

# **INSTRUCTION MANUAL**

MODEL CRW-S

N.O.A.A.

Weather receiver

FCC ID: MVZCRW-S

**GORMAN-REDLICH**

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## **FCC warning**

**Warning:** Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user authority to operate the equipment.

## **FCC Compliance Statement**

**This device complies with Part 15 of the FCC Rules.** Operation is subject to the following two conditions:

- (1) this device may not cause harmful interference, and
- (2) this device must accept any interference received including interference that may cause undesired operation.

**NOTE:** 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:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is needed
- Consult the dealer or an experienced radio/TV technician for help

## **WARRANTY**

For a period of 2 years from date of shipment, Gorman-Redlich will repair or replace, at its option, any Model CRW-S receiver that fails in normal service without a charge for parts or labor and with a flat \$25 fee, prepaid by purchaser, to cover shipping and handling. Receivers can only be accepted for adjustment under Warranty following notification by letter, telephone or e-mail. Receivers showing evidence of modification or abuse, in the judgment of Gorman- Redlich, cannot be accepted for repair under Warranty, but will be repaired for a reasonable fee, with the consent of the purchaser.

## **NOAA WEATHER RADIO**

The National Weather Service (NWS), a branch of the National Oceanic and Atmospheric Administration (NOAA), operates a network of stations broadcasting around-the -clock weather on seven frequencies, spaced at 25 KHz intervals from 162.4 MHz to 162.55 MHz. About 890 stations are in operation as of April 2004. Modulation is narrow-band FM, and polarization is vertical.

In addition to local and national weather, other information tailored to the locality, such as soil conditions and marine information, is broadcast by NWS. If a severe storm, flood, or nuclear attack threatens, three bursts of coded FSK is followed by a 1050 Hz signal tone transmitted for ten seconds by NWS. The Model CRW-S will be demuted after 6 seconds of 1050 tone for automatic warning of impending danger.

The FCC has authorized rebroadcast of NWS transmissions by commercial AM, FM and TV stations, provided: 1) rebroadcast must be within one hour of receipt, 2) commercials aired during rebroadcast must not convey an endorsement by the government, and 3) credit must be given to NWS.

## **GENERAL DESCRIPTION OF MODEL CRW-S RECEIVER**

The RF section of the Model CRW-S is a double-conversion superheterodyne, with both oscillators crystal-controlled. First IF is 21.4 MHz and second IF is 455 KHz. Receive frequency can be selected to be any one of the seven NWS frequencies between 162.4 and 162.55. The passband of the receiver is controlled by a four-pole crystal filter at 21.4 MHz and a four-pole ceramic filter at 455 KHz to produce a response characteristic with a nearly ideal rectangular shape about +/- 15 KHz wide and sufficient skirt selectivity so that adjacent channels at +/- 25 MHz are attenuated about 70 db. The RF amplifier (Q1) and the first mixer (Q2) are dual-gate MOSFETS, having excellent cross-modulation rejection. The second mixer and the second local oscillator are part of U1. Most of the receiver gain takes place at 455 KHz in a limiting amplifier that is part of U1. U1 also contains a product detector for demodulation of the narrowband FM signal, and an operational amplifier that is used to shape the audio passband and to provide a low-impedance audio output. Audio pre-amplification and power amplification take place in U9, U10, U11.

## **FRONT PANEL**

The front panel of the CRW-S weather receiver features, from the left:

1. Red alert LED labeled “ALERT”
2. To the right of the alert LED, a pushbutton switch labeled “MUTE-DEMUTE”
3. Yellow “RELAY CLOSED” LED
4. To the right of the relay LED, a pushbutton switch labeled “RELAY RESET”
5. Orange “REPLAY ALERT” LED
6. To the right of the replay LED, a pushbutton switch labeled “REPLAY ALERT”
7. Green Power-on LED
8. Volume control knob labeled “VOLUME
9. Speaker

## **REAR PANEL**

The rear panel of the CRW-S weather receiver features:

1. A table with the DIP switch positions for tuning to each of the seven weather service frequencies
2. An external antenna connector. A female **F** connector
3. A plug to wire in a 12V external power supply
4. The receptacle for the 15V DC power supply
5. The 8 position DIP switch for selecting the receiver operating frequency and programming the radio for the location of installation.
6. A ten terminal removable plug
7. A eight terminal removable plug
8. A P.C. port for down loading the programming to the CRW-S
9. An auxiliary port to connect external equipment to the CRW-S such as a sign board.

The positions on the 10 terminal strip, starting from the left end are:

- |      |  |
|------|--|
| 1:2  | A balanced 600 ohm continuous AUDIO OUT  |
| 3:4  | A balanced 600 ohm AUDIO OUT that is gated on when the CRW-S detects incoming 1050 Hz tone or when the front panel MUTE/DEMUTE button is toggled on. |
| 5:6  | A momentary contact closure across these terminals will toggle the internal relay on and off.  |
| 7:8  | When the internal relay is energized, a dry contact closure is supplied to these two terminals   |
| 9:10 | Spare terminals for future use.  |

The positions on the 8 terminal strip: starting from the left end are:

- 11:12      8 ohm gated audio out that is turned on by the 1050 cycle tone or when the front panel MUTE/DEMUTE button is toggled on.
- 13:14      These terminals can be used to set off a flashing LED on a remote panel when an alert message is received.
- 15:16      A momentary contact closure across these terminals will replay the last audio message received by the CRW-S on the front panel speaker, as well as, the terminals 3 & 4 and 11 & 12.
- 17:18      A momentary contact closure across these terminals will demute the front panel speaker, and put current NWS audio on terminals 3 & 4 and 11 & 12.

### **DECODING OF FSK**

The unit is programmed with the count of installation and a few adjacent counties. If the incoming message does not have one of these counties in the "Header" the incoming message is ignored. If it does have a county that is programmed into the unit in the "Header code" then the message is processed when the 1050 cycle tone is received.

### **USE OF 1050 HZ TONE SIGNAL**

The following control and indication functions are performed by the 1050 Hz alert tone:

1. Demutes receiver
2. Gates audio to terminals 3 & 4 and 11 & 12 on the rear panel
3. Energizes flashing "ALERT" LED
4. Energizes relay, causing a contact closure between terminals 7 & 8 on the rear panel.
5. Energizes "RELAY CLOSED" LED

Audio taken from the 600 Ohm balanced gated audio terminals 3 & 4 at the rear of the receiver can be used to drive a remote amplifier and speaker. The remote speaker will then be demuted by the National Weather Service transmission of 1050 Hz, and will therefore give remote audible warning of an impending sever storm, nuclear attack, or danger. Audio between the terminals 11 & 12 has 8 ohm source impedance is at a level of 200 mVPP with 8 ohm load.

The contact closure between the rear terminals 7 & 8 can be used to set off a remote flashing light or some other indicator.

To minimize deterioration of the relay contacts when switching an inductive load, a capacitor (about 0.05 microfarad) should be connected across the contacts 7 & 8. With a DC load, a back-biased diode can be used for the same purpose.

## **MUTE-DEMUTE**

If the receiver is muted, it will be demuted by one of the following:

- a. Pressing the front panel “MUTE-DEMUTE” pushbutton
- b. Making momentary contact between the rear terminals 17 & 18
- c. Reception of a 1050 Hz alert tone.

When the receiver is demuted, it can be muted by either

- a. Pressing the front panel “MUTE-DEMUTE” pushbutton
- b. Making momentary contact between the rear terminals 17 & 18

If the receiver is demuted by the 1050 Hz signal, the flashing “ALERT” LED will be energized. It will be extinguished by pressing the “PLAYBACK SPEECH” pushbutton, pressing the front panel “MUTE-DEMUTE” pushbutton, or by making momentary contact between the rear terminals 17 & 18. It will then remain extinguished regardless of further muting or demuting of the receiver, and will only be re-energized upon reception of another 1050 Hz signal.

A normally open pushbutton switch can be used in a remote location to make the required momentary contact for remote mute-demute control.

## **RELAY RESET**

If the relay is not energized, it will be energized by either:

- a. Reception of 1050 HZ signaling tone.
- b. Pressing front panel “RELAY RESET” pushbutton
- c. Making momentary contact between the terminals 5 & 6 on the rear panel.

If the relay is energized, it will be de-energized by:

- a. Pressing front panel “RELAY RESET” pushbutton
- b. Making momentary contact between rear terminal 5 & 6

A normally open pushbutton switch can be used in a remote location for making the required momentary contact to reset the relay.

## **ANTENNA, FEED LINE, AND SIGNAL PROPAGATION**

The Model CRW-S has a coaxial input (A female F connector) for an unbalanced 50-ohm antenna.

Feedline attenuation can make the difference between solid and marginal signals in weak signal locations; hence it may be advisable to use minimum feed line length consistent with a favorable antenna location, and to use large diameter coaxial cable such as RG-8 (3 db/100 ft. at 160 MHz) rather than the smaller-diameter RG-58 or RG-59 (7 db/100ft.).

Generally, increasing antenna height will increase signal pickup. In weak signal locations, significant variations in signal strength can often be found within a relatively small area, so that improved reception may possibly be obtained by experimenting with the antenna location.

Suitable outdoor antennas are available from Gorman-Redlich. Either a vertical quarter-wave element with three horizontal radials, or 6-element Yagi can be supplied, cut to the correct wavelength.

Daily variations in signal strength may be noticed, particularly at extreme range. Signals are almost always strongest just after sunrise, diminishing to an early-afternoon minimum. Weather conditions such as ground fog can produce short-lived signal enhancement.

## **TROUBLESHOOTING**

Some simple tests may localize trouble. Note whether the green power-on LED is illuminated with normal intensity. If not, a failure in the unregulated power supply transformer may have occurred or the 5 volt regulator U4.

Note whether the “RELAY CLOSED” indicator LED functions with normal intensity. This LED is energized with regulated voltage, and if it fails to operate, failure of the voltage regulator (U4) may have occurred or failure of IC U20. If the relay audibly operates, but the indicator LED does not function, the fault is most probably in the LED.

If receiver noise is heard but no stations can be received, the failure may have occurred in one of the local oscillator, in the antenna, or in the antenna feed line. To check the first local oscillator power down the receiver. Push the #6 dipswitch down and power the unit up. All the LED's will be on and the alert LED will flash, put a test lead between TP1 and GND and use a counter to measure the frequency of the 1<sup>st</sup> local oscillator crystal. The 8 MHz crystal should be operating within  $\pm 2$  PPM of 8 MHz ( $\pm 16$  cycles) trimmer cap C44 may have to be adjusted with a jeweler's screwdriver to bring the 1<sup>st</sup> local oscillator to 8 MHz.

Normal reception but failure to demute when the 1050 Hz alert tone is transmitted may be due to a failure of IC4, IC5 or IC 6. If the “MUTE-DEMUTE” switch works normally, IC5 and IC6 are okay.

## **RECEIVER ALIGNMENT**

The CRW-S receiver uses stable components and crystals with a slow aging rate, so it should seldom, if ever, need realignment.