

AF810 SERIES MANUAL

148MHz to 175MHz
PUBLIC SERVICE BAND COMMUNICATIONS MONITOR

This manual covers the **AF810 Series** receivers. These receivers operate in the Public Service Band (VHF High Band communications) 148 MHz to 175 MHz. The AF810 series receivers include:

AF810 Communications Monitor

AF812 Communications Monitor with CTCSS circuit

AF814 Communications Monitor with Dual Tone Detector circuit

AF816 Communications Monitor with both CTCSS and Dual Tone detectors.

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MODEL AF810 SERIES PUBLIC SERVICE BAND MONITOR OPERATION MANUAL

GENERAL:

A special receiver for the Public Service Band (148 to 175 MHz). This receiver is designed to meet professional monitoring and EAS equipment input requirements.

The receiver is PLL (phase lock loop) controlled. The frequency of operation is selected using internal BCD switches. A receiver LINE audio output and speaker output (SPKR) are provided. The output audio is controlled automatically by a CTCSS and/or sequential tone detector circuit, depending on model, that monitors the receiver audio for the presence of specified tones. There is also a TEST switch and a RESET switch for activating the LINE and SPKR audio and indicator lights manually.



AF816 in standard chassis

The receiver circuit board has 10 VDC automotive style regulators. Input power is derived from wall mounted power converters (115 VAC to 12 DC) or other 12 VDC sources. The receiver is housed in a metal case or configured as one receiver in the AFC3 multiple receiver rack mount chassis.

GENERAL SPECIFICATIONS:

Frequency of Operation: 148 to 175 MHz
Frequency Increments: 5 KHz

With modulation of 1 KHz at 5 KHz deviation:

SENSITIVITY:
12dB SINAD 0.25uV
20 dB S/N 0.50uV
30 dB S/N 1.20uV
Adjacent Channel Selectivity: 60 dB
Intermodulation Rejection: 65 dB
Image Rejection: 50 dB
Spurious Response Rejection: >60 dB

LINE Output: (Adj.) 1.0V RMS
(open circuit R out is 600 Ohms)

SPKR Output: 0.3 Watts, 8 Ohm
(Adjustable, Volume Control)

Power: 12VDC, 300 mA
(300 mA converter (provided))

Metal Case Size: 6.0" W x 8" D x 1-3/4" H
Weight: 1.5 lbs

TONE DETECTORS:

Model AF810: None
Model AF812: CTCSS (Sub-Audible Tone Decoder)
Model AF814: Dual Tone
Model AF816: CTCSS and/or Dual Tone

Add C3 to the Model number if ordering for the AFC3 chassis

OPTIONS: (Add Option designator to Model number)
Option- **MF** Individual 19 inch rack mount (1 3/4"),
Option- **B** Balanced Line output, (DIN connector),
Option- **R** Alarm Relay output, (DIN connector),

Options B & R are standard in monitors ordered for AFC3 chassis.

CTCSS: Standard 39 Tone Decoder
(1% Bandwidth)

DUAL TONE:

Alert Tone Range: Motorola, Reach & GE
Alert Response Time: 2 Seconds after 2nd Tone
Alert Tone Detection: 0.4 sec
Bandwidth: +/- 5 Hz

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1.0 SETTING THE FREQUENCY OF OPERATION:

There are three (3) BCD switches and one three position DIP switch used in setting the frequency of operation for this receiver. Access to the printed circuit board requires that the receiver top chassis panel be removed. A circuit board component placement diagram is attached to this manual.

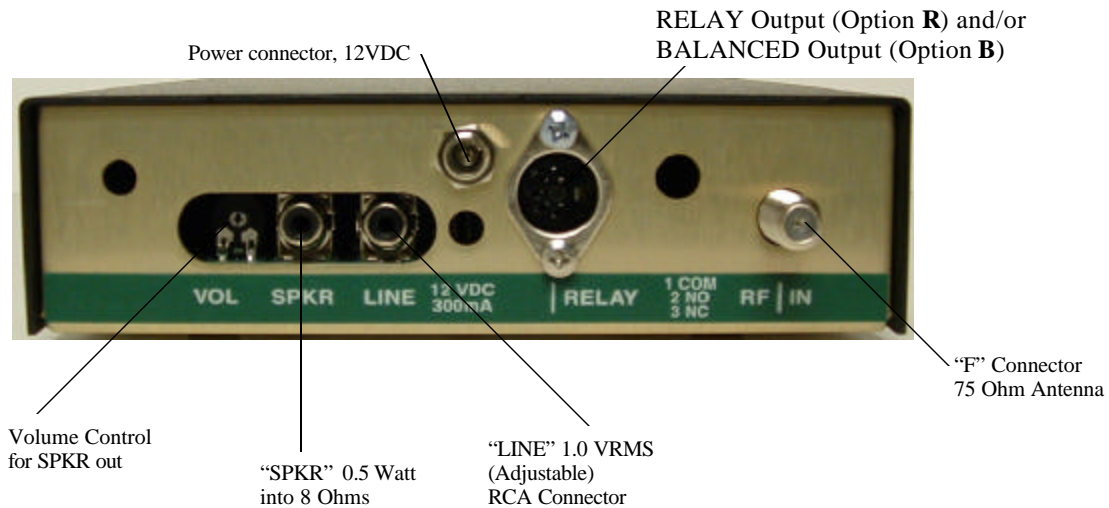
Switch SW1, the DIP switch has three switch positions. The third switch position (3) sets the channel spacing at either 5 KHz (“on”) or 10 KHz (“off”). The SW1 positions (1) and (2) select either the range 140, 150 , 160 or 170 (MHz) depending on switch positions.

FREQUENCY	14x.xxx	15x.xxx	16x.xxx	17x.xxx
Switch 1	OFF	OFF	ON	ON
Switch 2	OFF	ON	ON	OFF

The BCD switches, SW4, SW5, and SW6 set the 1.000 MHz, the 0.100 MHz, and the 0.010 MHz portions of the operating frequency. For example:

Frequency —>>	147.670 MHz	147.675 MHz	173.560 MHz	160.565 MHz
SW1 (3) (Sets 1xx.xx0 or 5)	OFF	ON	OFF	ON
SW1 (1) (w/ SW2 sets 1Xx.xxx)	OFF	OFF	ON	ON
SW1 (2) (w/SW21sets 1Xx.xxx)	OFF	OFF	OFF	ON
SW4 (Sets 1xX.xxx)	7	7	3	0
SW2 (Sets 1xx.Xxx)	6	6	5	5
SW3 (Sets 1xx.xXx)	7	7	6	6

2. 0 REAR PANEL CONNECTORS: (Series Standard)



AF810 SERIES REAR PANEL (Individual Unit Chassis)

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ANT: Antenna Input for the receiver. This is an “F” connector. The input should be 75 Ohm coaxial cable to the antenna.

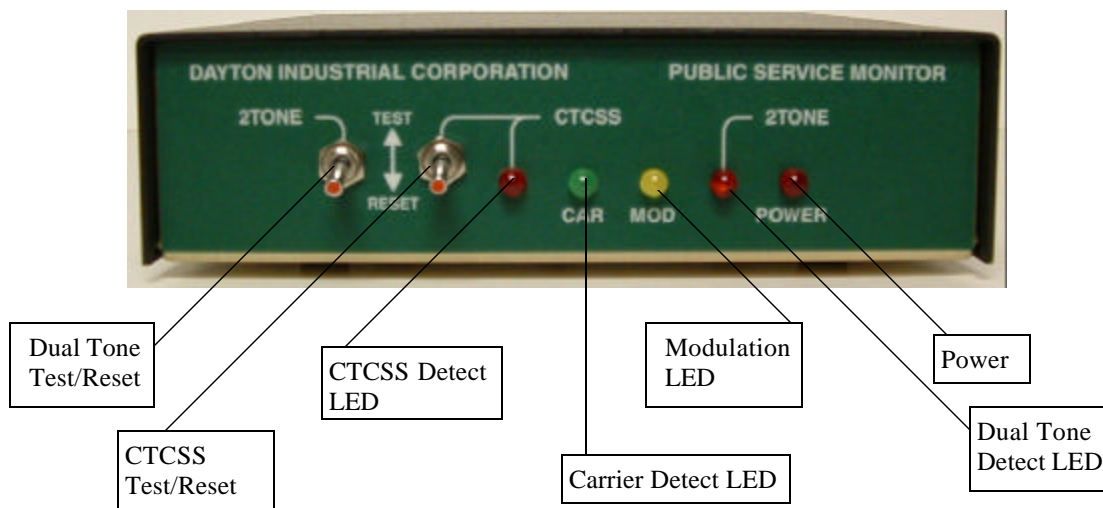
LINE Out: This is a LINE audio output, RCA connector, 1 volt RMS (unbalanced) with level adjust. This “LINE” audio output is controlled by the status of the CTCSS and/or Dual Tone detector circuits.

SPKR Audio Output: This output is controlled by the CTCSS and/or Dual Tone detector circuitry. This audio amplifier output is capable of driving a 4 or 8 Ohm speaker with 0.3 watts.

VOL: This is a screwdriver adjust potentiometer that sets the volume of the “SPKR” audio output.

POWER: In the individual units (AF810), this is a center positive connector for 12 VDC, 300 mA, input power. The input power is normally derived from a wall converter (115VAC to 12 VDC) (supplied). In the AFC3 chassis mounted unit, the power is derived from the AFC3 chassis.

3.0 FRONT PANEL INDICATORS/CONTROLS:



POWER: Indicator; Red LED that lights as long as the power is applied. In the AFC3, power is derived from the AFC3 chassis power supply.

2TONE DETECT: Indicator; Red LED that lights when designated dual tones are received. The Tone Detect indicator is activated when the receiver circuitry recognizes the presence of two sequential tones that meet the pre-set detection criteria. The pre-set tones are set at the factory. The circuitry is designed to detect the tones associated with Motorola, Reach and GE designs. This indicator is present on the AF814 and AF816 receivers only.

MODULATION: Indicator, Yellow LED that varies in intensity with the audio modulation.

CARRIER: Indicator, Green LED that lights when a carrier is present that exceeds the Squelch control level set by the internal control, RV2 “SQUELCH”.

CTCSS DETECT: Indicator, Red LED, that indicates the CTCSS circuitry has recognized the sub-audible tone and activated the audio outputs. The sub-audible tone is selected using the internal 6 position DIP switch SW5. This indicator is present on the AF812 and AF816 receivers only.

CTCSS TEST/RESET SWITCH: A two position switch. When in the “RESET” position, the CTCSS circuit is in operation and audio will be present only if the proper sub-audible tone is detected. When in the “TEST” position, the receiver audio will be present as long as the incoming signal exceeds the SQL threshold. The sub-audible tone does not have to be present. This switch is present on the AF812 and AF816 receivers only.

2TONE TEST/RESET: Switch; A front panel mounted momentary contact switch. When the TEST contact is made, this switch will "un mute" the receiver audio in the same manner as the reception of the dual sequential tones. Activate the TEST switch position to monitor all transmissions on the set frequency of operation. Use the RESET switch position to reset the receiver detection circuits and mute the audio until the next dual sequential tones are detected. This switch is present on the AF814 and AF816 receivers only.

NOTE: The “TEST” and “RESET” switch operations are normally used along with a speaker connected to the SPKR output to verify the receiver operation.

Model AF816: The Model AF816 contains both the CTCSS and the Sequential Dual Tone detectors. With both circuits in operation, both the CTCSS and Sequential Dual Tone detectors have to recognize their respective tones before the receiver audio will be available. To deactivate one or both of the circuits, internal jumpers are provided.

Jumper J16, also marked PTL (Push to Listen) will bypass the CTCSS circuitry when the front panel CTCSS TEST/RESET switch is placed in the TEST position.

Jumper J19, also marked “Monitor” and “Reset”, will bypass the Dual Tone detector circuits if a two pin jumper is placed in the “Monitor” position. The Dual Tone circuit is in normal operation when a two pin jumper is placed in the “Reset” position.

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4.0 OPERATION:

Generally, the following steps are required to place the receiver in operation.

1. Frequency of operation: Remove the receiver cover and locate the frequency setting switches SW1, SW4, SW2 and SW3. Set the desired operating frequency (See page 3, Para 1.0)
2. CTCSS Frequency: If the receiver contains the CTCSS circuit (Models AF812 and AF816), locate the switch SW5 (6 position DIP switch) and set the desired CTCSS tone by setting switches in accordance with Attachment A.
3. Dual Tone Frequencies: For Models AF814 and AF816 only. These may be set by the factory. If not, locate the 20 turn potentiometers P1, P2 and set according to Attachment B.
4. For the AF816 receiver with both the CTCSS circuit and the Dual Tone circuits, locate the jumpers J16 and J19.
 - a. For CTCSS operation but not Dual Tone operation, place a jumper on J19 in the "MONITOR" position.
 - b. For Dual Tone operation but not CTCSS operation, place the front panel switch CTCSS Test/Reset in the TEST position and place the J19 jumper (Dual Tone operation) in the "RESET" position.
 - c. For both CTCSS operation and Dual Tone operation, the J19 jumper should be in the "RESET" position and the front panel CTCSS Test/Reset switch should be in the RESET position.
 - d. For neither the CTCSS nor the Dual Tone circuits to be in operation (continuous monitoring), place the front panel switches in the TEST positions.
5. Replace the receiver cover.
6. Connections are made to the appropriate connectors and then power is applied. The front panel mounted LED marked POWER should be bright. The LINE audio output and SPKR audio output can be activated by placing both the CTCSS switch and the 2TONE switch in the RESET positions. SPKR output volume is controlled by the rear panel VOL screwdriver adjust control.

5.0 TROUBLESHOOTING:

If power is applied, but the receiver does not operate, and it is a new unit, then please return it to the factory for an exchange. If it should fail after some time in service, check the 115 VAC source to make sure power has not been disconnected. Check the 115 to 12VDC power converter for the VDC output (>12 VDC, but <20VDC). If the receiver still fails to operate, the failure must be internal to the receiver and the receiver should be returned to the factory for service.

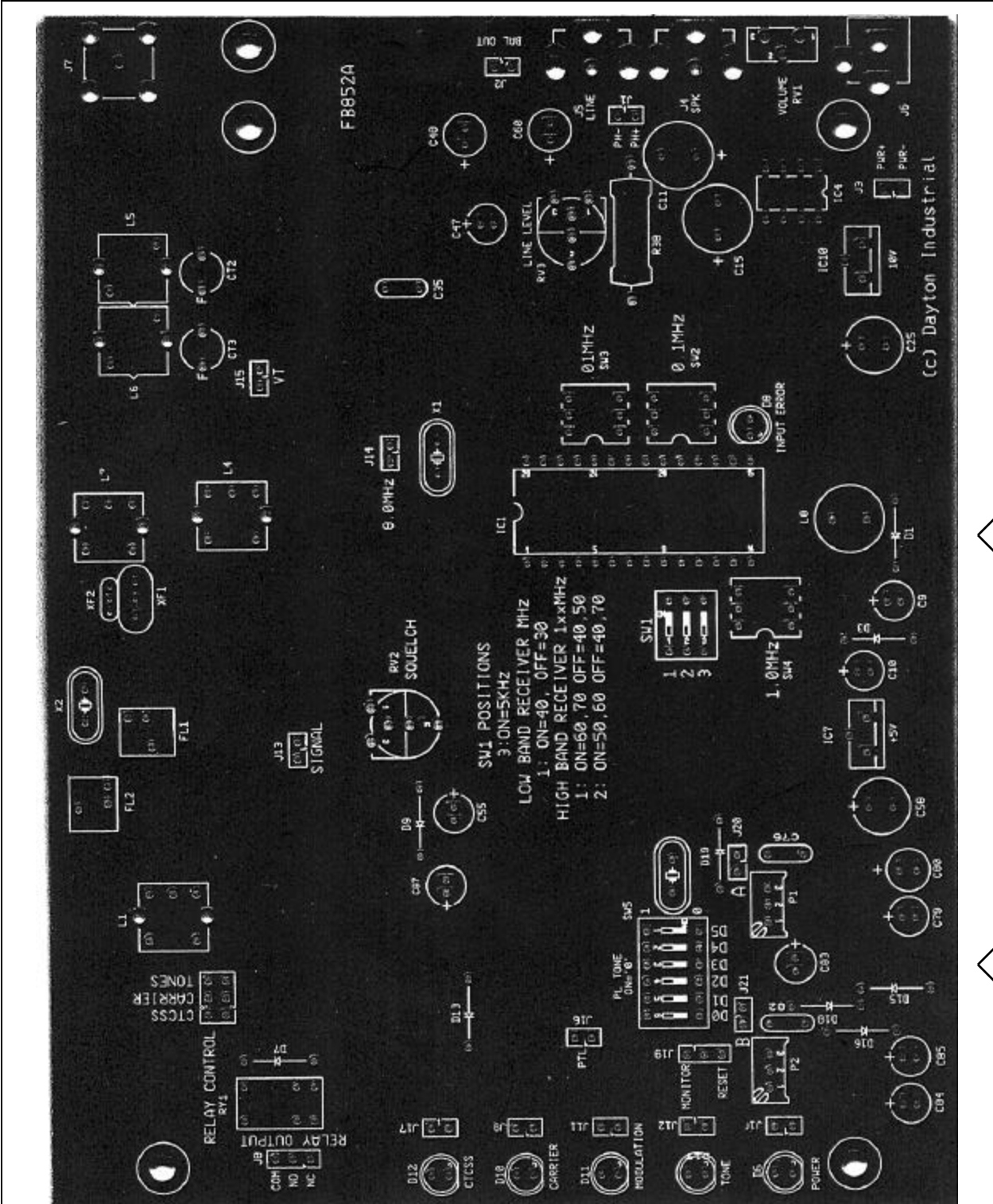
6.0 DIN CONNECTOR:

The rear panel DIN connector is used if Option R (RELAY) and/or Option B (Balanced Output) are present.

DIN PIN	RELAY	BALANCED OUTPUT
1	Common	N/A
2	Normally Open	N/A
3	Normally Closed	N/A
4	N/A	A Lead
5	N/A	B Lead

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Frequency Setting Switches

CTCSS and Dual Tone Controls

Model AF810 Series Public Service Monitor Printed Circuit Board Parts layout showing position of the DIP and BCD switches used to set the operating frequency, and the CTCSS frequency select switch SW5, the Dual Tone Sequential Potentiometers P1, P2 and J16 and J19.

ATTACHMENT A: SETTING THE CTCSS (SUB -AUDIBLE TONE)TONE DECODER:

CTCSS SUB-AUDIBLE TONE DECODER: (SW5) (Six Position DIP Switch)

The tone decoder can be set to detect any of the 39 standard CTCSS tones. In the CTCSS system, these tones are sent along with the transmitted audio. When received, the tones are below the normal frequency response of the receiver, and not heard in the audio. If the receiver is set to detect the tone being transmitted, the receiver will automatically un-mute the receiver audio section. This technique is particularly valuable to eliminate interfering signals on the same operating frequency. A continuous “ON” monitoring position is also provided. For the CTCSS tone detector circuit to be in operation, the front panel “CTCSS TEST/RESET” switch must be in the “RESET” position. The TEST position provides constant monitoring.

To set the tone frequency to be detected, the DIP switch **SW5, located on the circuit board**, is set according to the settings provided in the table below:

TONE FREQ (Hz)	SW5 SWITCH POSITIONS						TONE FREQ (Hz)	SW5 SWITCH POSITIONS					
	1	2	3	4	5	6		1	2	3	4	5	6
67.0	OFF	OFF	OFF	OFF	OFF	OFF	141.3	ON	ON	OFF	ON	ON	ON
69.3	OFF	OFF	OFF	ON	ON	OFF	146.2	ON	OFF	ON	OFF	OFF	OFF
71.9	ON	OFF	OFF	OFF	OFF	OFF	151.4	ON	ON	ON	OFF	OFF	OFF
74.4	OFF	OFF	OFF	OFF	OFF	ON	156.7	ON	OFF	ON	OFF	OFF	ON
77.0	ON	ON	OFF	OFF	OFF	OFF	159.8	OFF	OFF	ON	ON	ON	OFF
79.7	OFF	OFF	OFF	OFF	ON	OFF	162.2	ON	ON	ON	OFF	OFF	ON
82.5	ON	OFF	OFF	OFF	OFF	ON	167.9	ON	OFF	ON	OFF	ON	OFF
85.4	OFF	OFF	OFF	OFF	ON	ON	173.8	ON	ON	ON	OFF	ON	OFF
88.5	ON	ON	OFF	OFF	OFF	ON	179.9	ON	OFF	ON	OFF	ON	ON
91.5	OFF	OFF	OFF	ON	OFF	OFF	183.5	OFF	OFF	ON	ON	OFF	ON
94.8	ON	OFF	OFF	OFF	ON	OFF	186.2	ON	ON	ON	OFF	ON	ON
97.4	OFF	OFF	OFF	ON	OFF	ON	189.9	OFF	OFF	ON	ON	OFF	OFF
100	ON	ON	OFF	OFF	ON	OFF	192.8	ON	OFF	ON	ON	OFF	OFF
103.5	ON	OFF	OFF	OFF	ON	ON	196.6	OFF	OFF	ON	OFF	ON	ON
107.2	ON	ON	OFF	OFF	ON	ON	203.5	ON	ON	ON	ON	OFF	OFF
110.9	ON	OFF	OFF	ON	OFF	OFF	210.7	ON	OFF	ON	ON	OFF	ON
114.8	ON	ON	OFF	ON	OFF	OFF	218.1	ON	ON	ON	ON	OFF	ON
118.8	ON	OFF	OFF	ON	OFF	ON	225.7	ON	OFF	ON	ON	ON	OFF
123.0	ON	ON	OFF	ON	OFF	ON	233.6	ON	ON	ON	ON	ON	OFF
127.3	ON	OFF	OFF	ON	ON	OFF	241.8	ON	OFF	ON	ON	ON	ON
131.8	ON	ON	OFF	ON	ON	OFF	250.3	ON	ON	ON	ON	ON	ON
136.5	ON	OFF	OFF	ON	ON	ON	Monitor	OFF	OFF	ON	ON	ON	ON

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ATTACHMENT B: DUAL SEQUENTIAL TONE DECODER

SETTING THE DUAL TONE FREQUENCIES:

The AF814 and AF816 have a Dual Sequential tone decoder. The tones (A) and (B) that are detected are set at the factory. In case the tone detectors are to be set in the field, the following instructions should be followed. The dual tone detector circuits operate as phase locked detectors. When the incoming frequency matches the oscillator frequency set in the detector, the circuit output changes logic state and thus the state of an audio mute circuit. The desired tone frequencies are set by circuit board potentiometers P1 (A), and P2 (B). Both the (A) output and the (B) output must recognize their respective tones in the proper sequence and within a specified time.

Alert Tone Range:	Motorola, Reach & GE
Alert Response Time:	2 Seconds after 2nd Tone
Alert Tone Detection:	0.4 sec
Bandwidth:	+/- 5 Hz

To set the tone frequency, locate the potentiometers P1 and P2 on the circuit board. Associated with P1 and P2 are two pin headers marked J20 (P1) and J21 (P2). P1 sets the (A) tone frequency and P2 sets the (B) tone frequency.

With power applied:

Attach a frequency counter using a high impedance probe to J20 to set the (A) tone frequency. The frequency is adjusted by adjusting potentiometer P1.

Attach the frequency counter to J21 to set the (B) tone frequency. The frequency is adjusted by adjusting potentiometer P2.

To test the dual tone operation, either use a transmitted signal that has the desired frequencies in the desired sequence, or use test equipment designed to generate and sequence the dual tones.

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