



# INSTRUCTION BOOK

## SINGLE SIDEBAND RECEIVER CONVERTER

Type  
CRM-R3A

(MI-555721A)

The type CRM-R3A converter is a modified version of the Crosby-Mars Model RC-288A and is described in detail in the following pages. A parts catalog of the RC-288A is also included.



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SINGLE SIDEBAND COMMUNICATIONS

RECEIVER CONVERTER

Model RC-288

Section I

GENERAL DESCRIPTION

1. General

This section provides a brief discussion of the virtues of single sideband communications including a general description of Receiver Converter, Model RC-288, its application and its use in the single sideband communications field. Also included in this section is a summary of the functional characteristics and features of the single sideband Receiver Converter, figure 1.

a. Introduction. The techniques of single sideband and exalted-carrier reception provide important new tools to help overcome the many difficulties encountered in short wave transmission. By exalted-carrier detection, the harmonic distortion and cross modulation resulting from carrier fading, is removed. Also, additional degrees of selectivity are provided that are not available with ordinary diode detection.

The use of single sideband reception is a valuable aid in the elimination of the very frequent interference which is encountered in H-F transmission. The long-ranges from which signals may be received bring about so many possible cases of interference that all such devices become a necessity to obtain the utmost out of an H-F communications system.

When the communications link is by a single sideband transmitter and a single sideband receiver, not only is the ultimate realized with respect to spectrum economy, but a power gain of 9 db is realized with respect to double sideband AM systems. The single sideband receiver converter unit is the result of a long period of research devoted to the simplification of single sideband receiving equipment. It provides performance better than that which is actually necessary for reception of single sideband transmissions of all types, together with the capability of reception of double sideband amplitude and phase modulation by exalted-carrier detection of a single sideband only.

The RC-288 Receiver Converter is capable of operation with any communications receiver in which the I-F frequency lies in the range of 440 kc to 510 kc. The I-F bandwidth between the minus 1 db points of the communications receiver should not be less than 12 kc. The converter unit separates the sidebands of the incoming signal and converts this sideband intelligence into audio signals for operation of terminal equipment. These audio signals may also be used for redistribution to other landlines or communications circuitry. The single sideband filters within the receiver converter provide a reception of audio frequencies between 250 cps and 6000 cps. However, the I-F bandwidth of the communications receiver may be altered, or 3500 cps filters may be used in the Receiver Converter to lower the audio frequency response if desired.

b. Types of Reception. The RC-288 single sideband Receiver Converter is intended for use in applications between fixed installations having a heavy flow of message traffic. The output signal of the Receiver Converter will be identical with the multiplexed signals delivered over the wires in voice-frequency landline carrier telephonic transmission. Thus, the converter unit, operating in conjunction with a communications receiver, may be used to feed carrier terminal equipment that operates several channels of teletypewriters, facsimile, or voice reproducing equipment.

The single sideband Receiver Converter is also capable of the following types of reception:

(1) **EXALTED-CARRIER UPPER-SIDEBAND RECEPTION.** This type of reception provides the optimum reception of double sideband signals for the case of interference on the lower sideband.

(2) **EXALTED-CARRIER LOWER-SIDEBAND RECEPTION.** This type of reception provides optimum performance for the case of interference on the upper sideband.

(3) **SIMULTANEOUS RECEPTION OF THE UPPER AND LOWER SIDEBAND CHANNELS TRANSMITTED IN A SINGLE SIDEBAND TWIN-CHANNEL MULTIPLEX SYSTEM.** Separate outputs are provided for each sideband on the converter. Thus, simultaneous reception of the separate programs on both sidebands may be obtained. For instance, a voice or program channel might be transmitted on the lower sideband and a multiplex tone teletypewriter system on the upper sideband.

(4) **REDUCED-CARRIER OPERATION WITH CARRIER REDUCTIONS FROM ZERO TO TWENTY DB ON ANY OF THE ABOVE FORMS OF RECEPTION.** The present standards of commercial single sideband transmission employ carrier reductions of ten and twenty db, depending upon the types of programs being applied to the transmitters. The degree of received carrier reduction is controllable by means of a **CARRIER COMPENSATION** control on the single sideband Receiver

Converter. Zero db carrier reduction corresponds to ordinary double sideband A-M transmission.

c. Functional Characteristics. The following paragraphs describe the functional characteristics of the RC-288 single sideband communications Receiver Converter:

(1) **AUTOMATIC FREQUENCY CONTROL.** Automatic frequency control is provided to maintain the signal carrier exactly in tune with the local crystal oscillator. The maximum residual AFC error is less than 2 cps. The system holds-in over a range of  $\pm 2000$  cps with a pull-in range of 50 cps from the center frequency of the carrier filter. The mechanical servo system is capable of following an overall system frequency drift of up to 10 cps per second.

The automatic frequency control is operated from the output of the carrier filter. This "protects" the system from jamming signals since the jamming signals must be exactly in the range of the carrier filter to be effective. The same "protection" also eliminates the "sideband grabbing" of the AFC system when tone modulation is being received.

(2) **AFC SQUELCH.** An automatic squelch circuit stabilizes the servo AFC circuit when there is a decrease in the carrier signal below a pre-adjusted operating level. Operation of the AFC squelch is indicated by a visual alarm.

(3) **LOCAL CARRIER OSCILLATOR.** A local carrier oscillator, tuned to the incoming carrier by the use of a crystal oscillator which is tuned to the mid-frequency of the crystal carrier filter, is provided for single sideband reception. Operation with the local carrier oscillator provides complete protection against carrier fading effects and also serves as an aid in tuning weak signals and in tuning complex multiplex single sideband signals.

(4) **RECONDITIONED CARRIER.** The filtered and limited "reconditioned carrier" may be used as well as the local carrier oscillator. The reconditioned carrier is used for all double sideband reception or may be used with single sideband reception if it is desired to receive modulation material which is sensitive to the frequency error between the incoming carrier and the local carrier.

(5) **DRIFT CORRECTION INDICATOR.** A direct reading drift correction indicator is provided to indicate the amount of detuning in the receiver. The scale is calibrated in increments of 500 cps between minus 2000 cps and plus 2000 cps.

(6) **CARRIER STRENGTH METER.** This meter indicates the incoming signal level and provides an indication for determining when the signal is properly tuned.

(7) **AUDIO OUTPUT METER.** This meter indicates the audio output level in VU units. Switching is provided for monitoring either the upper or lower sideband. Two ranges, 0 VU and +10 VU, are provided as well as an OFF position, which may be utilized while retuning to another frequency.

(8) **AGC SYSTEM.** The automatic gain control may be controlled by a signal with a fast-attack/slow-decay time constant on either sideband for the reception of suppressed carrier single sideband voice or program modulation. The AGC system may also be regulated by the usual carrier-controlled AGC method or the total signal (DSB) AGC signal. Control by the total rectified signal is advantageous for tuning purposes. Control by the rectified filtered carrier or sidebands is advantageous for rejecting interference and jamming which might obtain control of the AGC system.

## 2. Specifications

All specifications for the single sideband Receiver Converter Model RC-288 are divided into two categories; electrical and physical.

a. Electrical. The electrical specifications of this unit include all electronic characteristics as well as the primary power requirements. These specifications are listed as follows:

(1) **PRIMARY POWER REQUIREMENTS**

115/230 volts  $\pm 10$  percent 50/60 cps  
single phase, 200 watts.

(2) **AUDIO OUTPUT**

+10 dbm at 600 ohms, each channel, balanced.

(3) **AUDIO FREQUENCY RESPONSE**

Within  $\pm 2$  db from 250 cps to 6000 cps.

(4) **TOTAL HARMONIC AND CROSS-MODULATION  
DISTORTION**

Overall distortion is less than 2 percent at rated  
power output.

(5) **HUM AND NOISE LEVEL**

-60 db or better.

(6) **METERING FACILITIES**

a. Carrier meter is operated by diode rectifier  
in carrier channel of the single sideband  
adapter.

- b. Drift correction indicator, mechanically connected to AFC servo system, displays tuning drift to maximum of  $\pm 2000$  cps.
- c. Audio output meter monitors either upper or lower sideband output. Range 0 VU or +10 VU.

(7) MONITOR OUTPUT

The monitor amplifier may be switched to either upper or lower sideband audio output.

(8) TERMINAL CONNECTIONS

- a. Terminal for each audio output channel.
- b. AGC Terminal.
- c. UG - 625/U I-F INPUT.

b. Physical. The physical specifications of the RC-288 Receiver Converter are provided in the following list:

WEIGHT 58 pounds

MATERIAL Chassis and Front Panels - Aluminum

FINISH Medium Grey, Semi-Gloss  
White Lettering

MOUNTING OF EQUIPMENT

Chassis is in horizontal position;  
all tubes vertical.

DIMENSIONS Width, 19 inches  
Height, 8 3/4 inches  
Depth, 17 1/2 inches

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