

RECEIVER DECODER (25.0KHZ) & (8.33KHZ)

RDL854-1A & RDL854-1E

HEAVY DUTY OPERATOR/MAINTENANCE MANUAL



For Technical Support Call:
1-888-964-1488
www.ruralelectric.com

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: RDL854 Heavy Duty Contactor 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 RDL854 Heavy Duty is an air to ground radio receiver/decoder designed to reliably control airfield lighting over a preset VHF frequency by closing one single pole double throw 40 Amp mechanical contactor relay in response to the “clicks” counted (3, 5 or 7) in a 5 second period. The controller has a selectable timeout feature of 15, 30 and 60 minutes and will maintain the pilot commanded state until the preset timeout has expired, or a new command set is received. The radio is tested to operate within a tolerance of less than or equal to 5uV (microvolts). An integrated heater is provided to allow operations in subzero environments.
2. Control for the RDL854 Heavy Duty uses 120VAC or 240VAC depending on the contactor rating.
3. Depending on the model contactor ordered, this radio receiver is capable of a range of operating voltages from a 120VAC or a 240VAC 60 or 50 Hz, through the use of a switching power supply. All input power is fused using a secondary panel mounted inline 5A fuse. Radio power, including the integrated heater, is controlled via a single on/off toggle switch on the face plate (see Figure 6).
4. One dry contact, single throw, double pole 12VDC coil relay with replaceable module, controls the 120VAC or 240VAC mechanical double pole single contactor, with two 40Amp contacts. Relay may be configured to operate in 3, 5 or 7 “clicks” and also in serial (one active at a time) or parallel (cumulatively active) with relay RA (Radio Active) being always energized if the radio has received 3, 5 or 7 clicks.
5. This unique configuration allows the Rural Electric RDL854 Heavy Duty to control airfield equipment directly without any additional relay panels or logic boards. Relay contacts in the RDL854 Heavy Duty should not be utilized above 40 Amps.

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: RDL8541A Heavy Duty or RDL8541E Heavy Duty 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 L-854 unit to existing conduit or other devices may induce unwanted electrical interference and will not meet surge. **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!

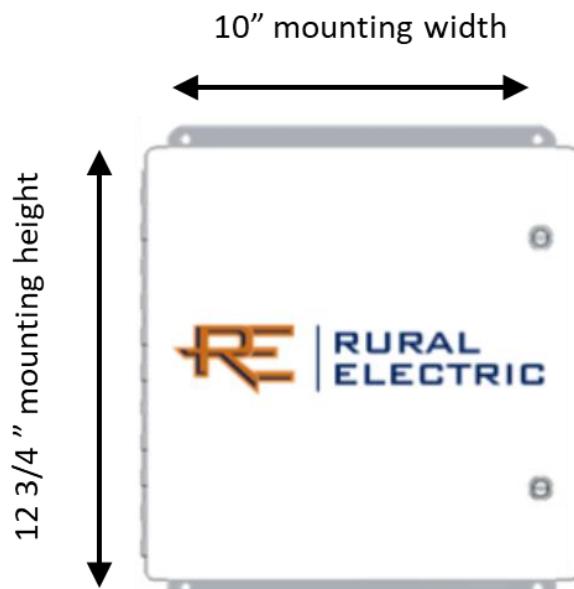


Figure 2 Cabinet Mounting

Antenna Connections:

Any suitable air band antenna may be used with the RDL8541A or RDL8541E 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 RDL854 Heavy Duty cabinet. Connections are critical to efficient radio operations; avoid modifying the factory connectors on the radio or antennas.

If you are using the provided antenna please refer to the RDL8541A / RDL8541E Antenna Information and Kit Installation Instructions in Appendix E of this manual.

Section 3: Wiring Connections

This section describes the required connections to place your RDL8541A or RDL8541E Heavy Duty Receiver/Decoder into service. These instructions assume the technician is familiar with airfield 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 with screw style terminal blocks, see Figure 3. Additional terminal block entry points are provided for jumpers and field connections.

Power Source Connections—Powering the Radio:

Choose a suitable power source depending on whether the contactor is 120VAC or 240VAC. And has a primary interrupt breaker or fuse. Make the following connections: (see figure 3)

1. Line in to terminal “L”
2. Neutral to terminal “N”
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.

Warning: terminals 5, 6, 7, & 8 are 12VDC and are not inputs. Jumpers may be used in them for different configurations.

This radio uses a single blue wire to select whether the contactor energizes on 3, 5, or 7 clicks. You may insert the blue wire jumper into either terminal 5, 6, 7, or 8. See figure 3... **For Heliports the blue wire installed in Terminal 5 (RA) will toggle the contactor ON with 3 clicks in both Parallel and Serial.**

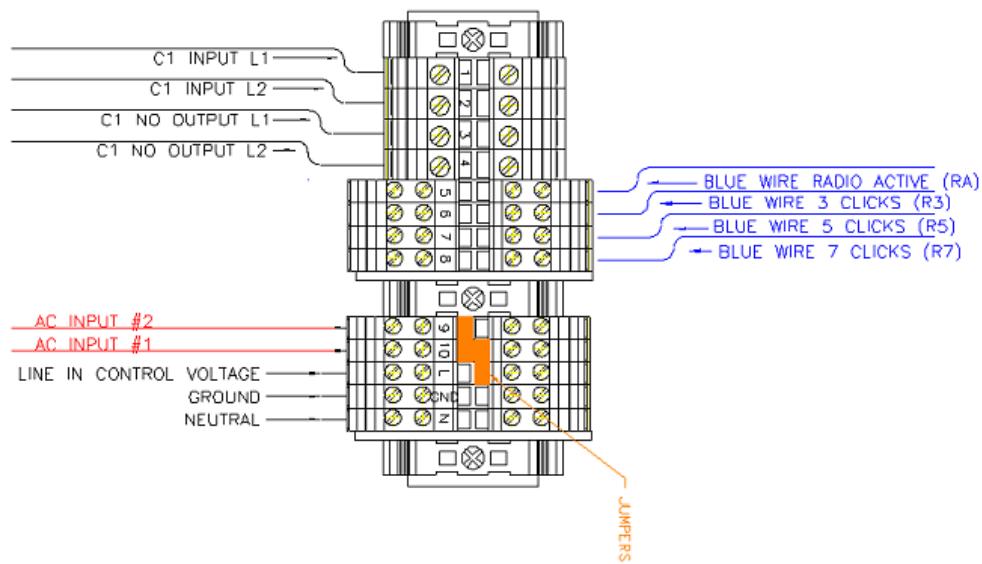


Figure 3 Power Connections

Control Output Connections...Wiring Contactor Outputs:

Terminals 1 & 2 are inputs to the 40 Amp contacts, see Figure 4. Terminals 3 & 4 are the outputs.

Inserting Jumpers:

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

1. Remove all control power to terminals.

To Switch Radio Power Line Voltage:

1. Insert jumper between terminals L-10 to power radio and contactor, or jumpers between, 10-9 to enable a photocell or/and timeclock.
2. Provide line voltage source at terminal "L"!

Warning: terminals 5, 6, 7, & 8 are 12VDC and are not inputs. Jumpers may be used in them for different configurations.

To Switch Radio Lighting Click Default:

1. Shut off power to Radio.
2. Insert blue wire into terminal for desired Click function then tighten the terminal screw.

The blue 12VDC wire may be moved to the following terminals for the desired lighting control.

1. RA (Radio Active)– Terminal 5
2. R3 (3 Clicks)– Terminal 6
3. R5 (5 Clicks)– Terminal 7
4. R7 (7 Clicks)– Terminal 8
5. Note- Any combination of jumpers may be inserted for custom controls.

Set the selector switch to “Parallel” or Serial

“X”=Closed/On

“-”=Open/Off

Normally Open Outputs																
	Idle				3 Clicks				5 Clicks				7 Clicks			
	RA	R3	R5	R7	RA	R3	R5	R7	RA	R3	R5	R7	RA	R3	R5	R7
Serial	-	-	-	-	X	X	-	-	X	-	X	-	X	-	-	X
Parallel	-	-	-	-	X	X	-	-	X	X	X	-	X	X	X	X

Table 1 Relay Outputs

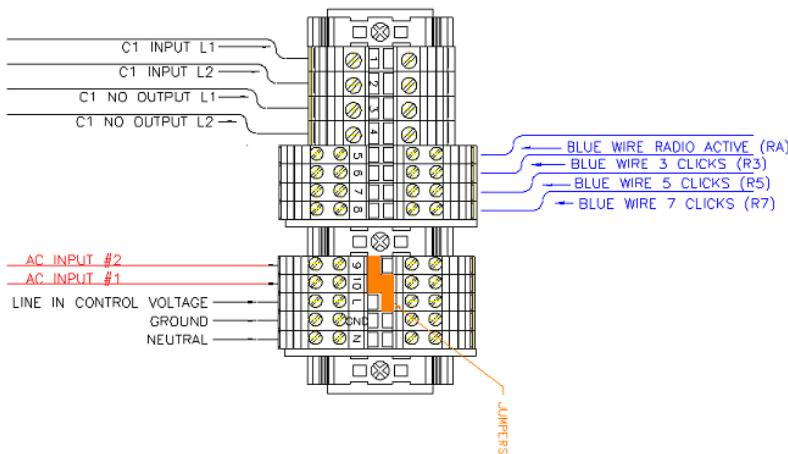


Figure 4 Input Connection

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:

This two position toggle switch will place the radio outputs either in Serial (singular) or Parallel (cumulative) mode. See Table 1 (page 13) for a complete functional description.

Timeout Selector:

This toggle switch is used to vary the timeout of radio outputs. A 15 minute standard timeout is default in the center position with optional times of 30 and 60 minutes for unique site requirements. Changing this switch while a current timing scheme is underway will have no effect until the new radio input is received at which time the newly selected time will be used by the processor. A text display and timer countdown will appear in the controller display to show both the selected timeout as well as present time elapsed in that period.

Carrier Test toggle switch:

This momentary contact toggle switch 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 toggle switch is used.

Reset toggle switch:

Using the reset toggle switch 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 toggle switch 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.

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 line and neutral 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.

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 instructions.
3. Remove the BNC connection at the receiver board.
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.

CCR does not cycle with radio commands:

1. Verify CCR is in “Remote”, field wiring is correct per manufacturer and CCR is powered on. Correct as necessary.
2. Verify relays cycle with radio commands as listed above.
3. Verify intended input voltage is present at each relay input terminal strip, correct as necessary.
4. Verify output voltage is present at the output terminals to each CCR. If correct voltage is present problem exists in the regulator or regulator control wiring. If no output voltage exists...
5. Remove all input power connections and validate relay closure with ohmmeter between the input and NO contacts. If relay cycles but contacts do not close replace removable relay modules.

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 RDL8541A and RDL8541E Heavy Duty are 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 relay 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

RDL8541A & RDL8541E Heavy Duty General Components:

Your Rural Electric RDL854 radio receiver is a complete kit featuring (1) radio receiver, also, sold separately (1)antenna with mounting bracket, 25' LMR240 coax cable terminated with BNC connector at the radio end and a UHF connector at the antenna end, also (1) lightning suppressor. No mast or other mounting hardware is provided.

RDL8541A & RDL8541E Heavy Duty Operation:

1. Major radio receiver subcomponents include the RE101 receiver, RE L12DWD controller; RE-TLD switched power supply, relay, 40 Amp Contactor, terminal blocks and cabinet heater. Power inputs are made at the terminal block (see Figure 3) using any voltage source from 120 to 240Vac (50 or 60 Hz). A single on/offswitch 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, 5, or 7 times the controller will process the click count and energize a relay coil in turn energizing a 40 Amp contactor after 3, 5, or 7 click depending upon the setting of the serial / parallel selector switch (see Figure 1). The pilot commanded output is held by the controller for a predetermined time interval (FAA standard is 15 minutes) that is adjustable by using the timeout toggle switch to 15, 30 or 60 minutes.
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, 5, 7 and stop. As an example, cycling the microphone button rapidly 12 times in 5 seconds will command 3, 5 and 7. Similarly, slowly clicking 7 times may result in the 5 second timing period expiring prior to getting to the 7th input click.
4. The output contactor has a two normally open contacts.
5. Field wiring of all relay output is covered in detail in section 3.
6. After the expiration of the preset timeout the radio will reset itself to the idle state and await further inputs. Anytime during the timeout period the radio is capable of receiving additional commands and will begin another timeout period at the newly commanded state immediately. The ground operator may reset the radio at any time by either cycling the power switch or depressing the reset toggle switch.
7. Operator interfaces and maintenance controls are provided via the faceplate for selecting timeout length, operating mode, simulating radio reception, and resetting control inputs. Detailed descriptions of these controls are provided in section 4.

Addendum A: 118-138 KHz Tuning & Squelch Guide



118-136 KHz Tuning & Squelch Guide

This RDL8541A & RDL8541E Heavy Duty have a receiver which is 100% field tunable throughout the airband, 118-136KHz, in **.00833KHz and .025KHz increments**.

The unit is shipped from the factory set to 122.80000KHz 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.

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 (threshold) 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.

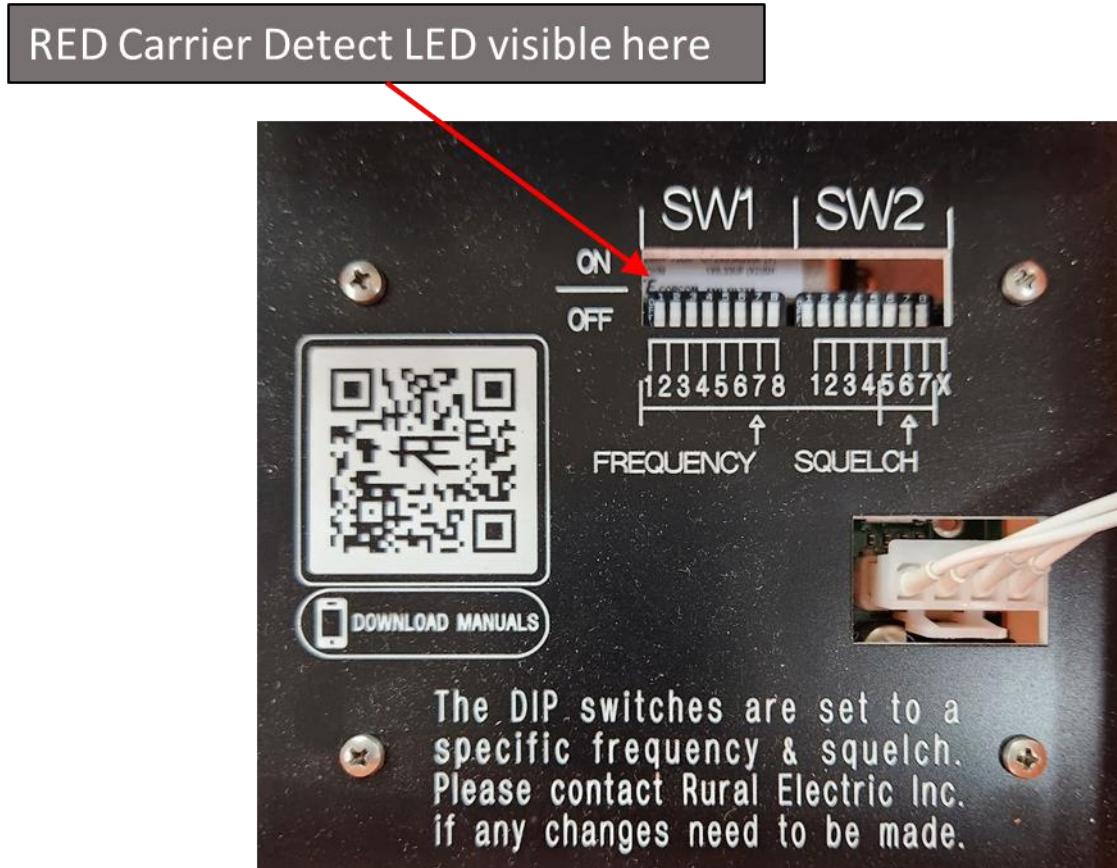


Figure 8 DIP Switch Locations (Frequency & Squelch)

SW1 (1-8), and SW2 (1-4) adjust the receiver's frequency. Refer to Table 3 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 RDL854 Heavy Duty 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, activate the "CARRIER TEST" toggle switch 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 toggle switch 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 threshold 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 threshold and five settings to decrease the threshold. Normally the factory setting will work well. If the threshold 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 threshold to minimize noise reception and unwanted operation.

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: Required Parts & Tools Not Supplied

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 RDL8541A & RDL8541E Heavy Duty 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's 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.

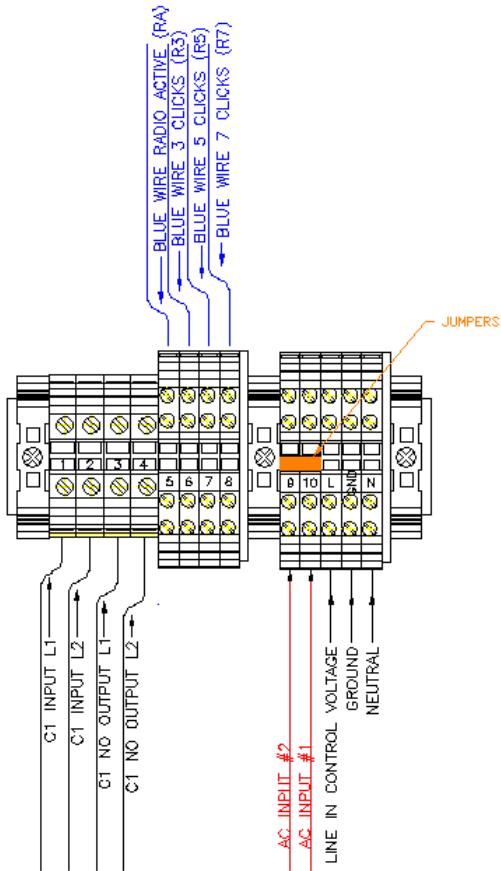
This limited warranty applies only to a product purchased for use from RE. Under no circumstances shall RE be liable to original purchaser or any other person for any incidental, special or consequential damages (including any lost profits, loss of goodwill or lost savings) whether arising out of breach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

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



Appendix C: Typical Wiring Diagrams

Typical Individual Control with Isolated Input



Appendix E: Antenna Installation



For Technical Support Call:
1-888-964-1488
www.ruralelectric.com

SAFETY NOTICE: Antenna Installation

- 1. READ ALL INSTRUCTIONS PRIOR TO BEGINNING ANY WORK**
 - 2. Always keep the antenna away from any overhead or other power line source.**
 - 3. Always install an appropriate Lightning Discharge Element in-line with the antenna cable**
 - 4. Always ground the Lightning Arrestor directly to earth ground. Do not use conduits or building structures that are not directly grounded via an earth ground rod.**
 - 5. Never route antenna lines adjacent to power or control lines.**
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Installation Diagram:

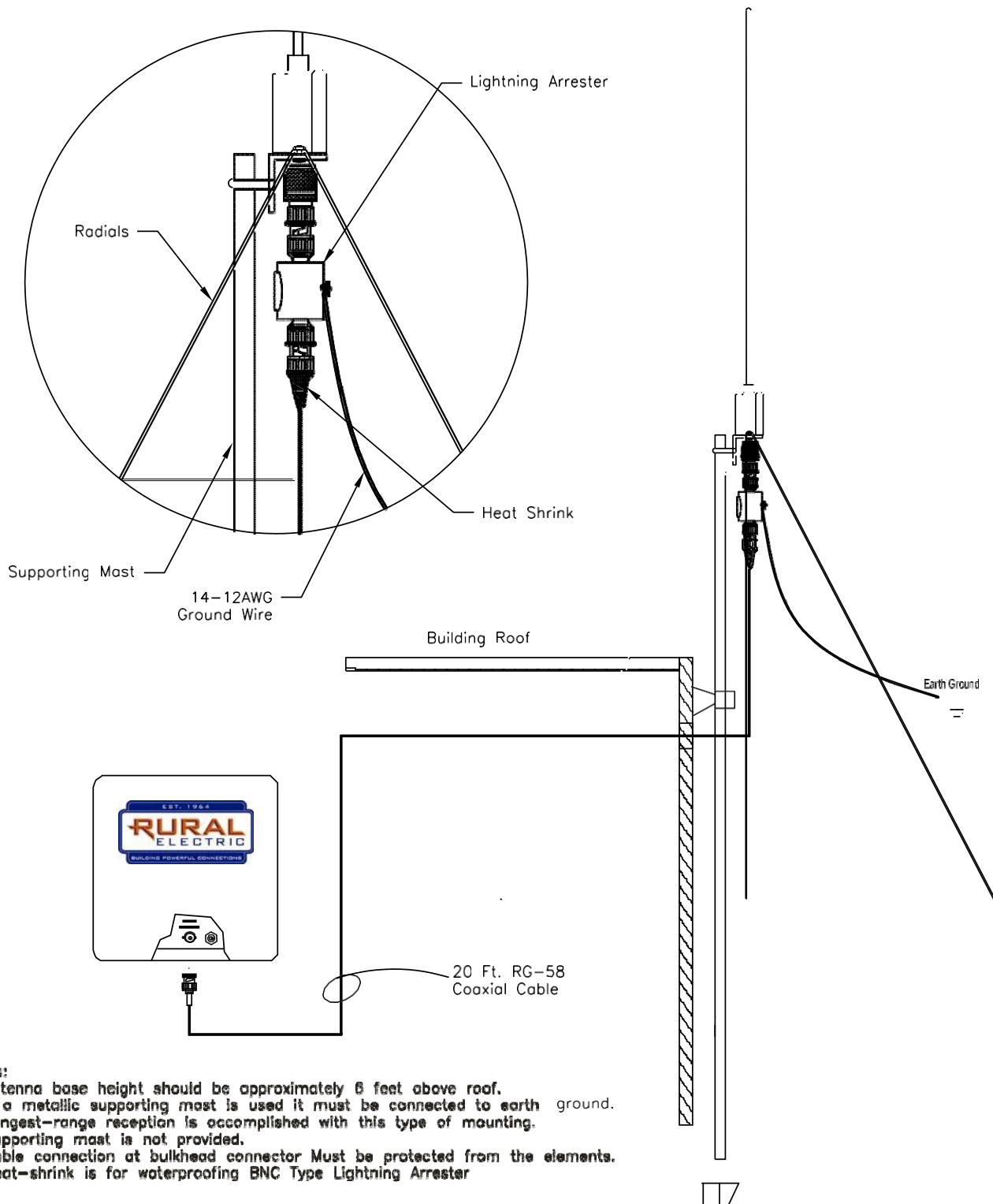


Figure 9: Antenna Install Details

Antenna Detail:

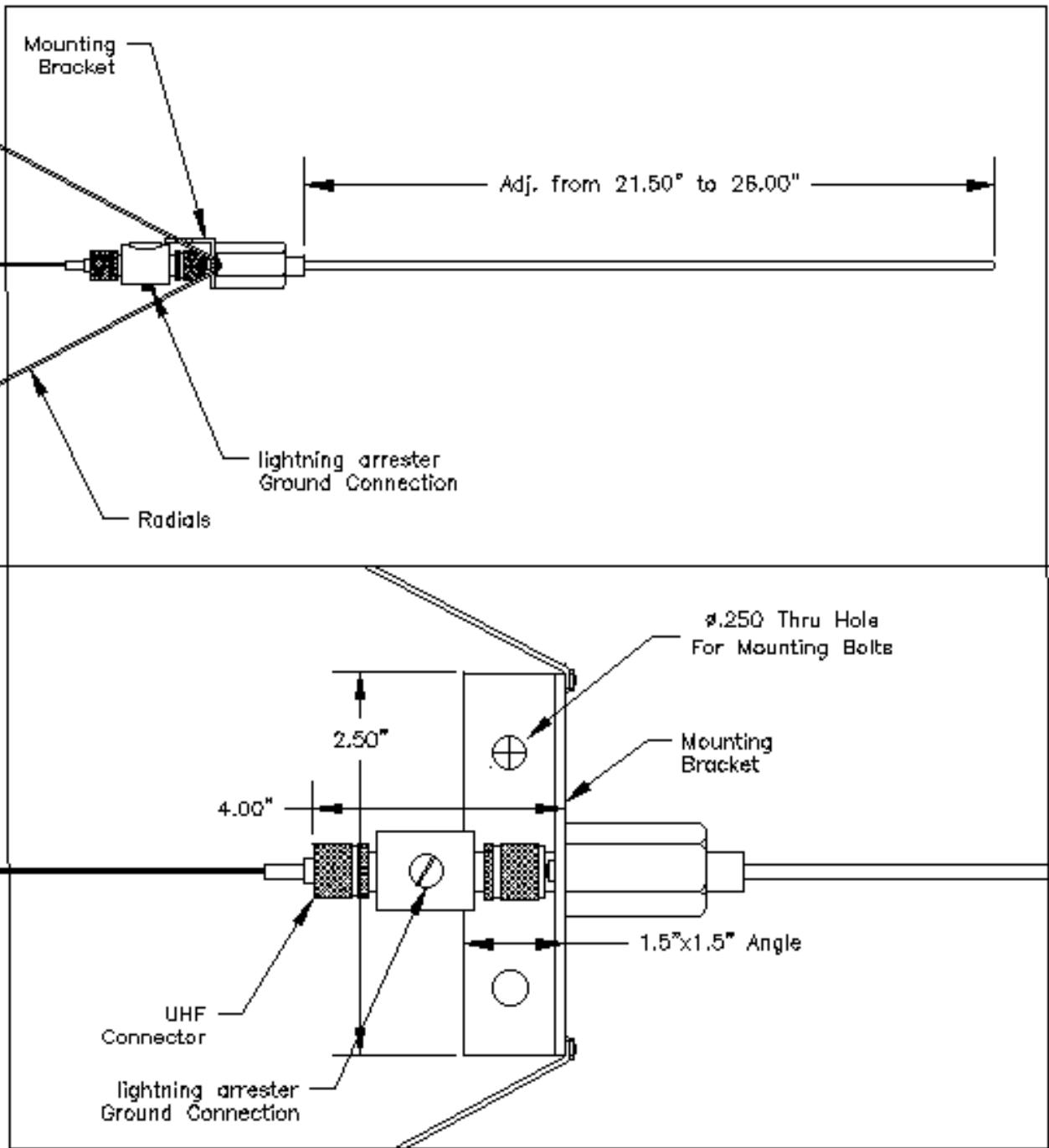


Figure 10: Antenna Details

Appendix F: System Schematic

