RECORDING PROCEDURES.—Follow the steps listed below to record data:

1. Depress the POWER switch. (Both the POWER ON and STOP TAPE switch indicators should light up.)
2. Set the RANGE selector for the channel(s) used to Ø-25V (normal position) or Ø-1 V (if low-level signals are anticipated).
3. Set the TAPE SPEED switch to 5 IPS. This is the normal position for obtaining signal parameters; however, to extract intelligence, the speed may be changed while the recorder is in operation.
4. Set the THRESHOLD switch to midway position. Care must be taken that the threshold level is not to be crossed through noise modulation of the signal. A more positive (clockwise adjustment) or negative (counterclockwise) threshold level may be obtained within the range indicated on the RANGE switch.
5. Set the POLARITY switch in NORMAL position if the "Ø" level is to be presented at the bottom of the channel. If the "1" level is to be presented at the bottom, set the POLARITY switch to the INVERT position.
6. Depress the START TAPE switch and check the recording as the tape passes through the viewing window. Representations of the input will appear on the tape if the threshold level is correct.

RD-112A/U PAPER TAPE RECORDER

The RD-112A/U (figure 7-16) is a paper tape recorder that responds to pulses of audio tones

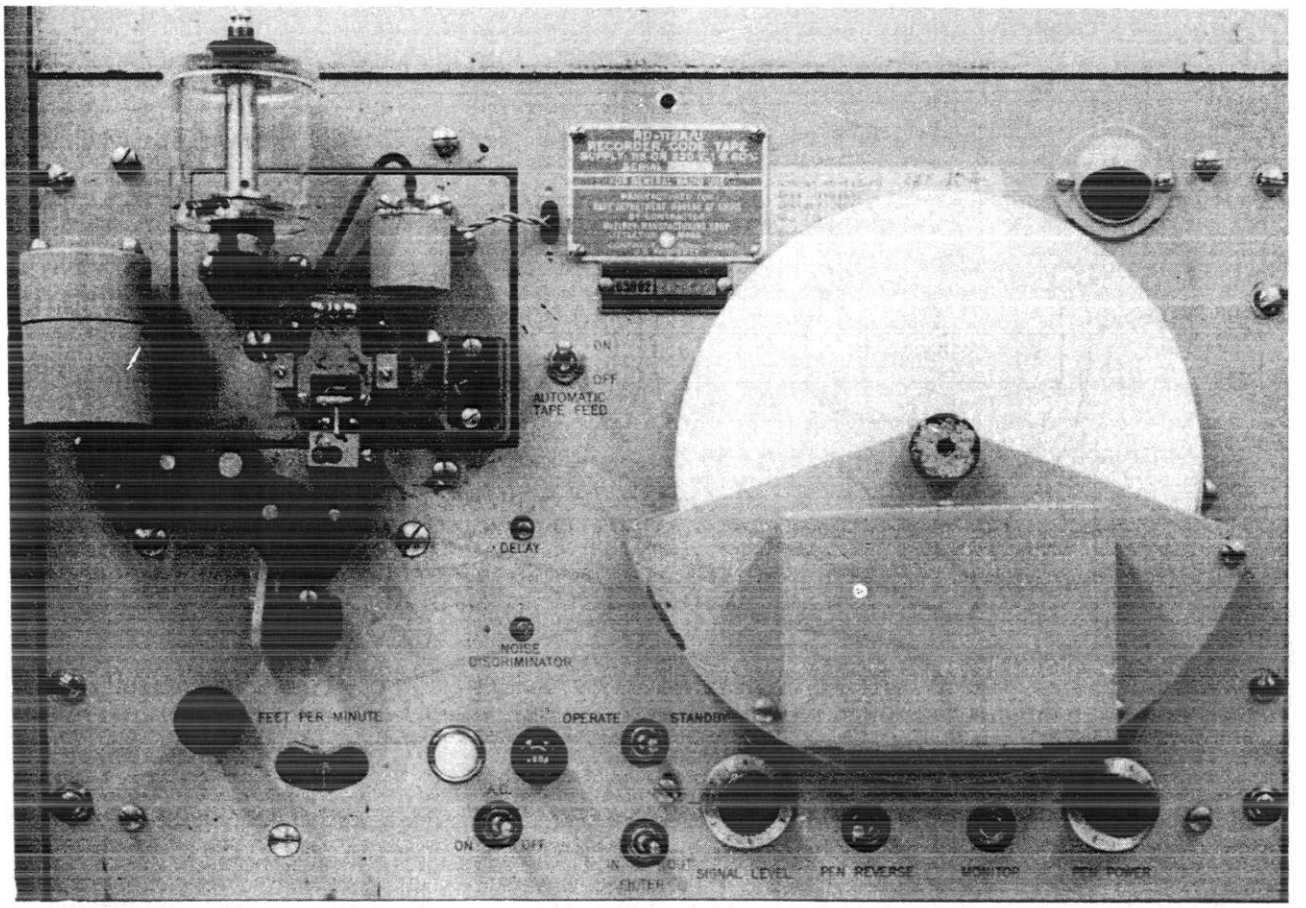

Figure 7-16.—RD-112A/U paper tape recorder. 264.72

(Audio Frequency or Keyed Tone) and records them with ink on paper tape. It is used to record high-speed morse code for subsequent visual transcribing and to record non-morse signals for analysis purposes. (Element length, element speed, operations per minute, etc. can be determined, but neither the frequency shift nor the frequency excursion can be determined from the undulator recording.) It can also be used for signal comparison (quality) checks of enciphered systems to ascertain the reliability of pageprinting equipment.

The RD-112A/U has an adjustable tape drive mechanism that permits tape speeds from 5 to 35 feet per minute, making it possible to record signals of up to 350 words per minute. The pulses of audio tone used for an input can be anywhere in the frequency range of 500 to 5,000 Hz, and may be supplied either directly from the phone jack of a radio receiver, or any other equipment that provides an audio tone output (AF or KT).

Controls, Indicators and Functions

The controls, indicators and functions are explained in table 7-7.

Table 7-7.—RD-112A/U Operating Controls, Indicators, and Functions

CONTROL/INDICATOR	FUNCTION
A.C. ON-OFF switch	Applies and removes primary power from the recorder (the indicator light should be lit in the ON position).
OPERATE-STANDBY switch	A two position switch which, when placed in the STANDBY position, removes power from the Tape Puller unit. In the OPERATE position, tape is fed out by the Tape Puller unit.
AUTOMATIC TAPE FEED ON-OFF switch	A two position ON-OFF switch which, when placed in the ON position, will automatically feed tape when a signal is present at the input terminal. When in the OFF position, tape feed is possible only when the OPERATE-STANDBY switch is in the OPERATE position.
FILTER IN-OUT switch	A two position switch (IN-OUT), when placed in the IN position, allows the filter to remove high noise peaks from the signal. In the OUT position, the filter is out of the circuit.
SIGNAL LEVEL control	A rotary type gain control that adjusts the level of the input signal for optimum performance.
PEN REVERSE switch	A switch which can be used to reverse the signal polarity.
MONITOR jack	A jack that allows the input signal to be monitored by means of headphones.
PEN POWER control	A rotary type control that controls the driving power of the recording pen.
FEET PER MINUTE control	A rotary type control that controls the recording speed of the recorder. The tape speed is visible through the glass window.
Inkwell Valve Control	A thumbscrew mounted on the inkwell that controls the amount of ink flowing through the pen to the paper tape.
"Magic Eye" indicator	An indicator located at the upper right-hand corner of the front panel that may be used as an aid for tuning signals. With the FILTER switch in the IN position, maximum closure of the "magic eye" indicates that the signal frequency is tuned to the filter center frequency and that the highest signal-to-noise ratio has been attained under the existing conditions of radio reception.

Loading and Threading the Tape

Follow the steps listed below when loading and threading tape:

1. Obtain a blank roll of standard 3/8 inch wide recorder tape.
2. Loosen the knurled thumbnut that positions the tape hub on the tape bin and remove the hub assembly.
3. Press the hub into the tape roll in such a manner that, when mounted, the tape will unwind in a clockwise direction.
4. Mount the tape roll in the tape bin and tighten the hub nut firmly.
5. Break the tape seal (if seal has not been broken) and unwind several feet of tape to ensure that the tape unwinds freely.
6. Tear off excess tape, leaving approximately 12 inches for threading.
7. Move the platen lever to the left. This lowers the tape platen and exposes the penpoint.
8. Thread the tape over the platen and between the drive roller and idler roller of the pressure arm, being careful not to engage the point of the recording pen.
9. Return the platen lever to its original position.

Preliminary Operating Procedures

1. Place the AC POWER ON-OFF switch to the ON position.
2. Place the AUTOMATIC TAPE FEED switch to the OFF position.
3. Adjust the FEET PER MINUTE control to the desired operating speed. (25 feet per minute is the speed used to obtain signal parameters.)
4. Place the OPERATE-STANDBY switch in the STANDBY position.
5. Place the FILTER IN-OUT switch in the OUT position.
6. The SIGNAL LEVEL control should be rotated counterclockwise as far as possible (zero dial reading).
7. The PEN REVERSE switch may be in either position.
8. The PEN POWER control should normally be set at five (5).

Calibration Procedures

It is necessary to calibrate the RD-112A/U at 25 feet per minute when any signal analysis functions are to be performed. The procedures for calibration are listed in the steps below:

1. Use a radio receiver to locate a timing signal (normally WWV/WWVH), located at 5, 10, and 15 MHz. A series of clicks and a voice transmission announcing the correct time will be heard. The clicks should be center-tuned in the receiver.
2. Plug your headphones into the MONITOR jack and make certain the signal input is present.
3. Place the OPERATE-STANDBY switch in the OPERATE position.
4. Open the Inkwell Valve control until a clear, well defined ink line appears on the undulator tape.
5. Rotate the SIGNAL LEVEL control in a clockwise direction until the pen follows the signal without skipping. (This control must be set in conjunction with the PEN POWER control.)
6. Rotate the PEN POWER control in a clockwise direction until sufficient driving force is delivered to the pen and causes it to follow the signal cleanly and quickly. Too much power to the pen will cause the ink to splatter and damage the pen.
7. The FILTER IN-OUT switch may be placed in the IN position to determine whether or not noise and distortion can be eliminated from the signal.
8. Using an "engineer scale" (20 scale), align the clicks on the tape with every ten major divisions on the scale by adjusting the SPEED control. In case an engineer scale is not available, a regular ruler may be used. Align the clicks so that they fall every five (5) inches. Once this has been accomplished, the RD-112A/U will have been calibrated for 25 feet per minute.

Final Operating Procedures

The input to the RD-112A/U can be taken either directly from a receiver (AF) or from the output of the AN/FRA-86 (KT); however, the KT from the AN/FRA-86 produces a much better recording. Only FSK or OOK type signals

can be recorded directly from the receiver. DFSK signals will require a demodulator to separate the canals of intelligence. When recording FSK signals directly from the receiver, one side of the signal must be ZERO BEAT OUT by using the BFO PITCH control (R-390A/URR). The BANDWIDTH switch must be set as low as possible while still maintaining a clear signal. Follow the steps listed below for normal (nonautomatic) operating procedures:

1. Place the AC POWER ON-OFF switch to the ON position.
2. Place the OPERATE-STANDBY switch to the OPERATE position and ensure that the AUTOMATIC TAPE FEED switch is in the OFF position.
3. Open the Inkwell Valve until a clear, well-defined ink line appears on the paper tape.
4. Adjust the SIGNAL LEVEL control until the signal follows the pen without skipping.
5. If background noise is present and your receiver has a BFO, place the FILTER switch in the IN position. Tune the BFO pitch control to give a condition of maximum closure of the "Magic Eye" indicator. Maximum closure of the magic eye indicates that the signal frequency is tuned to the filter center frequency. With the FILTER switch in the IN position, it may be necessary to change the setting of the SIGNAL LEVEL control.
6. The PEN REVERSE switch may be switched to the alternate position for the desired polarity.
7. Adjust the PEN POWER control only as far as necessary to produce a clear and accurate recording.
8. The SPEED control should be calibrated to 25 feet per minute, when recording, to obtain signal parameters. When recording morse code, the recording speed should be adjusted so that the dot (dit) characters appear to be approximately square. (This means that the horizontal and vertical lines should be equal in length.) Figure 7-17 shows examples of recorded tape signals.

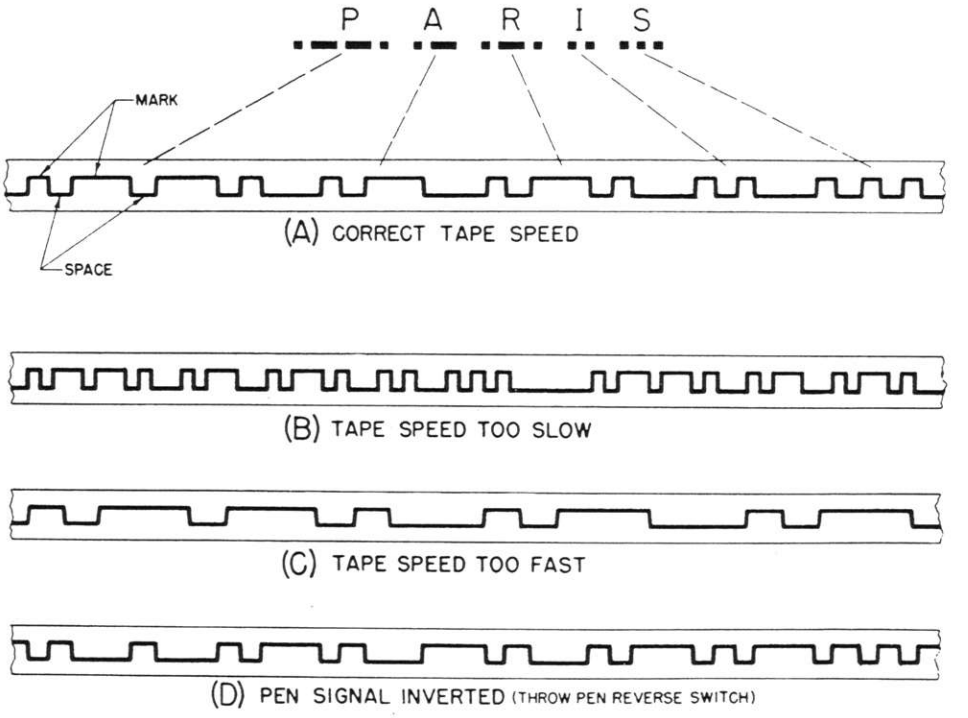

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Figure 7-17.—RD-112A/U recorded tape signals.

9. The RD-112A/U may be stopped by placing the OPERATE-STANDBY switch to the STANDBY position. (Make certain that the Inkwell Valve has been closed before the switch is placed in the STANDBY position.) If the recorder is to be out of service for several hours, place the AC POWER switch in the OFF position.

If the RD-112A/U is to be used for AUTOMATIC TAPE FEED operations, follow the steps listed below:

1. Place the AUTOMATIC TAPE FEED in the ON position and place the OPERATE-STANDBY switch in the OPERATE position.
2. Place the FILTER switch in the IN position to reduce the background noise.
3. Follow steps 3 through 9 above for the remaining steps.

NOTE: When the AUTOMATIC TAPE FEED switch is in the ON position, the ink supply is automatically shut off and on, depending upon whether or not a signal is present.

HONEYWELL 1508 OSCILLOGRAPH

The Honeywell 1508 (figure 7-18), commonly referred to as a "Visicorder," is a direct-recording oscillograph which simultaneously records up to 24 channels of data on light-sensitive paper. A Galvanometer Amplifier amplifies weak signals to a level

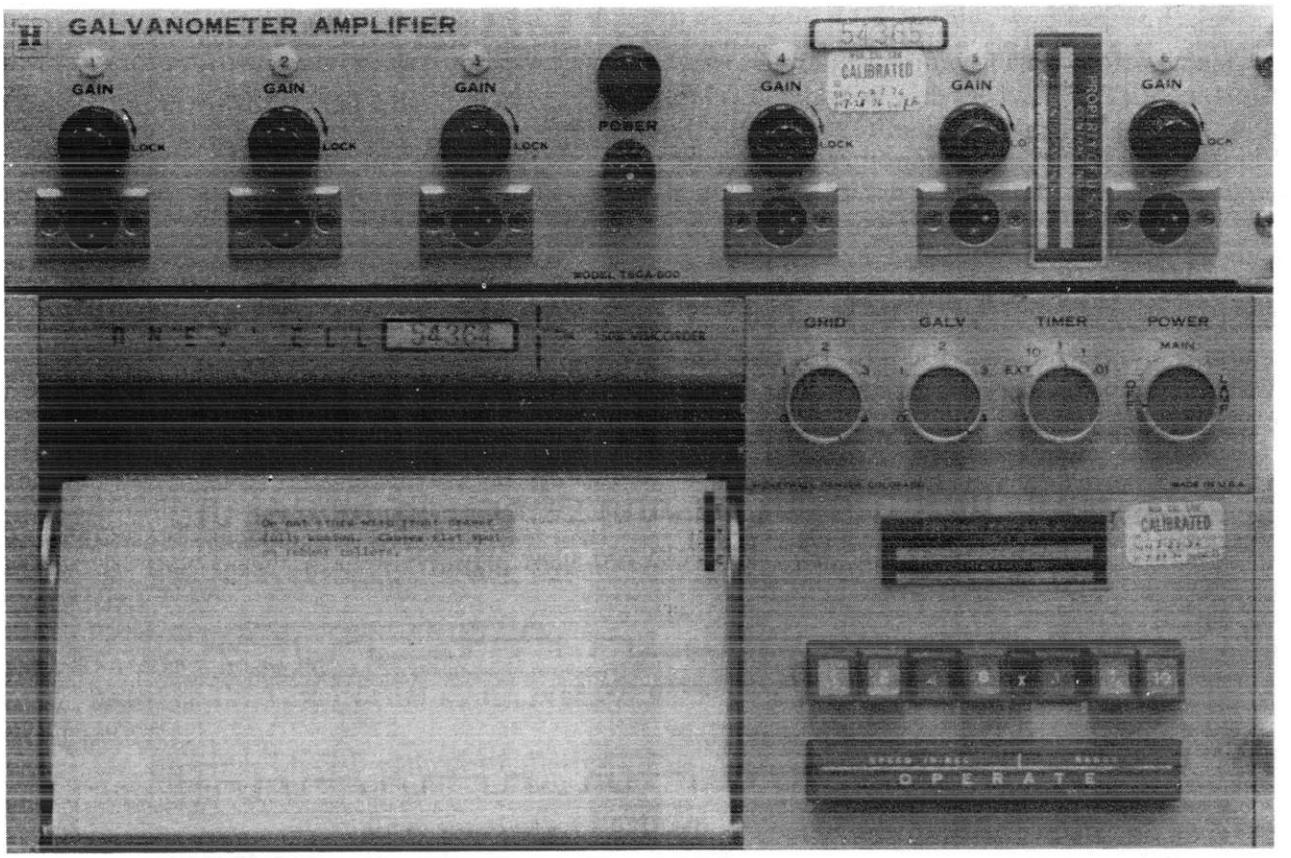

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Figure 7-18.—Honeywell 1508 Oscillograph.