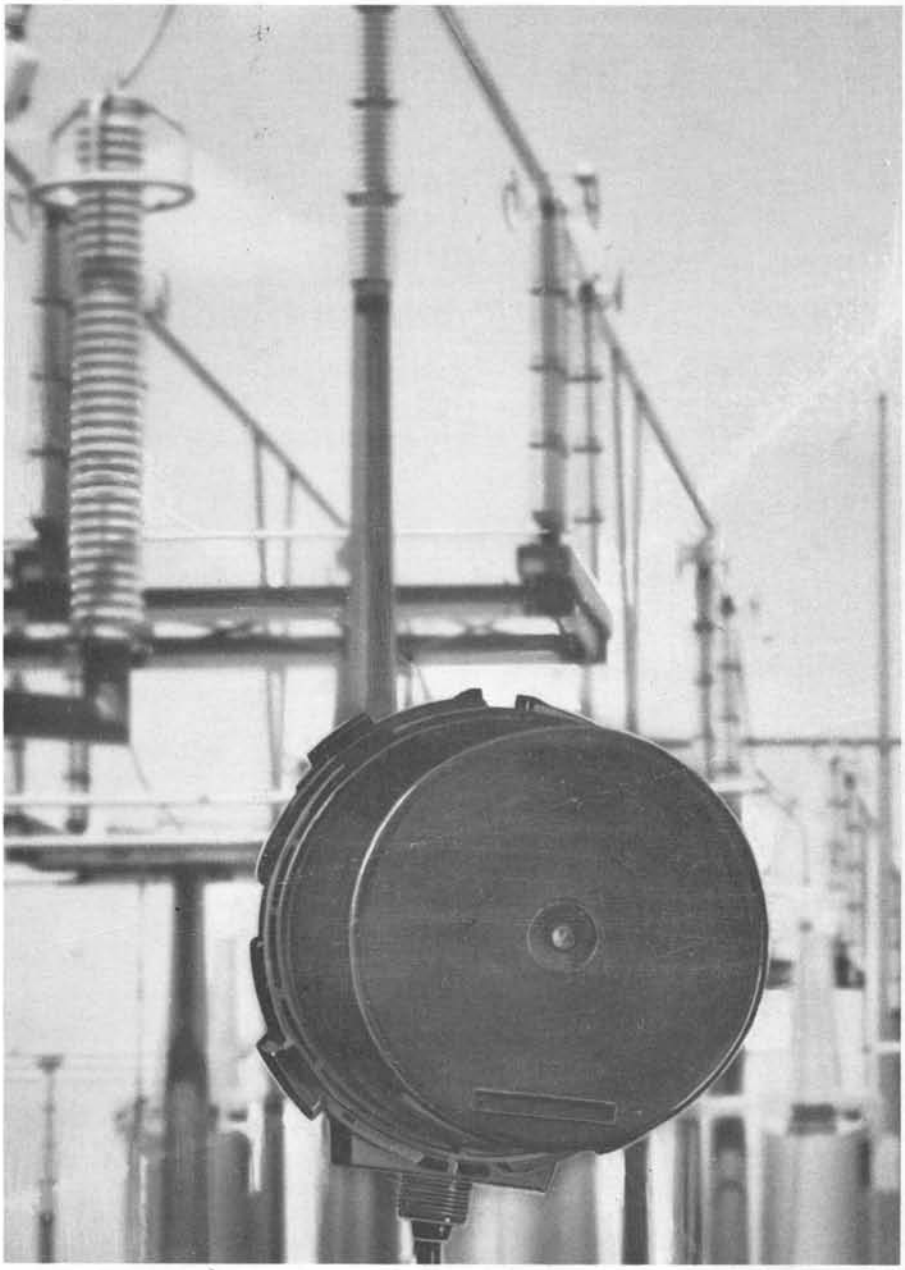
MOTOROLA

REMOTE RADIO SWITCH

Models C1186B/C, C1240A/B-C1242A/B, C1243A and C1244A

154.46375 and 139.650 MHz
24 V AC and 240 V AC
Normally Open Switch



Instruction Manual

68P81071A85-G

PERFORMANCE SPECIFICATIONS

GENERAL	
INPUT VOLTAGE	240 or 24 V ac ± 20%, 60 Hz, 8 watts maximum w/relay operated
OPERATING TEMPERATURE	-30°C to +60°C
DIMENSIONS	8" diameter, 6.5" deep
RECEIVER	
OPERATING FREQUENCY	154.463750 MHz or 139.650 MHz
SENSITIVITY	20 microvolts per meter with internal antenna. One microvolt at 50 ohms when matched to receiver low impedance input.
SPURIOUS & IMAGE REJECTION	More than 40 dB from carrier reference measured when receiver is matched to 50 ohms.
SELECTIVITY	50 dB minimum from carrier reference at ± 30 kHz
DEVIATION	± 2 kHz for specified operating sensitivity
FREQUENCY STABILITY	± .002%, -30°C to +60°C ambient (+25°C reference)
SPURIOUS EMISSIONS	Meets FCC specifications pertaining to emission per FCC Rules, Part 15, Subpart C, Section 15.6.
DECODER	
OPERATING FREQUENCY	One of 33 in the range from 457.5 to 937.5 Hz.(Standard Series) Two of 42 sequentially in the range from 292.5 to 937.5 Hz (High Address Series).
RELAY RATING	Contact rating 240 V ac 30A resistive load or 24 V ac 5A resistive load depending on model. Contact life 25,000 operations at rated load.
MEMORY	Memory timing starts at end of received tone transmission. (7 minutes ± 2 minutes for standard series, 4.5-9 minutes for High Address Series)
MEMORY SET	Standard — Tone Transmission of 440 milliseconds will establish a 7 minutes ± 2 minute memory. High Address — 2 Tone sequential code transmission (200 ms tone B, 800 ms tone A) will establish 4.5-9 minute memory.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

Table 1. Remote Radio Switch Code/Tone Correlation

CODE	TONE	CODE	TONE	
1	517.5	18	772.5	
2	532.5	19	787.5	
3	547.5	20	802.5	
4	562.5	21	817.5	Use Requires Reduced Deviation
5	577.5	22	832.5	
6	592.5	23	847.5	
7	607.5	24	862.5	
8	622.5	25	877.5	
9	637.5	26	892.5	
10	652.5	27	907.5	
11	667.5	28	922.5	
12	682.5	29	937.5	
13	697.5	41	502.5	
14	712.5	42	487.5	
15	727.5	43	472.5	
16	742.5	44	457.5	
17	757.5	45	442.5	
		46	427.5	
		47	412.5	Use on High
		48	397.5	Address Only
		49	382.5	
		50	367.5	
		51	352.5	
		52	337.5	
		53	322.5	
		54	307.5	
		55	292.5	

REMOTE RADIO SWITCH

MODELS C1186B/C, C1241A/B, 1244A
240 V AC NORMALLY CLOSED SWITCH
MODELS C1240A/B, C1242A/B, 1243A
24 V AC NORMALLY CLOSED SWITCH

CONTENTS

MOTOROLA INC.
Communications Division

service publications
1301 E. Algonquin Road. Schaumburg, IL 60196

68P81071A85-G
2/15/79-UP

FOREWORD

1. SCOPE OF MANUAL

This manual is intended for use by experienced technicians familiar with similar types of equipment. It contains all service information required for the equipment described and is current as of the printing date. Changes which occur after the printing date are incorporated by Instruction Manual Revisions (SMR). These SMR's are added to the manuals as the engineering changes are incorporated into the equipment.

2. MODEL AND KIT IDENTIFICATION

Motorola equipments are specifically identified by an overall model number on the nameplate. In most cases, assemblies and kits which make up the equipment also have kit model numbers stamped on them. When a production or engineering change is incorporated, revision suffix numerals are added to the affected kit model number. For example, a TLN4448A becomes a TLN4448A-1 with the first revision, TLN4448A-2 with the second revision, etc.

As diagrams are updated, information about the change is incorporated into a revision column. This revision column appears in the manual next to the parts list or, in some cases, on the diagram. It lists the reference number, part number, and description of the parts removed or replaced when the suffix number changed. With this information, the technician can find the information for the current version, and any previous version, of the equipment covered by the manual.

3. SERVICE

Motorola's National Service Organization offers one of the finest nation-wide installation and maintenance programs available to communication equipment users. This organization includes approximately 800 authorized Motorola Service Stations (MSS) located throughout the United States, each manned by one or more trained, FCC licensed technicians.

These MSS's are independently owned and operated and were selected by Motorola to service its customers. Motorola maintenance is available on either a time and material basis or on a periodic fixed-fee type arrangement.

The administrative staff of this organization consists of national, area and district service managers and district representatives, all of whom are Motorola employees with the objective to improve the service to our customers.

Should you wish to purchase a service contract for your Motorola equipment, contact your Motorola Service Representative, or write to:

National Service Manager
Motorola Communications Division
1303 E. Algonquin Road
Schaumburg, Illinois 60196

4. REPLACEMENT PARTS ORDERING

Motorola maintains a number of parts offices strategically-located throughout the United States. These facilities are staffed to process parts orders, identify part numbers, and otherwise assist in the maintenance and repair of Motorola Communications Division products.

Orders for all parts *except* crystals, active filters, code plugs, channel elements, and "Vibrasender" ® and "Vibrasponder" ® resonant reeds should be sent to the nearest area parts center. Orders for instruction manuals should also be sent to the area parts center.

When ordering replacement parts or equipment information, the complete identification number should be included. This applies to all components, kits, and chassis. If the component part number is not known, the order should include the number of the chassis or kit of which it is a part, and sufficient description of the desired component to identify it.

Orders for crystals, channel elements, active filters, code plugs, and reeds should be sent directly to the factory address listed on the following page. Crystal and channel element orders should specify the crystal or channel element type number, crystal and carrier frequency, and the chassis model number in which the part is used.

Orders for active filters, code plugs, "Vibrasender" and "Vibrasponder" resonant reeds should specify type number and frequency, and should identify the owner/operator of the communications system in which these items are to be used.

5. ADDRESSES

5.1 GENERAL OFFICES

MOTOROLA Communications and Electronics Inc.
Communications and Electronics Parts
1313 E. Algonquin Rd.,
Schaumburg, Illinois 60196
Phone: 312-576-3900

5.2 U.S. ORDERS

WESTERN AREA PARTS
1170 Chess Drive, Foster City,
San Mateo, California 94404
Phone: 415-349-3111
TWX: 910-375-3877

MIDWEST AREA PARTS
1313 E. Algonquin Road
Schaumburg, Ill. 60196
Phone: 312-576-7322
TWX: 910-693-0869

MID-ATLANTIC AREA PARTS
7230 Parkway Drive
Hanover, Maryland 20176
Phone: 301-796-8600
TWX: 710-862-1941

EAST CENTRAL AREA PARTS
12995 Snow Road,
Parma, Ohio 44130
Phone: 216-267-2210
TWX: 810-421-8845

EASTERN AREA PARTS
85 Harristown Road,
Glen Rock, New Jersey 07452
Phone: 201-447-4000
TWX: 710-988-5602

PACIFIC SOUTHWESTERN AREA PARTS
P.O. Box 85036
San Diego, California 92138
Phone: 714-578-2222
TWX: 910-335-1634

GULF STATES AREA PARTS
8550 Katy Freeway
Suite 128
Houston, Texas 77024
Phone: 713-932-8955

SOUTHWESTERN AREA PARTS
P.O. Box 34290
3320 Belt Line Road,
Dallas, Texas 75234
Phone: 214-241-2151
TWX: 910-860-5505

SOUTHEASTERN AREA PARTS
P.O. Box 368
Decatur, Georgia 30031
Phone: 504-981-9800
TWX: 810-766-0876

5.3 CANADIAN ORDERS

CANADIAN MOTOROLA ELECTRONICS COMPANY
National Parts Department
3125 Steeles Avenue,
East Willowdale, Ontario
Phone: 416-499-1441
TWX: 610-492-2713
Telex: 02-29944LD

5.4 ALL COUNTRIES EXCEPT U.S. AND CANADA

MOTOROLA, INC. OR MOTOROLA AMERICAS, INC.
International Parts Dept.
1313 E. Algonquin Road
Schaumburg, Illinois 60196 U.S.A.
Phone: 312-576-6492
TWX: 910-693-0869
Telex: 722443 or 722424
Cable: MOTOL PARTS

5.5 FACTORY ADDRESS FOR CRYSTAL, CHANNEL ELEMENT, ACTIVE FILTER, CODE PLUGS AND RESONANT REED ORDERS

ALL MAIL ORDERS
Motorola, Inc.
Component Products Sales & Service
P.O. Box 66191
O'Hare International Airport
Chicago, Ill. 60666

CORRESPONDENCE
Motorola, Inc.
Component Products Sales & Service
2553 N. Edgington Street
Franklin Park, Illinois 60131

MOTOROLA

MODEL CHART

FOR

HIGH ADDRESS SERIES

REMOTE RADIO SWITCH

(NORMALLY CLOSED)

154.4 MHz

24 & 240 V AC

CODE:

[X] = ONE ITEM SUPPLIED

[2] = QUANTITY OF 2 SUPPLIED

ITEM	DESCRIPTION	C1243A	C1244A
CRD6070A	RADIO SWITCH RECEIVER (154.4 MHz) 24 V	X	
CRD6080A	RADIO SWITCH RECEIVER (154.4 MHz) 240 V		X
CHN6042A	HOUSING KIT, 240 V		X
CHN6043A	HOUSING KIT, 24 V	X	
CLN6390A	LABEL, 24 V	X	
CLN6391A	LABEL, 240 V		X
KLN6536A	FILTER REED KIT	2	2
CLN6392A	HARDWARE KIT	X	X

DESCRIPTION

REMOTE RADIO SWITCH, 3-WIRE (154.4 MHz) 24 V 5 AMP N.C.

REMOTE RADIO SWITCH, 3-WIRE (154.4 MHz) 240 V 30 AMP N.C.

MODEL NUMBER

EPS-28282-O

MOTOROLA

STANDARD SERIES

LATER VERSIONS

MODEL CHART

FOR

REMOTE RADIO SWITCH

139.6 & 154.4 MHz

24 & 240 V AC

[X] = ONE ITEM SUPPLIED

ITEM	DESCRIPTION	C1186G	C1240B	C1241B	C1242B
	DESCRIPTION	REMOTE RADIO SWITCH (240 V; 154.4 MHz)	REMOTE RADIO SWITCH (24 V; 154.4 MHz)	REMOTE RADIO SWITCH (240 V; 139.6 MHz)	REMOTE RADIO SWITCH (24 V; 139.6 MHz)
CHN6042A	HOUSING KIT, 240 V	X		X	
CHN6043A	HOUSING KIT, 24 V		X		X
CLN6209A	REED CLIP KIT	X	X	X	X
CLN6381A	LABEL, 240 V	X			
CLN6382A	LABEL, 24 V		X		
CLN6380A	LABEL, 240 V			X	
CLN6379A	LABEL, 24 V				X
CRD6030A	REMOTE RADIO SWITCH, 154.4 MHz; 240 V (NORMALLY CLOSED)	X			
CRD6020A	REMOTE RADIO SWITCH, 139.6 MHz; 240 V (NORMALLY CLOSED)			X	
CRD6060A	REMOTE RADIO SWITCH, 154.4 MHz; 24 V (NORMALLY CLOSED)		X		
CRD6040A	REMOTE RADIO SWITCH, 139.6 MHz; 24 V (NORMALLY CLOSED)				X
KLN6536A	FILTER, REED	X	X	X	X

EPS-27179-A

MOTOROLA

STANDARD SERIES

EARLIER VERSIONS

MODEL CHART

FOR

REMOTE RADIO SWITCH

139.6 & 154.4 MHz

24 & 240 V AC

[X] = ONE ITEM SUPPLIED

ITEM	DESCRIPTION	C1186R	C1240A	C1241A	C1242A
	DESCRIPTION	REMOTE RADIO SWITCH (240 V; 154.4 MHz)	REMOTE RADIO SWITCH (24 V; 154.4 MHz)	REMOTE RADIO SWITCH (240 V; 139.6 MHz)	REMOTE RADIO SWITCH (24 V; 139.6 MHz)
	MODEL				
CHN6029A	HOUSING KIT	X		X	
CHN6039A	HOUSING KIT		X		X
CLN6209A	REED CLIP KIT	X	X	X	X
CLN6340A	LABEL, 240 V	X			
CLN6342A	LABEL, 24 V		X		
CLN6343A	LABEL, 240 V			X	
CLN6344A	LABEL, 24 V				X
CRD6006A	REMOTE RADIO SWITCH, 154.4 MHz; 240 V (NORMALLY CLOSED)	X			
CRD6008A	REMOTE RADIO SWITCH, 139.6 MHz; 240 V (NORMALLY CLOSED)			X	
CRD6009A	REMOTE RADIO SWITCH, 154.4 MHz; 24 V (NORMALLY CLOSED)		X		
CRD6010A	REMOTE RADIO SWITCH, 139.6 MHz; 24 V (NORMALLY CLOSED)				X
KLN6536A	FILTER, REED	X	X	X	X

EPS-24310-A

1. DESCRIPTION

1.1 The Motorola remote radio switch is a transistorized, dual conversion fm receiver-decoder with built-in antenna, power supply, and regulator. Depending upon the model, the unit operates on a frequency of 139.650 MHz or 154.46375 MHz, and an input voltage of 24 or 240 V ac. Refer to Table 2 for input power and frequency of operation for each model.

Table 2.

Model	Input Power	Frequency
C1186B/C	240 V ac	154.46375 MHz
C1240A/B	24 V ac	154.46375 MHz
C1241A/B	240 V ac	139.650 MHz
C1242A/B	24 V ac	139.650 MHz
C1243A	24 V ac	154.46375 MHz
C1244A	240 V ac	154.46375 MHz

1.2 The radio switch is equipped with an internal antenna and a normally-closed power relay. When a properly coded radio signal is received and decoded, the relay is activated and power to the controlled load is cut off. The relay will remain open for 4.5 to 9 minutes. This time may be prolonged by the reception of a second properly coded signal prior to the end of the first time-out period. At the end of the last time-out period, the relay will de-activate and power will be restored to the controlled load.

1.3 There are 2 decoder/timer schemes used in Motorola remote radio switches. The standard series radio switch operates on a single audio tone and use an r-c timer with a FET switch. The High Address series radio switch requires a 2 tone sequential code and use a 4.5 minute free-running clock and a digital counter to establish the cut-off time.

2. THEORY OF OPERATION

2.1 RECEIVER SECTION

2.1.1 Refer to the Block Diagram, DEPS-28043, and the Schematic Diagram, EEPS-28042. The receiver section is basically the same for all models. Some component values are dependent upon the operating frequency. These values are specified with the prefix M (operating frequency of 154.4 MHz) or the prefix L (operating frequency of 139.6 MHz) on the schematic diagram.

2.1.2 The local oscillator, Q3, is a crystal controlled series resonant type. An output (at test point H) is provided to the second mixer at the oscillator frequency. Also, a circuit tuned to the ninth harmonic of the oscillator provides an output (at test point G) of 9F0 to the first mixer. The tenth harmonic is rejected by a filter composed of C51 and L11.

2.1.3 The incoming signal is coupled to the first mixer (Q1) after the input filters. The signal is mixed with the 9F0 signal to provide the high intermediate frequency (fo + 455 kHz). The resulting signal is filtered and coupled to the second mixer (Q2) where it is mixed with the oscillator signal to provide the low intermediate frequency (455 kHz).

2.1.4 The 455 kHz signal is filtered and then amplified by 3 succeeding stages (Q4, 5, 6) and coupled to the limiter (Q7). The limiter removes any AM noise that may be present. The signal is then fed to the discriminator where the modulating audio is retrieved and coupled to the audio limiter in the decoder section.

2.2 DECODER/TIMER SECTION FOR STANDARD SERIES RADIO SWITCHES

2.2.1 After the audio limiter, the audio signal is applied to the reed driver (Q8) which amplifies the signal to the desired level. This stage is an emitter-follower whose load is a "Vibrasponder" resonant reed.

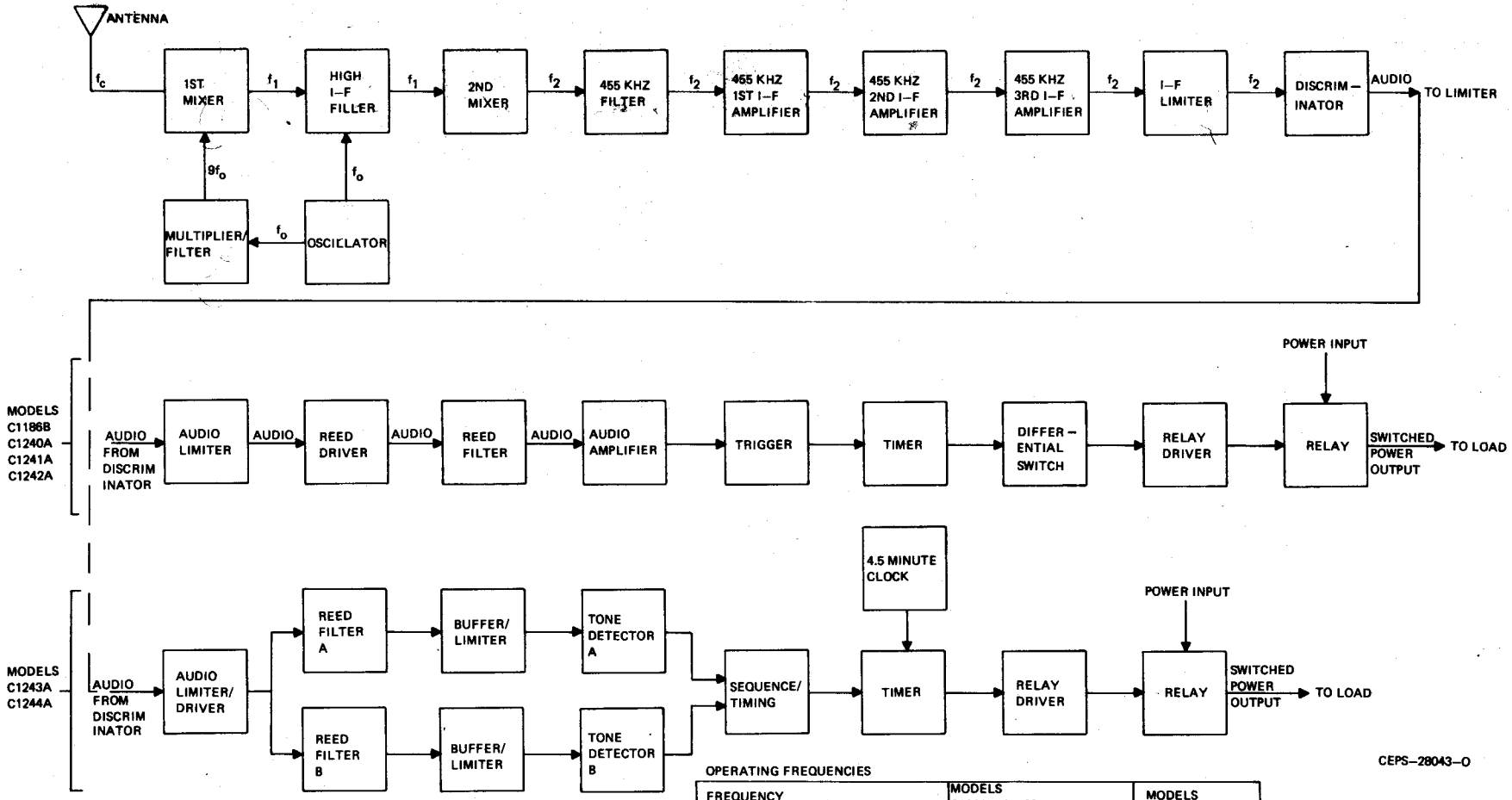
2.2.2 The "Vibrasponder" resonant reed used is of the two coil, single tine type. If a tone is applied to the input coil equal in frequency to that of the mechanical resonance of the "Vibrasponder" reed, the reed will vibrate strongly, acting as the electro-mechanical coupling device between the input and output coils. Therefore, the reed can be considered to be a very narrow bandpass filter which passes only the desired tone.

2.2.3 When a tone is received, it is passed through the "Vibrasponder" reed to the base of Q9, the audio amplifier. The tone is amplified and coupled through C46 to the base of Q10. Transistors Q10 and Q11 form a trigger circuit. Q10 is normally cut-off and Q11 is normally on. When the input is received at the base of Q10, the transistor begins to conduct and its collector goes negative (i.e., less positive). This transition is coupled to the base of Q11 causing it to decrease in conduction which allows the collector voltage of Q11 to go more positive. This positive transition is coupled through R42 back to the base of Q10, increasing its forward bias and causing greater conduction.

2.2.4 In the quiescent state, Q11 is turned on and Q12 is turned on. When the appropriate tone is applied to the resonant reed, Q11 is turned on and off at the resonant reed frequency. The following is a "slow motion" description of the trigger and timer circuit, Q11 and Q12, assuming that the value of R51 is 1k ohms.

NOTE

Resistor R51 is used to compensate for differences in Q12 transconductance. The value of R51 is factory selected. For purposes of discussion, this resistor is assumed to be 1k ohm.



OPERATING FREQUENCIES

FREQUENCY	MODELS C1244A, C1186B, C1240A, C1243A	MODELS C1241A, C1242A
f_c = (CARRIER FREQUENCY)	154.46375 MHZ	139.650 MHZ
f_o = (OSCILLATOR FREQUENCY)	15.400875 MHZ	13.9195 MHZ
f_1 = (HI INTERMEDIATE FREQUENCY)	15.855875 MHZ	14.3745 MHZ
f_2 = (LO INTERMEDIATE FREQUENCY)	455 KHZ	455 KHZ
	$f_o = \frac{f_c - 455\ KHZ}{10}$	

Figure 1. Block Diagram of Radio Switch

2.2.5 In the quiescent state with Q11 turned on, the voltage at the junction of R41, R51, and C47 is approximately half of supply and the gate of Q12 is approximately 0.1 volt positive. When Q11 is shut off by the detection of the first half cycle of the actuating tone, the voltage at the junction of R41, R51, and C47 rises and the voltage across C47 begins to increase. On the next half cycle of the actuating tone when Q11 turns back on, the voltage at Q12 gate goes to a negative value. The change in voltage at the Q12 gate is equal in magnitude to the increase in voltage developed across C47 while Q11 was shut off. This causes Q12 to shut off which allows C48 to start charging toward -11.5 volts through R43 and CR6 to the Q12 gate side of C47.

2.2.6 Approximately 100 on-off cycles of Q11 are required to charge C48 to the maximum level of 11.5 volts. Therefore, C47 and C48 are essentially pumped by successive on-off cycles of Q11 and Q12. The voltage across C48 charges to a voltage equal to the difference between the supply voltage and the maximum charge value appearing across C47. At the end of the tone detection cycle, Q11 turns back on but Q12 is held cut off by the large negative voltage appearing at its gate. The charge on C48 is bled off by resistor R49 providing a delay before C47 can discharge through CR6 and R49. At the end of a 5 to 9 minute delay, Q12 conducts and grounds the base of Q13. The variation in delay time is dependent upon the variation in circuit components, especially R49 and C48.

2.2.7 The value of R51 is selected at the factory to compensate for the different characteristics of Q12. The characteristic change depends upon the type number used in the circuit. If R51 is replaced by a jumper, the maximum voltage across C48 will be approximately twice the supply voltage, or 16 volts. If R51 is 470 ohms, the maximum voltage across C48 will be approximately 13 volts. The time delay, however, will remain between the 5 and 9 minute range.

2.2.8 Q13 and Q14 form a differential switch, with Q13 normally conducting (saturated) and Q14 normally cut off. When the output of Q12 goes positive, Q13 turns off. Due to the differential action of this circuit, Q14 turns on. This transition is speeded up by the positive feedback of Q15 and R48 to the base of Q14. The switching action of this circuit takes place when the voltage at the drain of Q12 equals the voltage at the base of Q14.

NOTE

The Q13 turn-on level may be factory adjusted from 4 to 2 V dc by removing R50.

2.2.9 Transistor Q14 controls the action of Q15 that drives relay K1. Diode CR7 is used for transient suppression. The relay contact is used for controlling the power of an associated device.

2.2.10 The power supply and regulator consist of a full-wave rectifier and a series voltage regulator. C50 and C33B comprise the input filter, while C33A is the output filter. Emitter follower Q16 absorbs voltage changes, while diode CR5 serves as a reference for controlling the output voltage. R31 is used to bypass any excess current around Q16 thus protecting the transistor. The regulator output is 8.4 V dc and is supplied to the receiver-decoder portion of this unit. The unregulated 18.4 V dc is supplied to K1, Q13, Q14, and Q15.

2.3 DECODER/TIMER SECTION FOR THE HIGH ADDRESS SERIES RADIO SWITCHES

2.3.1 The High Address Series Radio Switches operate on a 2 tone sequential signal. The coded signal must meet certain parameters:

- Tone B must be present at the decoder for at least 150 ms.
- The output of the 2 tone detectors must coincide for at least 50 ms but for less than 600 ms (integration times of the tone detectors provide coincidence of detection although the tones will not coincide).
- Tone A must persist after the coincidence of detection for at least 650 ms.

2.3.2 Audio from the discriminator is passed through a limiter/driver and presented to 2 "Vibrasponder" resonant reeds, each tuned for one of the tones in the sequence.

2.3.3 The "Vibrasponder" resonant reeds used are of the two coil, single tine type. If a tone is applied to the input coil equal in frequency to that of the mechanical resonance of the "Vibrasponder" reed, the reed will vibrate strongly, acting as the electromechanical coupling device between the input and output coils. Therefore, the reed can be considered to be a very narrow bandpass filter which passes only the desired tone.

2.3.4 The output of each reed filter is passed through a buffer/limiter (U201C and U201D) and fed to the tone detectors (U201A and U201B). The output of the detector will be brought low when the desired tone is present. (Integration times of the detectors will cause a delay in response to tone transmissions; refer to the Timing Diagram BEPS-28046.)

2.3.5 Refer to the Timing Diagram BEPS-28046. The outputs of the 2 tone detectors are coupled to the coincidence gate U203A. When the 2 tone detectors are low simultaneously, the output of the gate will be forced high. This action causes C206 (maximum coincidence) to begin charging. If the coincidence of 2 tones persists for more than 600 ms, C206 will charge to a value sufficient to present a high input to U203B and inhibit further circuit action. When the coincidence ends, C206 will begin discharging and C205 (sequence delay) will be discharged and begin recharging. While the coincidence gate output is low and the charge on C205 is below the turn-on voltage at the input of U203B, the output of U203B will be high.

2.3.6 The sequence delay capacitor (C205), after being discharged, will provide a low input to U203B for approximately 550 ms. This low input and the low input provided by the maximum coincidence capacitor will cause the output of U203B to remain high for approximately 550 ms, the sequence delay time. When the sequence delay capacitor charges to the turn-on voltage of U203B, the output will return low. This transition is passed through a capacitor (C207) to provide a negative-going pulse at the input to U203D (Function Enable).

2.3.7 With a properly coded signal input, the output of the tone A detector will still be low when the pulse occurs. These inputs will cause a positive pulse at the output of U203D. This pulse is coupled to the counter (U401) and resets it to zero.

2.3.8 The clock (U403) provides a square-wave output with a cycle time of 4 1/2 minutes. When the counter is reset, the Q1 output (pin 4) is brought low. This action enables U402D (clock enable) to pass an inverted clock signal to the counter. The Q1 output is also passed through an inverter (U402C) and coupled to the relay driver. When the Q1 output is low, the relay driver is turned on and activates the relay which removes power from the controlled load.

2.3.9 The counter is negative-edge triggered so the Q1 output will remain low until two negative transitions of the clock input occur. Since the clock is free-running, the actual time that the load is cut-off will depend upon when the counter reset occurs in relation to the clock cycle. The random nature of the time-out period provide a gradual restoration of the controlled power when many switches are operated on the same coded signal. This prevents a sudden surge in load demand which would occur if many controlled loads were to turn on at approximately the same time. (Timer-waveform combinations A and B show the randomness of the time-out period).

2.3.10 When the second negative input transition occurs, the Q1 output will go high, disable the clock input, de-activate the relay, and restore power to the controlled load. If a second properly coded signal is received and decoded before the timer times out, the counter is reset and the load remains cut off. In this way, by repeated signalling, the load may be cut off for an extended period of time.

2.3.11 The High Address radio switches also include a "cold-load" pickup feature. After a power interruption, the circuit of C401 and R224 provides a positive pulse to the reset input of the counter. This causes the load to be cut off for the time-out period as with a radio controlled cutoff. This feature provides a "soft" restoration of power to the controlled loads and prevents an excessive demand on power distribution systems after a power failure.

2.3.12 The power supply for the radio switch consists of a full-wave rectifier, a zener controlled series voltage regulator, and an operational amplifier voltage follower. An unregulated 18 volt source is provided at the output of the rectifier for the relay. The 8.4 V regulated source provides power to the receiver section and most of the decoder section. V_B, also an 8.4 V regulated source, provides an isolated supply to U203 and V_A provides a temperature compensated input to the tone detectors. In addition, the operational amplifier voltage follower (U202B) provides 4.6 volts to the audio limiter, the "Vibrasponders", and to the reed buffers.

3. INSTALLATION INSTRUCTIONS

3.1 GENERAL

The remote radio switch contains an fm radio receiver, antenna, control relay, and a power supply. The remote radio switch has an input power consumption of 8 watts maximum. Since the unit contains an fm radio receiver operating in the vhf frequency range, and has a built-in antenna, certain location requirements must be considered. The remote radio switch should be mounted as high as possible when installed in a basement location. Subbasement locations should be avoided unless sufficient receive signal strength is available at the mounting location to assure reliable operation.

3.2 SPACE REQUIREMENTS

The remote radio switch overall dimensions are shown in Figure 2. Refer to these dimensions when selecting an installation location.

3.3 LOAD SWITCHING CAPABILITIES

3.3.1 240 V AC Models

The C1186B/C, C1241A/B, and C1244A models are capable of switching 30 ampere loads at 240 V ac; a maximum of 7200 watts. Some water heaters have a total wattage rating in excess of 7200 watts. However, the high wattage heater element alone may have a rating less than 7200 watts. This element may be individually controlled by the remote radio switch. Wiring details are shown in Figure 6.

3.3.2 24 V AC Models

The C1240A/B, C1242A/B, and C1243A models are designed to operate from the 24 V ac thermostat control power source and control the voltage applied to the thermostat circuit. These 24 V ac models are used to control very large air conditioner units, home heating units, or industrial heaters with separate thermostat circuits where the primary power rating far exceeds the 7200 watt maximum of the 240 V ac models.

3.4 MOUNTING LOCATION CONSIDERATIONS

3.4.1 As stated in paragraph 3.1, special consideration should be given to the mounting location in below ground installations (basements, subbasements). If the remote radio switch is mounted outdoors, consider the possibility of damage from lawn mowers, bicycles, walkways, etc. when choosing the location. If possible, it is desirable to avoid mounting the radio switch on the condensing unit of the air conditioner.

3.4.2 When mounting a remote radio switch outdoors, or indoors in a high moisture environment, use a rubber gasket (see Figure 3) between the existing junction box and the mounting flange on the radio switch unit. A rubber gasket is not supplied but can be fabricated from the dimensions shown in Figure 2. Never mount the radio switch unit from the bottom or sides of a junction box in these environments since moisture can seep into the unit at the wire entry point and damage the internal electronic circuitry.

3.5 INSTALLATION PROCEDURE

3.5.1 Mechanical Details

Step 1. Select the mounting location for the remote radio switch keeping in mind the mounting location considerations discussed earlier. Refer to Figures 2 and 3 for typical mounting on air conditioners and water heaters.

Step 2. Prior to mounting the unit, remove the cover lock screw (see Figure 4) and rotate the cover to obtain the proper orientation of the label holder after the unit is mounted. Install and tighten the cover lock screw (from the back side for security reasons) at the proper location.

Step 3. Attach the remote radio switch to the junction box using a standard 3/4''-14 conduit connection nut (see Figure 5). Tighten the nut securely but avoid overtightening to prevent thread damage.

Step 4. Secure the mounting tab to the wall or mounting surface using a number 10 round head wood or metal screw or a 3/16'' stove bolt and nut, as applicable.

CAUTION

Be careful not to puncture the water heater tank or to drill or run a screw into hidden pipes or conduit during installation.

3.5.2 Electrical Details

3.5.2.1 Refer to Figure 6 for wiring a 240 V ac remote radio switch to a heater or air conditioner drawing less than 30 amperes, 7200 watts maximum.

3.5.2.2 Refer to Figure 7 for wiring a 240 V ac remote radio switch to control a single heater element of less than 7200 watts in high wattage heater installations.

3.5.2.3 Refer to Figure 8 for wiring a 24 V ac remote radio switch in a typical thermostat control circuit.

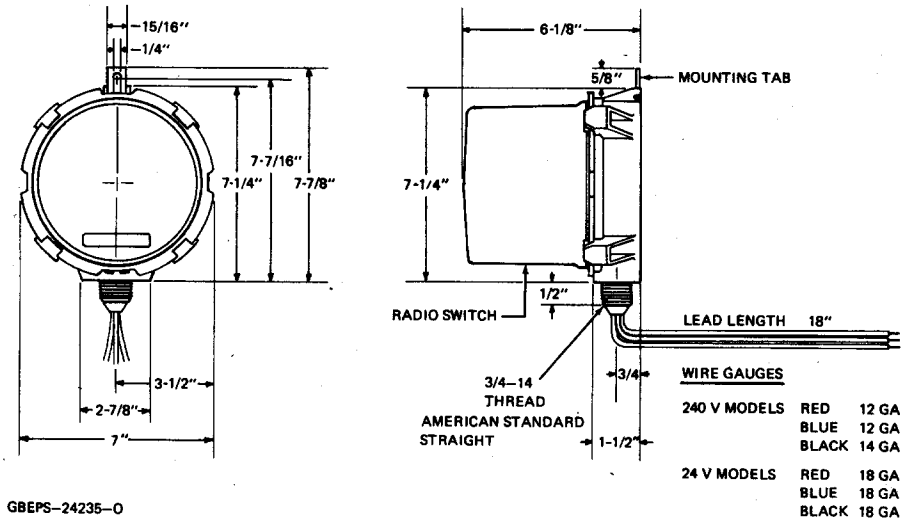


Figure 2. Outline Dimension Details

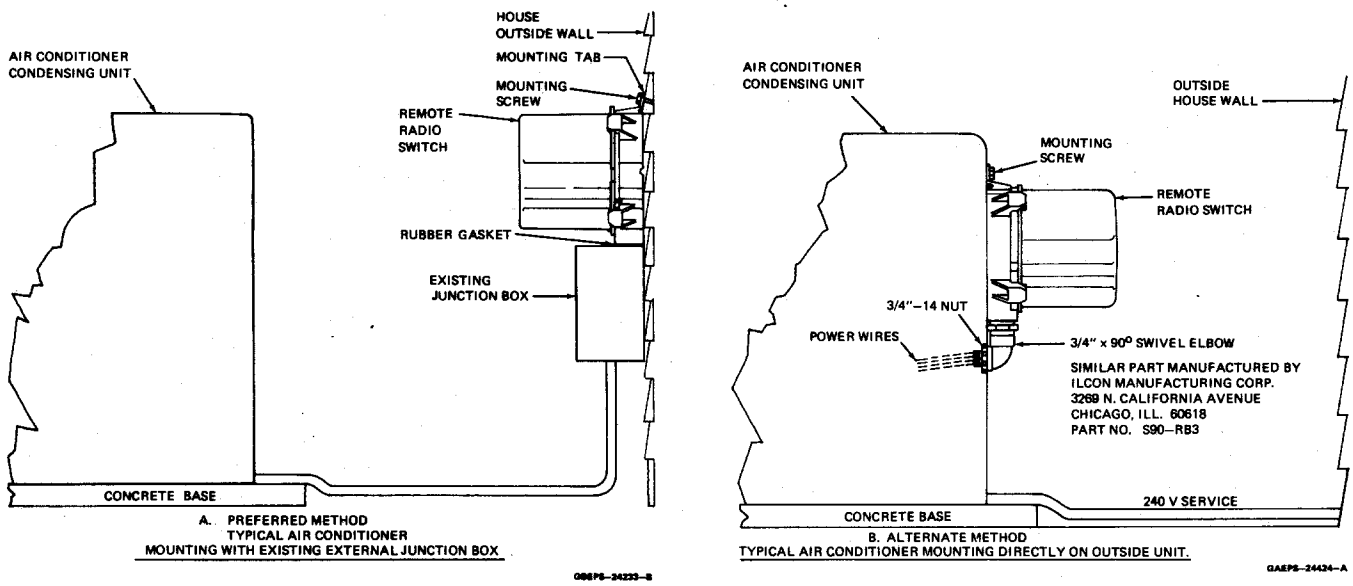


Figure 3. Typical Air Conditioner Installations

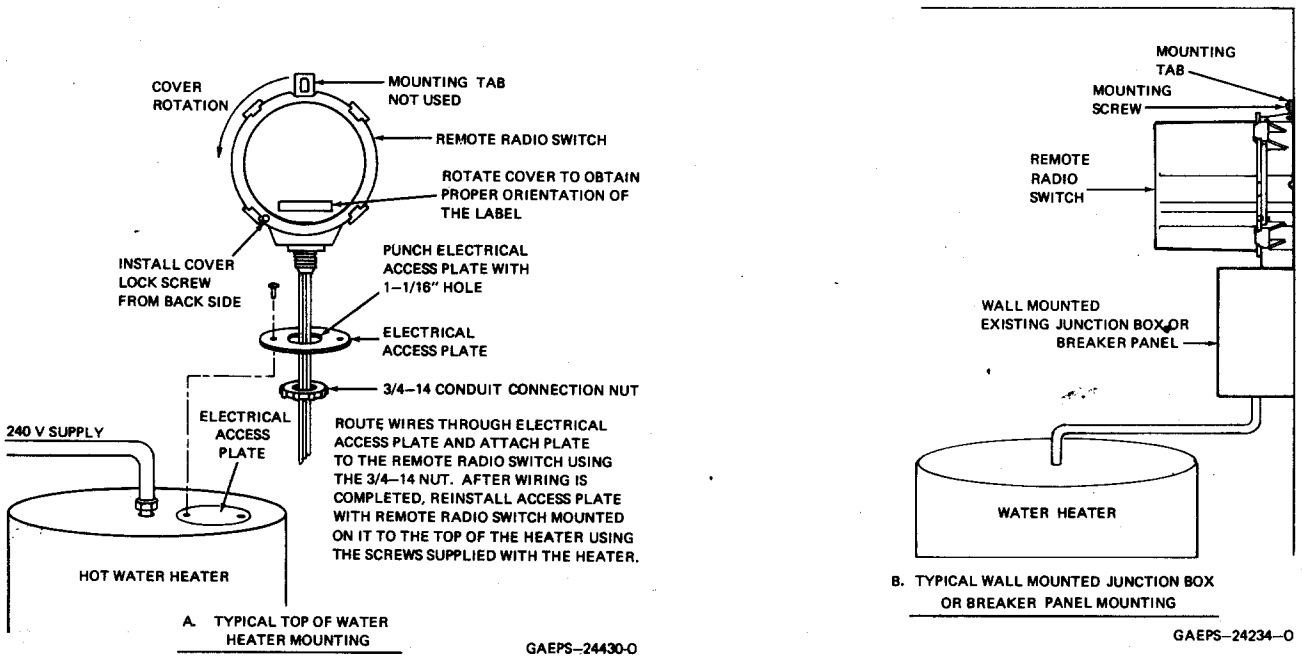


Figure 4. Typical Hot Water Heater Installations

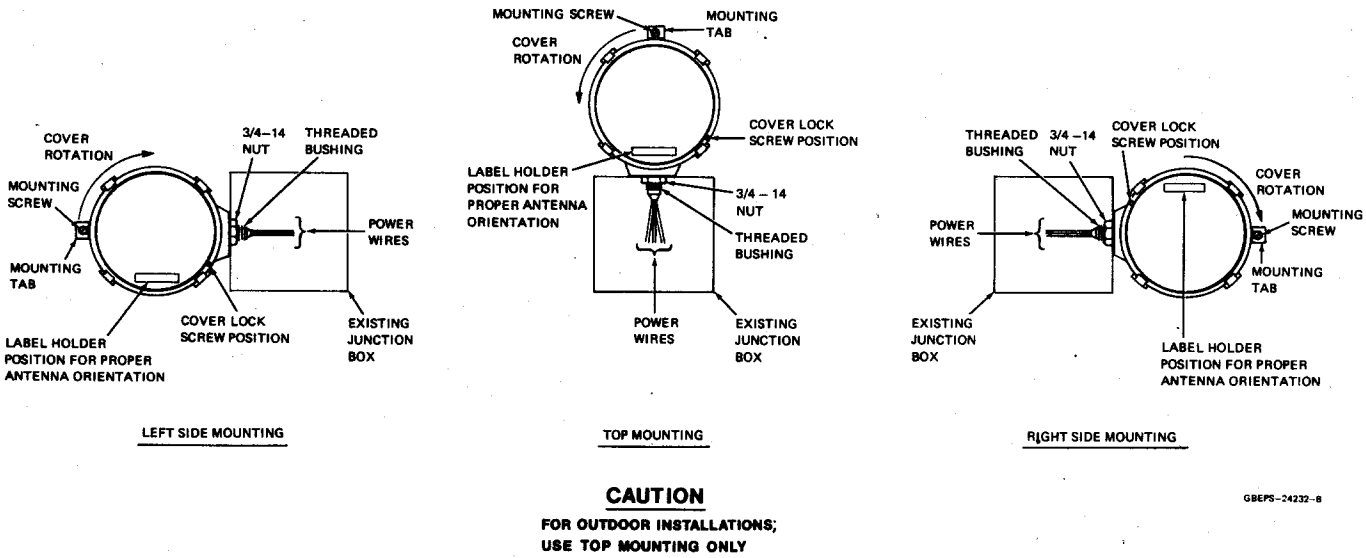


Figure 5. Remote Radio Switch to Junction Box Mounting Details

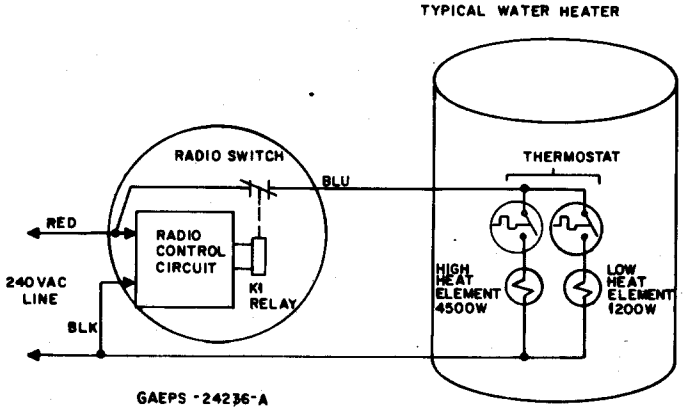


Figure 6. Standard 240 V ac Installation Wiring

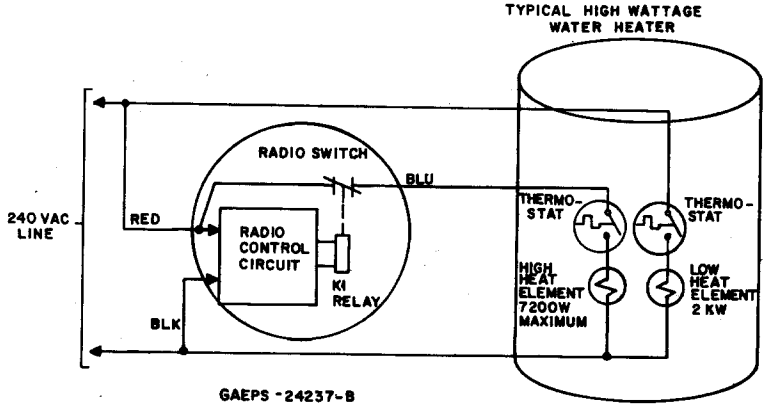


Figure 7. Typical 240 V ac High Wattage Heater Single Element Control, Installation Wiring

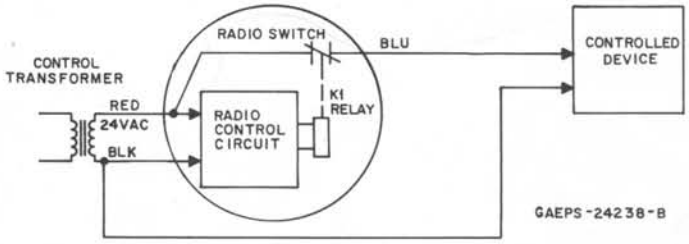


Figure 8. 24 V ac Thermostat Control Circuit Installation Wiring

4. MAINTENANCE

NOTE

The High Address Series radio switches contain logic components (CMOS) which are sensitive to static discharge. Follow approved handling procedures.

4.1 TEST EQUIPMENT

The following TEST EQUIPMENT chart lists the equipment required for alignment and testing of the radio remote switch. The listed items or their equivalents may be used.

Chart 1. Test Equipment

ITEM	APPLICATION
Motorola Transistorized DC Multimeter	DC measurements
Motorola Transistorized AC Voltmeter	AC Signal measurements
Motorola S1320A FM Signal Generator	Injects carrier frequency signal for alignment, sensitivity measurements, and stage measurements
Motorola S1056-9B Portable Test Set with 455 kHz crystal or 455 kHz crystal-controlled oscillator	Injects 455 kHz signal for alignment and testing of 455 kHz I-F, limiter, and discriminator stages
Motorola S1333A Universal Tone Generator	Generates tones for testing of tone circuits, the decoder section, and for sensitivity measurements
Frequency Counter (15 MHz Capability)	Tune oscillator
Oscilloscope (a dual-trace oscilloscope is necessary to properly service the High Address series radio switches)	Observing waveforms in timing circuits
Spectrum Analyzer or tunable receiver (154.00875 MHz for 154.46375 MHz models, 139.195 MHz for 139.650MHz)	Tune the 10th harmonic trap
Motorola Tuning Tools; they consist of the following:	
a. Part No. 66A824842	a. Adjusting tuning coil slugs L1 through L8 and potentiometer R30.
b. Part No. 66A83395A01	b. Adjusting transformer slugs T1, T2, and T3.
c. Part No. 66-847036	c. Coarse adjustment of coil slug L11.
d. Part No. 66-83255C01	d. Fine adjustment of coil slug L11.
"Vibrasponder" resonant reeds (High Address Series Only) KLN6536AF KLN6536AG KLN6536AH	2 tuned to the same frequency (required to test High Address Series decoders)

4.2 DISASSEMBLY PROCEDURE

4.2.1 Removal of Housing Front Cover

Step 1. Be certain that no power is applied to the remote radio switch.

Step 2. Remove cover locking screw.

Step 3. Rotate the housing cover about 45°until the cover slots are in line with the rear housing tabs. See Figure 2.

Step 4. Slide the cover forward about 5 inches and remove.

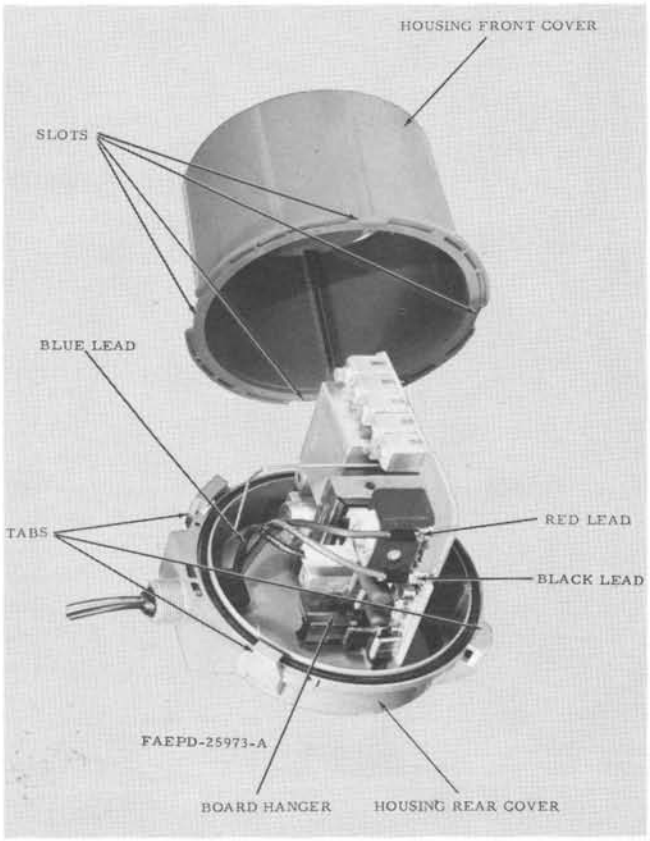
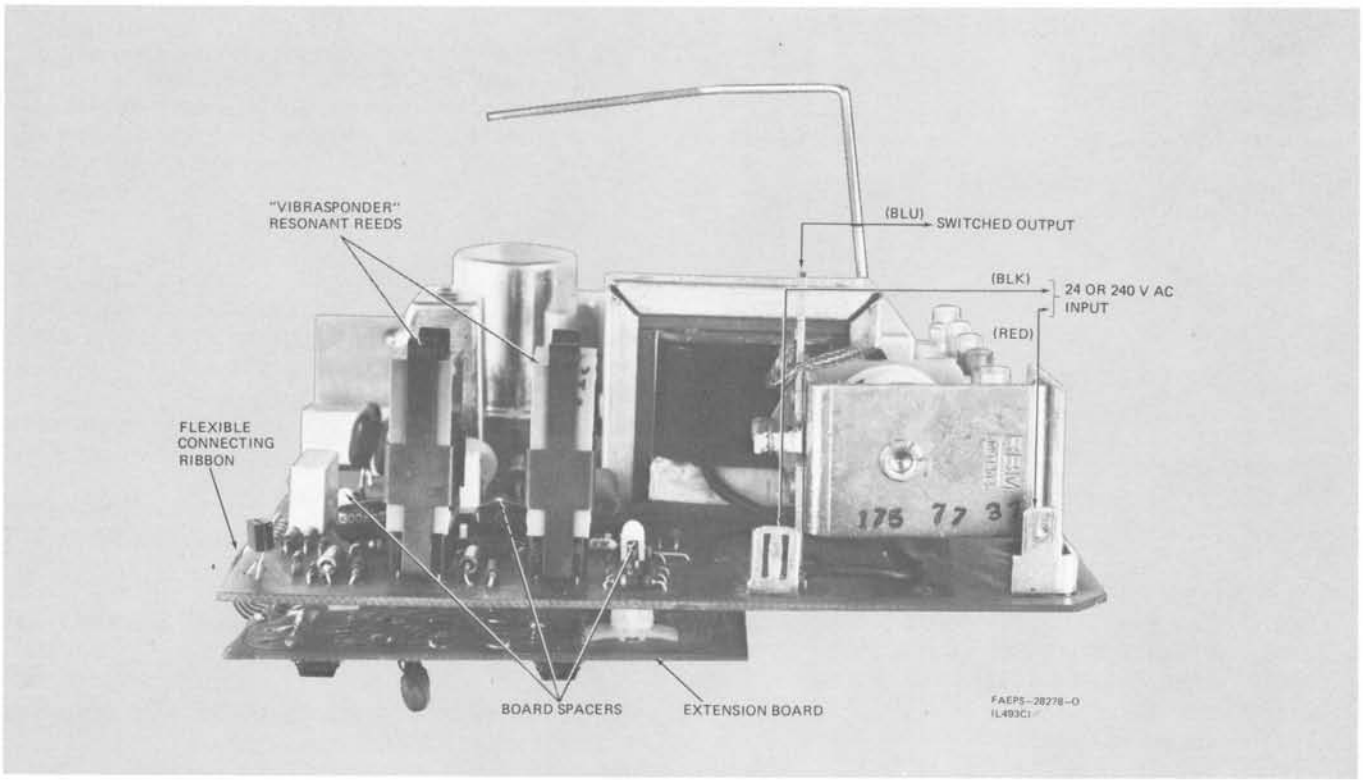


Figure 9. Housing and Board Removal



4.2.2 Removal of Printed Circuit Board
(Refer to Figure 9)

Step 1. Carefully remove the red, blue, and black leads from the board by gripping each quick-connect terminal with a gentle back and forth motion.

CAUTION

Be careful not to damage the relay. It is adjusted with precision and can unnoticeably be damaged.

Step 2. Release the board hanger by gently spreading it away from the circuitry side of the board with a screwdriver and at the same time lifting out the board.

Step 3. (High Address Series Only) Refer to Figure 10. Separate the extension board from the main board by gently pulling them apart until the board spacers are free of the main board. Take care not to damage the flexible connecting ribbon.

4.3 SERVICING PROCEDURE

When the radio switch requires service, use the following procedure to localize the fault.

Step 1. Make certain that the radio switch receives sufficient rf signal strength with proper modulation.

Step 2. Depending upon the model, check for an input voltage of 24 or 240 V ac ± 20% between the RED and BLACK leads on the radio switch.

Step 3. Perform the power supply tests described in paragraph 4.4.

Step 4. Perform the receiver section tests described in paragraph 4.6.

Step 5. Confirm the function of the decoder section as discussed in paragraphs 4.7 and 4.8.

4.4 POWER SUPPLY TESTING
(Refer to the schematic diagram EEPS-28223 circuit board details EEPS-28281 or PEPS-14927, and Figure 11)

Step 1. Apply 24 or 240 V ac to the power input terminals depending upon the model.

Step 2. The following voltage levels should be measured:

STANDARD SERIES MODELS

Input - 24 or 240 V ac ± 20%

Test Point J - 7.6-9.4 V dc

18 V Source 13-22 V dc

HIGH ADDRESS SERIES MODELS

Input- 24 or 240 V ac ± 20%

Test Point	Nominal Value
X	17.6* V dc
Y	8.4 V dc
Z	4.6 V dc
VA (at 22°C)	4.6 V dc

* Taken with relay closed.

4.5 RECEIVER SECTION ALIGNMENT

(Refer to Figure 11, the attached schematic diagram EEPS-28042 and Circuit Board Details EEPS-28281 or PEPS-14927.)

4.5.1 Pre-Alignment Procedure

NOTE

Make all alignments from plating side of board.

Step 1. Turn slugs L1 through L8 fully counterclockwise so they are closest to the board.

Step 2. Turn slugs T1 and T2 fully clockwise so they are at top of the cans and back off 10 turns.

Step 3. Turn slug T3 fully clockwise to the top of the can.

Step 4. Turn slug L11 fully counterclockwise and adjust to 12 turns toward the top of the can with the metal tip tool 66-847036.

4.5.2 Alignment Procedure

Step 1. Apply 24 or 240 V ac to the power input terminals.

Step 2. Monitor test point A with an ac voltmeter through a shielded 1 foot cable terminated with a 10k, 1/4 W resistor. The resistor and shield should have short leads and be soldered directly to the board.

Step 3. Apply a 455 kHz signal to test point B through a 2 pF capacitor. Tune T1 clockwise for a peak reading on the ac voltmeter. (T1 will display 2 peaks and must be tuned to the peak where the slug is closest to the board.)

NOTE

Throughout the tuning procedure, the input signal level should be adjusted to keep the monitor at point A at least 10 dB above the quiescent noise level and near -30 dBm.

Step 4. Tune transformer T2 for a peak reading on the monitor at point A. This transformer also has 2 peaks and must be tuned to the peak where the slug is closest to the board.

Step 5. Monitor test point C with a dc voltmeter on the 3 V dc scale.

Step 6. Turn the slug on T3 counter clockwise until the reading at test point C goes through a peak to O V dc, ± .05 V dc.

Step 7. Remove the 455 kHz signal from test point B.

Step 8. Monitor test point B with a frequency counter through a 0.1 uF capacitor.

Step 9. Tune L8 until the frequency counter reads the oscillator frequency ± 5 Hz. The oscillator frequency is stamped on the top of the oscillator crystal can.

Step 10. Remove the frequency counter and connections from test point B.

Step 11. Apply a signal of the oscillator frequency to test point D through a 50 ohm rf cable. This cable *must* have a maximum of 3/8" leads and be soldered directly to the board.

Step 12. Tune L1, L2, L3, L7, and L6, in that order, for a peak reading at point A.

Step 13. Tune L4 and L5, in that order, through a dip to the first peak reading at test point A.

Step 14. Connect the cable from point D to a spectrum analyzer, Monitor the 10th harmonic of the oscillator. The harmonic is defined by the equation--Harmonic = Carrier Frequency - 455 kHz.

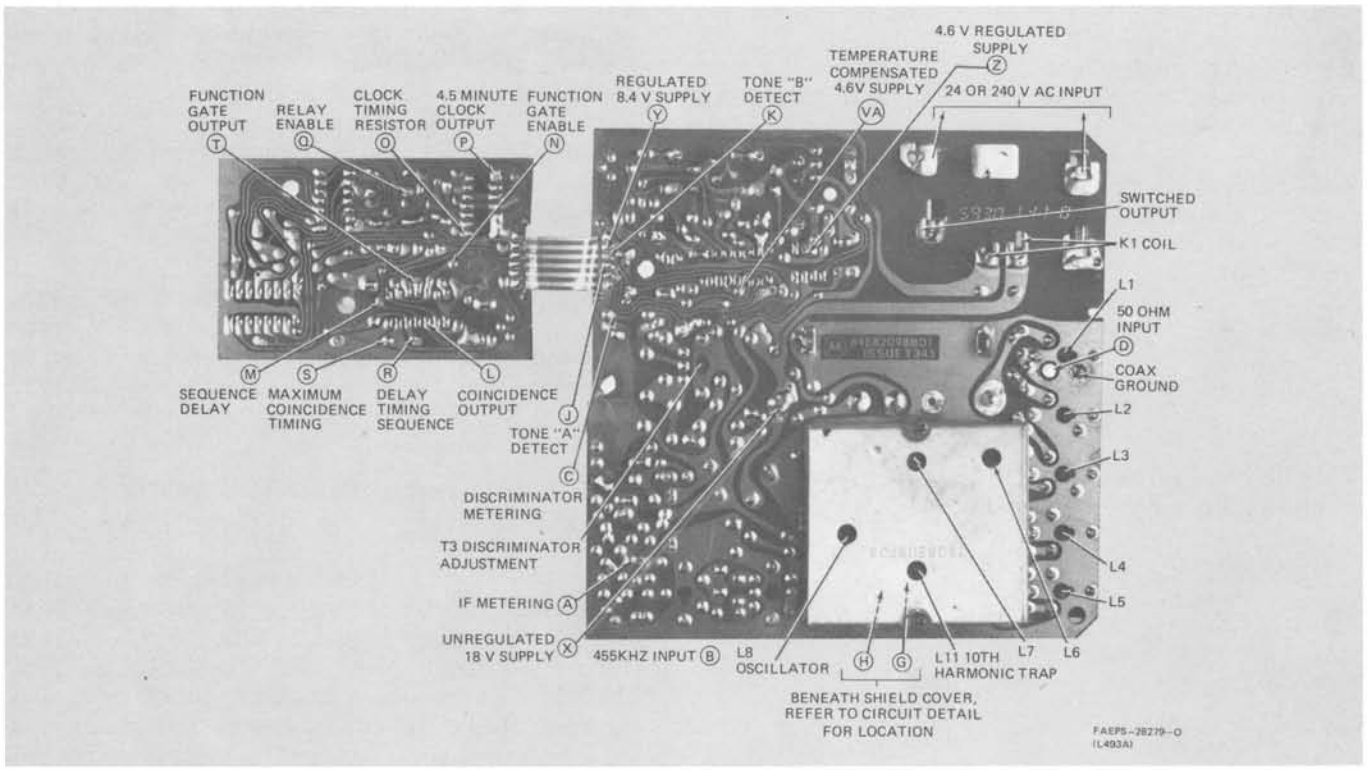
Step 15. Turn L11 counter clockwise for a minimum reading of the 10th harmonic.

Step 16. Disconnect the equipment of Step 13 and reconnect the signal generator as in Step 10.

Step 17. Retune L1, L2, and L3, in that order for a peak reading at test point A.

Step 18. Remove the ac voltmeter from the circuit but leave the signal generator attached to make the tests described in paragraph 4.6.

HIGH ADDRESS SERIES



STANDARD SERIES

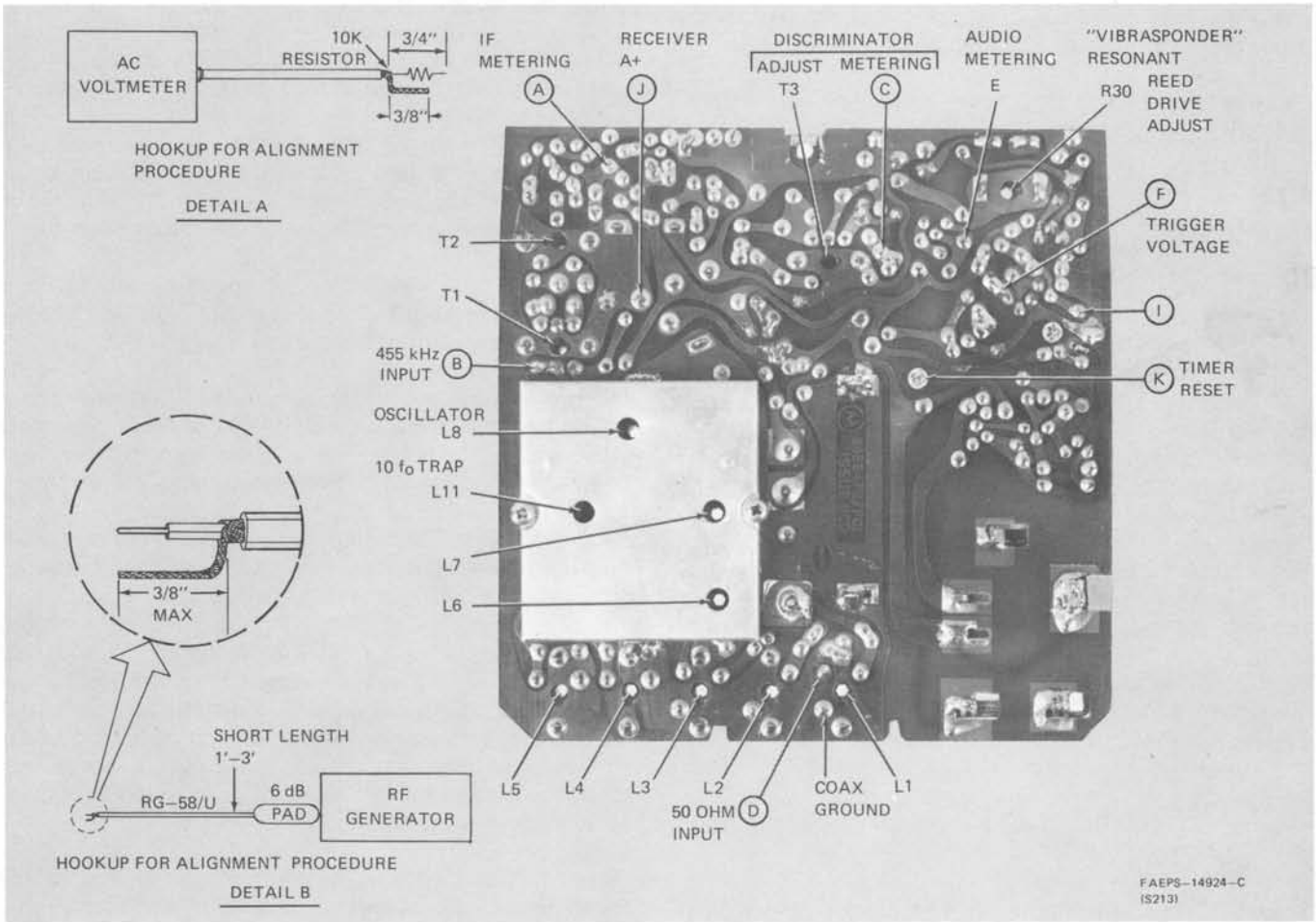


Figure 11. Alignment and Test Point Locations

4.6 RECEIVER SECTION MEASUREMENTS

When properly aligned, the following signal levels should be measured with an rf millivolt meter and a high impedence probe.

With an input of 300 mV to test point D at the carrier frequency (unmodulated):

Base of Q1	+7 dBm
Base of Q2	+10 dBm
Collector of Q2	+23 dBm

With an input of 30 uV to test point D at the carrier frequency (unmodulated):

Base of Q4	-41 dBm
Base of Q5	-4 dBm
Base of Q6	+16 dBm
Base of Q7	+17 dBm

With an input of 30 uV to test point D at the carrier frequency (modulated ±2 kHz):

Output of the discriminator (test point C)	at least 380 mV FMS (audio, taken with ac voltmeter)

NOTE

All of the above measurments are nominal and may vary ±4 dB

4.7 STANDARD SERIES DECODER SERVICING

When the receiver section has been properly aligned, the following procedure may be performed. Refer to the attached schematic diagram EEPS-28223 Figure 11, and to circuit board detail PEPS-28281.

Step 1. Apply a signal of the carrier frequency, modulated ±2 kHz with the reed frequency to test point D. Connect the signal generator as described in the receiver alignment procedure (Step 11).

Step 2. Note the audio signal at test point E as measured with an ac voltmeter. This level must be greater than 380 mV.

Step 3. Decrease the modulation level until the reading at point E is 8 dB less than that noted in Step 2.

Step 4. Monitor test point F with a dc voltmeter on a 10 volt or lower scale.

Step 5. Adjust the potentiometer R30 until the voltmeter at point F reads more than 1.0 volt. Decrease the modulation level further, the meter at point F should read less than 1.0 V dc.

Step 6. Test the signaling sensitivity of the unit by measuring the minimum signal level to point D required to energize the relay. This signal must be at the operating frequency of the unit and be modulated ±2 kHz at the operating frequency of the "Vibrasponder" reed. The relay should be energized by a signal of 1 uV for 440 mS. The relay will remain energized for 5-9 minutes once actuated. (The timer may be reset by shorting test point K to ground with a 10k resistor).

4.8 HIGH ADDRESS SERIES DECODER SERVICING

When the receiver section has been properly aligned, the following procedure may be performed for the high address series decoder. Refer to the attached schematic diagram EEPS-28223, circuit board detail EEPS-28281, the timing diagram BEPS-28046, and Figure 11. There are no adjustments to be made in the High Address decoder section; this procedure is provided to verify proper operation and to localize faults occuring in the decoder section.

Step 1. Insert two "Vibrasponder" reeds of the same frequency into the reed sockets on the unit.

Step 2. Monitor the detector outputs (test points J and K) with a dual-trace oscilloscope. Since a single tone is used, the detector outputs will not be shifted in relation to each other as shown in the timing diagram.

Step 3. Apply a signal at the operating (carrier) frequency at a level of 1 uV to test point D as described in the receiver alignment instructions (Step 11).

Step 4. Modulate the input signal ±2 kHz with bursts of audio tone corresponding to the reed frequency. Note the detector integration time (transition from a high output level to low), this time is nominally 160 ms.

Step 5. Move the oscilloscope inputs to the output of the coincidence gate (test point L) and to the output of the sequence delay gate (test point M).

Step 6. Apply tone bursts as in Step 4. (Allow 20 seconds between bursts.) Monitor the output of the sequence delay gate and adjust the duration of the bursts to the point where the output just pulses to high level and back to low. The duration of the output wave (Test Point L) under these conditions is the maximum coincidence time (nominally 650 ms).

Step 7. Readjust the duration of the pulses to the point where the output pulse of the coincidence gate (point L) has a duration of 200 ms.

Step 8. Note the delay between the fall of point L and the fall of point M . This time is the sequence delay time (nominally 560 ms).

Step 9. Disconnect the oscilloscope and measure the frequency at test point O . This reading is nominally 250 Hz.

Step 10. Add a 1k resistor in parallel with R408 (180k). Measure the frequency at test point O. This value is nominally 29 kHz. This resistor should not be in place during the receiver alignment or decoder testing procedures.

Step 11. Measure the period of the wave at point P. This value is nominally 2.2 seconds.

Step 12. Verify the operation of the timer by monitoring test points P and Q simultaneously with the oscilloscope. Apply a tone burst of the duration derived in Step 7. The waveform at test point Q should go high level and remain for 2 rising edges of the wave at point P.

Step 13. Verify the operation of the cold-load reset feature by interrupting the input power for 5 seconds. Check that the relay activates when the power is restored.

Step 14. Replace the original reeds in the unit and verify proper operation by applying the 2 tone sequential code (Tone B - Tone A) for the unit. The tone coded signal must modulate the carrier ± 2 kHz and consist of a 200 ms burst of tone B followed *immediately* by 800 ms of tone A. Observe the waveforms and relations shown in the timing diagram BEPS-28046.

Step 15. Remove the test equipment and the added resistor.

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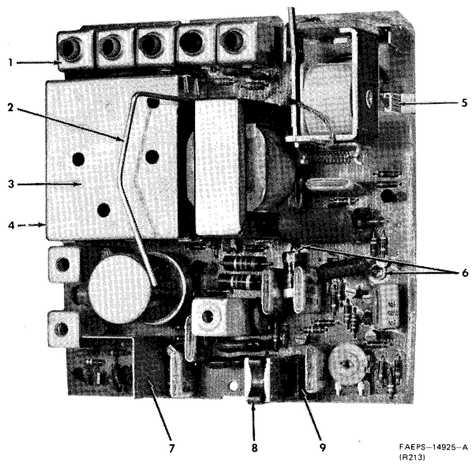
STANDARD SERIES MECHANICAL PARTS



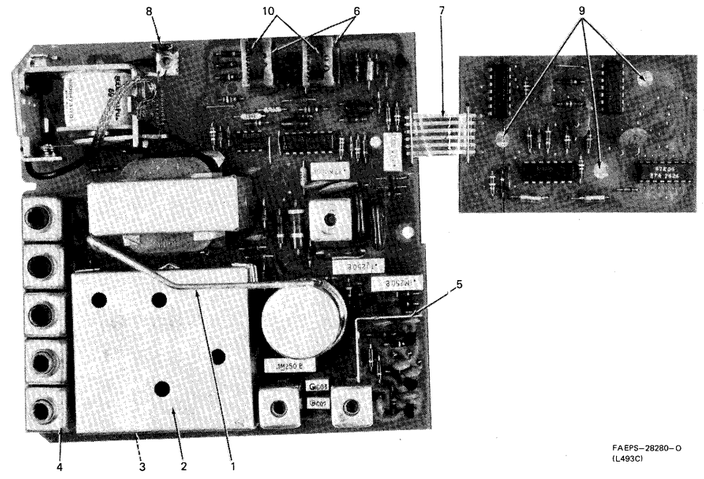
FAEPS-14925-A
(R213)

MECHANICAL PARTS LIST

Circuit Board PL-2868-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
1	1-80761B95	COIL SHIELD (8 used)
2	30-82129F01	ANTENNA
3	1-80762B01	OSC. SHIELD, top
4	1-80762B02	OSC. SHIELD, bottom
5	29-82114M01	POWER LUG (female) Later Models
	or 29-82241F01	POWER LUG (male) Earlier Models
6	14-82130F01	TEFLON INSULATOR
7	26-82132F01	IF SHIELD
8	42-82065F01	REED RETAINER
9	9-82063F01	REED SOCKET

HIGH ADDRESS SERIES MECHANICAL PARTS

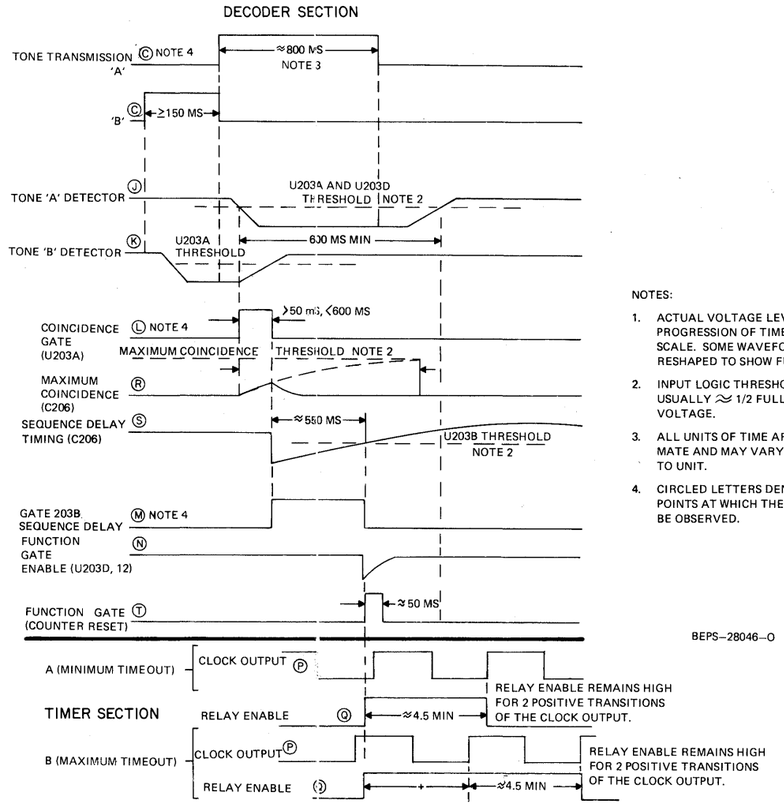


FAEPS-28280-O
(L493C)

PL-6466-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
1	30-82129F01	internal antenna
2	01-80762B01	oscillator shield (top)
3	01-80762B02	oscillator shield (bottom)
4	01-80761B95	coil
5	26-82132F01	i-f shields
6	09-82063F01	reed sockets
7	30-82906L06	flexible ribbon connector
8	29-82114M01	power lug
9	07-83030M01	board spacers
10	42-82065F01	reed retainers

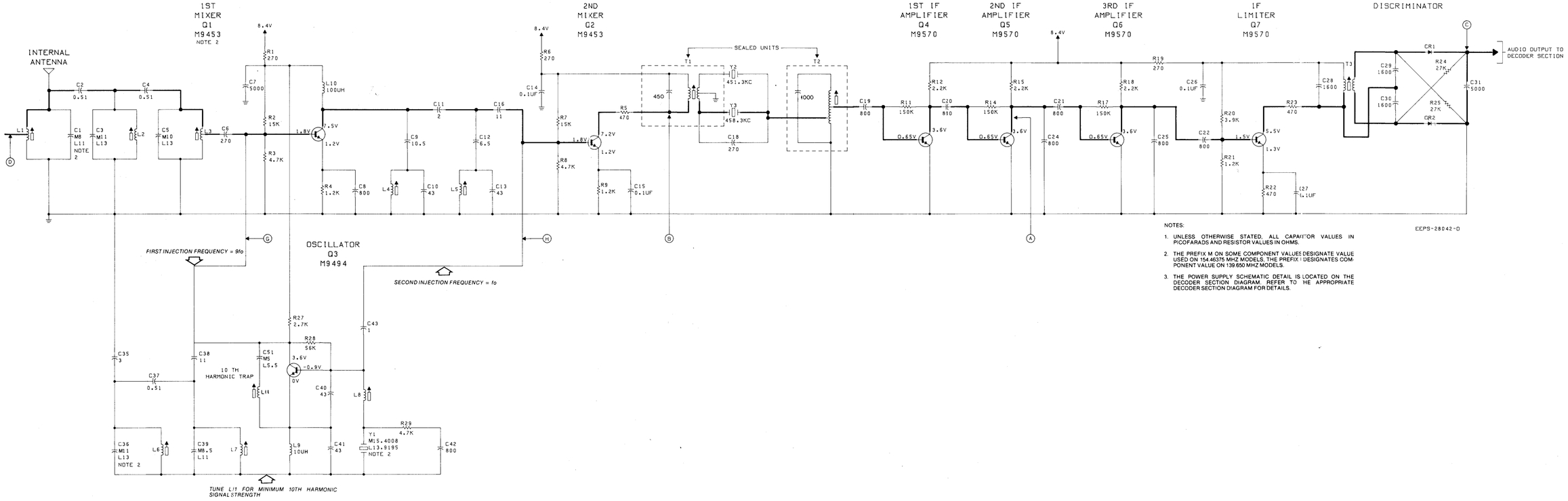
HIGH ADDRESS SERIES TIMING DIAGRAM



NOTES:

1. ACTUAL VOLTAGE LEVELS AND THE PROGRESSION OF TIME ARE NOT TO SCALE. SOME WAVEFORMS ARE RESHAPED TO SHOW FUNCTIONS.
2. INPUT LOGIC THRESHOLDS ARE USUALLY ≈ 1/2 FULL LOGIC VOLTAGE.
3. ALL UNITS OF TIME ARE APPROXIMATE AND MAY VARY FROM UNIT TO UNIT.
4. CIRCLED LETTERS DENOTE TEST POINTS AT WHICH THE WAVE MAY BE OBSERVED.

Remote Radio Switch
Mechanical Parts Details and
Timing Diagram
Motorola No. PEPS-28283-O
2/22/79-

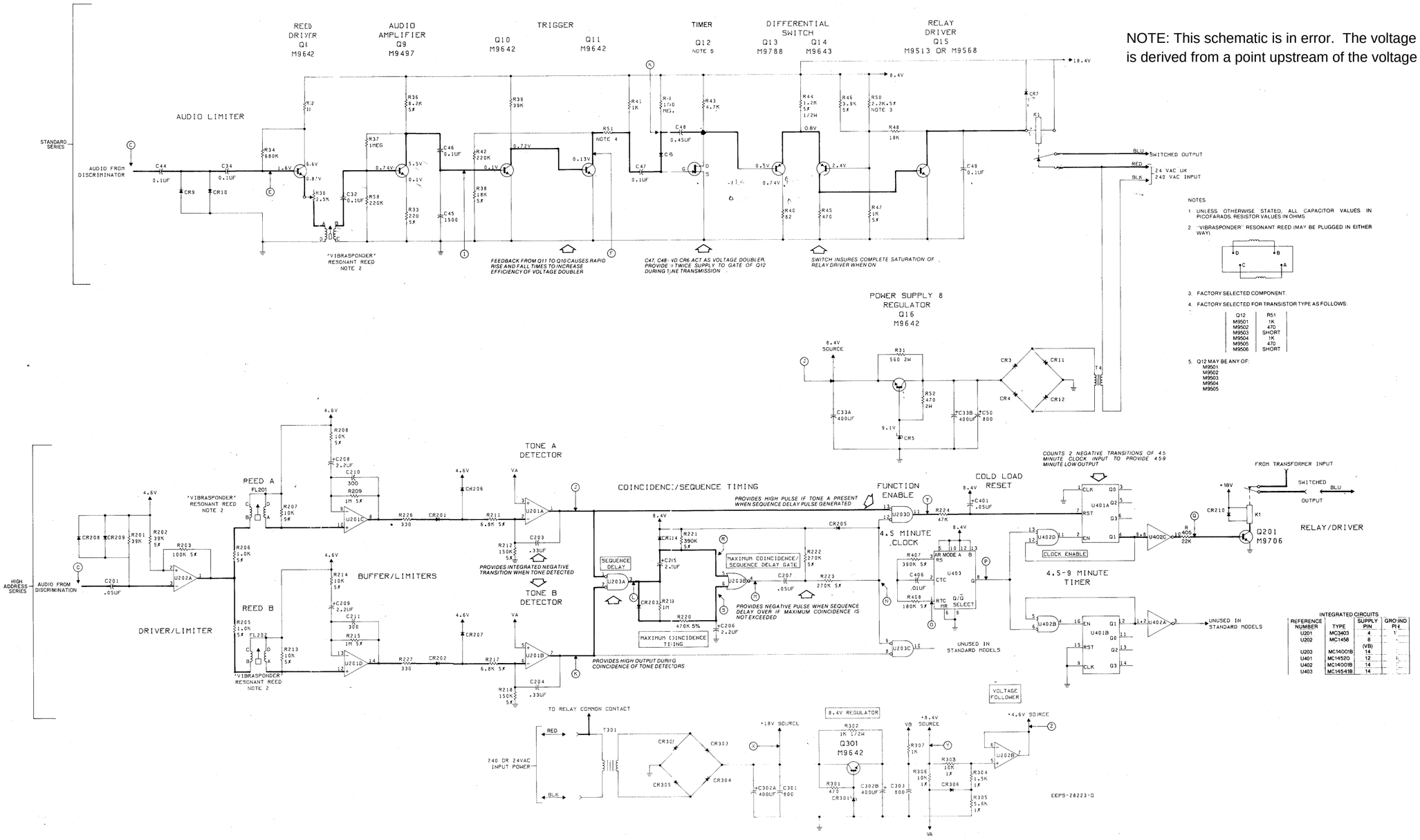


NOTES:

1. UNLESS OTHERWISE STATED, ALL CAPACITOR VALUES IN PICOFARADS AND RESISTOR VALUES IN OHMS.
2. THE PREFIX M ON SOME COMPONENT VALUES DESIGNATE VALUE USED ON 154.46375 MHZ MODELS. THE PREFIX I DESIGNATES COMPONENT VALUE ON 159.650 MHZ MODELS.
3. THE POWER SUPPLY SCHEMATIC DETAIL IS LOCATED ON THE DECODER SECTION DIAGRAM. REFER TO HE APPROPRIATE DECODER SECTION DIAGRAM FOR DETAILS.

Remote Radio Switch
Receiver Section
Schematic Diagram
Motorola No. EEPS-28042-O
2/21/79-

NOTE: This schematic is in error. The voltage to the left of this note is derived from a point upstream of the voltage regulator shown below.



NOTES

1. UNLESS OTHERWISE STATED, ALL CAPACITOR VALUES IN PICOFARADS, RESISTOR VALUES IN OHMS.
2. 'VIBRASPONDER' RESONANT REED (MAY BE PLUGGED IN EITHER WAY).

3. FACTORY SELECTED COMPONENT.
4. FACTORY SELECTED FOR TRANSISTOR TYPE AS FOLLOWS:

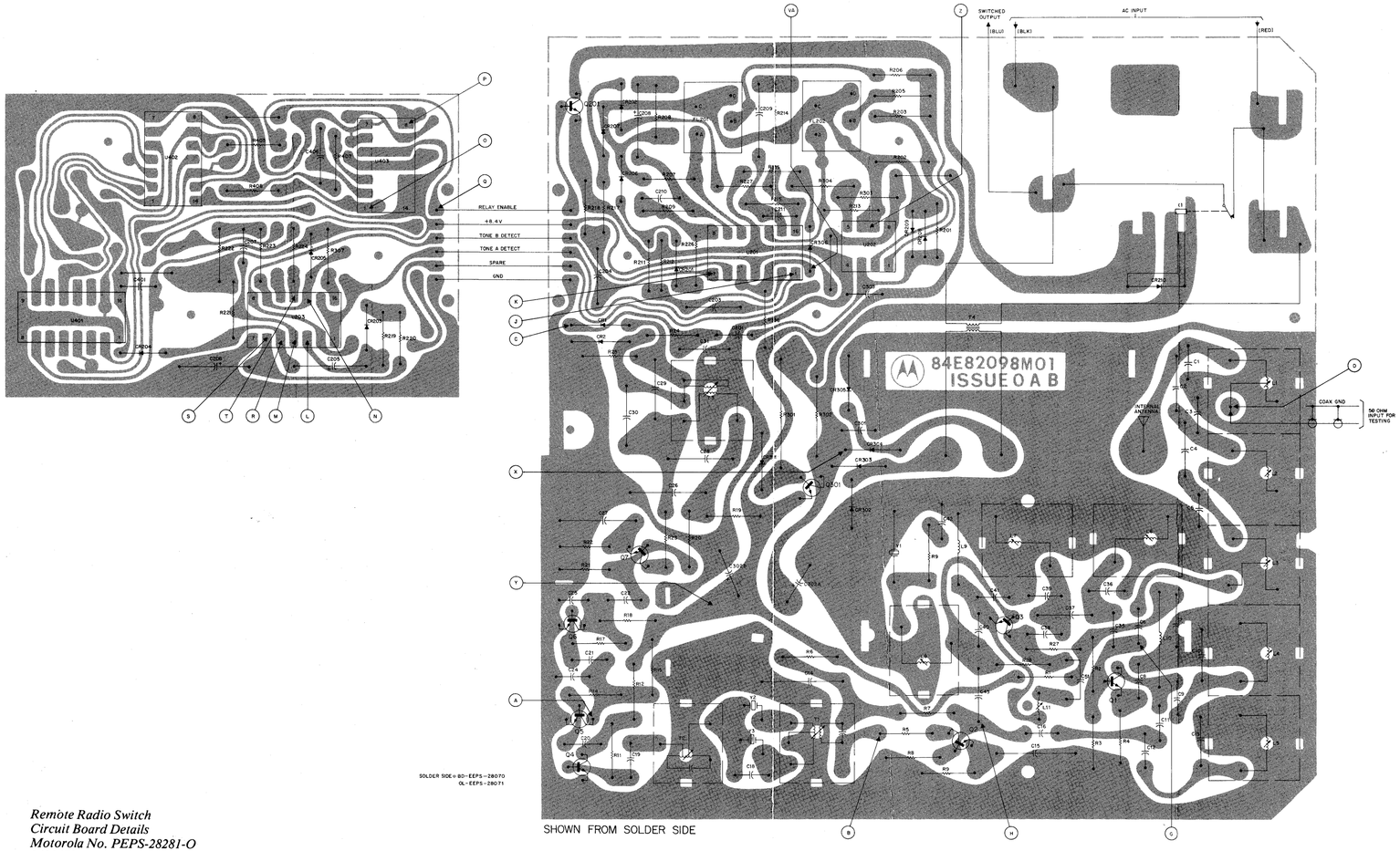
Q12	R51
M9501	1K
M9502	470
M9503	SHORT
M9504	1K
M9505	470
M9506	SHORT

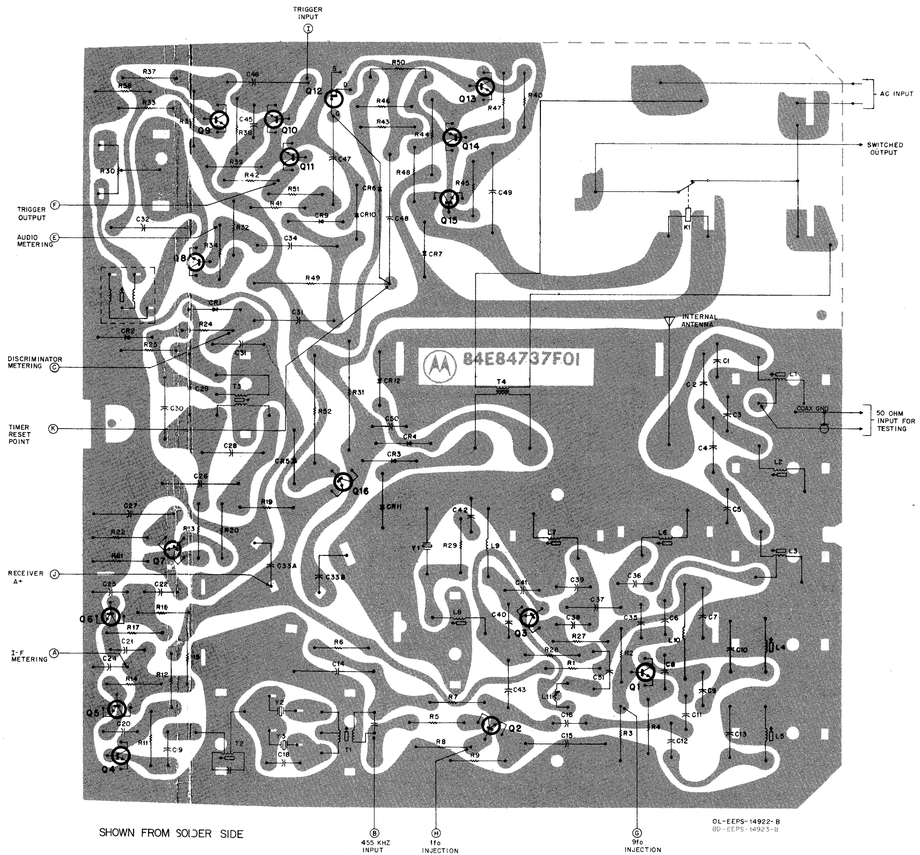
5. Q12 MAY BE ANY OF:
   M9501
   M9502
   M9503
   M9504
   M9505

INTEGRATED CIRCUITS

REFERENCE NUMBER	TYPE	SUPPLY PIN	GROUND PIN
U201	MC3403	4	11
U202	MC1458	8	4
		(VB)	
U203	MC14001B	14	7
U401	MC14520	16	8
U402	MC14001B	14	7
U403	MC14541B	14	7

Remote Radio Switch
Decoder Section (Standard Series)
Decoder/Timer Section (High Address Series)
Schematic Diagram
Motorola No. EEPS-28223-O
2/28/79





Remote Radio Switch
Circuit Board Details
Motorola No. PEPS-28281-O
2/21/79-

parts list

CRD6070A Remote Radio Switch, NC (154.4 MHz 24 V AC)
CRD6080A Remote Radio Switch, NC (154.4 MHz 240 V AC) PL-6455-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: pF ±10%; 500 V; unless otherwise stated
C1	21D82115F03	8 ±5%; NP0
C2, 4, 37	21D82075F01	0.51; NP0
C3, 16, 36, 38	21D82115F04	11; NP0
C5	21D82115F09	10; NP0
C6, 18	21D82073F05	270; X5F
C7, 31	21D82073F02	.005 uF; X5R
C8, 19, 20, 21, 22, 24, 25, 42	21D82073F01	800; X5R
C9	21D82115F07	10.5 ±0.25; NP0
C10, 13	21D82115F05	43 ±5%; NP0
C11	21D82115F01	2 ±0.25; NP0
C12	21D82115F08	6.5 ±0.25; NP0
C14, 15, 26, 27	8-82331F01	0.1 uF ±20%;
C28, 29, 30	21D82069F03	1600 ±10%; 100 V
C35	21D82115F02	3 ±0.25 uuF; NP0
C39	21-82989E20	8.5; NP0
C40, 41	21D82115F06	43; 200 V
C43	21D82075F02	1.0
C51	21-863466	5; N150
C201	21-82372C04	.05 uF +80-20%; 25 V
C203, 204	8-84637L34	.33 uF; 100 V
C205, 206	23-82783B16	2.2 uF; 15 V
C207	21-82372C04	.05 +80-20%; 25 V
C208, 209	23-82783B16	2.2 uF; 15 V
C210, 211	21-859944	300 ±5%
C301	21-82073F01	800
C302	23-82039F02	2-section
C302A		400 uF +150-10%; 35 V
C302B		400 uF +150-10%; 15 V
C303	21-82073F01	800
C401	21-82372C04	.05 uF +80-20%; 25 V
C406	8-82905G01	.01 uF 50 V
		diode: (see note)
CR1, 2	48-82126F01	germanium
CR201 thru 209	48-83654H01	silicon
CR301	48-82128F01	Zener, 9.1 V
CR302 thru 305	48-82466H13	silicon
CR306	48-83654H01	silicon
CR401	48-82466H18	silicon
		relay, normally closed:
K1	80-84731F01	spst, coil resist. 100 ohms ±10% @25°C
		coil, rf:
L1,3	24D82001F01	2-1/2 turns,coded grn
L2, 6, 7	24D82001F02	2-1/2 turns; coded brn
L4, 5	24D82046F01	warp, 15 turns; coded wht
	or 24D82046F03	warp, 15 turns coded wht
L8	24D82046F02	warp, 20 turns; coded red
	or 24D83046F04	warp, 20 turns; coded red
L9	24D82047F01	choke; 10 uH
10	24C82215F01	choke; 100 uH
L11	24-84755A10	warp, 5 turns; coded vio
		transistor: (see note)
Q1, 2	48-869453	NPN; type M9453,
Q3	48869494	NPN; type M9494,
Q4, 5, 6, 7	48869570	NPN; type M9570,
Q201	48-869706	NPN; type M9706
Q301	48-869642	NPN; type M9642
		resistors, fixed: ±10%; 1/4 W; unless otherwise stated
R1, 6, 9	6-124C35	270
R2, 7	6-124C77	15k
R3, 8, 29	6-124C65	4.7k
R4, 9, 21	6-124C51	1.2k
R5, 22, 23	6-124C41	470
R11, 14, 17	6-124D02	150k
R12, 15, 18	6-124C57	2.2k
R20	6-124C63	3.9k
R24, 25	6-124C83	27k
R27	6-124C59	2.7k
R28	6-124C91	56k
R201	6-124C87	39k
R202	6-124A87	39k ±5%
R203	6-124A97	100k ±5%
R205 206	6-124A49	10k ±5%
R209	6-124B22	1 meg ±5%
R211	6-124A69	6.8k ±5%
R212	6-124B02	150k ±5%
R213, 214	6-124A73	10k ±5%
R215	6-124B22	1 meg ±5%
R217	6-124A69	6.8k ±5%
R218	6-124B02	150k ±5%
R219	6-124D22	1 meg
R220	6-124B14	470k ±5%
R221	6-124B12	390k ±5%
R222, 223	6-124B08	270k ±5%
R224	6-124C89	47k
R226, 227	6-124C37	330
R301	6-124C41	470
R302	6-125C49	1k; 1/2 W
R303	6-10621C91	10k ±1%; 1/8 W
R304		1.5k
R305	6-10621C67	5.62k ±1%
R306	6-10621C91	10k ±1%; 1/8 W
R307	6-124C49	1k
R405	6-124C81	22k
R407	6-124B12	390k ±5%
R408	6-124B04	180k ±5%
		transformer, i-f:
T1	24D82040F01	input; sealed; coded blue
T2	24D82040F02	output; sealed; coded red
T3	24D82124F01	disc; coded yellow
		transformer, power:
T301	25C84712F01	pri; BLK, BLK (240 V); sec,terminals 3-5
	or 25C8352L01	pri; terminals 1, 2 (24 V); sec; terminals 3, 4
		integrated circuit: (see note)
U201	51-84621K21	type MC3403
U202	51-84621K71	type MC1458
U203	51-84887K09	type CD4001B
U401	51-84887K06	type MC4520B
U402	51-84887K09	type CD4001B
U403	51-84887K83	type MC14541B
		crystal:
Y1	ASD	15. 40087 MHz
		resonator, ceramic:
Y2	48-83192C03	451.3 ±1.0 kc; res. 20 ohms; coded blue
Y3	48-83192C07	458.3 ±1.0 kc; res. 20 ohms; coded red

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

CHN6042A Housing Kit
CHN6043A Housing Kit PL-6456-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	3-120430	SCREW, tapping: 6-20 x 1/2"
	4-82443F01	WASHER, 'C'
	7-82072F01	BRACKET, housing hanger
	30-84735F09	CABLE, power (C1243A)
	30-84735F07	CABLE, power (C1244A)
	32-82256F01	GASKET
	42-82066F01	CLIP, board support
	42-82214F01	CLIP, push-on

CLN6392A Hardware Kit PL-6457-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	7-83030M01	BRACKET, circuit board support
	42-82065F01	CLIP, reed retainer

KLN6536A Filter Reed Kit PL-6458-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
FL201, 202	M01	

PARTS LIST

CRD6006A Remote Radio Switch, NC (154.4 MHz 240 V AC)
CRD6008A Remote Radio Switch, NC (139.6 MHz 240 V AC)
CRD6009A Remote Radio Switch, NC (154.4 MHz 24 V AC)
CRD6010A Remote Radio Switch, NC (139.6 MHz 24 V AC)

EPD-26059-G

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: pF ±10%; 500 V; unless otherwise stated
C1	21D82115F03	8 ±5%; NP0 (CRD6006A, 6009A)
	or 21-82115F04	11; NP0 (CRD6008A, 6010A)
C2, 4, 37	21D82075F01	0.51; NP0
C3, 16, 36, 38	21D82115F04	11; NP0 (CRD6006A, 6009A)
	or 21-83406D57	13 ±5% (CRD6008A, 6010A)
C5	21D82115F09	10; NP0 (CRD6006A, 6009A)
	or 21-83406D57	13 ±5% (CRD6008A, 6010A)
C6, 18	21D82073F05	270; X5F
C7, 31	21D82073F02	.005 uF; X5R
C8, 19, 20, 21, 22, 24, 25, 42, 50	21D82073F01	800; X5R
C9	21D82115F07	10.5 ±0.25; NP0 (CRD6006A, 6009A)
	or 21-82204B04	12 ±5% (CRD6008A, 6010A)
C10, 13	21D82115F05	43 ±5%; NP0 (CRD6006A, 6009A)
	or 21-83406D21	47 ±5% (CRD6008A, 6010A)
C11	21D82115F01	2 ±0.25; NP0 (CRD6006A, 6009A)
	or 21-868487	1.5 ±0.25% (CRD6008A, 6010A)
C12	21D82115F08	6.5 ±0.25; NP0 (CRD6006A, 6009A)
	or 21-851845	11 ±5% (CRD6008A, 6010A)
C14, 15, 26, 27, 32, 34, 44, 46, 49	8-82331F01	0.1 uF ±20%; 250 V
C28, 29, 30	21D82069F03	1600 ±10%; 100 V
C33	23D82039F02	2 section
C33		400 uF +150-10%; 15 V
C33		400 uF +150-10%; 35 V
C35	21D82115F02	3 ±0.25 uuF; NP0
C39	21-82989E20	8.5; NP0
C40, 41	21D82115F06	43; 200 V
C43	21D82075F02	1.0
C45	21D82073F03	1500 ±20%; Y5 u
C47	8D82076F03	.10 ±2%; 100 V
C48	8D82076F04	0.45 uF ±10%; 100 V
C51	21-863466	5; N150
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1, 2	48C82126F01	germanium
CR3, 4, 7	48-82466H13	silicon; 100 V
CR5	48C82128F01	Zener; silicon; 9.1 V
CR6	48C82126F03	germanium
CR9, 10	48C82240F01	silicon
CR11, 12	48-82466H13	silicon; 100 V
		RELAY, indicator:
K1	80D84731F01	spst normally closed; coil res. 100 ohms 40% @ 25°C
		COIL, RF:
L1, 3	24D82001F01	2-1/2 turns; coded grn
L2, 6, 7	24D82001F02	2-1/2 turns; coded brn
L4, 5	24D82046F01	warp, 15 turns; coded wht
	or 24D82046F03	warp, 15 turns; coded wht
L8	24D82046F02	warp, 20 turns; coded red
	or 24D82046F04	warp, 20 turns; coded red
L9	24D82047F01	choke; 10 uH
L10	24C82215F01	choke; 100 uH
L11	24-84755A10	warp, 5 turns; coded vio
		TRANSISTOR: (SEE NOTE)
Q1, 2	48-869453	NPN; type M9453, silicon
Q3	48R869494	NPN; type M9494, silicon
Q4, 5, 6, 7	48R869570	NPN; type M9570, silicon
Q8	48-869642	NPN; type M9642, silicon
Q9	48R869497	NPN; type M9497, silicon
Q10, 11	48R869642	NPN; type M9642, silicon

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
Q12		FET; silicon (factory selected from the following)
	48-869501	type M9501
	or 48-869502	type M9502
	or 48-869503	type M9503
	or 48-869504	type M9504
	or 48-869505	type M9505
	or 48-869506	type M9506
Q13	48R869788	PNP; type M9788, silicon
Q14	48-869643	PNP; type M9643
Q15	48-869513	NPN; type M9513
	or 48-869568	NPN; type M9568
Q16	48R869642	NPN; type M9642, silicon
		RESISTOR, fixed: ±10%; 1/4 W unless otherwise stated
R1, 6, 19	6-124C35	270
R2, 7	6-124C77	15k
R3, 8, 29, 43	6-124C65	4.7k
R4, 9, 21, 44	6-124C51	1.2k
R5, 22, 23, 45	6-124C41	470
R11, 14, 17	6-124D02	150k
R12, 15, 18	6-124C57	2.2k
R20, 46	6-124C63	3.9k
R24, 25	6-124C83	27k
R27	6-124C59	2.7k
R28	6-124C91	56k
R30	18C82257F01	2.5k ±30%; 1/4 W
R31	17C82059F02	560; 2 W
R32, 41, 44	6-124C49	1k
R33	6-124A33	220; ±5%
R34	6-124D18	680k
R36	6-124A71	8.2k ±5%
R37	6-124D22	1 meg.
R38	6-124A79	18k ±5%
R39	6-124C87	39k
R40	6-124C13	82
R42, 58	6-124D06	220k
R46	6-124A63	3.9k ±5%
R47	6-124A49	1k ±5%
R48	6-124C79	18k
R49	6C82071F01	1000 meg. ±10%; 1/2 W
R50	6-124A57	2.2k (factory selected)
R51	6-124C49	1k (factory selected)
	or 6-124C41	470 (factory selected)
R52	17C82059F01	470; 2 W
		TRANSFORMER, IF:
T1	24D82040F01	input; sealed; coded blue
T2	24D82040F02	output; sealed; coded red
T3	24D82124F01	disc; coded yellow
		TRANSFORMER, power:
T4	25C84712F01	pri; BLK, BLK (240 V); sec; terminals 3-5
	or 25C83552L01	pri; terminals 1, 2 (24 V); sec; terminals 3, 4
		CRYSTAL:
Y1	ASD	15.40087 MHz P/O KLN1032A (CRD6006A, 6009A) or 13.91950 MHz (CRD6008A, 6010A)
		RESONATOR, ceramic:
Y2	48-83192C03	451.3 ±1.0 kc; res. 20 ohms
Y3	48-83192C07	458.3 ±1.0 kc; res. 20 ohms
NON-REFERENCED ITEM		
	9-82063F01	SOCKET, reed

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

CHN6029A Housing Kit (240 V)
CHN6039A Housing Kit (24 V) EPD-26060-B

	30-84735F02	POWER CABLE (CHN6029A)
	30-84735F04	POWER CABLE (CHN6039A)
	3-120430	SCREW, tapping; 6-20x1/2"
	4-82443F01	WASHER, "C"
	7-82072F01	BRACKET, housing hanger
	15-82168F02	HOUSING ASSY.
	32-82256F01	GASKET
	42-82066F01	CLIP, board mounting
	42-82214F01	CLIP, push-on
	14-82403F02	INSULATOR, lug locking (CHN6029A)

"Vibrasponder" Resonant Reed P/O KLN1032A EPD-16647-C

	KLN6209AF	(304.7-450 Hz)
	KLN6209AG	(450-625 Hz)
	KLN6209AH	(625-1063.2 Hz)

CRD6030A Remote Radio Switch, NC (154.4 MHz 240 V AC)
CRD6020A Remote Radio Switch, NC (139.6 MHz 240 V AC)
CRD6050A Remote Radio Switch, NC (154.4 MHz 24 V AC)
CRD6040A Remote Radio Switch, NC (139.6 MHz 24 V AC)
PL-6209-O

		CAPACITOR, fixed: pF ±10%; 500 V; unless otherwise stated
C1	21D82115F03	8 ±5%; NP0 (CRD6030A, 6050A)
	or 21-82115F04	11; NP0 (CRD6020A, 6040A)
C2, 4, 37	21D82075F01	0.51; NP0
C3, 38	21D82115F04	11; NP0 (CRD6030A, 6050A)
	or 21-83406D57	13 ±5% (CRD6020A, 6040A)
C5	21D82115F09	10; NP0 (CRD6030A, 6050A)
	or 21-83406D57	13 ±5% (CRD6020A, 6040A)
C6, 18	21D82073F05	270; X5F
C7, 31	21D82073F02	.005 uF; X5R
C8, 19, 20, 21, 22, 24, 25, 42, 50	21D82073F01	800; X5R
C9	21D82115F07	10.5 ±0.25; NP0 (CRD6030A, 6050A)
	or 21-82204B04	12 ±5% (CRD6020A, 6040A)
C10, 13	21D82115F05	43 ±5%; NP0 (CRD6030A, 6050A)
	or 21-83406D21	47 ±5% (CRD6020A, 6040A)
C11	21D82115F01	2 ±0.25; NP0 (CRD6030A, 6050A)
	or 21-868487	1.5 ±0.25% (CRD6020A, 6040A)
C12	21D82115F08	6.5 ±0.25; NP0 (CRD6030A, 6050A)
	or 21-851845	11 ±5% (CRD6020A, 6040A)
C14, 15, 26, 27, 32, 34, 44, 46, 49	8-82331F01	0.1 uF ±20%; 250 V
C16, 38	21-82115F04	11; NP0
C28, 29, 30	21D82069F03	1600 ±10%; 100 V
C33	23D82039F02	2 section; consists of:
C33A		400 uF +150-10%; 15 V
C33B		400 uF +150-10%; 35 V
C35	21D82115F02	3 ±0.25 uuF; NP0
C39	21-82989E20	8.5; NP0 (CRD6030A, 6050A)
	or 21-82115F04	11; NP0 (CRD6020A, 6040A)
C40, 41	21D82115F06	43; 200 V
C43	21D82075F02	1.0
C45	21D82073F03	1500 ±20%; Y5 u
C47	8D82076F03	.10 ±2%; 100 V
C48	8D82076F04	0.45 uF ±10%; 100 V
C51	21-863466	5; N150 (CRD6030A, 6050A)
	or 21-84493B39	5.6 ±5%; N150 (CRD6020A, 6040A)
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1, 2	48C82126F01	germanium
CR3, 4, 7	48-82466H13	silicon; 100 V
CR5	48C82128F01	Zener; silicon; 9.1 V
CR6	48C82126F03	germanium
CR9, 10	48C82240F01	silicon
CR11, 12	48-82466H13	silicon; 100 V
		RELAY, indicator:
K1	80D84731F01	spst normally closed; coil res. 100 ohms 40% @ 25°C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		COIL, RF:
L1, 3	24D82001F01	2-1/2 turns; coded grn
L2, 6, 7	24D82001F02	2-1/2 turns; coded brn
L4, 5	24D82046F01	warp, 15 turns; coded wht
	or 24D82046F03	warp, 15 turns; coded wht
L8	24D82046F02	warp, 20 turns; coded red
	or 24D82046F04	warp, 20 turns; coded red
L9	24D82047F01	choke; 10 uH
L10	24C82215F01	choke; 100 uH
L11	24-84755A10	warp, 5 turns; coded vio
		TRANSISTOR: (SEE NOTE)
Q1, 2	48-869453	NPN; type M9453, silicon
Q3	48R869494	NPN; type M9494, silicon
Q4, 5, 6, 7	48R869570	NPN; type M9570, silicon
Q8	48-869642	NPN; type M9642, silicon
Q9	48R869497	NPN; type M9497, silicon
Q10, 11	48R869642	NPN; type M9642, silicon
Q12		FET; silicon (factory selected from the following)
	48-869501	type M9501
	or 48-869502	type M9502
	or 48-869503	type M9503
	or 48-869504	type M9504
	or 48-869505	type M9505
	or 48-869506	type M9506
Q13	48R869788	PNP; type M9788, silicon
Q14	48-869643	PNP; type M9643
Q15	48-869513	NPN; type M9513
	or 48-869568	NPN; type M9568
Q16	48R869642	NPN; type M9642, silicon
		RESISTOR, fixed: ±10%; 1/4 W unless otherwise stated
R1, 6, 19	6-124C35	270
R2, 7	6-124C77	15k
R3, 8, 29, 43	6-124C65	4.7k
R4, 9, 21, 44	6-124C51	1.2k
R5, 22, 23, 45	6-124C41	470
R11, 14, 17	6-124D02	150k
R12, 15, 18	6-124C57	2.2k
R20, 46	6-124C63	3.9k
R24, 25	6-124C83	27k
R27	6-124C59	2.7k
R28	6-124C91	56k
R30	18C82257F01	2.5k ±30%; 1/4 W
R31	17C82059F02	560; 2 W
R32, 41, 44	6-124C49	1k
R33	6-124A33	220; ±5%
R34	6-124D18	680k
R36	6-124A71	8.2k ±5%
R37	6-124D22	1 meg.
R38	6-124A79	18k ±5%
R39	6-124C87	39k
R40	6-124C13	82
R42, 58	6-124D06	220k
R46	6-124A63	3.9k ±5%
R47	6-124A49	1k ±5%
R48	6-124C79	18k
R49	6C82071F01	1000 meg. ±10%; 1/2 W
R50	6-124A57	2.2k (factory selected)
R51	6-124C49	1k (factory selected)
	or 6-124C41	470 (factory selected)
R52	17C82059F01	470; 2 W
		TRANSFORMER, IF:
T1	24D82040F01	input; sealed; coded blue
T2	24D82040F02	output; sealed; coded red
T3	24D82124F01	disc; coded yellow
		TRANSFORMER, power:
T4	25C84712F01	pri; BLK, BLK (240 V); sec; terminals 3-5
	or 25C83552L01	pri; terminals 1, 2 (24 V); sec; terminals 3, 4

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

PL-6209-O

Y1	ASD	CRYSTAL: 15.40087 MHz P/O KLN1032A (CRD6030A, 6050A) or 13.91950 MHz (CRD6020A, 6040A)
Y2	48-83192C03 or 48-83192C23	RESONATOR, ceramic: 451.3 ±1.0 kc; res. 20 ohms; coded blue
Y3	48-83192C07 or 48-83192C24	458.3 ±1.0 kc; res. 20 ohms; coded red
NON-REFERENCED ITEM		
	9-82063F01	SOCKET, reed

CHN6042A Housing Kit (240 V)
CHN6043A Housing Kit (24 V)

PL-6210-O

	30-84735F07	POWER CABLE (CHN6042A)
	30-84735F09	POWER CABLE (CHN6043A)
	3-120430	SCREW, tapping; 6-20x1/2"
	4-82443F01	WASHER "C"
	7-82072F01	BRACKET, housing hanger
	15-82168F02	HOUSING ASSY.
	32-82256F01	GASKET
	42-82066F01	CLIP, board mounting
	42-82214F01	CLIP, push-on
	14-82403F02	INSULATOR, lug locking (CHN6043A)

NOTE: Replacement "ASD" crystals are available from International Crystal as ICM Catalog Number 167299.

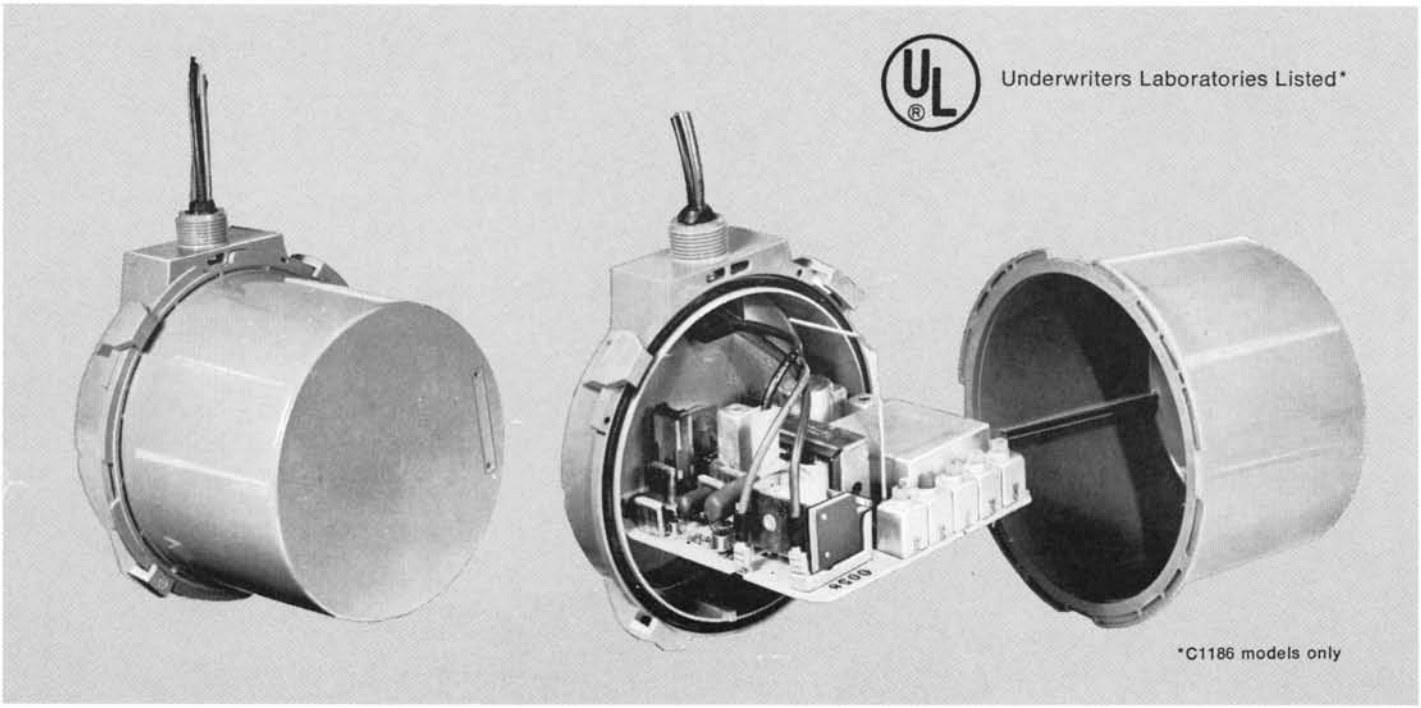
END OF DOCUMENT

MOTOROLA

800W SYSTEM

Single Function Radio Switch

NOTE: This brochure is not part of Manual #6881071A85-G, but is included simply to provide additional information.



The Motorola 800W SYSTEM receiver decoder represents a unique concept for fast control of remote devices through radio signaling. Discrete tone-coded signals transmitted from a central location are received and decoded by receiver-decoders located throughout the area. This single function switch is specifically designed to selectively remove and restore power from incidental devices, such as water heaters, during peak demand and emergency periods.

FEATURES

Rugged, Solid-State Design: State-of-the-art, solid-state design insures reliable, trouble-free operation.

Outdoor, Meter Type Case: The unit is housed in a rugged, outdoor, meter type case to complement normal meter installation.

Secure Selective Control: Each unit responds to its prescribed signal only. For positive assurance of secure, selective control, the signal is transmitted on exclusive frequencies that are designated and policed by the Federal Communications Commission.

Immediate Control: Output contacts are actuated within a fraction of a second upon receipt of the proper signal for fast control.

Fail Safe Control: Unless additional signals are received the unit is self-restoring within seven ±2 minutes after actuation.

Compact and Easily Installed: Measuring only 8-inches in diameter and 6½ inches in depth, unit is mounted by means of one-inch, threaded nipple and hanger. Three simple wire connections complete the installation. The antenna is mounted internally.

Underwriters Laboratories Listed as industrial control equipment meeting laboratory standards as to shock hazard and fire safety for mounting in the home.

800W SYSTEM

Performance Specifications

General

Model No:	C1186, C1240, C1241, C1242
Input Voltage:	C1186, C1241: 240V ac ±20%, 50/60 Hz C1240, C1242: 24V ac ±20%, 60 Hz
Operating Temp.:	−30°C to +60° C ambient; −22°F to +140°F

Receiver

Type:	Narrow band FM, double conversion, crystal controlled.
Sensitivity:	20 uV/m over temp. range −22°F to +140°F ambient
Freq. Stability:	±0.002% over temp. range −22°F to +140°F ambient
Frequency:	C1186, C1240: 154.463750 MHz C1241, C1242: 139.650 MHz (Military Applications Only)

Decoder

Type:	Single audio tone
Relay Contact Rating:	C1186, C1241: 240V ac, 30A resistive C1240, C1242: 24V ac, 5A resistive
Command Storage Period:	7 min. ±2 min. over temp. range −22°F to +140°F ambient

Housing

Dimensions:	8″ diameter, 6.5″ depth (204 mm, 166 mm)
Material:	Moulded plastic resin

Underwriters Laboratories Listed (C1186 models only)

MOTOROLA
Communications and Electronics Inc.
A Subsidiary of Motorola Inc.
1301 E. Algonquin Road, Schaumburg, Illinois 60196 • (312) 397-1000

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