Restricted

INSTRUCTIONS FOR INSTALLATION AND OPERATION OF MODEL

FSC FREQUENCY SHIFT CONVERTER

NAVSHIPS 900,078

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1. INSTRUCTIONS FOR INSTALLATION AND OPERATION OF MODEL FSC FREQUENCY SHIFT CONVERTER (Navships 900,078) is a RESTRICTED Publication.

2. This publication is intended for the use of Naval personnel (officer, enlisted and civilian) who are engaged in the installation, maintenance and operation of this equipment.

3. Additional copies of this publication may be obtained from the Bureau of Ships, Navy Department, Washington 25, D.C.

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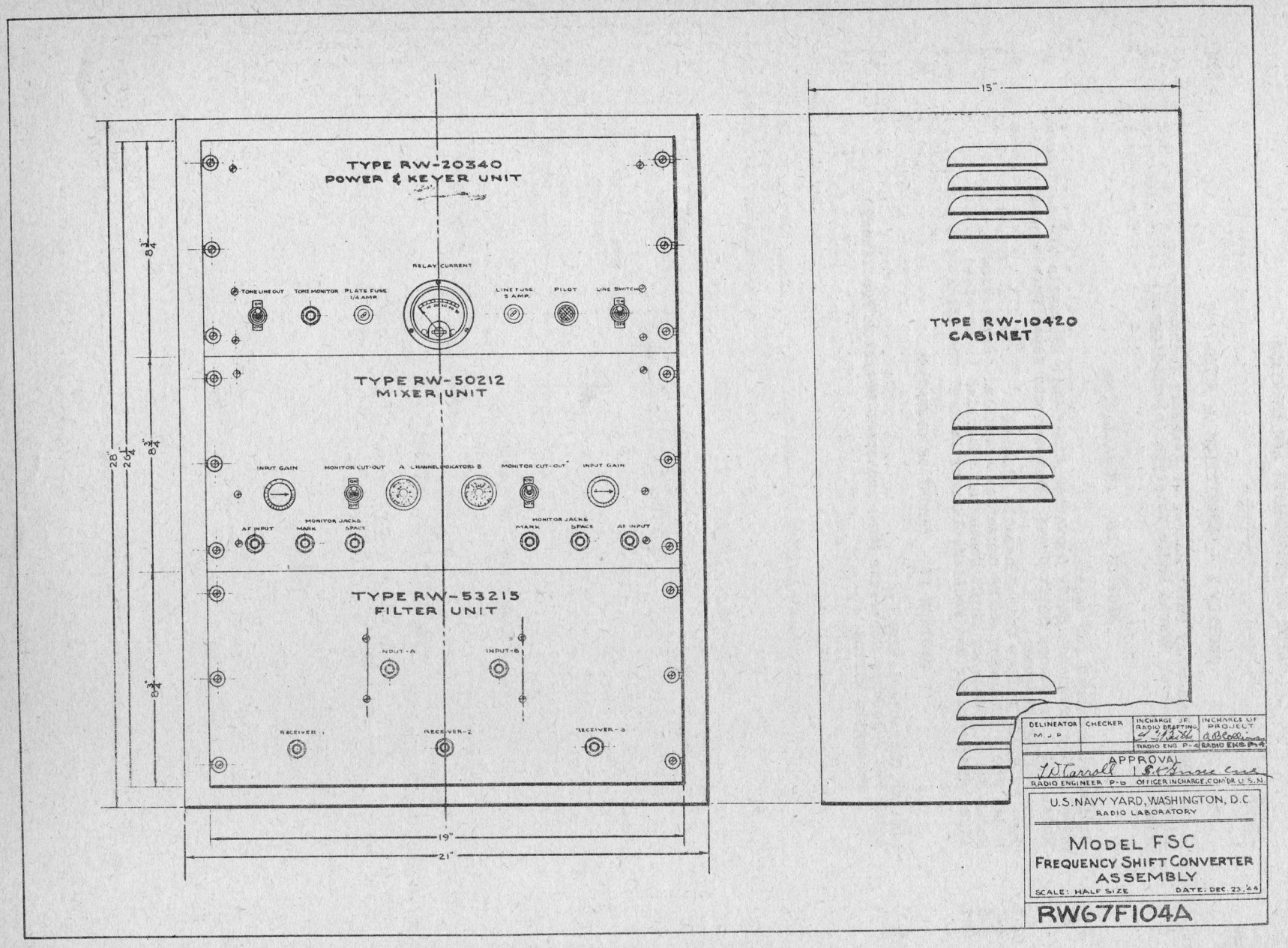

Model FSC - Frequency Shift Converter Assembly (schematic)

SECTION I - DESCRIPTION OF MODEL FSC - FREQUENCY SHIFT CONVERTER

1. General - This instruction book contains directions for the installation, operation and maintenance of the Model FSC Frequency Shift Converters, Serial Nos. 1 to 70 inclusive, the purpose of which is to demodulate frequency-shift-keyed radio teletype signals. The apparatus functions at audio frequencies and hence may be used with any stable communication receiver equipped with a beat frequency oscillator. This equipment was developed to meet an urgent need for which commercial equipment was not currently available. Extensive tests on actual operating circuits have demonstrated that results, favorably comparable with similar commercial apparatus, can be readily obtained.

2. Physical Description of Converter - The Converter is mounted in a steel cabinet (RW10420), 28" high by 21" wide by 15" deep (see drawing on page opposite) and weighs approximately 150 lbs. It consists of three basic units designated as the Mixer Unit (RW50212), Power and Keyer Unit (RW20340) and Filter Panel (RW53215). The Mixer Unit chassis contains two identical demodulators which separate the mark and space tones and combine the receiver outputs at DC. The Power Unit contains a regulated power supply giving plate, screen and bias potentials, a DC Amplifier for operating the output relay, and a Tone Keyer. The Filter Panel contains the input, mark and space filters for each demodulator channel.

3. Frequency Shift Keying - Briefly, frequency shift keyed signals are those in which marks are transmitted as a given frequency and spaces are transmitted as a slightly different frequency, usually about 850 cycles lower. Hence, signals are transmitted by both opening and closing the sending contacts of the teletypewriter, this being known as "polar keying", and results in a substantial improvement in the keying action. The transmitted carrier is therefore effectively continuous (since at any instant either marks or spaces are being transmitted), making it possible to employ receiving methods not normally practicable for an interrupted signal; that is, current limiting and automatic volume control. These improvements when coupled with frequency and spaced diversity provide a total improvement of approximately 40 db over an on/off keyed radio telegraph channel.

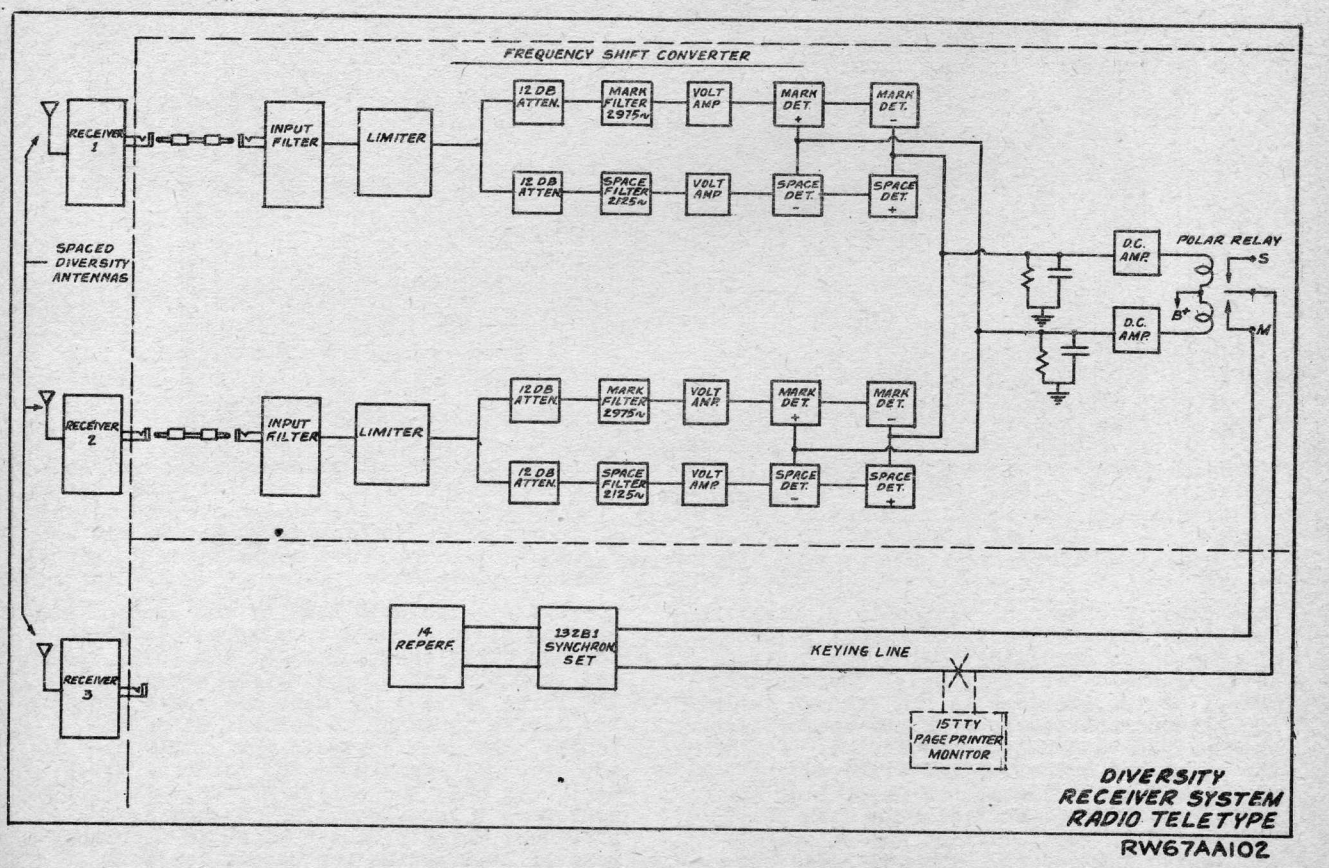

Figure 1-1 - Diversity Receiver System Radio Teletype.

creases to zero and begins to swing negative as 2550 cycles is passed. Move the positive lead from the voltmeter to terminal 1 of TB No. 3, adjust the oscillator frequency slightly to obtain maximum positive voltage, and reduce the space gain control until 10 volts is obtained. Shift the oscillator back to 2975 cycles, again observing the meter reading to decrease to zero as 2550 cycles is passed and swing negative as 2975 is approached. Return the positive lead to terminal 2 of TB No. 3 and check that 10 volts is still obtained. If not, make the necessary readjustments by decreasing both gain control settings until a point is reached where the adjustment of either does not affect the voltage controlled by the other. The final adjustment should preferably be between 8 to 10 volts although the unit will function on diode output voltages down to a minimum of 4.0.[1]

(2) Having completed the adjustment of Channel (A), repeat the process on Channel (B) by turning off (A) MONITOR CUT-OUT and turning (B) on. Channel (B) should be adjusted to provide exactly the same diode output voltage as did Channel (A).

(3) When the adjustment of Channel (B) is completed, set the oscillator at 2975 cycles and turn both MONITOR CUT-OUT switches ON. The relay current should remain at the same value (15 ma.) as obtained with only one channel running. If the current falls to zero ma. when both switches are ON, it indicates that the filters of one channel are reversed.

If any of the foregoing conditions cannot be met in preliminary testing of the equipment, refer to Section V - Maintenance. When tests are completed, assemble the unit in the cabinet, as shown in figures 2-5 and 2-6.

2. Installation

a. Receiver Requirements - The Converter will operate on the output of any type communication receiver equipped with a beat frequency oscillator. Obviously, stability and drift are the important criteria in the selection of a receiver that will provide reliable service and the minimum of operator adjustments. Three types of Navy receivers are particularly good in this regard and have been used successfully on operating circuits; preference is in the order listed: RBP, RBC and RDM.

b. Location of Converter - The Converter is normally mounted adjacent to the receivers with which it is used and there is no need for a special arrangement other than that the operator be able to see the tuning indicators and tune the receivers while his phones are plugged into the monitor jacks. There are no critical requirements as to the length of signal input or output keying lines. In existing shore installations the Converters have been used exclusively with RBP receivers (rack and panel type) and have been mounted at the end of the RBP bay in the same manner as is done with the FMA bay of the AN/FGC-1A. For such installations it is desirable to have the ship's carpenter construct a wooden cabinet about 30" high and of the same contour, width and depth as the Converter which will raise the unit to a height convenient for operation and give the appearance of a standard size rack.

c. Patch Panel - Five single circuit jacks are located on the filter panel and are used for selecting any two of the three receiving channels available in type RBP and RDM diversity receivers. This facilitates selecting the two receivers giving the best diversity action and also permits quick changeover in event of receiver failure or routine servicing.

d. Connection of RBP to Converter

(1) Input to the converter is obtained from the 500-ohm output transformer on the Monitor Detector of each receiver which feeds the monitor jacks in the Signal Control Panel. The center-tap of this transformer (T301) is grounded and must be opened since one side of the Converter input is grounded. T301 is physically located in the lower right hand corner (viewed from the rear of the receiver) of the I. F. Amplifier compartment at the base of each receiver bay. A long soldering lug connects the transformer center-tap directly to the chassis and it is simply lifted off with the aid of an iron. The output line from this transformer appears on the first three pairs of terminals (numbered 1, 2 and 3) on the left hand side of terminal strip TB No. 2 on the rear of the Signal Control Panel. Shielded two conductor lines are run from these terminals to the input terminal strip on the rear of the Converter filter panel, which is similarly numbered in pairs: 1, 2 and 3. The right hand terminal of each pair is the ground side and all are made common with the ground terminal at the far left side of the strip.

(2) Adjustment of BFO - To prevent detuning of the high frequency oscillator in order to obtain the beat frequencies required it is necessary to tune the existing BFO's in each receiver to the maximum possible difference frequency with the 50 kcs I.F. This is accomplished by loosely coupling the output of an LM or LP signal generator into the grid of V301, the first 450 kcs I.F. stage, placing the AF BEAT-ZERO BEAT switch on ZERO BEAT, then tuning the signal generator to obtain zero beat while listening at the monitor jack. The BFO switch is then thrown to AF BEAT and the padder condensers on the BFO 50 kcs Oscillator adjusted to obtain the maximum possible beat note. This results in the BFO being tuned to a frequency approximately 2300 cycles lower than the 50 kcs I.F., so that when the high frequency oscillator vernier is adjusted to provide the correct operating frequencies for the Converter, the signal is passed effectively through the center of the IF pass band. The switch is permanently left in the AF BEAT position for use with the Converter. The top of the BFO Oscillator is actually the mounting plate for the AF BEAT-ZERO BEAT switch and the padders are made accessible by simply slipping off the cover. In the event it would be desired to return the receiver to telegraph service and the

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[1] After placing the unit in operation on a circuit, the diode output voltage should be checked about once a month and any necessary readjustments made to compensate for inequalities of gain in the two channels that would arise due to aging of tubes.