CHAPTER 7

EW RECORDING DEVICES

Electronic warfare recording devices are as valuable to the ESM operator as they are to the analyst. They are used to record ESM and ECM information to be forwarded to the ELINT center for analysis. They are also excellent tools for training operators.

The EW recording devices covered in this chapter are magnetic tape recorders and cameras used to photograph the analysis scope.

RECORDER-REPRODUCER SET, AN/UNQ-7D

The AN/UNQ-7D Sound Recorder-Reproducer Set is a dual-track, magnetic tape recorder and reproducer which may be operated at any one of three tape speeds, 3.75, 7.5, or 15 ips (inches per second). Electrical signals falling within the normal audio frequency spectrum may be recorded on this equipment and this information either reproduced immediately or stored for an indefinite period of time. Recording and reproducing can be accomplished simultaneously, or the reproducing function can be performed subsequent to the recording process. Two information channels are provided: Channel A for voice and reference/tone and Channel B for recording data information. The equipment consists of three main components—an equipment cabinet, a tape transport, and a recorder-reproducer sound control.

CY6094/UNQ-7D CABINET, ELECTRICAL EQUIPMENT

This equipment consists of a cabinet assembly in which the tape transport and the following electronic assemblies are mounted: A record amplifier, two reproduce power amplifiers, a bias and erase oscillator, two reproduce preamplifiers and a power supply. With the exception of parts of the power amplifiers and power supply, all of these assemblies are self-contained modular components which plug into rack mounted receptacles within the cabinet. These receptacle connectors form part of the mounting tray, thus providing inter-connection as well as mounting support for the electronic assemblies.

RD259/UNQ-7D RECORDER-REPRODUCER, SOUND (TAPE TRANSPORT)

The tape transport, mounted on slides within the cabinet, is used to transport the magnetic recording tape past the head assembly, which is mounted on the front of the transport between the supply reel and the take-up reel. Three tape speeds are selectable, 3.75, 7.5, and 15 ips plus fast forward and rewind speeds. The transport control assembly, a part of the recorder-reproducer, contains the electronic parts, relays, etc., that control the operation of the recorder-reproducer. A three-digit counter with reset knob provides an indication of tape usage. Local operation of the equipment is accomplished by the controls located on the front panel. These controls include the MODE SELECTOR switch and the TAPE SPEED selector switch. A bias defeat switch, located on the chassis of the transport control assembly, permits removal of the bias signal from Channel B for certain applications.

C4957/UNQ-7D CONTROL SOUND RECORDER-REPRODUCER

This section is used to control the entire equipment operation, including the RECORD mode, once the tape threading is complete, system power is applied and the desired tape speed has been selected. The sound control permits the equipment to be placed in RECORD, REPRODUCE, FAST FORWARD, REWIND or STOP, from a remote location. Controls that govern system operation are located on the front panel of the sound control. There is also an AGC (automatic gain control) defeat switch, located inside the cabinet used to disable the AGC circuit in Channel B when necessary for certain applications.

The following electronic assemblies are mounted within the sound control cabinet: Record preamplifier, horizontal oscillator, vertical deflection, and display assembly. These assemblies are plug-in modules easily removed for servicing or replacement. A speaker is mounted inside the rear of the sound control to provide aural indication for either channel selected by a control switch located on the front panel. The chassis has a plug connector which mates with a matching receptacle inside the cabinet. This allows removal of the chassis from the cabinet and permits insertion of a service extender board during maintenance procedures. The sound control service extender board is stored inside the cabinet underneath the chassis assembly. A service extender board, also stored inside the chassis assembly, can be used to service the four plug-in modules.

EQUIPMENT ACCESSORIES

Each complete set of equipment is furnished with several accessories to assist in performing certain maintenance functions. These accessories and their function are as follows: An alignment tape from which previously recorded test data may be reproduced for the purpose of checking and/or alignment of the equipment electronics; a head demagnetizer for degaussing the head assembly and the tape guides with which the tape comes in contact; a tape splicer used in the repair of magnetic tape or when the tape is deliberately cut for the purpose of editing; and two empty 7-inch reels.

These accessories are stored in the maintenance kit container. Also included in the container are two extender service assemblies used to service the bias oscillator, power amplifiers, reproduce preamplifiers, and record amplifier modules; and a cable assembly extension to service the power regulator module.

OPERATING CONTROLS AND INDICATORS

Operating controls and indicators for the UNQ-7D are shown in figures 7-1 and 7-2. Their designations and purposes are listed in table 7-1. Additionally, two monitoring jacks (one for Channel A and one for Channel B) are located on the front panel of the amplifier assembly.

OPERATION

To operate the AN/UNQ-7D, first place a full reel of tape on the left-hand turntable and an empty reel on the right-hand take-up turntable. The reels should be the same size and both must have 2 1/4-inch hub diameter. Thread the tape as shown in figure 7-3. Then:

- Place the POWER switch to the ON position. The power light should come on and the capstan start to turn. Allow a 30-second warmup period before recording or reproducing.

- Select the tape speed desired by placing the TAPE SPEED switch in the appropriate position. For EW purposes, record at 15 ips.

- Set the amplitude on both channels. Place the CHANNEL SELECTOR switch on A, and while speaking into the microphone observe the vertical amplitude display on the face of the record level indicator. Adjust the RECORD LEVEL control until the signal peaks in the space between the upper and lower horizontal lines. Move the CHANNEL SELECTOR switch to B. With a signal coming into the channel, adjust the amplitude on Channel B as described for Channel A.

- Reverse the position of the CHANNEL SELECTOR switch and repeat the above procedure for the other channel.

- The equipment is now ready to record. To start the recording process, hold the

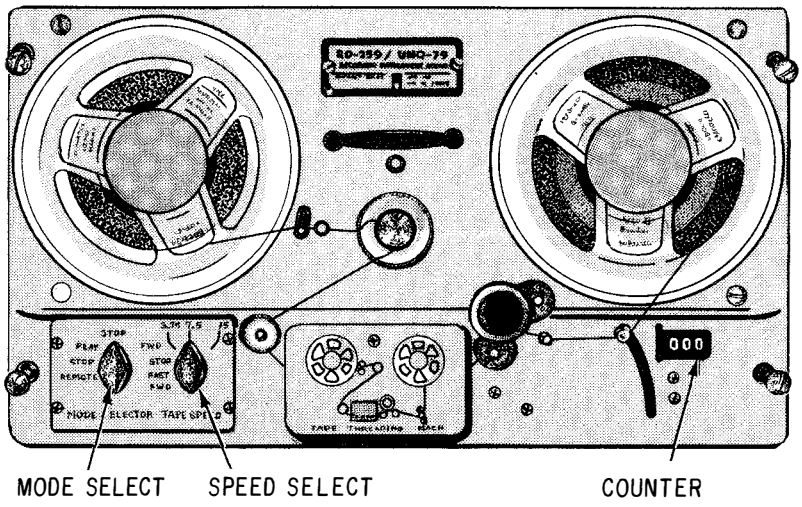

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Figure 7-1.—Operating Controls, Recorder-Reproducer.

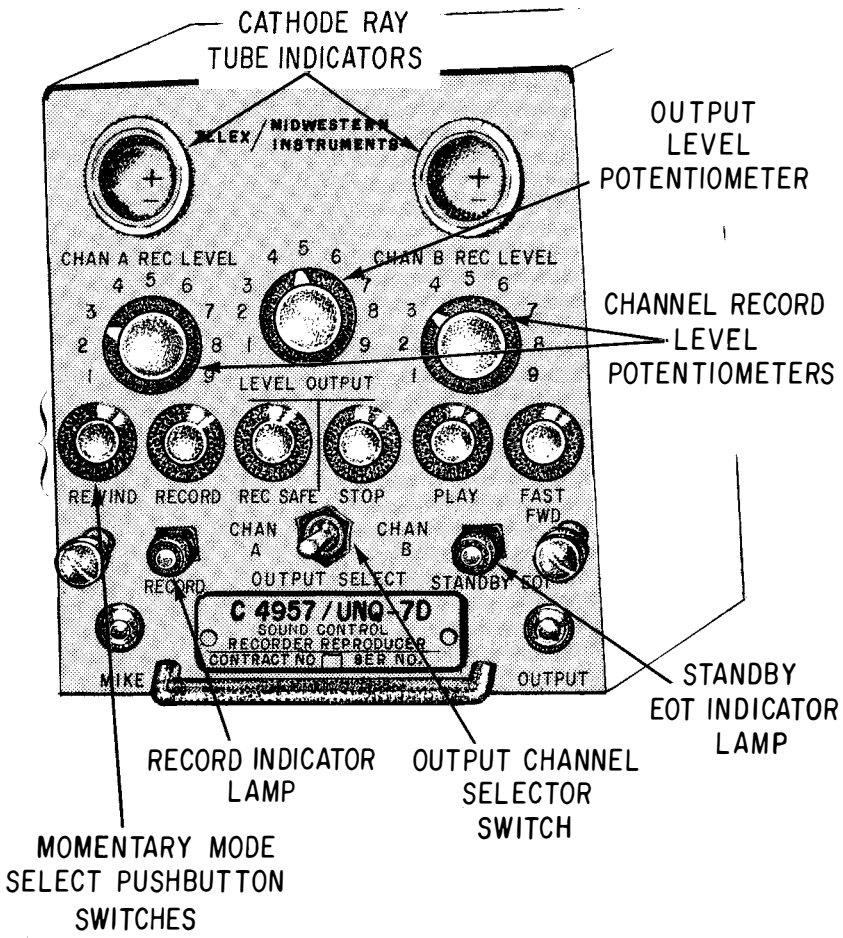

Figure 7-2.—Operating Controls, Sound Control.

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Table 7-1.—Operating Controls and Indicators

CONTROLS/INDICATORS	FUNCTION	NORMAL POSITION OR INDICATION
	Recorder-Reproducer Figure 7-1	
Power Switch	Controls power to the Recorder-Reproducer.	"ON" or "OFF" as desired.
PWR Indicator Lamp	Indicates that power is applied to equipment.	Illuminates when PWR switch is "ON."
MODE SELECTOR	Selects desired mode of operation.	As desired.
TAPE SPEED	Selects 3.75, 7.5 or 15-inches per second tape speed.	As desired.
Tape Counter	Indicates number of feet of tape used.	Set to 000 when new reel of tape is installed.
	Sound Control Figure 7-2	
CHAN A REC LEVEL	Controls the record level gain for Channel A.	See text
CHAN B REC LEVEL	Controls the record level gain for Channel B.	See text
LEVEL OUTPUT	Controls output gain of either the built-in speaker or the headset, whichever is used.	As desired.
REWIND Mode Switch	Used to rewind tape at high speed from the take-up onto the supply reel.	Depressed when in use.
RECORD Switch	Initiates the record mode of operation.	Depressed when in use.
REC SAFE	Used as a safety or interlock switch to be depressed at the same time the record switch is depressed, for record mode.	Depress with record switch.
STOP Switch	Used to stop tape movement.	Depressed when in use.
PLAY Switch	Used to playback recorded information.	Depressed when in use.
FAST FWD	Drives tape forward onto take-up reel at high speed.	Depressed when in use.
RECORD Light	Indicates equipment in record mode.	Illuminated when in record.
OUTPUT Select Switch	Selects Channel A or B as desired.	As desired.
STANDBY - E.O.T. Light	Indicates system in standby or end of tape is reached.	Illuminates steady when in standby and flashes when within 5-minutes at E.O.T.
Cathode Ray Tube, Indicators	Indicates the record level of both Channel A and Channel B.	Optimum level is indicated when vertical trace barely touches top and bottom reference marks.

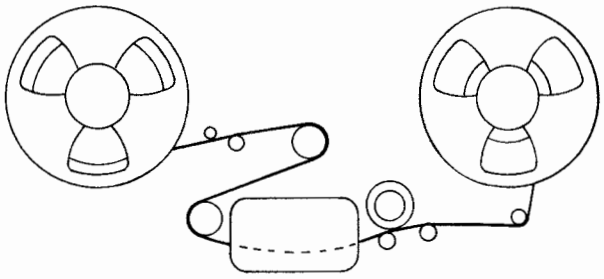

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Figure 7-3.—Tape Threading Path.

RECORD SAFETY INTERLOCK to the left and place the RECORD switch in its 1 position. The tape should be set in motion and the RECORD INDICATOR (green) light should be illuminated. Reset the RECORD LEVEL controls if necessary.

Recording can be stopped at any time by pushing the STOP button, which places the equipment in the standby condition. Under normal operating conditions the tape drive stops automatically at the end of a reel or if the tape breaks. When you use this recorder for ESM recordings, tape speed should be set for 15 ips. This speed provides a recording frequency range of 50-20,000 Hz. The 7.5 ips speed provides a recording frequency range of 50-10,000 Hz and may be used in an emergency if there is a trouble in the recorder precluding the use of the 15 ips speed. The use of the 3.75 ips speed provides a recording frequency range of only 50-5000 Hz. This frequency range is undesirable and inefficient for ESM work. As a rule of thumb you should remember that the faster the tape speed, the better the frequency response and the recording quality. Special care should be taken with the audio and IF gains when recording ESM intercept signals. Often the signal is overdriven which distorts the recorded signal, making it difficult to obtain beam-width estimates and scan rates.

Recording from the Remote Position

The remote control assembly provides the ESM operator with facilities for placing the equipment in the RECORD mode from the remote position. The previously mentioned operation steps should be followed. The switches on the remote control assembly will then control operation of the set.

An understanding of the indicating lights on the remote control assembly is necessary for proper operation. The STANDBY light only indicates that power is applied and that tape is threaded properly. It does not indicate that the proper tape speed has been selected nor that the recording levels have been adjusted. Neither the STANDBY nor RECORD light will illuminate if the power is not applied, the tape is not properly threaded, or if the equipment is being used to reproduce a previously recorded tape.

The RECORD light indicates that the equipment is in the RECORD mode either at the remote control unit or on the equipment itself.

The STANDBY-E.O.T. (end of tape) light is an amber full dimmer type light located below the PLAY mode switch. This light is illuminated any time the STOP mode switch has been depressed, thus placing the system in standby. The light will blink on and off any time the E.O.T. switch has been actuated. The E.O.T. switch is actuated approximately 5 minutes before the end-of-tape is reached when operating at 7.5 ips.

Reproducing Operation

To reproduce a tape:

- Thread the tape as before.
- Place POWER switch in the ON position, allowing a 30-second warmup period.
- Select the proper tape speed.
- Push the PLAY button.
- Adjust the LEVEL OUTPUT control for desired level.
- To stop reproduction, push the STOP button.

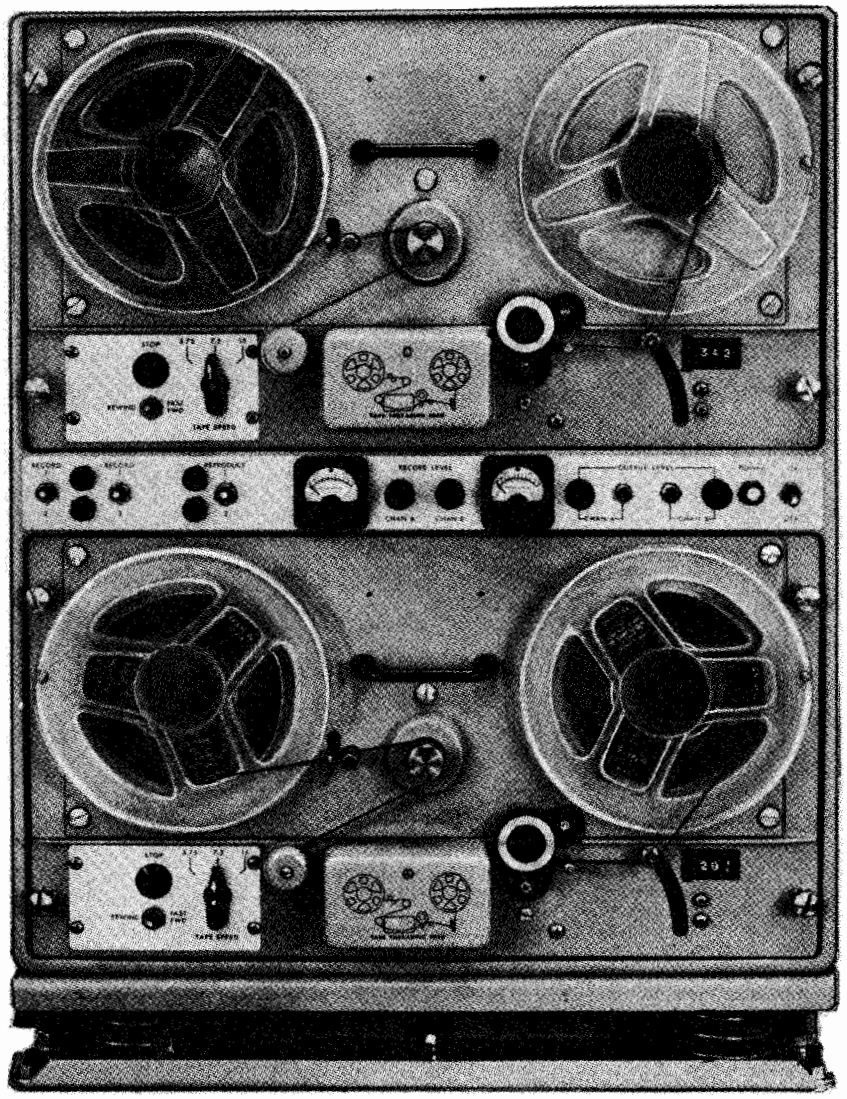

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Figure 7-4.—Operating Controls, Recorder-Reproducer.

Rewinding and Forward Operation

Tape that is threaded and not already in motion, can be moved at about 300 ips in either the forward (FAST-FWD) or reverse (REWIND) direction by placing the switch in the desired position.

Models (mods) -7A, -7B, -7C, -7D and -7E of the basic set UNQ-7 are installed on some ships for the purpose of recording EW information.

RECORDER-REPRODUCER AN/UNQ-7E

The AN/UNQ-7E (see figures 7-4 and 7-5) is a relatively new magnetic tape recorder used on surface ships. It consists of two dual track recorder-reproducers which can operate at 3.75, 7.5, and 15 ips. Recording and reproducing can be accomplished simultaneously on the same transport. One transport can record while the other reproduces pre-recorded data. The two information channels that are provided on each transport are the same as explained earlier in the chapter.

The primary advantage of the AN/UNQ-7E is the two tape transports. Due to equipment design, recording can be accomplished on only one transport at a time. The second transport however, can be in the ready or standby position with tape threaded and can be activated by the flip of a switch. This design greatly reduces or eliminates an intercepted signal not being recorded because a single transport has run out of tape and not been reloaded.

AN/UNQ-7E CABINET, ELECTRICAL EQUIPMENT

This unit (figure 7-4) consists of a cabinet assembly in which two tape transports and the following electronic assemblies are installed: a Channel A and B record preamplifier, a Channel A and B record amplifier, two reproduce preamplifiers, a Channel A and B reproduce amplifier, a bias and erase oscillator and a power supply. The record preamplifier incorporates a manually operated AGC defeat switch for disabling the Channel B AGC circuit during certain recording applications. All of these assemblies, with the exception of parts of the power supply and the power amplifiers, are self-contained modular components which plug into rack-mounted receptacles within the cabinet.

CONTROLS AND INDICATORS ON EQUIPMENT CABINET

All functions of the recorder-reproducer set, with the exception of the Channel B bias defeat and AGC defeat, can be controlled from the front of the equipment cabinet. A two-position toggle switch is used to turn the a.c. power OFF and ON. All other function control switches on the front of the unit are three-position, center OFF, momentary contact toggle switches. One tape transport can record while the other reproduces pre-recorded data, and one can record or reproduce while the other is in either the FAST FORWARD or REWIND mode of operation. The controls also facilitate any combination of simultaneous FAST FORWARD and REWIND operation of the two tape transports. A three-position, rotary speed selection switch, a momentary, push-action STOP button, and a FAST FORWARD-REWIND toggle switch are located just below the supply reel on each transport. The following jacks, level controls, and indicators are also located on the front of the cabinet: Channel A and B RECORD LEVEL VU meters and RECORD LEVEL controls, Channel A and B output jacks and OUTPUT LEVEL controls, RECORD and REPRODUCE indicator lights for Tape Transports 1 and 2, and a POWER ON indicator light. All five indicator lights have mechanical dimmer mechanisms.

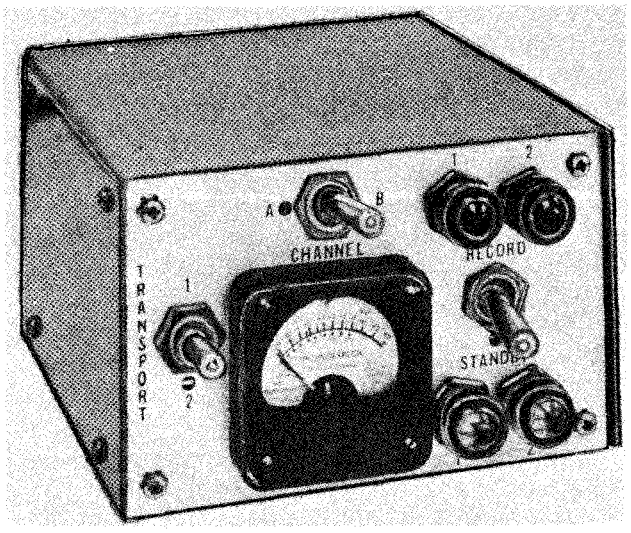

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Figure 7-5.—Remote Control Unit.

TAPE TRANSPORTS

Two identical tape transports (1 and 2) are mounted on slides, one above the other in the electrical equipment cabinet, and are used to transport magnetic recording tape past the head assemblies which are mounted on the front of each transport between the supply and take-up reels. These units can be operated at speeds of 3.75, 7.5, and 15 ips for RECORD and REPRODUCE. For FAST FORWARD and REWIND they operate at 300 ips averaged over 1200 feet of tape. Each tape transport has a control assembly that contains the electronic parts, relays, etc., that control the operation of the individual tape transports. A bias defeat switch, located on the chassis of the control assembly, permits removal of the bias from Channel B. A three-digit counter with reset knob is located on the front of each tape transport and provides an indication of tape usage.

REMOTE CONTROL UNIT (RCU)

The Remote Control Unit (RCU) permits operation of the RECORD function of either tape transport at locations away from the equipment cabinet. This unit (figure 7-5) contains the following controls and indicators: One three-position, center OFF, TRANSPORT selector switch; one two-position, RECORD-STANDBY switch; two RECORD lamps; and two STANDBY lamps. A record level VU meter and a two-position selector switch for monitoring the record level of Channel A or B are also included on the RCU.

EQUIPMENT ACCESSORIES

Each complete set of equipment is furnished with several accessories to aid in performing certain maintenance functions. These accessories and their functions are as follows: An alignment tape from which previously recorded test data may be reproduced for the purpose of checking or alignment of equipment electronics; a head demagnetizer for degaussing the head assembly and the tape guides with which the tape comes in contact; a tape splicer used in the repair of magnetic tape or when the tape is cut for the purpose of editing; and two empty 7-inch reels. Also included in the equipment package are two extender service assemblies, one extender board assembly for servicing all record and reproduce amplifier modules, and one extender cable assembly for servicing the bias oscillator and power regulator modules.

FUNCTIONAL OPERATION

The AN/UNQ-7E Recorder-Reproducer Set is designed as a dual tape transport to record and reproduce audio frequencies on standard 1/4-inch magnetic recording tape. Two separate channels or "tracks" are used simultaneously on one transport or the other. Channel A, the longitudinal section of the tape, or "strip" nearest the machine, is used to record voice and reference tone, and Channel B, the strip on the outside of the tape, is used to record data information. There are three inputs on Channel A: Microphone, Line, and Bridging; and Channel B has two inputs: Line and Bridging. Recording can be accomplished on only one transport at a time. Previously recorded information on one transport can be played back at the same time other information is being recorded on the second transport.

All functions of the recorder-reproducer set can be operated at the front of the equipment cabinet. The RECORD and STOP functions can be operated at the RCU.

All toggle switches on the front of the recorder-reproducer cabinet are of the three-position, momentary-ON, center-OFF type with the exception of the POWER switch which is a two-position ON-OFF type. The associated numbers 1 and 2 refer to the upper and lower tape transports respectively. The functions of these switches and other controls and indicators are tabulated in tables 7-2 and 7-3.

The RECORD function is initiated at the recorder-reproducer by simultaneously operating the two RECORD switches to position 1 or 2 depending on transport selected. When initiating

Table 7-2.–Equipment Cabinet Operating Controls and Indicators

CONTROLS/INDICATORS	FUNCTION	NORMAL POSITION OR INDICATION
Power Switch	Controls Power to Recorder-Reproducer	ON or OFF
Power Indicator Lamp	Indicates when power is applied to equipment	Illuminated white when power is ON
Tape Speed (1 on each tape transport)	Selects either 3.75, 7.5 or 15 ips.	As desired
Stop Button (1 on each tape transport)	Stops tape. NOTE Stop button must be activated before change of operational mode.	Momentarily depressed
Fast FWD-REW switch (1 on each tape transport)	Initiates Fast Forward and Rewind	Center OFF
Tape Counter (1 on each tape transport)	Counts from zero to indicate tape usage	Setting of 000
Record switch (2)	Initiates Record function on tape transport 1 or 2, when actuated simultaneously	Center OFF position
Record lights (2)	Indicates when tape transport 1 or 2 is in Record mode.	Illuminates red during RECORD function
Reproduce switch	Initiates Reproduce function on tape transport 1 or 2.	Center OFF
Reproduce lights (2)	Indicates when tape transport 1 or 2 is in Reproduce mode.	Illuminates green during Reproduce function.
Channel A record Level Control	Controls Channel A record Signal level.	Not applicable
Channel B Record Level Control	Controls Channel B record Signal level.	Not applicable
Record Level VU Meters (2)	Indicates level of record signal.	Proportional to signal
Channel A output Level Control	Controls level of output signal in Reproduce mode.	Not applicable
Channel B output Level Control	Controls level of output signal in Reproduce mode.	Not applicable
Channel A and B output jacks.	See Paragraph 2.8	Not applicable

Table 7-3.—Remote Control Unit Operating Controls and Indicators

CONTROLS/INDICATORS	FUNCTION	NORMAL POSITION OR INDICATION
Transport Selector Switch	Locks out local control of transport 1 or 2 and prepares transport for record function.	Center off
Record-Standby Switch	Initiates Record function on transport selected by Transport Selector switch.	Standby
Standby 1 lamp	Indicates Tape Transport 1 is in Standby mode, or nearing end of tape	Illuminates steady amber when in standby and flashes when near end of tape.
Standby 2 lamp	Same as above for Tape Transport 2	Same as above
Record Level VU meter	Indicates level of record signal for either tape transport selectively.	Proportional to signal
Channel A or B Switch	Selects channel to be monitored by VU meter.	At either A or B
Record 1 lamp	Indicates when Tape Transport 1 is in Record mode.	Illuminates red
Record 2 lamp	Indicates when Tape Transport 2 is in Record mode.	Illuminates red

the RECORD function at the RCU, the transport selector switch must be operated before the RECORD-STANDBY switch can control the RECORD function.

The Channel A and Channel B record levels, are set by the RECORD LEVEL controls on the recorder-reproducer control panel. It is not necessary to be in the RECORD mode of operation to obtain record level indications.

The STANDBY lamps located on the RCU will illuminate continuously when tape is threaded and transports are in the STOP position. The lamps also act as end-of-tape indicators by flashing when a transport is within 5 minutes of end of tape. This 5 minute warning is based on a tape speed of 7.5 ips. The time to end of tape will vary proportionately for the other tape speeds of 3.75 and 15 ips.

The meter on the RCU is used to monitor Channel A or B depending on the position of the Channel A-Channel B selector switch.

Pre-operation Instructions

Before operating the equipment, perform the following steps:

1. Rotate all dimmer mechanisms on indicator lights counterclockwise to the full open position.

2. Turn POWER switch, on the central control panel, to ON. Observe that the white POWER light is illuminated.

3. Install a full reel of tape on the supply turntable of Tape Transports 1 and 2. Place an empty reel on each take-up turntable. Thread the tape from the supply reel, through the tape head (figure 7-3) and onto the take-up reel. Perform this operation on both tape transports.

4. Set both tape counters to 000.

5. Set speed selector on tape transports to desired speed.

6. Adjust signal input level by observing appropriate VU meter.

NOTE: Perform the full sequence of the following instructions on Tape Transport 1 and then perform them on Tape Transport 2.

Operating Instructions

Perform the following steps in operating the equipment:

1. Actuate both RECORD switches momentarily to position 1, simultaneously. Observe that tape begins moving forward at required speed, and that the RECORD 1 red lamp illuminates.

2. Press STOP button on Tape Transport 1. Observe that tape stops moving and RECORD lamp extinguishes.

3. Momentarily actuate the REPRODUCE switch to position 1. Observe that the tape moves as in Step 1 and that the REPRODUCE 1 green lamp illuminates.

4. Press STOP button on Tape Transport 1. Observe that the tape stops and REPRODUCE lamp extinguishes.

5. Actuate the FAST FWD-REWIND toggle switch momentarily to the FAST FWD position. Observe that tape moves rapidly from the supply reel to the take-up reel. Allow FAST FWD operation until the supply reel is very close to being empty before stopping the transport. Observe that the STANDBY 1 amber lamp at the RCU is flashing, denoting end of tape.

6. Reactuate the switch to the FAST FWD position and observe that the flashing amber light extinguishes and that both reels stop immediately after tape comes off the supply reel.

7. Thread the loose end of the tape across the heads and back onto the supply reel.

8. Actuate the FAST FWD-REWIND switch momentarily to the REWIND position. Observe that tape moves rapidly from the takeup to the supply reel. Stop the transport before full rewind so that tape remains threaded.

9. At the RCU observe that both STANDBY amber lamps are illuminated, then initiate RECORD at the RCU by actuating the TRANSPORT select switch to 1 and the RECORD-STANDBY switch to RECORD. Observe that STANDBY 1 amber lamp extinguishes and that RECORD 1 red lamp illuminates.

10. Return the RECORD-STANDBY switch to STANDBY and the TRANSPORT selector switch to the center position. Observe that the STANDBY 1 lamp illuminates and the RECORD lamp extinguishes.

NOTE: Perform the above sequence of steps on Tape Transport 2.

AUXILIARY SWITCHES

AGC Defeat Switch. This toggle switch is located on record preamplifier card in the equipment cabinet and provides or defeats automatic gain control action on Channel B only. AGC action starts at 3 dB above optimum record level.

Bias Defeat Switch. This toggle switch is located on the control chassis of each tape transport and provides or eliminates record head bias on Channel B only. The bias defeat switch does not affect the erasing action of the erase head but controls only the record head bias necessary for normal audio recording.

CAMERAS

Each of the various cameras used to record data from the analysis scope is equipped with an accessory kit. These kits include detailed instructions for proper operation required to produce photographs of the best quality. It is important that these operating instructions be studied thoroughly so that the photographs you take of a signal will show the exact fingerprint of the signal to the analyst at the ELINT center.

The following narrative on the various cameras addresses the capabilities but not their operations that are covered in the individual detailed instructions. Since most ships only have one camera, it is suggested that you obtain the

operating instructions for the camera on board your ship and familiarize yourself with them.

The Polaroid (CR-9 Model), KD-2, EYE MO (movie camera), or KS-63A or equivalent are the recommended cameras to be used for ESM analyzer scope photography.

The Polaroid CRZ-6 or CR-1A camera or equivalent camera is recommended for radarscope photography. The best application for these types is to record jamming presentations. The Polaroid camera has the advantage of providing a print for immediate evaluation as well as for laboratory analysis.

The Polaroid CR-9 Oscilloscope Camera is specifically designed for oscilloscope spectrum analysis. The CR-9 has its own attachable hood which is compatible with the AN/WLR-1 scope, thus eliminating the need for a hood to be attached to the WLR-1. The CR-9 also features a trigger handle for ease of operation.

Photographic procedures for submitting photographs with ELINT Reports are covered in detail in chapter 14.