

CLASS NOTES: HF Systems Week Seven (7-2-1)

TITLE: Introduction to the C-1138/UR Radio Set Control, Transmitter and Receiver Transfer Switchboards and the Receiving Antenna Distribution System

OBJECTIVES: Upon completion of this lesson you will be able to:

- A. State the purpose and Describe the operation of the C-1138/UR Radio Set Control
- B. State the purpose and Describe the operation of the SB-863/SRT Transmitter Transfer Switchboard and the SB-973/SRR Receiver Transfer Switchboard
- C. State the characteristics and Describe the operation of a Receiving Antenna Distribution System

I. C-1138/UR Radio Set Control

A. Purpose

1. The C-1138/UR Radio Set Control is the medium for remote operation of a standard shipboard radio transmitter and receiver. It provides the means to:

- a. Turn the Transmitter ON and OFF
- b. Voice modulate or key the output of the controlled transmitter
- c. Regulate the level of the Audio Output of the controlled Receiver

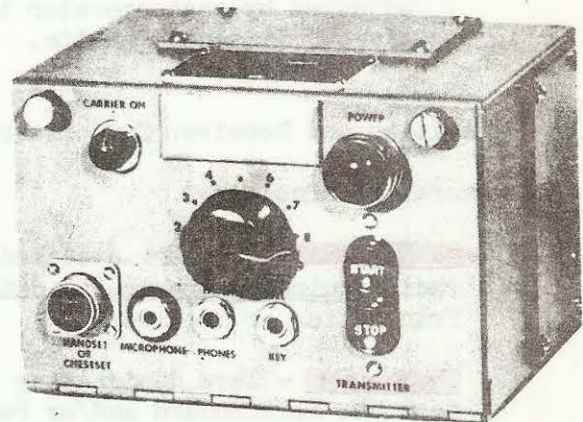
2. Commonly referred to as a RPU (Radiophone Unit)

- a. Each RPU will be assigned a NUMBER
- b. Often referred to on Patch Panels and Switchboards by PHYSICAL LOCATION (i.e., CIC #4, P.H. #6)

B. Operation

1. TRANSMITTER ON-OFF buttons

- a. To energize the controlled transmitter press the START button momentarily. This energizes the starting relay in the Transmitter and the POWER INDICATOR is illuminated.
- b. To de-energize the transmitter press the STOP button. This shorts the start relay coil de-energizing the starting relay and the POWER INDICATOR.



*Gotta Know Purpose*

## 2. TRANSMITTER INPUT circuits

- a. Depending upon what type of emission is being utilized, the operator may use a CW Key, handset, chestset or microphone.
- b. When voice modulation is used the operator must actuate the push-to-talk button on the microphone, handset or chestset he is using. This energizes the CARRIER ON indicator on the C-1138 indicating that the transmitter is in use.

## 3. EARPHONE LEVEL control

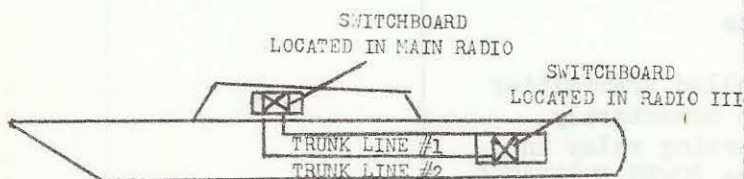
- a. Controls the volume of the receiver being utilized.
- b. The earphone level potentiometer is adjusted by each operator to suit his own listening habits.

## II. Transmitter and Receiver Switchboards

### A. General Terminology

1. **REMOTE STATION** - Term utilized to describe radio equipment physically detached from Transmitter or Receiver.
2. **TRUNK LINE** - Term designating line leading from one Switchboard and/or Patch Panel to another Switchboard and/or Patch Panel located in a physically separated space.
  - a. Trunk Lines are utilized to connect equipment output from one area to another.
  - b. USUALLY NUMBERED

#### EXAMPLE



3. TRANSFER PATCHING - Term designating the process of transferring control of one switchboard to another. Utilized when the number of transmitters or receivers are too numerous to be handled by one switchboard

B. SB-863/SRT Transmitter Transfer Switchboard

1. Purpose - Interconnects and Transfers Remote Stations output to Transmitter

2. Operation

- a. Each SB-863/SRT contains TEN 21 position rotary selector switches in two vertical columns
- b. Each Rotary Selector switch corresponds to a remote station or trunk line and each switch position (1 through 19) corresponds to a controlled transmitter or trunk line
- c. Position 20 of each Rotary Selector switch is provided for connection to an additional switchboard in cases where transmitters are too numerous to be handled by one SB-863/SRT (TRANSFER PATCHING)

ADD MORE SB 863 HORIZONTALLY FOR MORE THAN 10 STATIONS

ADD MORE SB 863 VERTICALLY FOR MORE THAN 10 REMOTE STATIONS

d. When the switchboard is installed, the remote stations and trunklines assigned to each Rotary Selector switch, and the Transmitters and trunk lines assigned positions 1 through 19, are engraved on engraving plates

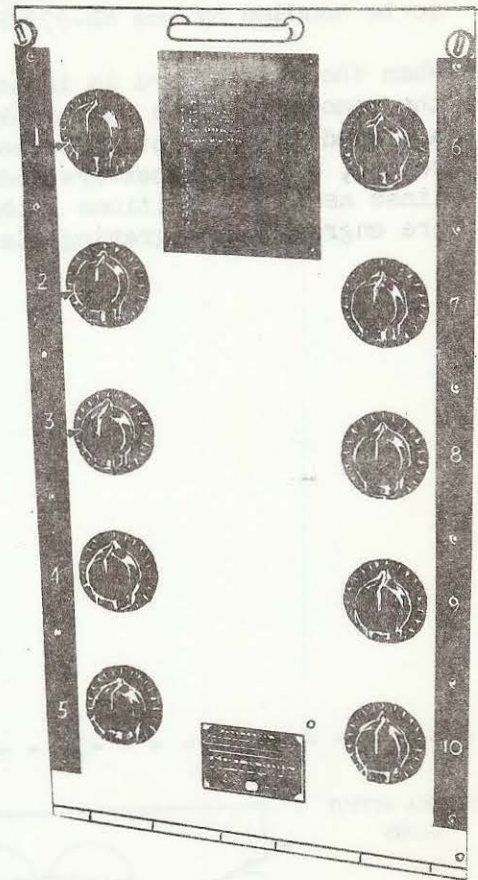
Position # 21 - OFF


C. SB-973/SRR Receiver Transfer Switchboard

1. Purpose - Interconnects and Transfers Receiver audio output to Remote Station

2. Operation

- a. Each SB-973/SRR contains ten 7 position rotary selector switches in two vertical columns
- b. Each Rotary Selector switch corresponds to a remote station or trunk line and each switch position (1 through 5) corresponds to a controlled receiver or trunk line
- c. Position "X" of each Rotary Selector switch is provided for connection to an additional switchboard in cases

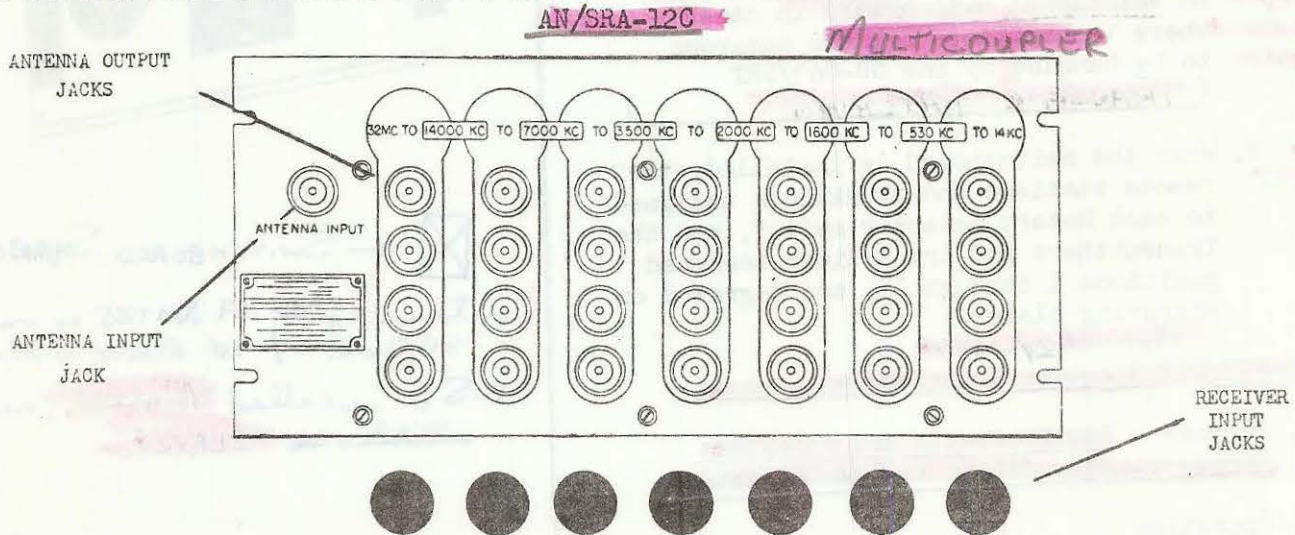
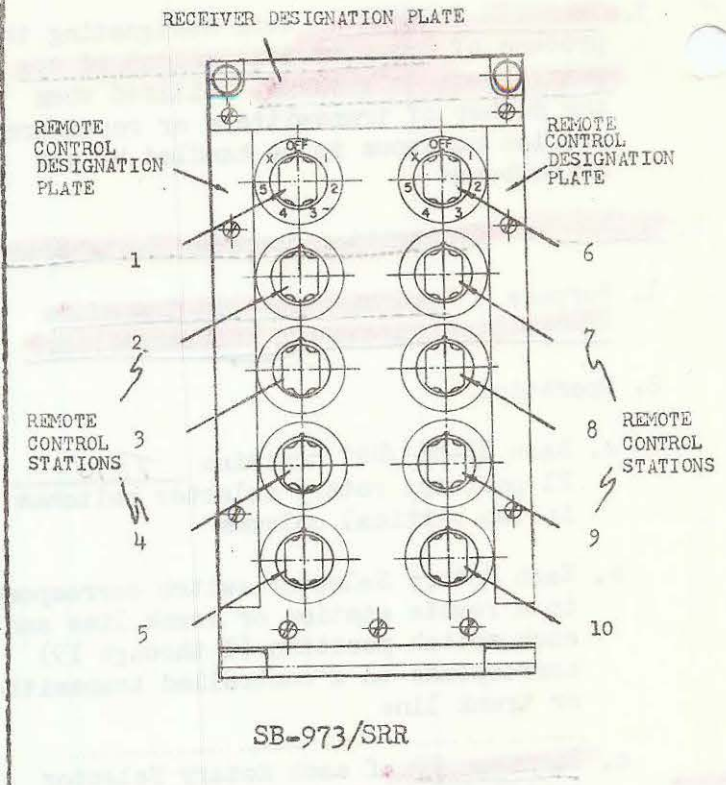


 ← SWITCHBOARD SYMBOL

Contains up to 19 REMOTES on one SB 863. & 10 REMOTE STATIONS  
1st SB is called "MASTER", next ones are "SLAVES"

where receivers are too numerous to be handled by one SB-973/SRR

- d. When the switchboard is installed the remote stations and trunk lines assigned to each Rotary Selector switch, and the Receivers and trunk lines assigned positions 1 through 5, are engraved on engraving plates



### III. Receiving Antenna Distribution System

#### A. Characteristics

1. Purpose - Enables multiple operation of a maximum of 28 radio receivers from a single antenna.
2. Commonly referred to as a Multicoupler

3. Contains seven (7) radiofrequency channels in the frequency range from 14 KHz to 32 MHz
4. Separation of the frequency range into channels is accomplished by combinations of filter subassemblies which accept only frequencies falling within their range while rejecting all others
5. Each channel consists of four (4) vertical antenna output jacks. The bottom jack in each row is CIRCLED RED to indicate that it is connected directly to the ANTENNA subassembly. The other three (3) jacks are separated from the subassembly by 300 Ohm resistors to prevent feedback

MAX SIGNAL STRENGTH  
(FOR DISTANT STATIONS)

#### B. Operation

1. Connection to the receivers are made by coaxial patch cords with quick-disconnect type RF connectors
2. Red jack should be utilized whenever maximum signal strength is desired
3. Input jacks for receivers will appear in close proximity to antenna output jacks
4. Using coaxial patchcord, connect one end to desired receiver input jack and other end to applicable antenna filter assembly jack

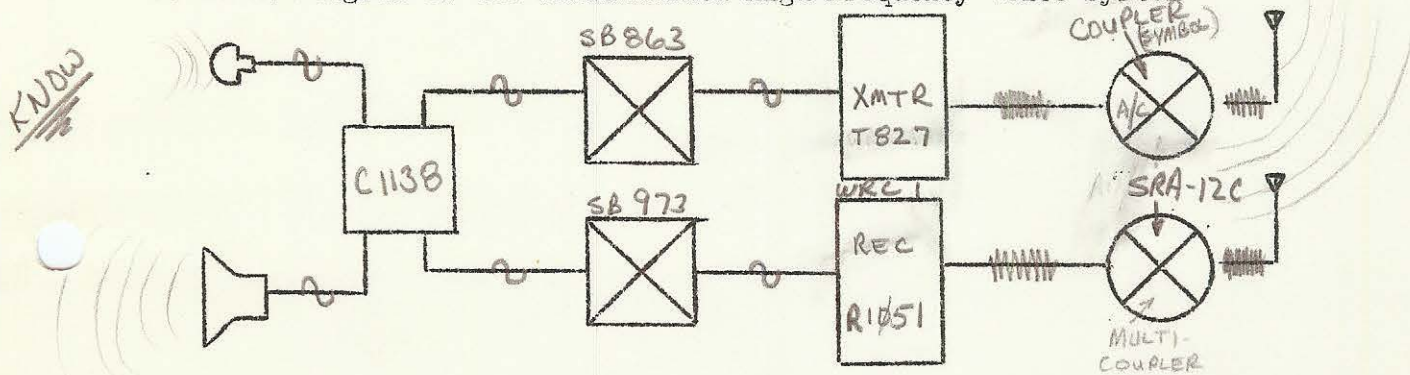
CLASS NOTES: HF Systems Week Seven (7-2-2)

TITLE: Introduction to the Unclassified High Frequency Voice System

OBJECTIVES: Upon completion of this lesson you will be able to:

- A. Draw a block diagram of an Unclassified High Frequency Voice System
- B. State the function of each component of the Unclassified High Frequency Voice System
- C. Indicate input and Output waveforms of each component of the Unclassified High Frequency Voice System

I. Block Diagram of the Unclassified High Frequency Voice System



II. Component Function and Input and Output Waveforms Produced

A. Transmit Operation

1. Microphone (Source Transducer)

a. Function - Converts mechanical energy into electrical energy

b. Waveform

(1) Input - Sound Wave

(2) Output - AF

2. C-1138/UR Radio Set Control

a. Function - Enables control of a Transmitter or Transceiver from a remote position

b. Waveform - Input and Output: AF

3. SB-863/SRT Transmitter Transfer Switchboard

a. Function - Interconnects and Transfers remote stations output to Transmitter

b. Waveform - Input and Output: AF

4. Transmitter or Transceiver

a. Function

(1) MODULATES, AMPLIFIES

(2) Transmission

b. Waveforms

(1) Input - AF

(2) Output - RF

5. Antenna Coupler

a. Function - Electrically matches antenna to transmitter output

(1) Inductance INCREASES

(2) Capacitance DECREASES

b. Waveforms - Input and Output: RF

6. Transmitting Antenna

a. Function RADIATION

b. Waveforms - Input and Output: RF

B. Receive Operation

1. Receiving Antenna

a. Function - Interception

b. Waveforms - Input and Output: RF

2. Receiving Antenna Distribution System

a. Function - Enables multiple receiver operation while utilizing single antenna input

- b. Waveforms - Input and Output - RF
- 3. Receiver or Transceiver
  - a. Function
    - (1) Reception (FREQ. SELECTION)
    - (2) DEMODULATION, AMPLIFICATION
  - b. Waveforms
    - (1) Input - RF
    - (2) Output - AF
- 4. SB-973/SRR Receiver Transfer Switchboard
  - a. Function - Interconnects and transfers receiver audio output to remote station(s)
  - b. Waveforms - Input and Output: AF
- 5. C-1138/UR Radio Set Control
  - a. Function - Regulates the level of the audio output of the receiver earphones
  - b. Waveforms - Input and Output - AF
- 6. Speaker (Information Transducer)
  - a. Function - Converts electrical energy into mechanical energy
  - b. Waveforms
    - (1) Input - AF
    - (2) Output - Soundwave



CLASS NOTES: HF Systems Week Seven (7-3-1)

TITLE: Introduction to the Types and Methods of Teletype Communications, the AN/URA-17 Converter/Comparator Group and the SB-1203/UG General Purpose Teletype Patch Panel

OBJECTIVES: Upon completion of this lesson you will be able to:

- A. Explain the Types and Methods of Teletype Communications utilized in the Navy today
- B. State the characteristics of the AN/URA-17 Converter/Comparator Group
- C. Locate, Identify and State the functions of the front panel controls and indicators of the AN/URA-17 Converter/Comparator Group
- D. State the characteristics and describe the operation of the SB-1203/UG General Purpose Teletype Patch Panel

I. Types and Methods of Teletype Communications

A. Types

1. Audio Frequency Tone Shift (AFTS) - System which converts DC Mark and Space pulses from a teletype into corresponding audio tones, which AMPLITUDE MODULATES the transmitter

← UHF SYSTEMS

- a. Formerly referred to as TONE MOD RATT
- b. Normally utilized for SHORT RANGE teletype communications

2. Radio Frequency Carrier Shift (RFCS) - System which shifts the frequency of the transmitter corresponding to the DC Mark and Space pulses from a teletype. ~~The frequency will be shifted to a certain frequency for a Space signal and a few hundred cycles higher for a Mark signal~~

← HF SYSTEMS

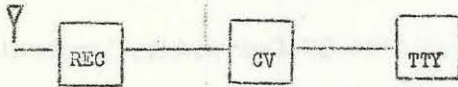
SHIFTS 425 ABOVE &  
425 BELOW

- a. Formerly referred to as FREQUENCY SHIFT KEYING (FSK)
- b. Normally utilized for long range teletype communications

## B. Methods

### 1. Single Receiver Method

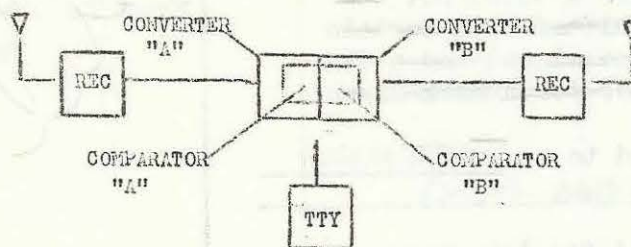
- a. Description - A single receiver is tuned to the designated RF frequency. The audio output of the receiver is applied to a converter where it is RECTIFIED and sent to a teletypewriter.
- b. Advantage - Minimal equipment requirement



### 2. Diversity Method

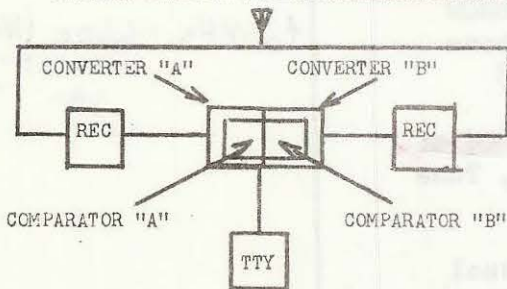
#### a. Space Diversity Operation

- (1) Description - Two receivers are tuned to the same designated RF frequency but their receiving antennas are spaced several wavelengths apart. The audio output of each receiver is applied to a separate converter where it is rectified. These DC pulses are then applied to a comparator circuit in each converter. The comparator circuits continuously select the stronger of the two signals present, and allows only that signal to pass to the teletypewriter.
- (2) Advantage - Maximum fading of a given frequency usually does not coincide in time at points so separated
- (3) Utilization - SHORE STATIONS

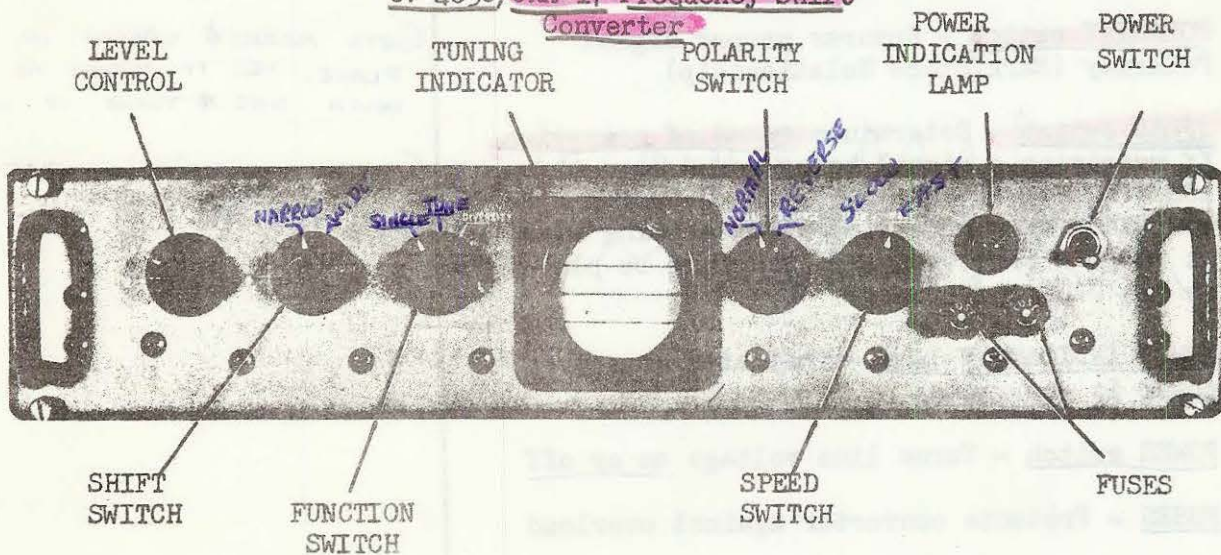


b. Frequency Diversity Operation

- (1) Description - Two receivers are tuned to different RF frequencies, both containing the same intelligence. The audio output of each receiver is applied to a separate converter where it is rectified. These DC pulses are then applied to a comparator circuit in each converter. The comparator circuits continuously select the stronger of the two signals present, and allow only that signal to pass to the teletypewriter.
- (2) Advantage - Maximum fading of two different carrier frequencies seldom occur at the same time in a given location
- (3) Utilization - SHIPBOARD



CV-483C/URA-17 Frequency Shift Converter



## II. Characteristics of the AN/URA-17

- A. Composition - Two Frequency Shift Converters  
CV-483C/URA-17
- B. Purpose - Convert the audio output of a receiver into corresponding Mark and Space DC Pulses (RECTIFICATION)
- C. Description - Each converter is installed in a navy gray aluminum cabinet. A handle is provided on each side of the front panel

## III. AN/URA-17 Front Panel Controls and Indicators

- A. LEVEL control - Adjusts the amplitude of the incoming signal
- B. SHIFT switch - Determines desired shift of incoming signal. If copying a frequency below 2 MHz place shift switch to NARROW position, if frequency is 2 MHz or above shift switch should be placed in WIDE
- C. FUNCTION switch - Determines the Method of Converter Operation (Single Receiver, Tune or Diversity)
- D. TUNING indicator - Allows a quick visual signal presentation for receiver tuning.  
(CATHODE RAY TUBE)
- E. POLARITY switch - Ensures proper signal Polarity (Mark/Space Relationship)
- F. SPEED switch - Determines speed of operation. If receiving a signal being keyed less than 100 WPM, switch should be placed in the SLOW position. When receiving signals being keyed at 100 WPM or above, switch should be placed in the FAST position.
- G. POWER INDICATION lamp - Indicates source of power is energized
- H. POWER switch - Turns line voltage on or off
- I. FUSES - Protects converter against overload

IT TAKES 2 FREQ. SHIFT CONVERTERS TO MAKE ONE URA-17.

↓ 2 MHz - NARROW (500 Hz PASS)  
↑ 2 MHz - WIDE (1000 Hz PASS therefore 850 Hz CAN PASS)

GETS MARKS & SPACES IN PROPER PLACE. I.E. IT TAKES AN UPSIDE DOWN ONE & TURNS IT OVER.

← 100 WPM OR ABOVE - FAST  
LESS THAN 100 WPM - SLOW

## IV. SB-1203/UG General Purpose Teletype Patch Panel

### A. Characteristics

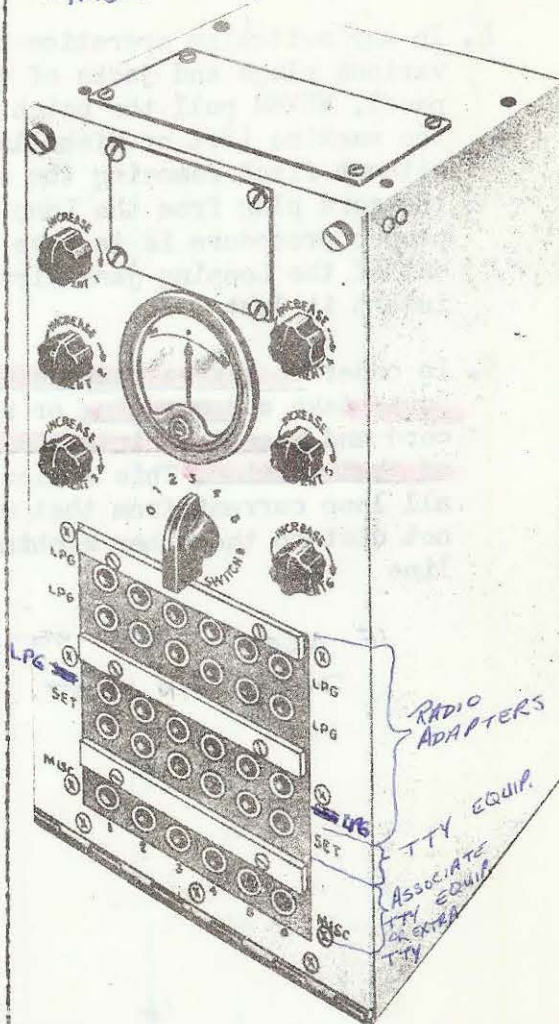
- ★ 1. Purpose - Interconnects and transfers teletype equipment to various radio adapters, such as transmitters and converters
  2. Description - The SB-1203/UG contains six channels. Each channel consists of THREE Looping jacks, a Set jack, and a Rheostat for adjusting line current. Each panel includes a Meter and Rotary Selector switch for measuring line current in any one channel. Any teletype equipment not regularly assigned to a channel may be connected to six Miscellaneous jacks.
    - a. Radio Adapters will appear as Looping jacks (LPG) XMTRS, URA-17, ETC.
    - b. Teletype Equipment will appear as SET JACK
    - c. Associate Teletype equipment and/or teletype equipment too numerous to be handled by Set jacks will appear as Miscellaneous jacks (MISC)
3. Commonly referred to as the BLACK or UNCLAS Patch Panel

### B. Operation

1. Turn the Meter Selector switch to the desired channel and adjust the corresponding rheostat to give a line current indication of 60 MA. Return Selector switch to 0.
2. Find Teletype equipment desired in either Set or Miscellaneous jack. Insert one end of patch cord into selected jack, insert other end of patch cord into appropriate Loop jack for radio adapter desired.
3. If the desired Teletype equipment appears as a Set jack and is wired in the same Looping channel as the Radio Adapter to be utilized, no patch cords are required (HARDWIRED)

MISC. JACK IS NOT HARDWIRED

BLOCK  
DIAGRAM  
SYMBOL - X



RHEOSTATS INCREASE OR DECREASE RESISTANCE, & INCREASE OR DECREASE CURRENT.

HARDWIRE - ELIMINATES PATCH CORDS. LESS CONFUSION.

SET METER SELECTOR TO CHANNEL WHERE LOOP IS COMING FROM.

ALWAYS PATCH SET TO LPG OR MISC TO LPG.

ALWAYS UNPATCH LPG TO SET OR LPG TO MISC.

4. In any switching operation between the various plugs and jacks of a teletype panel, NEVER pull the patch plug from the machine (Set or Miscellaneous) jack without first removing the other end of the cord plug from the Loop jack. The proper procedure is to take the plug out of the Looping jack first, and to insert it last

5. In order to take a machine out of a Loop, take a dummy plug or a patch cord and insert it into the Set jack of that machine. This action will remove all loop current from that machine and not disturb the other machines in the line

IF NEED LPS TO MISC., PUT  
DUMMY IN SET.

UNPATCH LPS FIRST &  
PATCH LAST.