

L-854 RECEIVER DECODER

RDL854-Heli-Hydrant OPERATOR/MAINTENANCE MANUAL



For Technical Support Call:
1-888-964-1488
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SAFETY NOTICE:

Important

1. Dangerous voltages are present in airfield lighting equipment and only qualified personnel should service or install airfield lighting equipment.
2. Always read and understand the entire installation manual prior to connecting the radio receiver to any equipment. Comply with limitations of load and maximum current contained in this manual. Always follow all local electrical safety codes for the installation of this equipment.

Removing power from the radio receiver may not always remove control power from the device... always follow appropriate lock out and tag out procedures whenever servicing the radio receiver or associated control equipment.

Section 1: L-854 Introduction

Operators Notice:

Read the entire manual prior to installing or operating this equipment. Rural Electric assumes no liability for installation, use or modifications completed by the installer.

Overview:

1. The L-854 Heli-Hydrant version is an air to ground radio receiver/decoder designed to reliably control water tank control valves over a preset VHF frequency by pulsing two of four single pole double throw dry contact relays in response to the “clicks” counted (3 or 5) in a 5 second period. This version of radio decoder is custom configured to work with the Heli-Hydrant system.
2. This radio receiver works ONLY on 24VDC. All input power is fused using a secondary panel mounted inline 5A fuse. Radio power is controlled via a single on/off toggle switch on the face plate (see Figure 6).
3. Four dry contacts, single pole double throw, with replaceable modules, are provided (RA, R3, R5 and R7). Relay RA (Radio Active) being always energized if the radio has received 3 or 5.
4. All relay contacts in the L-854 are for control purposes only and should not be utilized above 250V or 5 Amps. High power connections to downstream loads should always be accomplished using an interface relay if necessary.

Important Information:

1. **Read the entire manual before installing or operating!**
2. Rural Electric, Inc. reserves the right to revise the contents of this manual at any time.
3. Only qualified personnel should install, maintain and repair airfield electrical equipment and the equipment should only be utilized as designed. Field modifications will void all warranties and may result in equipment damage, serious injury or death.
4. Follow all state, local and federal building and safety codes when installing or servicing this equipment. Always follow lock out and tag out procedures whenever working around or on airfield electrical equipment. Lethal voltages are present; removing radio power may not remove all control power to associated equipment. The radio is not intended to function as an electrical lock out.
5. Always ensure all equipment is properly grounded, appropriately fused and all antenna lines have the provided surge suppressors properly installed.

Equipment Orientation:

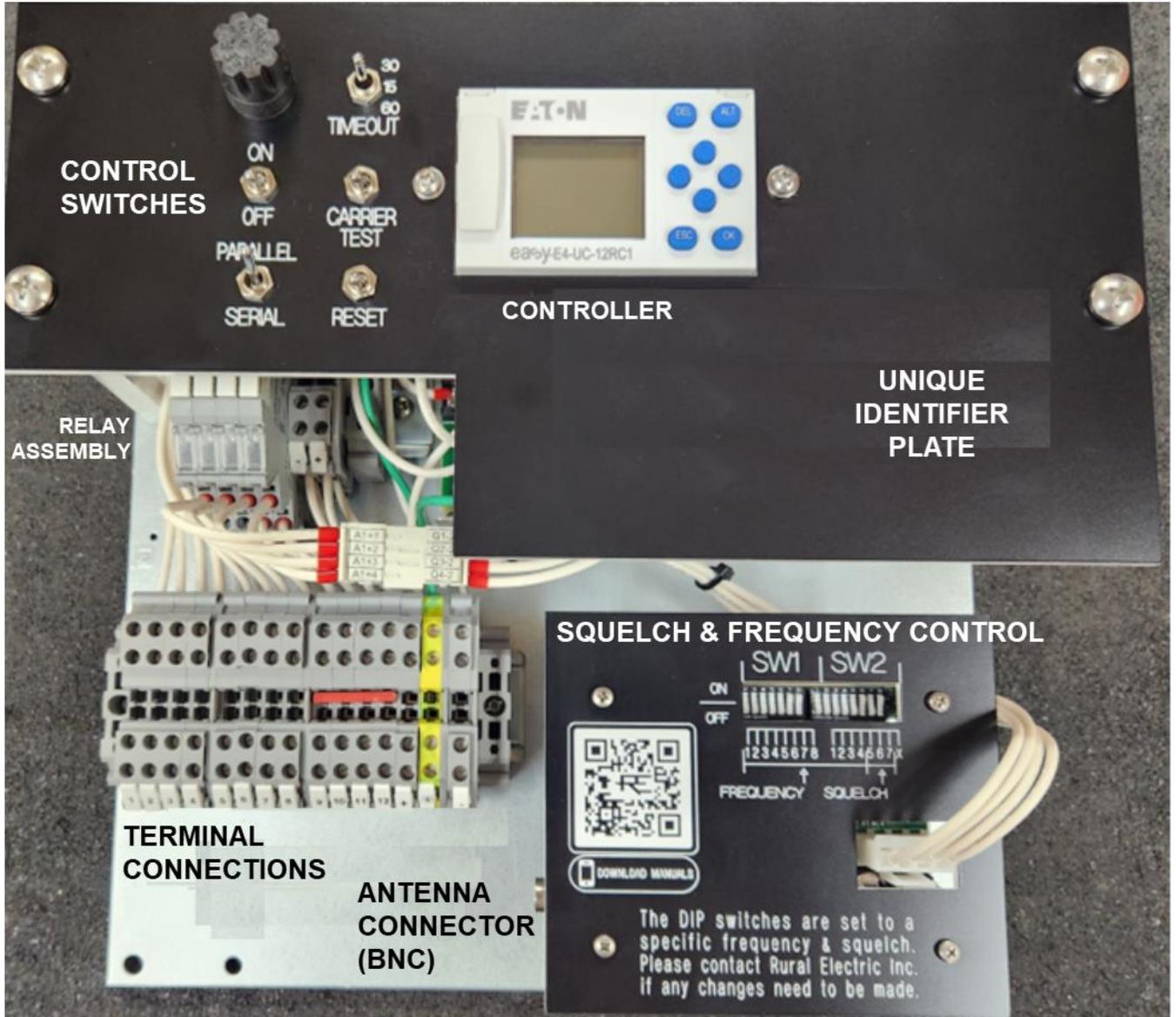


Figure 1 Radio Layout

Section 2: L-854 Cabinet and Antenna Installation

Site Selection:

1. Radio control equipment should be located as far away from the antenna as possible. Secure the antenna mast to a sturdy structure approximately 10 feet high, and in clear view from approaching aircraft. All antenna cabling should be routed in a conduit by itself, away from power and control wiring which may induce unintended radio signals through the cabling. Cable distances in excess of 100' induce high losses and is suggested to request the appropriate coax cable (LMR-400)
2. All mounting positions must have a power source and earth ground available. Grounding the unit to existing conduit or other devices may induce unwanted electrical interference and will not meet surge arrester requirements. **ALWAYS use a primary earth ground.**

Cabinet Mounting / Conduit Entry:

The radio receiver is housed inside a NEMA 12/4 enclosure of the highest quality. Utilize all mounting holes for a secure wall mount.

1. Temporarily place the unit on the wall in the desired location and level the enclosure.
2. Mark locations for the four mounting holes.
3. Remove the enclosure and set aside.
4. Drill four holes in the pre-marked locations and install appropriate anchoring hardware.
5. Install the anchors in the wall.
6. Secure Radio to wall or other surface, in desired location.
7. Plumb electrical conduits as required using a separate conduit run for antenna cabling away from all other electrical cables to avoid interference. Avoid penetrating the top of the enclosure if you wish to maintain the NEMA 4 rating of the enclosure!

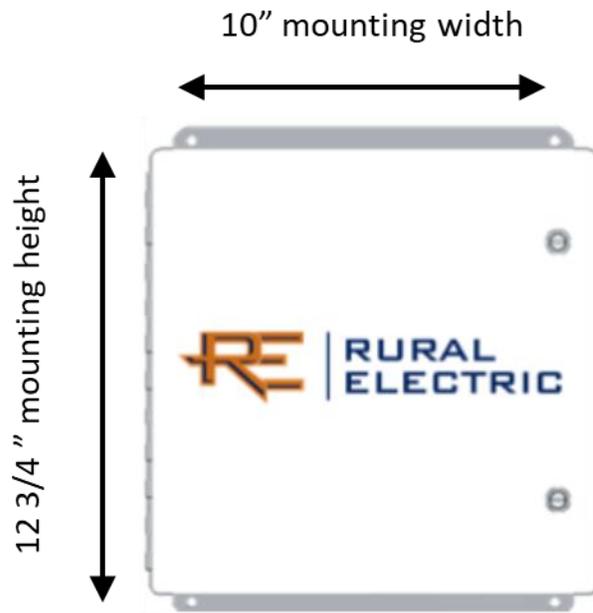


Figure 2 Cabinet Mounting

Antenna Connections:

Any suitable air band antenna may be used with the L-854 receiver / decoder using these general procedures:

1. **Ensure all antenna wiring is routed away from power and control cabling that may introduce noise and unwanted operations.**
2. **All antennas must have a lightning arrestor placed in line with the antenna cabling, preferably immediately below the antenna with a direct earth ground attached.**
3. **Antenna locations should be selected to allow line of sight to transmitting radios, either from the ground or air as appropriate. Failure to achieve line of sight to the antenna will create inconsistent control results.**
4. **Avoid grounding the antenna against a structure or other object. The antenna must stand in free space clear of vegetation, building materials or other items that may create a path to ground and lower antenna gain.**
5. **Utilize a BNC connector to connect with the receiver plug located in the L-854 cabinet. Connections are critical to efficient radio operations; avoid modifying the factory connectors on the radio or antennas.**

Section 3: Wiring Connections

This section describes the required connections to place your L-854 Receiver/Decoder into service. These instructions assume the technician is familiar with control wiring and is not intended to replace a thorough review of technical documentation for all connected equipment. If you are unsure of any connections do not proceed!

Terminal Strips:

All field power and control connections are made using screw style terminal blocks, see Figure 3. Additional terminal block entry points are provided for jumpers and field connections. Wire connections to these terminal blocks are made as follows

1. Strip the wire approximately 3/8" (9-10mm). Wire gauges from 12AWG-28AWG are suitable, either stranded or solid.
2. To secure the wire use correct torque specifications with a flat blade screwdriver.
3. Test each connection by gently pulling the wire.

Power Source Connections—Powering the Radio:

Choose a suitable power source with a primary interrupt breaker or fuse. 24VDC must only be used.

Make the following connections: (see figure 3)

1. 24VDC (+) to terminal “+”
2. 24VDC (-) Negative to terminal “-”
3. Earth Ground to terminal “GND”. Ensure that you use a dedicated ground conductor to a ground bus. Do not rely on conduit grounds or grounds that run through equipment generating substantial electrical noise.

This radio uses dry contact closures for the RA, R3, R5 and R7 outputs. To use 24VDC voltage switched via RA, R3, R5 and R7 you may insert the provided jumpers in the small rectangular holes and pressing firmly until seated level with the terminal block. This will parallel the line in voltage to the relay inputs for switching.

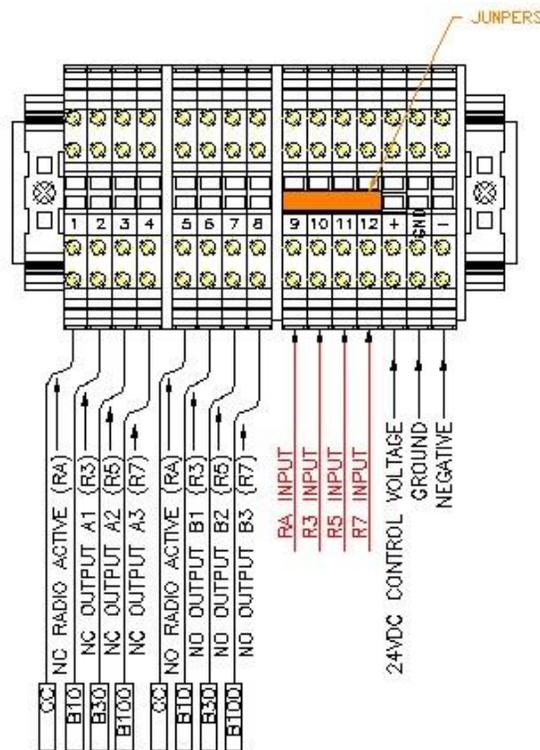


Figure 3 Power Connections

Control Voltage Connections—Wiring Relay Inputs:

Terminals 9-12 are inputs to relays RA, R3, R5 and R7 respectively, see Figure 4. These input terminals are isolated but may be joined to use a common input voltage. You may jumper the isolated relay inputs to form a common input or create unique inputs as you desire using the jumpers provided.

Inserting Jumpers:

(Jumpers are provided as a convenient and safe way to join isolated terminals)

1. Remove all control power
2. Place the metal jumper into position shown in Figure 3 at the desired location(s)
3. Press the jumper firmly until it seats flush with terminal strip face

Removing Jumpers:

1. Remove all power sources
2. Using a small flat blade screwdriver gentle pry the jumper up approximately ¼” to release
3. Remove and retain the jumper for future use

To switch a common external control voltage source:

1. Insert jumpers between terminals 12-11, 11-10, 10-9 (4 terminals total)
2. Provide control voltage at any one of the terminals 12, 11, 10 or 9
(Note---Any voltage from 5VDC to 250V AC is suitable and a maximum of 5 Amps)

To switch isolated control voltages at any individual relay(s):

1. Provide the desired control voltage to the corresponding relay input terminal
2. RA – Terminal 9
3. R3 – Terminal 10
4. R5 – Terminal 11
5. R7 – Terminal 12
6. Note- Any combination of jumpers may be inserted for custom controls

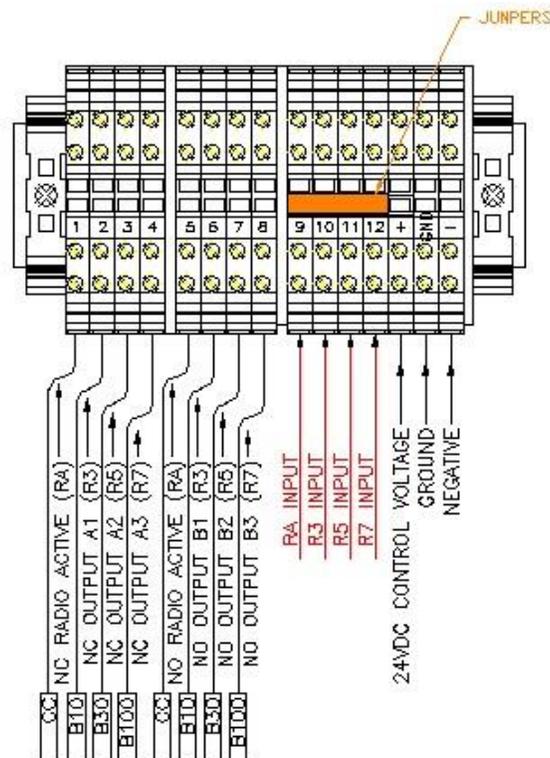


Figure 4 Input Connections

Control Output Connections...Wiring Relay Outputs:

Outputs of the four control relays (RA, R3, R5 and R7) are arranged in two banks as shown in Figure 5. The normally closed (NC) bank is connected to terminals numbered 1-4 and the normally open (NO) bank is connected to terminals numbered 5-8. The relays are active when the radio has received a 3, 5 or 7 click response and controlled as listed in Table 1 depending upon the setting of the “Serial / Parallel” selector.

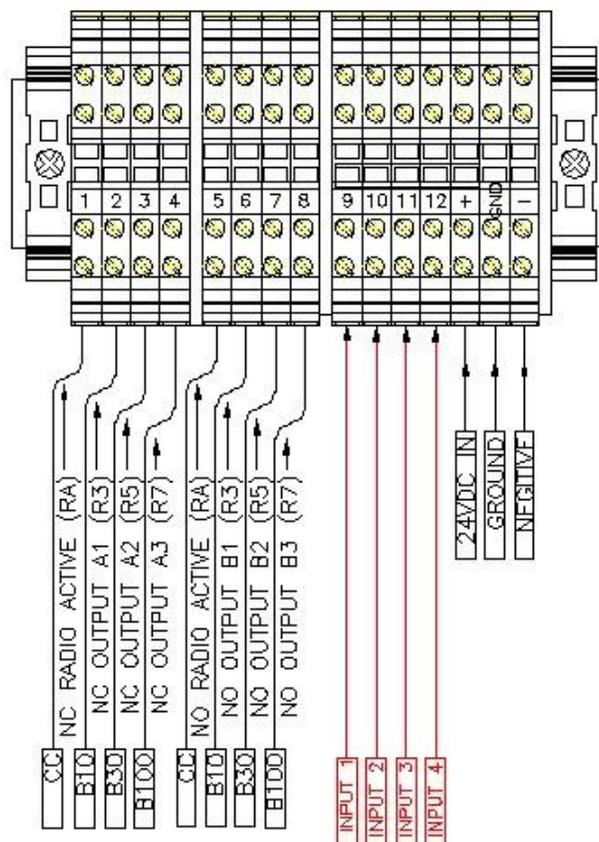


Figure 5 Output Connections

Control Methodology:

1. The radio receiver will count clicks (squelch breaks) in a preset 5 second time. It is important to note that the radio does not discriminate between noise, voice transmissions, or intentional microphone clicks, it only sees the carrier detect level rise high enough (approximately 5 μ V) to declare a squelch break. The 5 second “count” period begins upon receiving the first squelch break and the relays will pulse depending upon the number of clicks (squelch breaks) counted in that period. The counter is reset upon the expiration of the 5 second period automatically.

Relay operation is summarized as:

1. RA is energized anytime the radio has a signal.
2. R3 is pulsed (2 seconds) at 3 clicks.
3. R5 is pulsed (2 seconds) at 5 clicks.
4. R7 is pulsed (.5 seconds) 2 seconds after R5 is pulsed to reset the internal timer,
5. A small indicator light atop each relay signals the relay coil is energized.

Section 4: Controls & Indicators

Operating Controls:

The radio is configured with a raised faceplate where all controls and indicators are available. Each labeled item is described below:

Fuse:

A single 5A, 250V inline fuse is provided for supplementary protection of all components.

On / Off Selector:

This toggle switch removes all power from the receiver, encoder and heater assembly.

Parallel / Serial Selector:

Not applicable for this Heli-Hydrant version.

Timeout Selector:

Not applicable for this Heli-Hydrant version.

Carrier Test Pushbutton:

This momentary contact pushbutton is designed to simulate the reception of a “click” on the tuned frequency. The words “Carrier Detect” will appear in the controller display whenever this pushbutton is used.

Reset Pushbutton:

Pressing the reset pushbutton will reset any active timing scheme underway, de-energize all relays, and clear the carrier detect count cycle. This is normally a maintenance function for troubleshooting purposes only. Using this button while the radio is in service will cancel any pilot commanded settings...use caution!

Controller LCD Display:

The controller display is used to pass information on the operating status of the radio receiver. The following messages are displayed

1. “Rural Electric 480 984-1488”—Default message when the controller is powered up and idle
2. “Carrier Detect” – Either the carrier test button was depressed or a valid “click” was detected. This message is displayed for a minimum of 300 milliseconds after the detection to aid operator viewing so individual clicks of a duration shorter than 300 milliseconds will result in “carrier detect” remaining in view steady.
3. “XX: XX” countdown timer appears whenever a valid series of clicks has been received and the decoder is executing the programmed timeout scheme. Directly below the countdown timer the programmed timeout is displayed. The fidelity of the countdown timer varies with the timeout setting
4. 15-60 Minute timeouts use a minutes and seconds display

Delete / Alt / Menu / OK / Esc Buttons (Controller):

These buttons are used during programming and factory maintenance. They are locked out during normal field use. No user functions can be performed with these buttons.

Output Relay Active Lights:

Each of the four output relays will illuminate when the output coil is energized. The relays are arranged from left to right as RA, R3, R5 and R7. Each relay has a normally open (NO) and normally closed (NC) contact sharing a common input. Energizing the relay will open the NC contact and close the NO contact.

Section 5: Troubleshooting & Repair

Quick Solutions Guide:

No power to controller display:

The controller display should always show some text, lack of a controller display is indicative of a power input problem or controller failure:

1. Check power inputs at each terminal strip for proper Positive and negative orientation, repair as necessary.
2. Verify power switch is on.
3. Verify fuse continuity by removing the fuse from the canister (**remove power first**), repair as necessary.
4. Verify 12V power at the “+ “and“-“terminals beside relay R7. If DC power is present but still no display suspect controller failure.

Relays do not cycle with radio commands:

Relay cycling can be confirmed by viewing the output indicating lights atop each relay:

1. Confirm power to the controller display above, correct as necessary.
2. Confirm click count is > 3 in a 5 second period, correct as necessary.
3. Cycle “Carrier Test” and verify text appears in controller display, if no response from the carrier test but controller has a display suspect a controller or wiring failure.
4. If relays cycle normally using carrier test move on to “Verifying Radio Receiver Operations”

Verifying Radio Receiver Operations:

Either an appropriately tuned handheld radio or signal generator may be used to test for receiver operation:

1. Confirm power and relay cycling as listed above, correct power problems as necessary.
2. Confirm the receiver frequency matches the transmitter frequency. Correct as necessary, refer to Addendum A at the end of this manual for detailed instruction.
3. Remove the BNC connection at the small metal receiver box.
4. Verify the antenna cable has an “Open” circuit, between the Center Conductor (of the cable) and Shield (shell of the BNC connector). If a short is indicated investigate the cable, cable connectors, antenna mount method and lightning arrestor for the source of the short. Correct as necessary.
5. Using an appropriately tuned handheld radio near the open BNC connector, cycle the transmitter and observe for carrier detect. Alternatively connect a signal generator to the BNC connector and at 5 μ V input signal and verify carrier detect on the controller screen. If no carrier detect and the appropriate frequency is used, suspect receiver failure.

Replacing relay modules:

1. Remove control power and radio power sources.
2. Loosen the cover plate retaining screws (4) and cover plate.
3. Remove the faulty module by pressing the small release tab up while gently pulling the module out.
4. Insert a replacement module, depress until it “clicks” into place.
5. Replace the cover plate retaining screws (4) and cover plate.

Section 6: Maintenance

Your Rural Electric L-854 is a robust piece of equipment designed for harsh environments but, like any electronic device it should be routinely inspected for environmental conditions that may cause failures. Follow these guidelines to help prevent issues-

Annually:

- 1. Inspect the enclosure housing for evidence of dust or water penetration. Repair gaskets or conduit entries as required.**
- 2. Cycle relays to confirm proper operation.**
- 3. Inspect control wiring for failing insulation, open conductors or other wiring flaws.**
- 4. Always close and latch the enclosure door for best exterior environmental protection. Subjecting the interior components to environmental conditions by leaving the door open may void the warranty.**

Section 7: Theory of Operation

L-854 General Components:

Your Rural Electric L-854 radio receiver is a complete kit featuring (1) radio receiver, (1) antenna with mounting bracket, 20' RG58U coax cable terminated with BNC connectors, and (1) VHF lightning suppressor. No mast or other mounting hardware is provided.

L-854 Operation:

1. Major radio receiver subcomponents include the RE101 receiver, RE L12DWD controller, 24VDC/12VDC switched power supply, relays, and terminal blocks. Power inputs are made at the terminal block (see Figure 3) using only 24VDC. A single on/off switch controls power to all receiver components and is supplementary protected by a 5A inline fuse.
2. When in operation the receiver awaits a squelch break on the tuned VHF frequency and begins counting “clicks” in a 5 second period to determine pilot intent. If the radio is keyed 3 or 5 times the controller will process the click count and energize relay coils RA, R3, and R5. The pilot commanded output are pulsed for 2 seconds.
3. It is important to understand that the 5 second click count period begins upon receipt of the first squelch break and the control sequence will respond to the click counts from 3 and 5.
4. Each of the four output relays has a normally closed and normally open contact with a common pole. These common poles may be connected to isolated inputs sources or combined into a unified input using the provided jumpers (see wiring instructions). The contacts are suitable for switching up to 250 volts AC and 5 amps and are intended for control signals only. All the relay outputs are wired to terminal blocks which are grouped by normally closed relay outputs RA-R7 (terminals 1-4), normally open relay outputs RA-R7 (terminals 5-8) and common relay inputs RA-R7 (terminals 9-12).
5. Field wiring of all relay outputs is covered in detail in section 3.
6. After the pulse of the 5-click OFF command, the radio will reset itself to the idle state and await further inputs. A ground operator may activate and reset the radio at any time by pressing the carrier test and the reset button.

Addendum A: 118-136 kHz Tuning & Squelch Guide



118-136 KHz Tuning & Squelch Guide

This L-854 has a receiver which is 100% field tunable throughout the airband, 118-136KHz, in .025KHz increments.

The unit is shipped from the factory set to 122.800KHz unless a different frequency is requested at the time of order. This frequency will be noted on a silver label attached to the receiver faceplate.

To verify the frequency setting of your unit, or to change the desired frequency of operation, refer to the charts on pages below.

NOTE THAT “0” ON THE CHARTS MEANS THE SWITCH IS “OFF” OR DOWN, AND THAT “1” MEANS THE SWITCH IS “ON”, OR UP.

Squelch is set to an optimum level at the factory. Should it be necessary to adjust the squelch, use the instructions & Table 2 located below.

IMPORTANT NOTE: NEVER ADJUST SWITCHES WITH THE POWER ON. TURN THE POWER SWITCH ON THE FRONT PANEL OFF BEFORE MAKING ANY CHANGES TO FREQUENCY OR SQUELCH SETTINGS!

1. DIP Switches:

The operating frequency and squelch (sensitivity) is set via DIP switches located on the receiver. Figure 8 shows the location and numbering for the switches and the Carrier Detect LED indicator.

RED Carrier Detect LED visible here

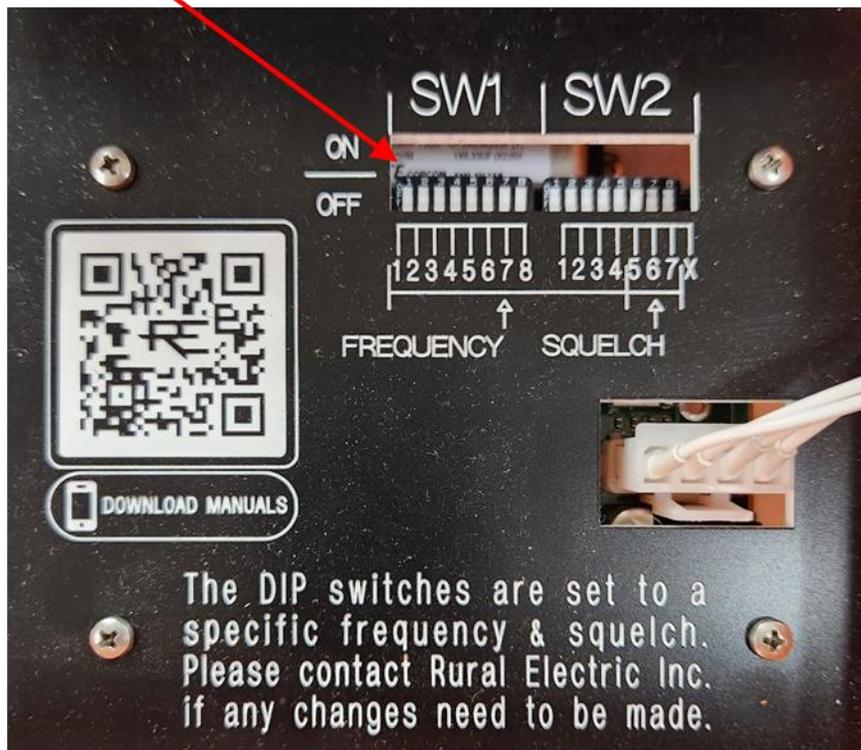


Figure 8 DIP Switch Locations (Frequency & Squelch)

SW1 (1-8), and SW2 (1-4) adjust the receiver's frequency. Refer to Pages 22-25 to find the correct switch settings for your particular frequency. The switches are set according to binary code and begin with SW1-1 as the least significant digit, increasing to the right with SW2-4 as the most significant digit. Refer to page 21 for SW2 (5-7) adjust the squelch. SW2-8 (Marked "X" on faceplate) is for factory use only and is inactive in normal operation. It should be left in the OFF position.

When you have the switches set according to the charts, test operation with a handheld or nearby mobile transmitter:

Turn the power switch of the L-854 to ON.

Set the transmitter to the correct frequency and press and hold the transmit button.

You should see the decoder display show "CARRIER DETECT" and the Red Carrier Detect LED under the Receiver Board faceplate will be energized (see Figure 8). This indicates that the receiver is operating on the correct frequency and receiving signals.

Providing you see the "CARRIER DETECT" display you can now test the decoder operation using short clicks of the transmitter.

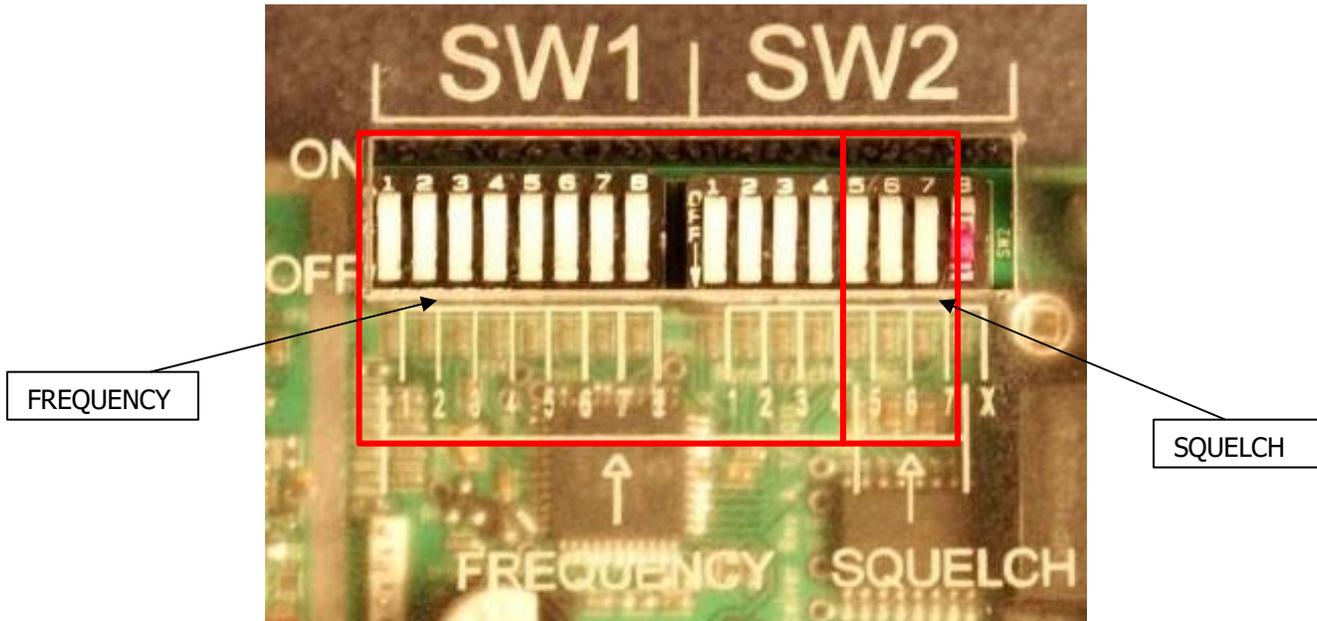
If you don't see the display change, push the "CARRIER TEST" button on the front panel. You should see the display indicate "CARRIER TEST". If this is the case turn the unit OFF and check the frequency switch settings again.

If the frequency settings are correct and pushing the transmitter button doesn't show the "CARRIER DETECT" display, the squelch setting should be checked:

2. Squelch Control:

SW2 5-7 adjust the squelch. The squelch will ship from the factory set at the optimum level. It is possible to increase or decrease the sensitivity as shown here:

The switches are shown in the table below reading from left to right, SW2 (5, 6 and 7):



Squelch Settings			
Sw2	#5	#6	#7
-6dB	1	1	1
-3dB	0	1	1
Nominal (Factory Setting)	1	0	1
+3dB	0	0	1
+6dB	1	1	0
+9dB	0	1	0
+12dB	1	0	0
+15dB	0	0	0

Table 2 Squelch Settings

There are two settings below the factory setting to increase the sensitivity and five settings to decrease the sensitivity. Normally the factory setting will work well. If the sensitivity needs to be increased, the antenna connections and installation should be inspected. Refer to Appendix E for the recommended antenna installation instructions.

In some cases local interference may require decreasing the sensitivity to minimize noise reception and unwanted operation.

Frequency Settings:

1. The frequency settings are shown below.
2. Switch Settings are shown SW1 1-8 & SW2 1-4 From LEFT to RIGHT as shown on the FACEPLATE

Frequency: 118.000 to 123.175							
118.000	111111111111	119.300	110100111111	120.600	111010011111	121.900	110001101111
118.025	011111111111	119.325	010100111111	120.625	011010011111	121.925	010001101111
118.050	101111111111	119.350	100100111111	120.650	101010011111	121.950	100001101111
118.075	001111111111	119.375	000100111111	120.675	001010011111	121.975	000001101111
118.100	110111111111	119.400	111000111111	120.700	110010011111	122.000	111110101111
118.125	010111111111	119.425	011000111111	120.725	010010011111	122.025	011110101111
118.150	100111111111	119.450	101000111111	120.750	100010011111	122.050	101110101111
118.175	000111111111	119.475	001000111111	120.775	000010011111	122.075	001110101111
118.200	111011111111	119.500	110000111111	120.800	111100011111	122.100	110110101111
118.225	011011111111	119.525	010000111111	120.825	011100011111	122.125	010110101111
118.250	101011111111	119.550	100000111111	120.850	101100011111	122.150	100110101111
118.275	001011111111	119.575	000000111111	120.875	001100011111	122.175	000110101111
118.300	110011111111	119.600	111111011111	120.900	110100011111	122.200	111010101111
118.325	010011111111	119.625	011111011111	120.925	010100011111	122.225	011010101111
118.350	100011111111	119.650	101111011111	120.950	100100011111	122.250	101010101111
118.375	000011111111	119.675	001111011111	120.975	000100011111	122.275	001010101111
118.400	111101111111	119.700	110111011111	121.000	111000011111	122.300	110010101111
118.425	011101111111	119.725	010111011111	121.025	011000011111	122.325	010010101111
118.450	101101111111	119.750	100111011111	121.050	101000011111	122.350	100010101111
118.475	001101111111	119.775	000111011111	121.075	001000011111	122.375	000010101111
118.500	110101111111	119.800	111011011111	121.100	110000011111	122.400	111100101111
118.525	010101111111	119.825	011011011111	121.125	010000011111	122.425	011100101111
118.550	100101111111	119.850	101011011111	121.150	100000011111	122.450	101100101111
118.575	000101111111	119.875	001011011111	121.175	000000011111	122.475	001100101111
118.600	111001111111	119.900	110011011111	121.200	111111101111	122.500	111010011111
118.625	011001111111	119.925	010011011111	121.225	011111101111	122.525	010100101111
118.650	101001111111	119.950	100011011111	121.250	101111101111	122.550	100100101111
118.675	001001111111	119.975	000011011111	121.275	001111101111	122.575	000100101111
118.700	110001111111	120.000	111101011111	121.300	110111101111	122.600	111000101111
118.725	010001111111	120.025	011101011111	121.325	010111101111	122.625	011000101111
118.750	100001111111	120.050	101101011111	121.350	100111101111	122.650	101000101111
118.775	000001111111	120.075	001101011111	121.375	000111101111	122.675	001000101111
118.800	111110111111	120.100	110101011111	121.400	111011101111	122.700	110000101111
118.825	011110111111	120.125	010101011111	121.425	011011101111	122.725	010000101111
118.850	101110111111	120.150	100101011111	121.450	101011101111	122.750	100000101111
118.875	001110111111	120.175	000101011111	121.475	001011101111	122.775	000000101111
118.900	110110111111	120.200	111001011111	121.500	110011101111	122.800	111111001111
118.925	010110111111	120.225	011001011111	121.525	010011101111	122.825	011111001111
118.950	100110111111	120.250	101001011111	121.550	100011101111	122.850	101111001111
118.975	000110111111	120.275	001001011111	121.575	000011101111	122.875	001111001111
119.000	111010111111	120.300	110001011111	121.600	111101101111	122.900	110111001111
119.025	011010111111	120.325	010001011111	121.625	011101101111	122.925	010111001111
119.050	101010111111	120.350	100001011111	121.650	101101101111	122.950	100111001111
119.075	001010111111	120.375	000001011111	121.675	001101101111	122.975	000111001111
119.100	110010111111	120.400	111110011111	121.700	110101101111	123.000	111011001111
119.125	010010111111	120.425	011110011111	121.725	010101101111	123.025	011011001111
119.150	100010111111	120.450	101110011111	121.750	100101101111	123.050	101011001111
119.175	000010111111	120.475	001110011111	121.775	000101101111	123.075	001011001111
119.200	111100111111	120.500	110110011111	121.800	111001101111	123.100	110011001111
119.225	011100111111	120.525	010110011111	121.825	011001101111	123.125	010011001111
119.250	101100111111	120.550	100110011111	121.850	101001101111	123.150	100011001111
119.275	001100111111	120.575	000110011111	121.875	001001101111	123.175	000011001111

Table 3a DIP Switch Settings (Frequencies 118.000 – 123.175)

Frequency: 123.200 to 128.375							
123.200	111101001111	124.500	110111110111	125.800	111000110111	127.100	110010010111
123.225	011101001111	124.525	010111110111	125.825	011000110111	127.125	010010010111
123.250	101101001111	124.550	100111110111	125.850	101000110111	127.150	100010010111
123.275	001101001111	124.575	000111110111	125.875	001000110111	127.175	000010010111
123.300	110101001111	124.600	111011110111	125.900	110000110111	127.200	111100010111
123.325	010101001111	124.625	011011110111	125.925	010000110111	127.225	011100010111
123.350	100101001111	124.650	101011110111	125.950	100000110111	127.250	101100010111
123.375	000101001111	124.675	001011110111	125.975	000000110111	127.275	001100010111
123.400	111001001111	124.700	110011110111	126.000	111111010111	127.300	110100010111
123.425	011001001111	124.725	010011110111	126.025	011111010111	127.325	010100010111
123.450	101001001111	124.750	100011110111	126.050	101111010111	127.350	100100010111
123.475	001001001111	124.775	000011110111	126.075	001111010111	127.375	000100010111
123.500	110001001111	124.800	111101110111	126.100	110111010111	127.400	111000010111
123.525	010001001111	124.825	011101110111	126.125	010111010111	127.425	011000010111
123.550	100001001111	124.850	101101110111	126.150	100111010111	127.450	101000010111
123.575	000001001111	124.875	001101110111	126.175	000111010111	127.475	001000010111
123.600	111100011111	124.900	110101110111	126.200	111011010111	127.500	110000010111
123.625	011100011111	124.925	010101110111	126.225	011011010111	127.525	010000010111
123.650	101100011111	124.950	101011110111	126.250	101011010111	127.550	100000010111
123.675	001100011111	124.975	000101110111	126.275	001011010111	127.575	000000010111
123.700	110100011111	125.000	111001110111	126.300	110011010111	127.600	111111001111
123.725	010100011111	125.025	011001110111	126.325	010011010111	127.625	011111001111
123.750	100100011111	125.050	101001110111	126.350	100011010111	127.650	101111001111
123.775	000100011111	125.075	001001110111	126.375	000011010111	127.675	001111001111
123.800	111010001111	125.100	110001110111	126.400	111101010111	127.700	110111001111
123.825	011010001111	125.125	010001110111	126.425	011101010111	127.725	010111001111
123.850	101010001111	125.150	100001110111	126.450	101101010111	127.750	100111001111
123.875	001010001111	125.175	000001110111	126.475	001101010111	127.775	000111001111
123.900	110010001111	125.200	111101110111	126.500	110101010111	127.800	111011001111
123.925	010010001111	125.225	011101110111	126.525	010101010111	127.825	011011001111
123.950	100010001111	125.250	101101110111	126.550	100101010111	127.850	101011001111
123.975	000010001111	125.275	001101110111	126.575	000101010111	127.875	001011001111
124.000	111100001111	125.300	110101110111	126.600	111001010111	127.900	110011001111
124.025	011100001111	125.325	010101110111	126.625	011001010111	127.925	010011001111
124.050	101100001111	125.350	101001110111	126.650	101001010111	127.950	100011001111
124.075	001100001111	125.375	000101110111	126.675	001001010111	127.975	000011001111
124.100	110100001111	125.400	111010110111	126.700	110001010111	128.000	111101100111
124.125	010100001111	125.425	011010110111	126.725	010001010111	128.025	011101100111
124.150	100100001111	125.450	101010110111	126.750	100001010111	128.050	101101100111
124.175	000100001111	125.475	001010110111	126.775	000001010111	128.075	001101100111
124.200	111000001111	125.500	110010110111	126.800	111110010111	128.100	110101100111
124.225	011000001111	125.525	010010110111	126.825	011110010111	128.125	010101100111
124.250	101000001111	125.550	100010110111	126.850	101110010111	128.150	100101100111
124.275	001000001111	125.575	000010110111	126.875	001110010111	128.175	000101100111
124.300	110000001111	125.600	111100110111	126.900	110110010111	128.200	111001100111
124.325	010000001111	125.625	011100110111	126.925	010110010111	128.225	011001100111
124.350	100000001111	125.650	101100110111	126.950	100110010111	128.250	101001100111
124.375	000000001111	125.675	001100110111	126.975	000110010111	128.275	001001100111
124.400	111111110111	125.700	110100110111	127.000	111010010111	128.300	110001100111
124.425	011111110111	125.725	010100110111	127.025	011010010111	128.325	010001100111
124.450	101111110111	125.750	100100110111	127.050	101010010111	128.350	100001100111
124.475	001111110111	125.775	000100110111	127.075	001010010111	128.375	000001100111

Table 3b DIP Switch Settings (Frequencies 123.200 – 128.375)

Frequency: 128.400 to 133.575							
128.400	111110100111	129.700	110101000111	131.000	111011111011	132.300	110000111011
128.425	011110100111	129.725	010101000111	131.025	011011111011	132.325	010000111011
128.450	101110100111	129.750	100101000111	131.050	101011111011	132.350	100000111011
128.475	001110100111	129.775	000101000111	131.075	001011111011	132.375	000000111011
128.500	110110100111	129.800	111001000111	131.100	110011111011	132.400	111111011011
128.525	010110100111	129.825	011001000111	131.125	010011111011	132.425	011111011011
128.550	100110100111	129.850	101001000111	131.150	100011111011	132.450	101111011011
128.575	000110100111	129.875	001001000111	131.175	000011111011	132.475	001111011011
128.600	111010100111	129.900	110001000111	131.200	111101111011	132.500	110111011011
128.625	011010100111	129.925	010001000111	131.225	011101111011	132.525	010111011011
128.650	101010100111	129.950	100001000111	131.250	101101111011	132.550	100111011011
128.675	001010100111	129.975	000001000111	131.275	001101111011	132.575	000111011011
128.700	110010100111	130.000	111110000111	131.300	110101111011	132.600	111011011011
128.725	010010100111	130.025	011110000111	131.325	010101111011	132.625	011011011011
128.750	100010100111	130.050	101110000111	131.350	100101111011	132.650	101011011011
128.775	000010100111	130.075	001110000111	131.375	000101111011	132.675	001011011011
128.800	111100100111	130.100	110110000111	131.400	111001111011	132.700	110011011011
128.825	011100100111	130.125	010110000111	131.425	011001111011	132.725	010011011011
128.850	101100100111	130.150	100110000111	131.450	101001111011	132.750	100011011011
128.875	001100100111	130.175	000110000111	131.475	001001111011	132.775	000011011011
128.900	110100100111	130.200	111010000111	131.500	110001111011	132.800	111101011011
128.925	010100100111	130.225	011010000111	131.525	010001111011	132.825	011101011011
128.950	100100100111	130.250	101010000111	131.550	100001111011	132.850	101101011011
128.975	000100100111	130.275	001010000111	131.575	000001111011	132.875	001101011011
129.000	111000100111	130.300	110010000111	131.600	111110111011	132.900	110101011011
129.025	011000100111	130.325	010010000111	131.625	011110111011	132.925	010101011011
129.050	101000100111	130.350	100010000111	131.650	101110111011	132.950	100101011011
129.075	001000100111	130.375	000010000111	131.675	001110111011	132.975	000101011011
129.100	110000100111	130.400	111000000111	131.700	1101011011011	133.000	111001011011
129.125	010000100111	130.425	011100000111	131.725	010110111011	133.025	011001011011
129.150	100000100111	130.450	101100000111	131.750	100110111011	133.050	101001011011
129.175	000000100111	130.475	001100000111	131.775	000110111011	133.075	001001011011
129.200	111111000111	130.500	110100000111	131.800	111010111011	133.100	110001011011
129.225	011111000111	130.525	010100000111	131.825	011010111011	133.125	010001011011
129.250	101111000111	130.550	100100000111	131.850	101010111011	133.150	100001011011
129.275	001111000111	130.575	000100000111	131.875	001010111011	133.175	000001011011
129.300	110111000111	130.600	111000000111	131.900	110010111011	133.200	111110011011
129.325	010111000111	130.625	011000000111	131.925	010010111011	133.225	011110011011
129.350	100111000111	130.650	101000000111	131.950	100010111011	133.250	101110011011
129.375	000111000111	130.675	001000000111	131.975	000010111011	133.275	001110011011
129.400	111011000111	130.700	110000000111	132.000	111100111011	133.300	110110011011
129.425	011011000111	130.725	010000000111	132.025	011100111011	133.325	010110011011
129.450	101011000111	130.750	100000000111	132.050	101100111011	133.350	100110011011
129.475	001011000111	130.775	000000000111	132.075	001100111011	133.375	000110011011
129.500	110011000111	130.800	111111111011	132.100	110100111011	133.400	111010011011
129.525	010011000111	130.825	011111111011	132.125	010100111011	133.425	011010011011
129.550	100011000111	130.850	101111111011	132.150	100100111011	133.450	101010011011
129.575	000011000111	130.875	001111111011	132.175	000100111011	133.475	001010011011
129.600	111101000111	130.900	110111111011	132.200	111000111011	133.500	110010011011
129.625	011101000111	130.925	010111111011	132.225	011000111011	133.525	010010011011
129.650	101101000111	130.950	100111111011	132.250	101000111011	133.550	100010011011
129.675	001101000111	130.975	000111111011	132.275	001000111011	133.575	000010011011

Table 3c DIP Switch Settings (Frequencies 128.400 – 133.575)

Frequency: 133.600 to 136.000							
133.600	111100011011	134.900	110110101011				
133.625	011100011011	134.925	010110101011				
133.650	101100011011	134.950	100110101011				
133.675	001100011011	134.975	000110101011				
133.700	110100011011	135.000	111010101011				
133.725	010100011011	135.025	011010101011				
133.750	100100011011	135.050	101010101011				
133.775	000100011011	135.075	001010101011				
133.800	111000011011	135.100	110010101011				
133.825	011000011011	135.125	010010101011				
133.850	101000011011	135.150	100010101011				
133.875	001000011011	135.175	000010101011				
133.900	110000011011	135.200	111100101011				
133.925	010000011011	135.225	011100101011				
133.950	100000011011	135.250	101100101011				
133.975	000000011011	135.275	001100101011				
134.000	111111101011	135.300	110100101011				
134.025	011111101011	135.325	010100101011				
134.050	101111101011	135.350	100100101011				
134.075	001111101011	135.375	000100101011				
134.100	110111101011	135.400	111000101011				
134.125	010111101011	135.425	011000101011				
134.150	100111101011	135.450	101000101011				
134.175	000111101011	135.475	001000101011				
134.200	111011101011	135.500	110000101011				
134.225	011011101011	135.525	010000101011				
134.250	101011101011	135.550	100000101011				
134.275	001011101011	135.575	000000101011				
134.300	110011101011	135.600	11111001011				
134.325	010011101011	135.625	01111001011				
134.350	100011101011	135.650	10111001011				
134.375	000011101011	135.675	00111001011				
134.400	111101101011	135.700	11011001011				
134.425	011101101011	135.725	01011001011				
134.450	101101101011	135.750	10011001011				
134.475	001101101011	135.775	00011001011				
134.500	110101101011	135.800	11101001011				
134.525	010101101011	135.825	01101001011				
134.550	100101101011	135.850	10101001011				
134.575	000101101011	135.875	00101001011				
134.600	111001101011	135.900	11001001011				
134.625	011001101011	135.925	01001001011				
134.650	101001101011	135.950	10001001011				
134.675	001001101011	135.975	00001001011				
134.700	110001101011	136.000	111101001011				
134.725	010001101011						
134.750	100001101011						
134.775	000001101011						
134.800	111110101011						
134.825	011110101011						
134.850	101110101011						
134.875	001110101011						

Table 3d DIP Switch Settings (Frequencies 133.600 – 136.000)

Addendum B: FCC Part-15 Compliance

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

1. Reorient or relocate the receiving antenna
2. Increase the separation between the equipment and receiver
3. Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
4. Consult the dealer or an experienced radio technician for help

Modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment under FCC rules

Appendix A: Parts Lists, Required Parts & Tools Not Supplied

Bill of Materials:

Field replaceable components are listed below. Subassemblies are not field serviceable, see Figure 1 for the relative positioning of these parts.

Part Number	Description	Rating
RE-857-303	Relay Assembly	250VAC, 6A Max, 12V Coils
RE-857-150	Replaceable Relay Modules	250VAC, 6A Max, 12V Coil
RE-SD50B12	24/12vdc Power Supply	Input 19-36vdc @ 3A Output 12vdc 4.2A 40 Watts Max
RE-101	VHF FM Receiver Assembly	12vdc, 118-136KHz
RE-L12DWD	Controller Assembly	12vdc
RE-854-681	Terminal Block Assembly	12-28AWG, 35A Max
RE-Ant	Antenna	22" ¼ dipole, 50Ω
RE-Arr1	Lightning Arrestor	70W, 20kA, 90-130V breakdown, 50Ω
RE-12126	Cabinet	NEMA 12/4, Flange Mount Polyester Powder Coated Finish
RG-58U	Cabling	PVC Jacket, Braided Coax, 50Ω

Table 4 Bill of Material

Required Parts & Tools Not Supplied:

Each installation will vary, below is a list of common parts not provided with the standard radio:

- Antenna Mast
- Antenna Mast Mounting Bolts (Bracket is designed for standard U-Bolt)
- Silicone Sealant for sealing building penetrations
- Conduit, Conduit hubs for control and communication wiring
- Cabinet Mounting Hardware
- Hand Tools for installation

Appendix B: Limited Warranty

Rural Electric, Inc. Terms of Limited Warranty L-854 Radio Receiver/Decoder

Subject to each of the terms and conditions stated herein, Rural Electric, Inc. (hereinafter “RE”) warrants solely to the original purchaser that such product is free from defects in materials and workmanship, and is in compliance with RE published specifications (current at the time of purchase) for normal use and service for 2 years from the date of manufacture or 1 year from date of purchase, whichever is sooner. Our obligation under this warranty shall be limited to the repair or exchange of any part which may prove defective under normal use and service by the original purchaser and which our examination shall disclose to our satisfaction to be defective or not in compliance with said specifications.

This warranty is expressly in lieu of all other warranties expressed or implied. Including the warranty of merchantability and fitness for use of all other obligations or liabilities on our part, and we neither assume or authorize any other person to assume for us any other liability in connection with the sale of this product. This warranty shall not apply to this product or any part thereof which has been subject to accident, negligence, modification, alteration, abuse or misuse.

We make no warranty whatsoever in respect to accessories or parts not supplied by us likewise, this warranty does not apply if the product is repaired or serviced by anyone other than RE or personnel trained by RE or if operated in a manner contrary to the instructions which accompany the product or by damage caused by circumstances beyond RE’ control, Whether in use or otherwise. The term “original purchaser” as used in this warranty shall be deemed to mean that person whom the product is originally sold and no other person or persons. This warranty shall apply only to products sold or purchased within the United States.

In any and all events, RE shall, not be liable for any breach of warranty in an amount exceeding the purchase price of the product. RE shall repair or replace at its sole option any fabricated part consisting of components or nonconforming (with specifications) parts of the product without charge for the part or parts and shall bear the entire labor expense for any such repair when any such labor is performed or part or parts furnished by RE only. To obtain warranty service, purchaser must notify RE of any alleged defect within the warranty period.

This limited warranty applies only to a product purchased for use from RE. Under no circumstances shall RE be liable to original purchaser or any other person for any incidental, special or consequential damages (including any lost profits, loss of goodwill or lost savings) whether arising out of breach of warranty, breach of contract or otherwise.

9502 E. Main Street
Mesa, AZ 85207
Phone: 888-964-1488
Fax: 480-984-0319



Appendix D: Certificate of Conformance



Intertek

PROGRAM ADMINISTRATOR
DEPARTMENT ALECP
INTERTEK
3933 U.S. ROUTE 11
CORTLAND, NY 13045-0950

ORIGINAL ISSUE DATE: May 23, 2017

Recertification due: March 2025

An Activity Sponsored and Administered by
Intertek

Rural Electric Inc.
9502 E. Main St.
Mesa, AZ 85207

AIRPORT LIGHTING EQUIPMENT CERTIFICATION PROGRAM

CERTIFICATE OF CONFORMANCE

The product described below is hereby approved for listing in the next issue of the Federal Aviation Administration (FAA) Advisory Circular (AC) 150/5345-53, Appendix 3 Addendum "Airport Lighting Equipment Certification Program. The approval is based on successful completion of tests in accordance with the specifications listed in, and the requirements for approval described in the Advisory Circular, and the reporting to the Program Administrator the results of such tests, accompanied by related documents by an Intertek recognized testing laboratory. The certification is not valid for a product modified with non-OEM replacement parts or non-production components.

L-854 – Radio Controls (AC 150/5345-49D)		
Manufacturer	Type	Manufacturer's Catalog Number
Rural Electric Inc.	I	RDL854-1A

1. This Equipment requires continuing validation in accordance with the requirements of AC 150/5345-53, and the Intertek Airport Lighting Equipment Certification Program.
2. Product tested and Report issued by: Intertek

(A) Report No: 102919202MIN-001A; (B) Date of Report: 3/2017; 3/2017; 4/2017
102919202MIN-001B; 102919202CRT-001

NOTE: PLEASE REVIEW, AND ADVISE ADMINISTRATOR AT INTERTEK IMMEDIATELY IF DATA, AS SHOWN, NEED TO BE CORRECTED.

Approved for Certification by:

Jeremy N. Downs, P.E. Program Administrator

Date: May 23, 2017

Form AL-3 1/2006

Appendix F: System Schematic

