

INIVEN™ IR-10 AM TONE RECEIVER

INSTRUCTION MANUAL

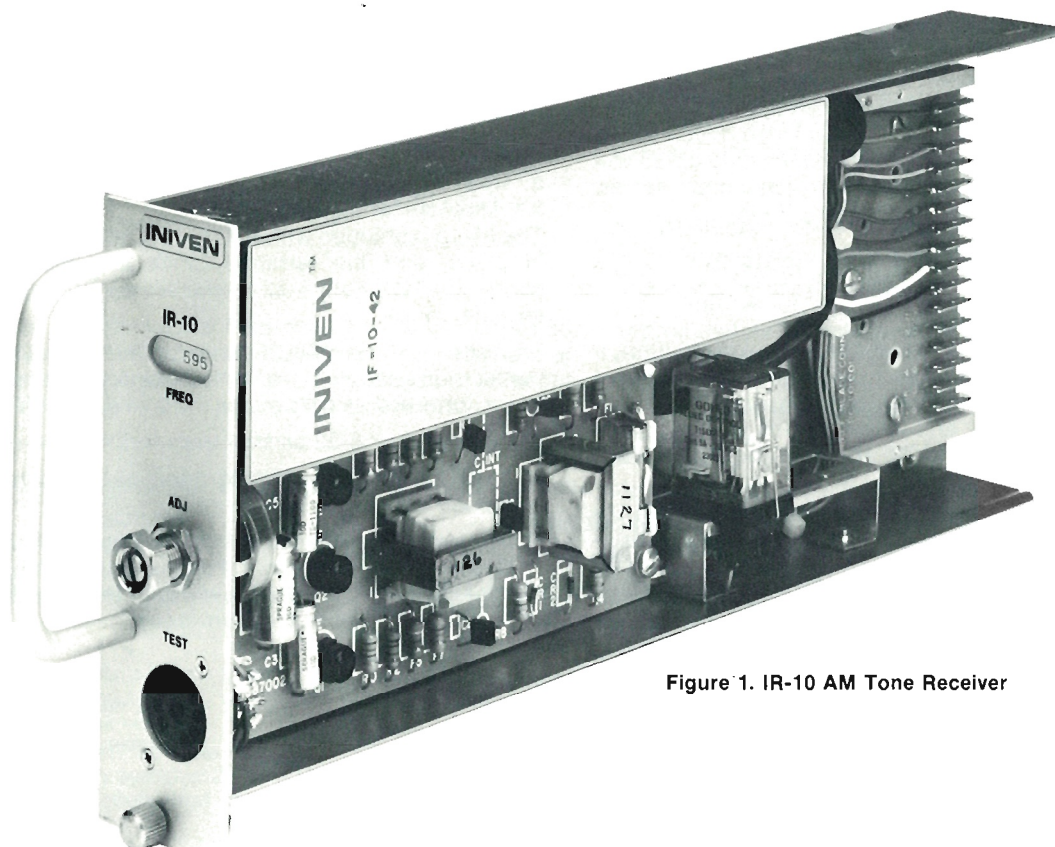


Figure 1. IR-10 AM Tone Receiver

1. DESCRIPTION (See Figure 1)

1.1 The IR-10 is an AM tone receiver intended for use in remote supervisory control, remote telemetering, and data transmission applications. In response to a received tone within its specified pass-band, the IR-10 produces output contact closures (via relay) or voltage level shifts (via voltage output adapter).

1.2 The operating frequency and pass-band of the receiver are determined by a plug-in filter module (IF-10). Each IF-10 bears a number denoting its center frequency (in Hz). This number appears in a front-panel cutout when the filter is installed.

2. SPECIFICATIONS

Sensitivity: Adjustable to -35 DBM

Input Impedance: 600 ohms at center frequency, with rising characteristics outside the pass-band.

Dynamic Range: 6 DB (recommended)

Output: DPDT relay contacts rated at 5 A at 29 Vdc or 117 Vac (non-inductive; voltage output of 9 to 11 Vdc)

IF-10 Filter: 100 Hz standard, 21 DB minimum crossover attenuation and a minimum of 40 DB attenuation at 75 Hz above and below center frequency. For others refer to Table 7-2 and filter diagram.

Pulsing Characteristics: 20 PPS maximum

Operating Temperature Range: -30°C to $+60^{\circ}\text{C}$

Power Requirements: 12 Vdc $\pm 10\%$; 64 mA receiving, 17 mA standby

Protection: 0.5 A fuse located internally (on printed circuit board A1); protects against excessive current drain within receiver module

Weight: 4 lb. approx. (1.8 Kg)

CAUTION

Although this receiver is completely interchangeable with any other INIVEN™ IR-10 AM receiver, its components may not be interchangeable with those of other units. Check all components before attempting any substitutes.

3. FEATURES

3.1 Sensitivity Adjustment—A sensitivity adjustment (ADJ) control is accessible on the front panel of the IR-10. This control allows the receiver to be operated with a wide range of input signal levels.

3.2 Test Socket—A TEST socket is located on the IR-10 front panel. The TEST socket provides access to the following functions:

PIN NUMBER	FUNCTION
1 and 2	Tone input
3	Positive side of 12 Vdc power supply input
4	Negative side of 12 Vdc power supply input
5 and 3	Output of some voltage adapters (when used)
6 and 3	Detector output voltage
8 and 3	Output of final driver stage of receiver

3.3 Noise Protection—Additional protection against erroneous response to noise can be achieved by installing an optional integrating capacitor (CINT) on printed circuit board A1 (see Figure 2). Install a capacitor of at least 200 uf, 25 volt rating, whenever the IR-10 is used for control of pumps, valves, report-back, etc. (but not telemetered functions).

4. THEORY OF OPERATIONS (See Figure 2)

4.1 The IR-10 consists of an input bandpass filter, a two-stage amplifier, a detector filter, and a relay driver.

4.2 Input tones to the receiver are applied to the IF-10 filter, a frequency-selective network that passes only the desired frequencies and rejects all others. The filter output appears across potentiometer VR1, and a portion of this signal is amplified by transistors Q1 and Q2, the two-stage amplifier.

4.3 Local degeneration, provided by the emitter resistors of Q1 and Q2, and degenerative feedback from the collector of Q2 to the emitter of Q1, through R7, ensure overall amplifier stability. The amplified AC signal at the collector of Q2 is transformer-coupled to the detector-filter consisting of diodes CR1 and CR2, and capacitor C6. The dc voltage thus obtained

is applied to the base of relay driver Q3. When the signal-derived voltage exceeds the bias of this normally off transistor, Q3 conducts, energizing relay K1. The relay remains energized only as long as the required input signal level is maintained (-35 DBM, minimum).

4.4 When the IR-10 receiver is operated on a high-noise-level line, an additional filter capacitor (CINT) can be connected in parallel with detector-filter C6 to provide greater immunity against false operation of the output relay (or voltage adapter, when used). However, although the integrating capacitor provides some protection from line noise, its installation in the circuit will decrease the maximum pulsing speed that the receiver can follow.

5. INSTALLATION

5.1 Mechanical Installation

The IR-10 is shipped with the IF-10 filter (module Z1) mounted in place, and the terminal block assembly plugged into connector TB1. Four 6-32 screws are partially screwed into the terminal block.

The receiver is normally mounted in an IX-3 or IX-11 mounting frame, or in a cradle-type frame. To install the receiver into the frame, proceed as follows:

1. Remove four 6-32 screws from terminal block.
2. Push the receiver, with terminal block attached, into the frame.
3. Secure the receiver to the frame, using the knurled retaining screw on the front panel. Precautions must be taken when aligning the front panel screw with the hole in the frame to prevent damage to the front panel.

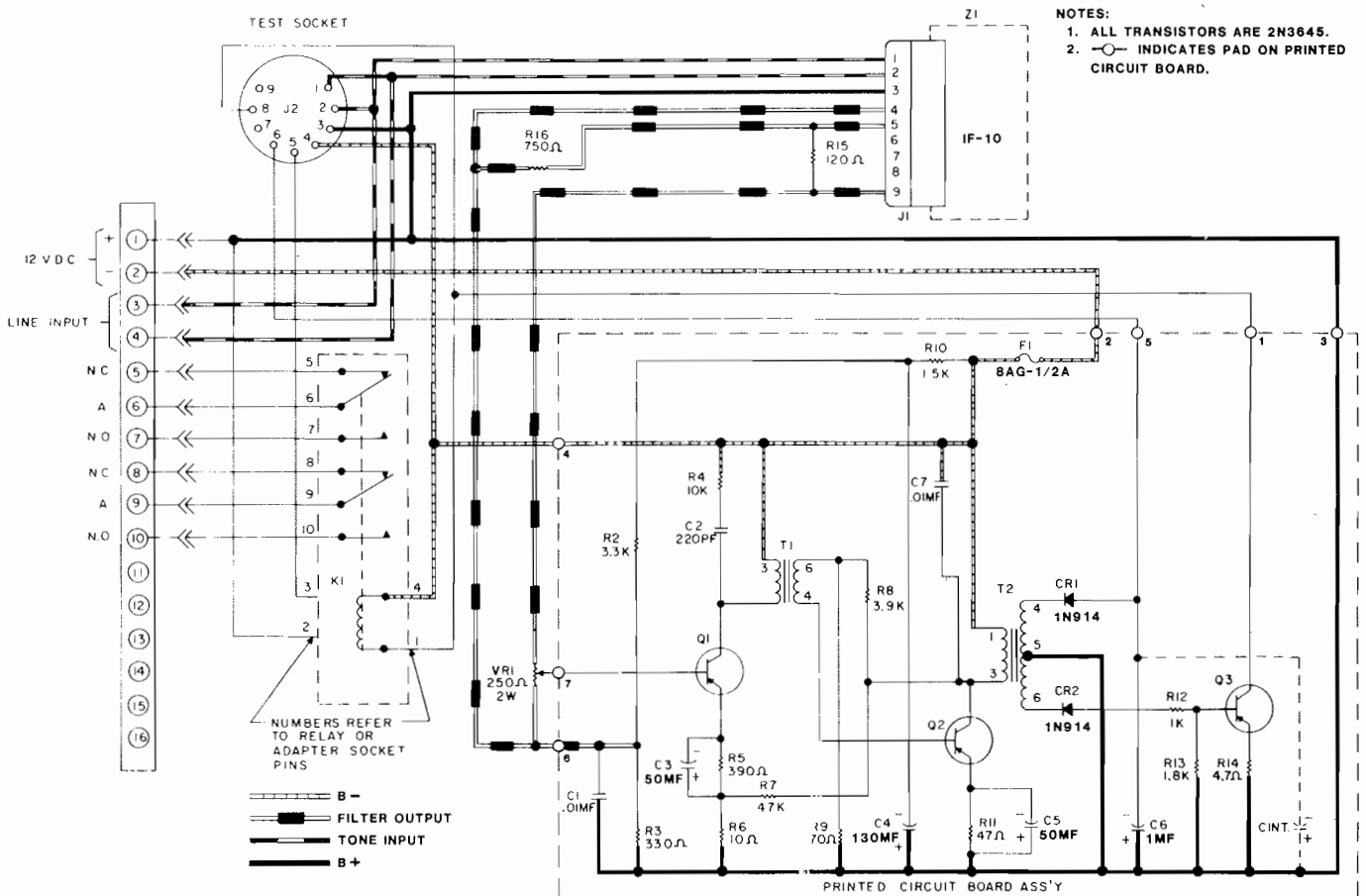


Figure 2. IR-10 AM Receiver Schematic Diagram

4. At the rear of the frame, use the 6-32 screws provided to fasten the terminal block securely to the frame. The IR-10 can now be removed from (and installed into) the frame by using the front-panel knurled retaining screw.

5.2 Terminal Block Connections

All electrical connections are made to the terminal block at the rear of the frame (see Figure 3):

TERMINAL	FUNCTION
1	Positive (+) side of 12 Vdc power supply input
2	Negative (-) side of 12 Vdc power supply input
3 and 4	Tone input
5 thru 10	Output relay contacts (see Figure 2) for voltage adapter output connections refer to appropriate adapter schematic.

CAUTION

Resistance of the connected load must be a minimum of 80 ohms when connected to an IA-10 adapter or a minimum of 250 ohms when connected to an IA-11 adapter to avoid damage to the receiver from excessive current drain.

NOTE

When using the IA-10 voltage adapter in place of the output relay, output is taken from terminal 7 (-) and terminal 10 (+). Output is approximately 12 volts. Resistance of the connected load must be 80 ohms or more to avoid excessive current drain which may damage the unit. (Terminal 10 is internally connected to terminal 1 when the IA-10 is plugged into the relay socket.)

When using the IA-11 voltage adapter in place of the output relay, output is taken from terminal 6 (-) and terminal 5 (+). (Terminal 6 is internally connected to terminal 2 when the IA-11 is plugged into the relay socket.) Output is approximately 12 volts. Resistance of the connected load must be at least 250 ohms to avoid damage to the receiver from excessive current drain.

11 thru 16 Not used

5.3 Additional Noise Protection

To improve the noise immunity of the receiver, an integrating capacitor (CINT) may be mounted on printed circuit board A1 (see Figures 2 and 4). This capacitor will introduce approximately 1.5 milliseconds of delay for each microfarad of capacitance; the recommended rating of the capacitor is given in the footnote under the tabulation is para. 3.3. When installing, observe polarity.

Table 6-1. Quick Check Malfunction Isolation System Checks

SYMPTOM	POSSIBLE CAUSE	REMEDY
SYSTEM CHECKS		
No operation.	Power failure of commercial power or IP power supply.	Check voltage.
Intermittent operation of some tone receivers at receiving station.	Transmission circuit failure. Signal level shifted due to transmission circuit change.	Call telephone company or responsible agency. Check all tone receivers to see if sensitivity has been affected. If so, notify responsible agency of change in circuit attenuation.
Tone receivers in "off" condition exhibit erratic and unsteady symptoms when checked using multimeter and Test Adapter.	Transmitter outputs set too high. Telephone company circuit trouble. Grounded telephone company circuit or defective filter or oscillator.	Check with telephone company or responsible agency for correct settings. For quick reference refer to Table 7.1. Call telephone company and advise of problem. Determine if ground is on telephone line or due to tone equipment by measuring each side of line to ground with line connected and then disconnected from equipment. If ground is on line, call telephone company. If ground is due to tone equipment, it may be caused by a defective oscillator or filter. Pull out each module in turn while monitoring ground with multimeter until absence of low resistance indication signifies module containing defective filter or oscillator.
IR-10 CHECKS		
No sensitivity or detector voltage at points 6 (-) and 3 (+) of TEST socket or no direct variation with adjustment of sensitivity control.	Q1 or Q2 defective.	Replace transistors one at a time.
No output (Relay or Adapter).	Defective fuse on printed circuit board. Defective relay or adapter. Q3 Defective. IF-10 Filter defective.	Replace fuse. Replace relay or adapter. Replace transistor. Replace with IF-10 of same or different frequency and check for output. Replace transistor, relay or adapter.
Output with no tone input.	Q3 or output device (Relay or adapter defective).	

5.4 Sensitivity Adjustment

Before performing this adjustment, make certain that the tone receiver is receiving 12 Vdc operating power and specified tone frequency. The following equipment is required to set the sensitivity level of the IR-10 AM tone receiver.

Test Adapter Multimeter	INIVEN	TA
	Simpson	Model 260 (or equivalent)

5.5 Adjustment Procedure. Adjust the sensitivity level of the receiver as follows:

NOTE

If Test Adapter is not available, take measurements directly from TEST socket.

- Strap terminals 5 and 6 of matching transmitter.
- Insert Test Adapter plug into TEST socket of receiver.
- Set the multimeter of 2.5 Vdc scale and insert test leads into jacks 6(-) and 3(+) of test adapter.
- Rotate the ADJ potentiometer, on front panel of receiver, to obtain the following applicable voltage indication:
 - Relay output -2.5 Vdc
 - IA-11 output -2.5 Vdc
 - IA-10 output -1.0 Vdc
- Remove strapping from matching transmitter.
- Disconnect multimeter from test adapter.
- Unplug test adapter from TEST socket of receiver.

5.6 Electrical Grounding

To reduce ground loop interference effects, it is necessary that the chassis of each tone unit be grounded. When the tone unit is mounted in an IX-3, IX-11 or cradle-type frame, a good earth ground on the relay racks or other equipment on which the frame is installed is necessary. Station batteries or other power supplies with grounded negative or positive leads can be employed in place of regular INIVEN power supplies.

When individual tone receivers are operated out of the frame, the receiver chassis should be connected to the earth ground.

6. MAINTENANCE

This section contains corrective maintenance procedures that can be used in conjunction with the operation test and sensitivity adjustment procedures in Section 5.

6.1 The module you have purchased has been thoroughly inspected and tested in accordance with our specifications. The module does not require preventive maintenance. However, it is recommended that signal levels be checked and adjusted every 6 months.

6.2 In-plant quality assurance procedures specify transmission levels that vary for "hardware" and "system" orders. Testing the modules, in either case, is over a transmission link simulating a telephone circuit (600 ohms impedance) with a loss of -25 dbm from origin to destination. The attenuation and frequency response of the circuit is due to a number of factors which cannot be duplicated at the factory. The factors include:

- Distance between stations.
- Diameter and length of wire used in transmission circuit.
- Actual impedance of transmission circuit.
- Inductance and capacitance of transmission circuit.

Any references to transmit levels in the manual is a factory setting and must be reset in the field in accordance with the sensitivity level adjustment procedures in paragraphs 5.4 and 5.5.

6.3 Quick-Check—Table 6.1 contains quick-check procedures designed to isolate trouble in the majority of cases. When use of these procedures fails to locate the cause of the malfunction, refer to Section 4 for detailed theory of operation and the referenced schematics as an aid in signal tracing.

7. ORDERING INFORMATION

7.1 When ordering please specify:

Model Number—Center Frequency—i.e. IR-10-1775 would specify a Model IR-10 receiving at the carrier frequency of 1775 Hz.

7.2 Refer below for list of available frequencies.

CHANNEL CENTER FREQUENCY (Hz)

Channel Spacing (Hz)	75	100	120	170	240	340
Baud Rate	50	50	60	80	120	170
-01	365	365	420	425	480	850
-02	440	465	540	595	720	1190
-03	515	565	660	765	960	1530
-04	590	665	780	935	1200	1870
-05	665	765	900	1105	1440	2210
-06	740	865	1020	1275	1680	2550
-07	815	965	1140	1445	1920	2890
-08	890	1075	1260	1615	2160	3230
-09	965	1175	1380	1785	2400	
-10	1040	1275	1500	1955	2650	
-11	1115	1375	1620	2125	2880	
-12	1190	1475	1740	2295	3120	
-13	1275	1575	1860	2465	3360	
-14	1350	1675	1980	2635		
-15	1425	1775	2100	2865		
-16	1500	1875	2220	2975		
-17	1575	2000	2340	3145		
-18	1650	2100	2460	3315		
-19	1725	2200	2580	3485		
-20	1800	2300	2700			
-21	1875	2400	2820			
-22	1950	2500	2940			
-23	2025	2600	3060			
-24	2100	2700	3180			
-25	2175	2800	3300			
-26	2250	2900	3420			
-27	2325	3000				
-28	2400	3100				
-29	2475	3200				
-30	2550	3300				
-31	2625	3400				
-32	2700	3500				
-33	2775					
-34	2850					
-35	2925					
-36	3000					
-37	3075					
-38	3150					
-39	3225					
-40	3300					
-41	3375					
-42	3450					

Table 7.1. Suggested Multiple Tone Transmitter Output Levels When Information is not Available From Telephone Co.

Number of Tone Channels On Line	Recommended Levels	
	DBM	RMS Volts (600Ω)
1	0	0.78
2	-3	0.55
3	-5	0.45
4	-6	0.40
5	-7	0.35
6 to 7	-8	0.30
8 to 10	-10	0.25
12 to 16	-12	0.20
17 to 25	-13	0.17

8. PARTS LIST

The following parts list included to facilitate maintenance of the IR-10 AM tone receiver. All parts are listed in the order of their reference designations, as applicable. Figure 3 contains a parts list for the major components of the receiver; Figure 4 contains a parts list for printed circuit board, A1.

8.1 IR-10 Receiver Assembly (See Figure 3)

Figure 3. IR-10 AM Receiver—Dimensions and Component Identification.

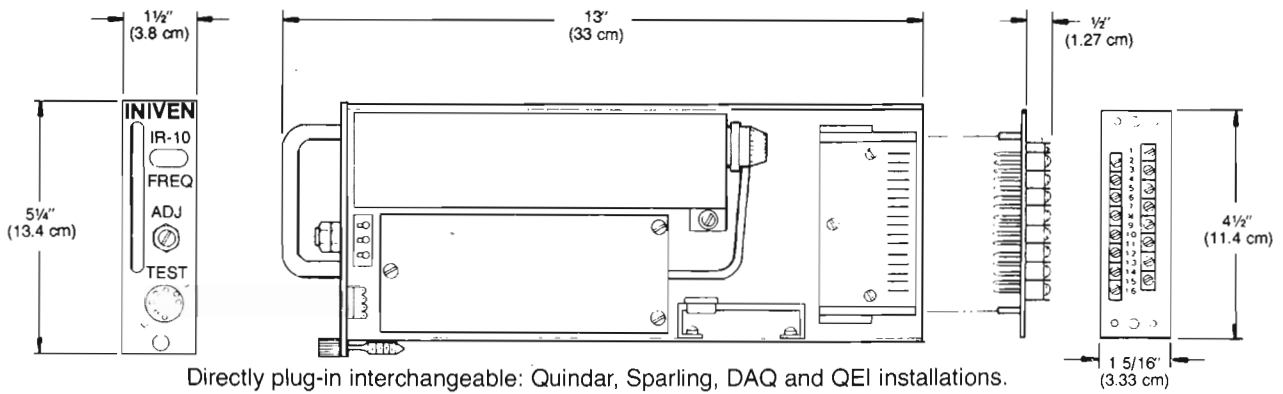
REF DESIG	DESCRIPTION	QTY	PART NUMBER	MFR
	IR-10 AM RECEIVER ASSY			
	• HANDLE	1	23018AL832C	Promptus Elec.
	• FACEPLATE	1	06B1087-OIN	INIVEN
	• SCREW, Captive	1	08A1088-OIN	INIVEN
J1	• CONNECTOR, Socket	1	401A2	Connector Corp.
J2	• CONNECTOR, Socket	1	417A4	Connector Corp.
TB1	• CONNECTOR BOARD ASSY	1	CC1101-00	INIVEN
VR1	• RESISTOR, Variable, 250 ohm, 2W	1	380C2-250-Z	Clarostat
Z1	• FILTER ASSY	1	*IF-10-XXXX	INIVEN
A1	• PRINTED CIRCUIT BOARD ASSY (See Figure 4 for breakdown)	1	AB1087-OIN	INIVEN

*For complete ordering number substitute frequency for XXXX.

8.2 Printed Circuit Board Assembly A-1 (See Figure 4)

REF DESIG	DESCRIPTION	QTY	PART NUMBER	MFR
	PRINTED CIRCUIT BOARD ASSY A1	Ref	AB1087-OIN	INIVEN
C1, C7	• CAPACITOR, 0.01 uf, 50V, 20%	2	CK05BX103M	Kemet
C2	• CAPACITOR, 220 pf, 200V, 20%	1	CK05BX221K	Kemet
C3, C5	• CAPACITOR, Electrolytic, 50 uf, 6V, +100 -10%	2	ST6V506X	INIVEN
C4	• CAPACITOR, Electrolytic, 130 uf, 15V, +100 -10%	1	SK16V137X	INIVEN
C6	• CAPACITOR, Tant, 1 uf, 35V, 20%	1	DT35V105M	INIVEN
CR1, CR2	• DIODE	2	1N914	
F1	• FUSE	1	8AG-1/2 AMP	Littlefuse
Q1-Q3	• TRANSISTOR	3	2N3645 (T0105 Pkg)	
	• SOCKET, Transistor	3	3-LPS-B	Cinch
R2	• RESISTOR, 3.3K, ½W, 5%	1	RCF20J332	
R3	• RESISTOR, 330 ohm, ½W, 5%	1	RCF20J331	
R4	• RESISTOR, 10K, ½W, 5%	1	RCF20J103	
R5	• RESISTOR, 390 ohm, ½W, 5%	1	RCF20J391	
R6	• RESISTOR, 10 ohm, ½W, 5%	1	RCF20J100	
R7	• RESISTOR, 47K, ½W, 5%	1	RCF20J473	
R8	• RESISTOR, 3.9K, ½W, 5%	1	RCF20J392	
R9	• RESISTOR, 470 ohm, ½W, 5%	1	RCF20J471	
R10	• RESISTOR, 1.5K, ½W, 5%	1	RCF20J152	
R11	• RESISTOR, 47 ohm, ½W, 5%	1	RCF20J470	
R12	• RESISTOR, 1K, ½W, 5%	1	RCF20J102	
R13	• RESISTOR, 1.8K, ½W, 5%	1	RCF20J182	
R14	• RESISTOR, 4.7 ohm, ½W, 5%	1	RCF20J4R7	
T1	• TRANSFORMER	1	CC1126-00	INIVEN
T2	• TRANSFORMER	1	CC1127-00	INIVEN

DIMENSIONS



Directly plug-in interchangeable: Quindar, Sparling, DAQ and QEI installations.

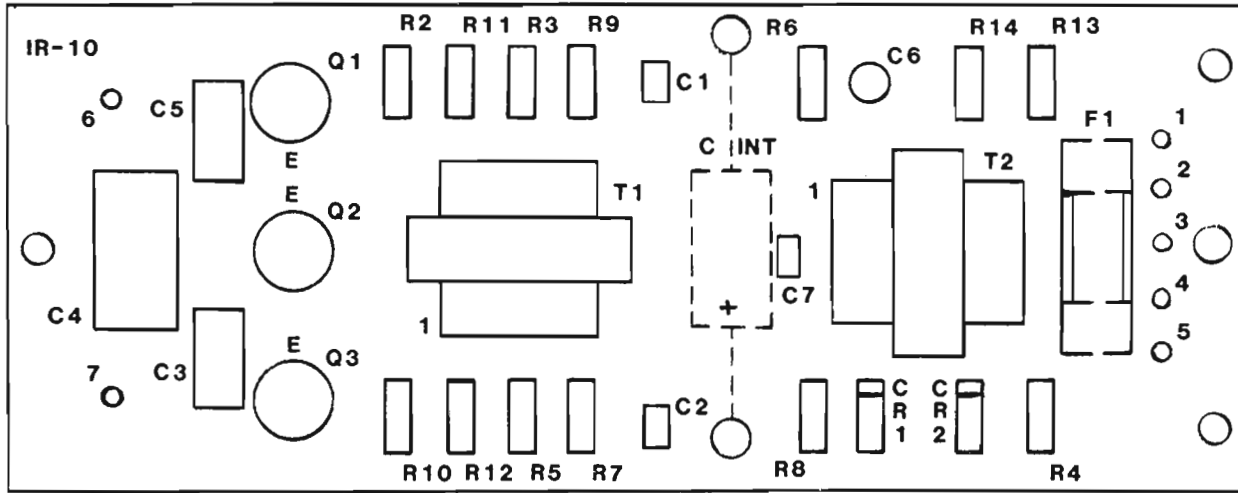
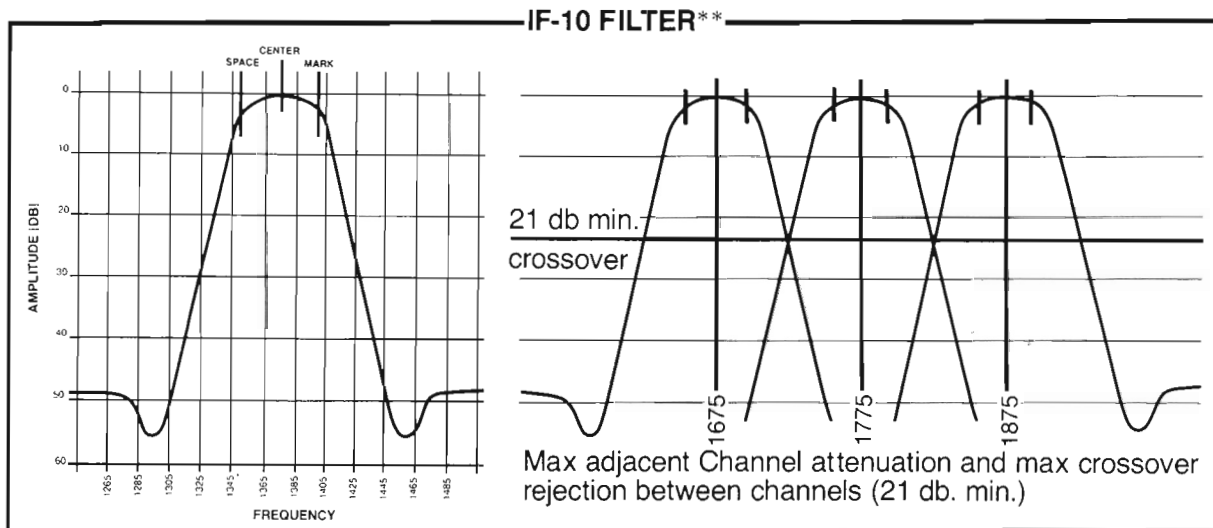


Figure 4. Printed Circuit Board Assembly A-1



When Ordering

State in this order:

1. Model number
2. Channel center frequency (in Hz)
3. Channel Spacing

Example:

Model number

Channel frequency in Hz
(From table)

Channel Spacing
(From table head)

IR-10—1375—100

Model number — IR-10

AM Receiver at 1375 Hz

Center frequency 100 Hz channel spacing

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