MODEL 28 ASR TEXT

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CHAPTER I

GENERAL FUNCTIONAL DESCRIPTION

1. INTRODUCTION

The requirements for telecommunication data transmission have continuously grown broader and more complex over the past few years, therefore creating a need for a complete new line of data transmission apparatus. This need has led to the design and development of the Model 28 Send-Receive and the Receive-Only Page Printer. Next, the Model 28 Page Printer features were combined with variable tape punch and tape reader apparatus. This new arrangement of equipment in a single, compact, integrated unit is called the Model 28 Automatic Send-Receive Set, and offers a greatly increased range of communication applications (Figure 1-1).

The Model 28 Automatic Send-Receive Set, usually referred to as Model 28 ASR Set, is a high capacity send-receive message station with tape punch and tape reader units. The equipment is designed to serve as the center or originating station of data processing and message transmission systems and will operate at 100 words per minute.

The Model 28 ASR Set is a part of a complete line of apparatus employing standardized basic components in various combinations, with a capacity of special functions that allow for the addition of accessory units; is designed for future expansion; and requires infrequent lubrication and service.

2.0 GENERAL DESCRIPTION

The Model 28 ASR is composed of a group of basic integrated components consisting of a keyboard, page printer, tape punch, tape reader, electrical service unit, transmitter control device, console and motor (Figure 1-2).

2.1 Keyboard (LAK6XL) (Figure 1-3)

The keyboard unit was especially developed for the Model 28 ASR to provide a centralized control for the preparation and transmission of data. The modern keyboard design aids the increase of operator output, comfort and efficiency. The keyboard arrangement is similiar to the typewriter with special keys, in addition to character selecting keys, reserved for off-line functions such as power backspace for tape correction, local line feed for paper feed out, repeat function, and local carriage return.

2.1.1 Automatic Send-Receive Control

The Automatic Send-Receive Control is a manually operated switching device which gives versatility to the keyboard functions. By manipulation of this control, the keyboard may be used to transmit messages, transmit and punch tape, or punch tape only.

2.1.2 Signal Generator

The signal generator is a single contact unit, mechanically operated by the keyboard to transmit electrical impulses. The unit is mounted in a metal box and is shielded against creating radio interference. Keyboard action engages the clutch and completes one full cycle for each character selected.

2.1.3 Character Counter

A Character Counter is used in conjunction with tape perforation for monitoring the number of characters perforated. The counter is adjustable for a line length of 10 to 80 characters.

2.2 Printing Unit (LP-12) (Figure 1-4)

The Model 28 Page Printer used with the Model 28 ASR Set is identical to that used with the Model 28 R-0 Set. The proven selector, all-steel clutches, versatile "STUNT BOX" and type box all contribute to the

advancement in the recording of transmitted data. This printing unit may be utilized to perform many electrical and mechanical functions for selective calling, remote control, integrated data processing, and other special functions.

2.3 Tape Punch (Figures 1-5, and 1-6)

Four versatile tape punch units have been designed for use with the Model 28 ASR Set. These consist of a Non-Typing Perforator, a Typing Perforator, a Non-typing Reperforator, and a Typing Reperforator.

The tape punch selected depends upon the requirements of the particular facility for recording and storing 5-level information. The perforators may be used for the preparation of tape by operation of the local keyboard only. The reperforators may be used for tape preparation from information initiated locally or from information received on the circuit. All four of the mentioned units perforate standard 11/16" paper tape into 5-level chadless form. Units for 6-level, 7-level, or 8-level tape are also available and are especially adaptable to computor usage.

2.3.1 Perforator (LPE-1)

The Model LPE-1 Perforator, which is a non-typing perforator for 5-level coded tape, is used with the Model 28 ASR Set in many of the FAA installations and is the one to be discussed in more detail during this course.

2.4 Tape Reader

A group of four versatile tape readers have been designed for use with the Model 28 ASR Sets. This group of readers, known as Transmitter-Distributors, consists of:

1. FIXED HEAD SINGLE CONTACT
2. PIVOTED HEAD MULTICONTACT

3. FIXED HEAD MULTI-CONTACT
4. PIVOTED AND FIXED HEAD MULTI-CONTACT

The transmitter-distributor selected for use at a certain facility would be determined by the particular communication needs.

2.4.1 Transmitter-Distributor (LBXD4) (Figure 1-7)

The fixed Head Multi-contact Transmitter-Distributor, Model LBXD4, is frequently used in FAA installations with the Model 28 ASR Set and will be covered in this course.

This tape reader has such features as: a 3-position switch for STOP, START, and FREE-WHEELING; easy tape threading; TAPE OUT pin which detects the end of tape and stops operation; and TAUT TAPE switch to stop the unit when the slack is taken up. The unit operates at a speed of 100 words per minute.

2.5 Electrical Service Unit (LESU-21) (Figure 1-8)

The electrical service unit, Model LESU 21, is designed to provide and distribute the electrical needs for the equipment. The unit consists of a chassis, line relay, power switch, cables, terminal strips, rectifier assembly, line shunt relay, fuse, line test key assembly, and DC control relay assembly. The chassis containing these subassemblies is located to the rear of the printing unit.

2.6 Transmitter Control Device (Figures 1-9, 1-10)

The Transmitter Control Device is designed for use with the Model 28 ASR Set to provide such features as: Prevention of automatic sending into either an open or busy line; Retention of a "START-REQUEST" until an idle line condition exists; and Provision for a "START-GROUND" when a "START-REQUEST" is received from either a function box contact or a manual push button.

This device consists of a relay group mounted on a bracket in the lower portion of the Model 28 ASR cabinet with a push button control panel

located on the front of the console. The control panel utilizes a number of switches, jacks and an indicator light. (See Figure 1-10)

2.7 Console Cabinet (LAAC-206AB 826)

The Console Cabinet houses the entire Model 28 ASR unit. It provides terminals for attachment of power and signal lines, internal circuits, and control equipment. Copy illuminating lamps are provided in page printer, tape punch and tape reader areas, and a right margin indicator. The cabinet hood swings open for easy maintenance. There are small doors in the dome to provide easy access for replacing expendables such as tape supply, ribbon and printer paper.

2.8 Model 28 Motor Unit (LMU-12)

The Model 28 ASR Set is provided with a 1/12 H. P. 115 volt 60 cycle AC, single phase, two-pole, capacitor start, synchronous motor which runs at 3600 RPM. The ratings for start current is 12.25 amps; run at no load is 2.48 amps; and run at full load is 2.58 amps. Other motors are available for specific needs.

3.0 PRINCIPLES OF OPERATION

3.1 System (Figure 1-11)

Nation-wide flight-control networks have been installed by FAA and are using the Model 28 line of Printing and Transmitting Apparatus. This equipment will be operating at 100 words per minute and is associated in many cases with other equipment operating at higher speeds of operation. The network may consist of as many as 400 stations divided into approximately 24 circuits. Each circuit contains from 10 to 30 stations, including relay stations for transmission to and from adjacent circuits. The automatic Send-Receive Sets may be employed at many of these stations. A segment of the service "B" system is illustrated in Figure 1-11.

3.2 ASR Set

The ASR equipment having both manual and automatic features, is very versatile. The equipment may be used to transmit data by use of the tape reader or the signal generator, to store data on punched tape and the printed page by use of the tape punch and the page printer, and respond to selective calling by the use of the "Stunt Box" in the page printer. Selective calling may be for the purpose of setting up the printer to receive a message from a previously prepared tape.

3.2.1 Block Diagram of Set

The relation of the various components and a better understanding of the individual component operation is illustrated in Figure 1-12. A driving force is established, by use of a motor, connecting shafts and clutches, for the purpose of operating the keyboard, signal generator, perforator, printing unit and transmitter-distributor.

3.2.2 Keyboard (Figure 1-4)

The keyboard is always operated manually and provides for manual signal generation and high speed tape perforation. Three modes of operation are provided. The selection of the desired mode is accomplished by use of a three position keyboard control knob mounted at the left front of the base.

These operating positions of the keyboard knob are: K (KEYBOARD), K-T (KEYBOARD-TAPE) and T (TAPE).

KEYBOARD - In this position of the control knob, the keyboard can be used to transmit messages directly to another station or group of stations at a speed of up to 100 WPM. A record of the message is made available on the local printing unit. The tape perforator is in-operative in this control position.

KEYBOARD - TAPE - In this position of the control knob the keyboard can be used to perform the dual operations of

transmitting messages electrically while simultaneously perforating tape by mechanical means at a speed of up to 100 WPM. The printing unit may also record the message on the printed page at the same time it is perforated on the tape.

TAPE - In this position of the control knob, the keyboard can be used for direct mechanical perforation of tape at speeds up to 150 WPM. In this setting the page printer is available for the receipt of incoming messages or to monitor transmission from the Transmitter-Distributor.

In the two positions, "K" and "K-T", the signal generator actually makes and breaks the signal line to produce the MARK and SPACE pulses. (MARK - current flow) (SPACE - no current flow).

In the two positions, "K-T" and "T", the tape punch mechanically perforates the tape according to the code selected by the keyboard action.

3.2.3 Transmitter - Distributor

The Transmitter-Distributor in the Model 28 ASR Set is the tape reading facility that controls the automatic transmission of data and operates at 100 WPM.

The transmitter portion of the unit senses the code represented by the arrangement of perforations in the locally prepared tape and converts this code into electrical impulses for distribution by the distributor portion of the unit on a sequential basis to one or more receiving points.

The transmitter - distributor may be prepared for operation by applying power and inserting the perforated tape. The actual transmitting operation is started by manually pressing the "START" button or by Selective-Calling Stunt-Box action through the printing unit.

3.2.4 Model 28 Printer

The printing unit may be operated independently of the keyboard,

signal-generator, or transmitter - distributor; or may be operated in unison with the associated equipment. The printer serves as a means of recording transmitted data at a speed of 100 WPM and performs many other special features such as switching and controlling associated apparatus.

Most of the teletypewriter networks are equipped with the Model 28 Line of equipment and stations are permitted to call one another on a selective basis. This operation is referred to as SELECTIVE CALLING and is accomplished by utalizing discretely coded characters to select the desired stations and is made possible by the versatility of the STUNT BOX in the Model 28 Printer. The stunt box may be operated by local use of keyboard or receiving call up codes from other transmitting stations.

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KEYBOARD PERFORATOR TRANSMITTER

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KEYBOARD PERFORATOR TRANSMITTER

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CHAPTER TWO

KEYBOARD PERFORATOR TRANSMITTER

1.0 INTRODUCTION (Figures 2-1, and 2-2)

The Model 28 Keyboard Perforator Transmitter (Figures 2-1 and 2-2) is one of the major assemblies of the complete line of the Automatic Send-Receive Set and serves as a centralized control for the preparation and transmission of message data. This equipment may be used to manually transmit a message directly into the signal line in the form of electrical code impulses or prepare tape by way of perforations to be transmitted into the signal line at some future time. A keyboard control feature provides a means of selecting the desired mode of operation to allow:

1. Direct keyboard transmission, plus the monitoring of the message by the typing unit.
2. Direct keyboard transmission, plus simultaneous perforation of tape, plus the monitoring of the message by the typing unit.
3. Perforation of tape only, plus allowing the printing unit to monitor some remote signal transmission.

The keyboard perforator transmitter operates in conjunction with other associated ASR units such as the printing unit, Electrical Service Unit, Transmitter Distributor, Motor and connecting shafts and gears.

2.0 GENERAL DESCRIPTION (Figures 2-1, 2-2, 2-3, and 2-4)

The keyboard perforator transmitter assembly is composed of a group of basic components consisting of a base, keyboard, keyboard control linkage, signal generator and perforator.

2.1 Base (Figures 2-1 and 2-2)

The entire keyboard perforator transmitter assembly is built around or mounted on the keyboard base which may easily be removed from the console cabinet. The motor and printing unit are considered as associated equipment and are also mounted on this base.

2.2 Keyboard Mechanism (Figures 2-2, 2-3 and 2-4)

The keyboard mechanism is mounted on the right front portion of the base and has an extension out forward with an arrangement of character and function keys similiar to that of a standard typewriter. (Figure 2-2)

Through a series of links, levers and bails the manual operation of the keyboard results in the arrangement or positioning of code bars which determine the characters of data to be transmitted. (Figures 2-3 and 2-4)

2.3 Keyboard Control Linkage (Figures 2-1, 2-2, and 2-4)

The keyboard control linkage mechanism is located near the left front section of the keyboard base. The mechanism serves as a mechanical switching device and links the keyboard to the signal generator or perforator mechanisms individually, or simultaneously. A manual control knob with a three position dial is located at the front of the base just to the left of the keyboard. The operator may select the desired mode of operation by manually positioning the control knob to one of the three positions.

The three control knob positions and their functions are as follows:

1. "K" - Keyboard position - Direct Signal Transmission - Perforator completely disabled.
2. "K-T" - Keyboard and Tape position - Direct Signal Transmission plus tape perforation.
3. "T" - Tape position - Tape Perforation - Signal Generator completely disabled.

A reset cam follower mechanism provides a means of resetting the code bar bail when the keyboard control linkage is in the "T" position.

2.4 Signal Generator Mechanism (Figures 2-3 and 2-12)

The signal generator mechanism is basically a single contact unit mechanically operated to transmit electrical impulses into a signal line. (Fig. 2-12). The signal generator is allowed to operate when the keyboard control knob is in the "K" or "K-T" position.

This mechanism utilizes an all steel clutch which is driven from the main shaft of the printing unit to perform its operation. The signal generator is completely dependent upon code bar positioning for all character code selection.

2.5 Perforator Mechanism

The perforator mechanism is for the purpose of perforating tape for some future transmission or for data storage. The type to be discussed is the non-typing perforator and referred to as the Model LPE-1.

The perforator is driven by the power from the motor through a two-stop all-steel clutch and rocker bail mechanism. This clutch is also utilized as a means of power drive for resetting the code bar bail when the keyboard control knob is in the "T" position.

The perforator is dependent upon the code bar positioning to determine the code to be perforated in the tape. The perforator is inactive when the keyboard control knob is in the "K" position.

2.6 Character Counter Mechanism

The character counter mechanism is located near the right front section of the keyboard base and consists of a Ratchet Device, a Character Counter Bar, Carriage Return Bar, and a Dial for registering each character as it is perforated in the tape. Certain code functions do not register in the "K-T" and "T" position and the mechanism is made inoperative when the keyboard control knob is in the "K" position.

2.7 Special Features

The keyboard perforator transmitter has certain features in addition to the basic performance of operation such as Local Line Feed, Local Carriage Return Repeat Mechanism, Perforator Tape Back Space, Margin Indicator Switch, End-of-Line Switch, and Tape Supply container. There are many optional features designed for this equipment which are not used by FAA.

3.0 THEORY OF OPERATION

The keyboard perforator transmitter is versatile in its performance and will be discussed in a manner to fully describe the action of each component and their combined or associated actions.

3.1 Keyboard (Figures 2-2, 2-3, 2-4, and 2-5)

The basic purpose of the keyboard in its mechanical action is to select and position the code bars according to a desired or predetermined code. When any one of the character or function keys is depressed the code bars will immediately take a position resulting in either a MARK or SPACE condition, depending on the code of the particular key being depressed. There are thirty-two possible combinations for the code bars to be arranged.

All of the code levers (Figure 2-5) pivot about points near their mid-portions and are all mounted on the code bar lever shaft. The Clutch Trip Bar, The Carriage Return Bar, Character Counter Bar, and the code bars are mounted above the rear half and at right angles to the code levers. The physical sequence is as follows: (From rear to the front)

Clutch Trip Bar
#1 Code Bar
#2 Code Bar
#3 Code Bar
#4 Code Bar
#5 Code Bar
Carriage Return Bar
Character Counter Bar

When the keyboard is at rest, the Clutch Trip Bar, Character Counter Bar, Carriage Return Bar, and all of the code bars are held near the extreme leftward travel by a code bar bail and the rear portion of each code lever is held downward by a spring and the front end with its attached keylever, is held upward.

3.1.1 Code Bar Positioning (Figures 2-5, 2-6, and 2-7)

When any keylever in the three lower rows or the space bar is operated, the rear end of the associated code lever moves up against the front blade of the code lever Universal Bail (Figure 2-5). This action causes the Universal Bail to rotate in a clockwise direction as viewed from the right end and moves its rear blade down and slightly forward to hold the rear end of the code lever up in its operated position. Mounted on the Universal Bail, near its midpoint, is the Universal Bail Extension Roller that moves to the rear as the Universal Bail rotates clockwise. The Universal Bail Extension Roller moves from under the inverted step at the rear of the Universal Bail Latch Lever. The Universal Bail Latch Lever then moves downward due to the tension of its spring and comes to rest in front of the Universal Bail Extension Roller and locks the Universal Bail and code lever in this operated position until the code bars are reset to their normal rest position. As the Universal Bail Latch Lever moves down, it strikes the Code Bar Bail Latch (Figure 2-6) and moves the right end of the latch downward. The lower edge of the Code Bar Bail is constantly engaged in a notch in the Clutch Trip Bar (Figure 2-6) and the Clutch Trip Bar is spring loaded to the right. All of the code bars have projections extending upward just to the left side of the Code Bar Bail and each code bar is also spring loaded to the right. (Figures 2-7 and 2-8) While at rest the Code Bar Bail is latched in a leftward position, therefore, the Clutch Trip Bar, Character Counter Bar, Carriage Return Bar, and all of the code bars are held slightly to the right of their extreme leftward position. When the upper left corner of the Code Bar Bail Latch moves down below the horizontal centerline of the Code Bar Bail Latch Roller, which is mounted on the Code Bar Bail, the Code Bar Bail is then released and swings to the right by the Clutch Trip Bar spring tension. (Figures 2-7 and 2-8) As the lower edge of the Code Bar Bail moves to the right, it will allow all of the code bars, the Character Counter Bar, and the Carriage Return Bar to move to the right.

The code bars selected for MARK condition are pulled to the extreme right by their individual spring tensions while the code bars selected

for SPACE move only slightly to the right from their latched position and become blocked when the teeth, or tines, underneath their lower edge come in contact with the operated code lever.

For example, (Figure 2-7) if the "Y" keylever is depressed, its connecting code lever moves up between the teeth of all the code bars. The rear end of the code lever strikes the Code Lever Universal Bail front blade and the Universal Bail Extension Roller moves from underneath the Universal Bail Latch Lever and the latch lever drops down and strikes the Code Bar Bail Latch. This forces the latch down enough to release the code bar bail roller and the spring tension of the Clutch Trip Bar pulls the Clutch Trip Bar and the code bar bail to the full right hand position. As the code bar bail moved to the right, all of the code bars were allowed to move to the right by their individual spring tensions. After a slight movement, code bars 2 and 4 will be blocked as the teeth on their lower edge come in contact with the "Y" code lever and would then be selected to the space position. Code bars 1, 3, and 5 are permitted to move to the extreme right position due to a lengthy notch (or omission of teeth) on these code bars in the area of the "Y" code lever. Therefore, code bars 1, 3, and 5 are selected for a mark condition. The "Y" code is 1, 3, and 5 mark and 2 and 4 space.

3.1.2 Code Bar Bail Resetting (Figures 2-6, 2-11, 2-10, and 2-5) The resetting of the Code Bar Bail is accomplished by power drive from one of the all steel clutch cam assemblies. (Figure 2-6 and 2-11) The leftward movement of the code bar bail will cause all of the code bars to be moved to the left. A projection and roller toward the rear of the code bar bail, called the Code Bar Bail Extension Roller, engages a shoulder on the Non-Repeat Lever (Figure 2-10) and as the code bar bail is moved to the left, it carries the non-repeat lever with it. The non-repeat lever is mounted on the lower projection of a non-repeat lever crank by a shoulder screw which allows pivot action. As the non-repeat lever is moved to the left, the non-repeat lever crank moves clockwise on its fixed pivot point and the left extension of this crank moves upward

and lifts the universal bail latch lever upward. (Figure 2-5) The Universal Bail Latch Lever is moved up until the rear portion frees the universal bail extension roller and allows the extension roller to move forward by spring tension into the inverted step on the underside of the Universal Bail Latch Lever. As the universal bail is returned to the normal unoperated position, an extension which is mounted on the universal bail moves down and causes the left end of the non-repeat lever to move down. This action disengages the non-repeat lever from the Code Bar Bail Extension Roller and the non-repeat lever crank moves counterclockwise by spring tension to its stop position.

As the code bar bail is pulled to the extreme left position of its travel, the code bar bail needle bearing is moved far enough to the left to allow the code bar bail latch to move up on the right side of the bearing and as the code bar bail moves back to the right it is blocked by the latch and held there firmly by spring tension of the clutch trip bar. The code bars are now reset and ready for a new code selection to be made.

3.1.3 Wedgelock (Figure 2-9)

A Wedgelock feature (Figure 2-9) is mounted on the lower front projection of all code levers. If one of the key levers is operated, its wedgelock moves down between the lock balls in the lock ball channel and crowds them together. There is room between the lock balls for only one wedgelock at the time, therefore, preventing simultaneous operation of two or more code levers.

This mechanism is not intended as a down stop for the key levers. A stop is provided for the upward travel of the rear half of the code levers as they are depressed. This is called the code lever up-stop.

3.2 Keyboard Control Linkage (Figure 2-13 and 2-11)

The keyboard control linkage is operated by a control cam and may be set to one of three positions: "K", "K-T", and "T". This setting determines whether the perforator or signal generator or both will be operated when the keyboard is operated.

3.2.1 Operation in "K" Keyboard Position (Figures 2-11, 2-12, and 2-13)

This method of operation is set up by turning the keyboard control knob to the "K" position. There is direct keyboard transmission with monitoring of the message by the typing unit. In this position signals are generated by the keyboard as described in the signal generator mechanism part of this chapter and the perforator is inoperative. This conditions the keyboard perforator linkage as follows:

The control cam is engaged by the keyboard control knob. A lobe is located near the middle of the control cam which operates the Blocking Bail S ide as the cam is turned. The Blocking Bail is attached to the rear side of the Blocking Bail Slide and Blocking Bail Slide Extension Lever is attached to the front side of the blocking bail slide. When the keyboard control knob is turned counterclockwise to the "K" position, the Blocking Bail (Figure 2-13) shown in the illustration is moved to the left to the dotted position by the action of the control cam. When a code bar is selected for mark and moves to the right, the Code Bar Extension is prevented from moving to the right by the blocking bail, therefore, information is not transmitted to the punch.

The Blocking Bail Extension Lever is moved to the left by the control cam. The Extension Lever has a projection that engages a notch on the left end of the Character Counter Bar and the Carriage Return Bar. This projection prevents the two bars from moving to the right. As the blocking bail slide moved to the left, its fork like projection engages the lower arm on the Clutch Trip Bar Link Bell Crank and the Bell Crank is rotated clockwise. (Figure 2-14) The right bell crank arm moves down against a forward projection of the Trip Bar Link Latch. The Latch is held down by the right bell crank arm as long as the control knob remains in the "K" position. This disengages the latch from the clutch trip bar link so that, as the clutch trip bar moves to the right, the clutch trip bar link does not move and the perforator clutch is not tripped.

The keyboard control selection lever is pivoted counterclockwise when the control knob is in the "K" position. In this position, the selection lever pin at point "B" in Figure 2-11 is free of the hook of the Reset Lever.

At the same time, the extension on the right end of the Keyboard Control Selection Lever moves up to the dotted position shown at point "C". In this position, as the clutch trip bar moves to the right, the projection at the right end of the selection lever trips the signal generator clutch trip lever, operating the signal generator mechanism.

3.2.2 Operation in "K-T" Keyboard Tape Position (Figures 2-11, 2-13, and 2-14)

With the control knob in the "K-T" position, there is direct keyboard transmission and simultaneous perforation of tape with monitoring of the message by the typing unit. This operation conditions the keyboard perforator linkage as follows:

The control cam is engaged by the keyboard control knob and the cam is turned by the knob to the "K-T" position (Figure 2-13). The control cam allows the blocking bail slide to go to the right when the control knob is in this position. The Blocking Bail and the Extension Lever, which are mounted on the Blocking Bail Slide, are also positioned to the right, releasing the Code Bar Extensions, the Character Counter Bar and the Carriage Return Bar. The character will be counted. When a code bar is selected for mark and moves to the right, the respective code bar extension will move to the right and the punch mechanism will be positioned.

As the Blocking Bail Slide moved to the right, the Clutch Trip Bar Link Bell Crank is pivoted counterclockwise freeing the Trip Bar Link Latch. When the Clutch Trip Bar moves to the right, the Trip Bar Link Latch will move the perforator Clutch Trip Bar Link, (Figure 2-14) tripping the perforator clutch and allowing it to engage

and rotate. The Keyboard Control Selection Lever (Figure 2-11) remains in its counterclockwise position so that it is not engaged by the Reset Lever and is still in position to trip the signal generator clutch trip lever.

3.2.3 Operation in the "T" Tape Position (Figures 2-11 and 2-13) Tape is perforated by the perforator but no signals are generated by the keyboard while the control knob is in the "T" position. The code bar bail is reset by the perforator since the signal generator mechanism is inoperative. Turning the keyboard control knob to the "T" position will condition the keyboard-perforator linkage as follows:

The Keyboard Control Selection Lever is pivoted clockwise, as shown in Figure 2-11 that its pin at point "B" is in position to be engaged by the hook of the reset lever. The right end of the keyboard control selection lever moves down and it will not engage the signal generator clutch trip lever when the clutch trip bar moves the selection lever to the right. In the "T" position, therefore, the signal generator clutch is not tripped and the signal generator is inoperative.

The keyboard control linkage (Figure 2-13) and the perforator clutch trip bell crank action is as described in the "K-T" position. The character counter bars and the code bar extensions are operative in this position.

3.2.4 Keyboard Control Selection Switch (Figures 2-11, 2-24, and 2-19)

The Keyboard Control Selection Switch controls the circuit for the Right Margin Indicator Switch and the End-of-Line Switch. (Figure 2-11) The upper contacts are closed when control knob is in the "T" position and sets up the circuit for the End-of-Line Switch. (Figure 2-19) The lower contacts are closed in "K" and "K-T" position and sets up the circuit for the Right Margin Indicator Switch. (Figure 2-24)

3.3 Signal Generator Mechanism (Figures 2-3 and 2-12)

The signal generator mechanism is operated by the keyboard action any

time the keyboard control is in the "K" or "K-T" position. The three basic assemblies which make up the signal generator are the all steel Clutch and Cam Assembly, the Locking Bail and Transfer Lever Assembly, and the Contact Box Assembly (Figure 2-3).

The contact assembly (Figure 2-12) acts as one pair of contacts in series with the signal line when it is in the operate condition. This pair of contacts are keyed for make and break conditions at a constant rate of speed to produce code impulses.

3.3.1 Signal Generator Clutch Action

A Keyboard Control Selection Lever is mounted on the left end of the clutch trip bar, (Figure 2-11). It is mounted on a stud which acts as a pivot point for the selection lever. When the clutch trip bar moves to the right, the keyboard control selection lever moves to the right also. When the keyboard control knob is in the "K" Keyboard or "K-T" Keyboard Tape position, a projection at the right end of the selection lever trips the signal generator Clutch Trip Lever as the selection lever moves to the right. When the Clutch Trip Lever is tripped, the clutch shoes engage the serrated surface on the inside of the clutch drum. When power is on (motor unit operating), the clutch drum rotates continuously in a clockwise direction (viewed from the front) because it is a part of the geared signal generator shaft. Since the clutch shoes are mounted on a disk that is part of the signal generator cam assembly, the cam rotates upon engagement of the clutch. The signal generator clutch is a one stop clutch. The printer has to be operating to operate the signal generator as its drive comes through the printer main shaft.

3.3.2 Transfer Lever Positioning (Figures 2-5 and 2-12)

Each numbered code bar has a vertical extension upward (Figure 2-3) near its left end, which is used to move its respective signal generator Transfer Lever (Figure 2-12) to the right and in a clockwise direction about the Transfer Levers pivot point when selected for mark condition.

The Transfer Levers are positioned according to the code each time a keylever is operated, regardless of the position of the keyboard control knob. However, in order for a code signal to be transmitted the clutch and signal generator cam must operate. In addition to the five mentioned transfer levers, there are two others which are not associated with code bars. These are used to originate the Start and Stop Pulses.

3.3.3 Cam Action (Figure 2-16)

The signal generator cam lobes are numbered from 1 to 8 from rear to front. There are seven signal pulse lobes on the cam - one for each transfer lever. The eighth cam lobe is used to actuate the Locking Bail (Figure 2-16). There is a cam eccentric at the front end of the signal generator cam which is used in the resetting of the code bars to their latched position. The cam lobes numbered 1, 2, 4, 5, and 6 respectively represent the 1, 2, 3, 4, and 5 numbered pulses in a character. The number 3 cam lobe is associated with the start pulse. The number 7 cam lobe is associated with the stop pulse.

3.3.4 Transfer Lever Locking Bail (Figures 2-12 and 2-16)

The transfer levers are always positioned while the Transfer Lever Locking Bail is on the peak of its cam, (Figure 2-12). The Locking Bail is spring loaded upward and it rides to the low part of its cam after a selection has been made and the cam assembly starts its revolution. The blade of the Locking Bail moves up beside the extension of the transfer levers and locks them in their previously selected position. These extensions extend downward from the horizontal portion of their transfer levers. When transfer levers are selected for mark the extensions would be to the right of the locking bail blade and when selected for space the extensions would be to the left of the locking bail blade.

In the first few degrees of the signal generator cam rotation (Figure 2-16) the transfer levers are locked in either the Mark or Space position and the code bars are free to be reset to their normal latched positions.

The locking bail blade holds the transfer levers in the locked position until the beginning of the stop pulse. The rotation of the number 8 cam lobe cams the Locking Bail downward and all of the transfer levers are free. The ones which were previously selected for mark are returned to the left by spring tension.

3.3.5 Signal Transmission (Figure 2-12)

Transfer lever #3 is the Start Pulse transfer lever (3rd transfer lever from rear). There is no code bar to engage this lever, hence it is always held to the left by its spring. As cam lobe 3 moves this lever down, the hook on the upper right of the lever engages the right hand side of the transfer bail. The downward movement of the transfer lever trips the transfer bail to the right and pulls the contact drive link to the right (Figure 2-12). The resulting action is that the mark contacts open. These contacts are in the signal generator Contact Box which is located just to the left of the Transfer Bail. Under this condition, there is "no current" in the signal circuit. This is known as a Space Pulse. The first pulse (or start pulse) of any character is a space pulse.

The signal generator cam lobe #1 moves its transfer lever downward next. For the character "Y", it has been shown that transfer lever #1 is positioned to the right. The upper left hook of this transfer lever pulls downward on the Transfer Bail, tilting the Bail back to the left. This pushes the drive link to the left, closing the mark contacts and allowing a Mark Pulse to be transmitted.

Similarly, transfer levers 2, 4, 5, and 6 are pulled downward by their respective cam lobes. The resulting pulse will be marking if the transfer lever is to the right or space if the transfer lever is to the left.

Transfer lever #7 is the stop pulse transfer lever. This lever is permanently held to the right by a stop post, therefore, the stop pulse

is always a mark pulse.

3.3.6 Code Bar Bail Eccentric Follower (Figures 2-6 and 2-16)
When the keyboard control knob is in the "K" or "K-T" position the resetting of the code bar bail is accomplished by means of an eccentric on the front of the signal generator cam (Figure 2-6 and 2-16). The Cam Eccentric drives the Code Bar Bail Eccentric Follower. The follower engages the Eccentric Stud mounted on the lower front of the Code Bar Bail and pulls the bail to the left as the cam rotates. As the code bar bail moves to the left, the Code Bar Bail Latch clears the Code Bar Bail Latch Roller and is pulled upward under spring tension to latch or reset the code bar bail. As the code bar bail moved to the left and into reset position, it engaged projections on the Code Bars, Clutch Trip Bar, Charater Counter Bar, Carriage Return Bar, and the non-repeat lever, thus moving all these elements to the left and into the latched or reset position.

3.4 Perforator Mechanism (LPE) (Figures 2-2, 2-3, and 2-13)
The perforator under discussion in this chapter is the LPE Non-Typing Model. This is the type of perforator most generally used with the ASR groups. Its purpose being that of preparing 5 - Level Chadless Tape for immediate or future transmission into the Signal Line.

The action of the Perforator is dependent upon the Keyboard and operates when any one of the 32 code keys is depressed provided the Keyboard Control Knob is in the "K-T" or "T" position.

The five basic components which make up the perforator are; the two stop All-Steel Clutch, Rocker Bail, Code Bar Extension Assembly, Punch Unit and a Backspace Mechanism.

3.4.1 Perforator Mainshaft
The Perforator Mainshaft is driven by power of the motor through a drive shaft, gear and pinion and an all steel clutch. The shaft assembly consist of two cams for Rocker Bail Action, One Reset Cam, a Two-Stop Clutch, Fiber Gear, Backspace Eccentric and Mainshaft Bearings.

Any Character Perforation is completed in 180° rotation of the clutch. The functions are as follows:

1. Rocker Bail Cams provide driving power for punching and feeding the tape.
2. The Reset Cam provides driving power for resetting the Code Bar Bail if the keyboard control knob is in the "T" position. Pins in the cam also provide a means of disengaging the clutch.
3. The Backspace Eccentric provides driving power to operate the Backspace Mechanism.

3.4.2 Perforator Clutch Action (Figure 2-14)

When any code key is depressed and the Code Bar Bail is released, the clutch Trip Bar moves to the right. There is a clutch Trip Bar Link Latch attached to the left end of the Clutch Trip Bar which would be engaged with the Clutch Trip Bar Link when the Keyboard Control Knob is in the "K-T" and "T" positions.

The clutch Trip Bar Link and the Perforator Trip Lever Latch are pulled to the right as the Clutch Trip Bar moved to the right. The Perforator Trip Lever Latch connects with the Perforator Trip Lever at point "B" and rotates the Lever counterclockwise until its upper extension disengages from underneath the Clutch Release Arm at point "A". The Clutch Release Arm is pulled downward by its spring tension causing its shaft and the Clutch Trip Lever to rotate counterclockwise enough to allow the clutch to engage and begin its half cycle of rotation.

The upper portion of the Trip Bar Link Latch comes in contact with the stop at point "D" (Figure 2-14) as the Clutch Trip Bar nears the end of its movement to the right. The latch then pivots counterclockwise, releasing the Clutch Trip Bar Link which moves rapidly to the left under the action of the compression spring shown immediately below the stop. The Clutch Trip Bar Link is stopped in its movement to the left by its

extension striking the stop at point "C". The Perforator Trip Lever Latch is to the left of, and completely free of the Perforator Trip Lever. As the Clutch Release Arm pivots clockwise under the resulting action of the Reset Pin on the Reset Cam, the perforator trip lever is released from its counterclockwise position and allowed to rotate clockwise to its normal position as shown in Figure 2-14.

During the same period of time, the Clutch Trip Bar is being reset and is moving to the left. As the Trip Bar Link Latch moves to the left away from the stop at point "D", it pivots clockwise to its normal position so that when the Clutch Trip Bar is at the extreme left of its reset travel, the latch is again allowed to hook under the Clutch Trip Bar Link. This completes the operating cycle.

3.4.3 Reset Cam Follower Action (Figure 2-11)

Code Bar Bail resetting is accomplished by the Reset Cam Follower mechanism which is driven by the perforator clutch action. When a keylever is operated, the Code Bar Bail and the Clutch Trip Bar move to the right and the reset lever with hook is in position to engage the pin (B) at the left end of the Keyboard Control Selection Lever (Figure 2-11). When the Perforator Clutch is tripped, the Reset Cam begins to rotate counterclockwise and, as it does, the Reset Cam Follower Arm and associated Reset Lever rotate clockwise. The hook on the Reset Lever engages the pin on the Keyboard Control Selection Lever and pulls the clutch trip bar to the left. The configuration of the Reset Cam is such that near the end of the operating cycle, the Reset Lever with hook will move slightly to the right away from the pin of the Keyboard Control Selection Lever. The Clutch Trip Bar again starts to move to the right until the Code Bar Bail becomes latched, thus preventing further movement of the Clutch Trip Bar.

3.4.4 Punch Slide Positioning (Figure 2-13 and 2-14)

When one of the code keys of the Keyboard is depressed, the Code Bar Bail is released and the Clutch Trip Bar and Code Bars move to the

right. The Code Bars selected for MARK and their respective Code Bar Extensions move farther to the right. As the Code Bar Extensions selected for MARK moved to their full right position, their upper extensions (Figure 2-13) engage their respective Punch Slide Latches at point "C", causing the Slide Latches to rotate counterclockwise and unlock the Punch Slides at point "B".

As the Code Bar Bail moves to the right and causes the Perforator Trip Lever (Figure 2-14) to move counterclockwise, allowing the clutch to become engaged, the Reset Bail Slide Trip Lever which is clamped to the Perforator Trip Lever moves the Punch Slide Reset Bail Extension down. The Punch Slide Reset Bail along with its extension moving downward becomes disengaged from the shoulders underneath the Punch Slides and allows all of the Punch Slides to move to the left by their spring tension (Figure 2-14). The Punch Slide selected for SPACE will move only as far as the latch pawls will allow and the ones selected for MARK will move to their extreme leftward travel and their left ends will come to rest beneath their respective punch pins. After the tape is perforated the Punch Slides will be reset and ready for future selection.

3.4.5 Tape Perforation (Figure 2-15 and 2-17)

The tape perforation is accomplished by forcing punch pins through the paper tape. A perforation represents a MARK condition and an unperforated portion of tape represents a SPACE condition.

The punch mechanism is operated by the Rocker Bail through the Perforator Drive Link (Figure 2-15). The Rocker Bail receives its motion from the function cam through two Rocker Bail Cam Follower Rollers. The rollers are positioned, relative to two lobes of the cam, in such a way that one roller provides power for tape perforating and the other provides power for tape feeding.

The Perforator Drive Link connects the Rocker Bail to the Rocker Arm. The Rocker Arm, is connected through a Toggle Bail to operate the Punch Main Bail and Reset Bail. When the Punch Slides are selected for MARK they move to the left under spring tension. A hook type projection on the Punch Slide moves over a post on the Main Bail so that the Punch Slides move with the Main Bail during the perforating cycle. The Main Bail then drives the Punch Slides which were selected for MARK upward to operate their respective Punch Pins. The tape is perforated adjacent to each operated Punch Pin.

The Retractor Bail engages a notch in each Punch Pin to retract the pin after perforation. During the perforating operation, the notch in the selected Punch Pins engage the Retractor Bail which, under spring tension, holds the Punch Pins against their respective punch slides until the pins clear the lower edge of the tape and the retractor bail reaches its rest position.

The Retractor Tension Springs are connected to the Main Bail assembly so that when the Punch Slide contacts the Punch Pin, the slide, bail, retractor, and retractor tension spring move as a unit. A compression spring is mounted on the #3 punch pin. This arrangement makes the peak punching load approximately equal to the peak feed load.

During the tape feeding half of the perforating cycle, the Punch Slides are moved to their unoperated positions by the reset bail. The tape feeding function is accomplished by the Perforator Feed Pawl (Figure 2-21) which is attached to the Toggle Bail. The Feed Pawl drives the Feed Wheel to its detented position during the tape feeding cycle.

Feed holes are rolled into the tape for ten characters per inch spacing. The tape is pressed on the Feed Wheel by the Die Wheel and is held by the Tape Shoe and its torsion spring. The tape is stripped from the feed wheel by a Stripper Plate of the punch block assembly and fed into the punch block. A Tape Guide Spring holds the tape against a reference

block, and the feed holes are maintained a constant distance from the tape edge.

The Stripper Plate of the punch block assembly and the tape shoes are designed in such a way that tape feeding from the feed wheel is pressed against the stripper plate by the tape shoe, thereby eliminating the necessity of a tape shield. This facilitates printing on the tape and prevents the tape from jamming.

3.4.6 Power Drive Backspace Mechanism (Figures 2-17 and 2-18) The Power Drive Backspace Mechanism is used to backspace perforated tape to delete errors in character information. The tape is backspaced until the first erroneous character is over the punch pins. The erroneously punched character is effectively erased by operating the LTRS Keylever.

Backspacing is accomplished automatically by operating the TAPE B. SP. keylever (Figure 2-18). The detailed operation of the mechanism is as follows:

The Tape Backspace Switch circuit is completed by operating the TAPE B. SP. Keylever. The fircuit to the magnet assembly of the Power Drive Backspace Mechanism is then energized, causing the Armature Bail to move down. When the Armature Bail moves down, an extension on the bail moves down disengaging the Drive Link Latch Extension, allowing the Drive Link Latch to pivot clockwise and engage the Eccentric Arm.

The Eccentric Arm, which is driven by the cam shaft of the perforator, moves to the right. This action causes the Bell Crank handle to be depressed through the system of linkages between the Drive Link Latch and the Bell Crank. Depressing the handle of the Bell Crank causes the Rake Shaft to be rotated counterclockwise through the gearing of the Rake Shaft and the segment gear. The Rake Shaft teeth contact and depress the chads of the tape.

When the Bell Crank handle is partially depressed, it contacts an extension of the Perforator Feed Pawl. Further movement downward causes the Perforator Feed Pawl to be disengaged from the Feed Wheel Ratchet. The Backspacing Feed Pawl then engages the Feed Wheel Ratchet and rotates the Feed Wheel clockwise, backspacing the tape to the next row of perforations. Backspacing is continued until the erroneously punched character (or the first of several erroneously punched characters) is above the punch pins. The LTRS Keylever is then operated to effectively erase the erroneously punched character or characters.

When the magnet assembly is de-energized upon the release of the TAPE B. SP. Keylever, the Armature Bail extension moves upward and disengages the Drive Link Latch from the Eccentric Arm. In the unoperated position, the fork of the Eccentric Arm slides freely along the pivot post of the Drive Link.

3.5 Character Counter Mechanism (Figures 2-19, 2-20, and 2-21)

The Character Counter will operate only when the Keyboard is in the "K-T" Keyboard Tape or the "T" Tape position. The Character Counter mechanism (Figure 2-19 and 2-20) is driven mechanically by the action of the Character Counter Bar and the Carriage Return Bar. These bars have drive projections which engage the Reset Bail and the Drive Lever Feed Bail. The bars move to the right when a keylever is operated, the counter mechanism is then tripped. As the Keyboard is reset under power, the counter performs its required functions. These functions may be divided into three distinct phases of operation:

1. Stepping
2. Counter Reset
3. Restart

3.5.1 Stepping (Figure 2-21)

When certain keylevers are operated, the Character Counter Bar moves to the right and moves the lower end of the Drive Lever Feed Bail to the

right. (Refer to sequence A, Figure 2-21). The Rachet Drive Lever, which is linked to the Drive Lever Feed Bail, moves to the left slightly more than one tooth. As the bars are reset under power, the Drive Lever Feed Bail moves clockwise, causing the Ratchet Drive Lever to advance the ratchet drum one tooth. The Ratchet Latch Lever prevents the Ratchet Drum from rotating counterclockwise when the Drive Lever is tripped for the following character. When this occurs, the Ratchet Drum rotates slightly counterclockwise, coming to rest against the Latch Lever.

3.5.2 Counter Reset (Figure 2-21)

The tripped position of the Counter Mechanism for a reset function is illustrated in sequence B (Figure 2-21). The reset Bail moves counterclockwise as the Carriage Return Bar moves to the right, causing the Reset Lever to rotate clockwise. As the Reset Lever rotates clockwise, the Reset Lever Extension moves downward, until it falls under the shoulder of the projection on the Drive and Latch Levers, due to the tension of its spring. When the bars are reset, the Reset Bail is rotated clockwise to its original position. (See sequence C, Figure 2-21). As the Reset Bail moves clockwise, the Reset Lever rotated counterclockwise, moving the Reset Lever extension upward and moving both the Drive and Latch Levers out of engagement with the Ratchet Teeth. The mechanism remains in this condition and the Ratchet Drum assembly rotates rapidly counterclockwise (under the tension of its return spring) until it reaches the zero position.

As the Ratchet Drum reaches the zero position, a projection from the rear of the ratchet strikes a Stop Lever fastened to the counter bracket. The elastic impact is transmitted through the Stop Lever to the Anti-Bounce Lever whose lower end is normally in contact with the Stop Lever. The Anti-Bounce Lever rotates clockwise, dropping in behind the ratchet stop projection long enough to prevent any mechanical bounce

action. The ratchet stop projection comes to rest in contact with the Stop Lever. The Anti-Bounce Lever returns counterclockwise under spring tension to its normal at rest position.

3.5.3 Restart (Figure 2-21)

The restarting action of the counter mechanism for the character following a carriage return is illustrated in sequence D, Figure 2-21. When a key lever is operated, the Character Counter Bar moves to the right, the Drive Lever Feed Bail moves counterclockwise and the Ratchet Drive Lever moves to the left. The Ratchet Drive Lever moved to the left and disengaged from the Reset Lever Extension and dropped into engagement with a ratchet tooth. As the bars are reset under power, the Drive Lever Feed Bail rotates clockwise moving the ratchet drive lever to the right. The lower projection on the Ratchet Drive Lever moves the reset lever extension to the right and out of engagement with the Ratchet Latch Lever. The Ratchet Latch Lever drops into engagement with the Ratchet Drum. As the Ratchet Drive Lever completes its movement, the ratchet is advanced one tooth as in the normal stepping operation.

3.6 Special Features

The Keyboard Perforator Transmitter has certain Model 28 features other than the basic operation which will be discussed here.

3.6.1 Local Line Feed Mechanism (Figure 2-22)

Operation of the LOC LF Keylever will result in paper being fed out of the typing unit when the power is on. Operating the LOC LF Keylever raises the forward end of the local line Feed Bail (Figure 2-22). This bail pivots and its upper end pushes the attached Local Line Feed Trip Link toward the rear until the link engages the Line Feed Clutch Trip Lever on the typing unit. The line feed mechanism on the typing unit is made to operate without a signal and other typing units on the same line circuit are not disturbed.

3.6.2 Local Carriage Return Mechanism (Figure 2-23)

Operation of the LOC CR Keylever will result in the Type Box Carriage being returned to the left margin of the typing unit. The Local Carriage Return Mechanism is not dependent on motor power to complete its function. The spring in the spring drum of the typing unit is used as the force that returns the Type Box Carriage to the left margin.

When the LOC CR Keylever is operated, its function lever raises the forward end of the Local Carriage Return Bail (Figure 2-23). This bail rotates about its pivot point until the upper end of the bail engages the Carriage Return Lever on the typing unit. The carriage return mechanism operates in this manner without a signal that would cause other units. in the line circuit to function.

3.6.3 Repeat Mechanism (Figure 2-10)

Operation of the REPT Keylever simultaneously with one of the keylevers in the three lower rows or the space bar disables the Non-Repeat Mechanism. The character or function selected will be repeated as long as the REPT Keylever is held operated. The operated REPT Keylever causes its function lever to raise the right end of the Non-Repeat Lever (Figure 2-10). The Non-Repeat Lever will rotate counterclockwise a very short distance. In this position, the Non-Repeat Lever cannot be engaged and operated by the Code Bar Bail, therefore, the Non-Repeat Lever Crank will not reset the operated Code Bar Bail Latch. The Code Bar Bail and Universal Bail Latch Lever are thus maintained in their operated positions. The code Bar Bail continues to follow the Eccentric Arm movement back and forth until the REPT Keylever is released.

3.6.4 Margin Indicator Mechanism (Figure 2-24)

The margin indicator cam disc on the typing unit spring drum rotates with the drum as spacing occurs. The cam surface of the disc makes contact with the margin indicator contact switch lever and rotates the lever clockwise about its pivot point as the right hand margin is approached, Figure 2-24. When the switch lever rotates, it releases the margin

indicator switch plunger. The normally open contacts close, completing the circuit to a margin indicator light in the cabinet. The carriage return cycle returns the cam disc to its left margin position and the margin indicator switch opens. The switch may be operated only when the keyboard is in the "K" Keyboard and "K-T" Keyboard Tape positions. When the keyboard is in the "T" Tape position, the typing unit is not being operated and the margin indicator cam disc is not turning.

3.6.5 End of Line Switch (Figure 2-19)

The end-of-line switch operates the margin indicator light located in the cabinet. The switch circuit is operative only when the keyboard is in the "T" Tape position. In the "K" Keyboard and "K-T" Keyboard Tape positions, the margin indicator light is operated by the margin indicator switch.

Operation of the character counter end-of-line indicator switch is controlled by a switch cam (Figure 2-19). The switch cam rotates with the ratchet drum and can be adjusted to close the switch at any typed line length of from 10 to 80 characters.

3.6.6 Tape Supply Container (Figure 2-2)

The tape supply container is located at the left rear corner of the perforator transmitter base. The container holds the roll of tape in a vertical position. A low-tape switch mechanism is available, as an optional feature with the container, to initiate a signal when the supply of tape is low.

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TRANSMITTER DISTRIBUTOR (LBXD-4)

1.0 INTRODUCTION

The LBXD-4 Transmitter Distributor is a tape reader designed to meet today's transmission needs as well as tomorrow's multi-level tape requirements. It will handle 5, 6, 7 and 8 level codes with tapes of appropriate widths and is easily converted from one to the other of these standard codes. The LBXD-4 we use will be adjusted to handle the 5 level baudot code. The LBXD series may be identified by a multi-contact stationary tape sensing head and a signal distributor. The tape sensing head and the signal distributor may be operated together as a unit or each may be actuated indpendently of the other by either local or remote control. Signals sensed in the transmitter portion may be fed into the distributor section for sequential transmission into a signal line or forwarded as 5-wire output. Input into the distributor can also be from any 5 wire external source for immediate conversion to sequential transmission into a signal line.

2.0 OPERATIONAL FEATURES AND SIGNAL CODE

The LBXD-4 incorporates provisions for the following operational features:

a. Storing the last character sensed for subsequent transmission.

b. Sensing and distributor mechanisms capable of being actuated independently of one another from either a local or remote source.

c. Wiring of the transmitter distributor terminating at three 14-point connectors facilitates removal of the unit from the cabinet.

d. Accomodation of fully perforated or chadless tape, straight or advanced feed, round or square hole.

e. Operating speeds up to 100 words per minute with gear change only.

f. Auxiliary contacts "A" and "B" operated from the sensing cam sleeve for controlling external circuits. The "B" contact operates the distributor clutch magnet.

g. Auxiliary contact "C" operated from the distributor cam sleeve for controlling external circuits.

h. An oil reservoir for extending lubrication intervals.

i. An index mark located seven characters ahead of the sensing pins for aligning the message start position.

j. Spring-biased tape lid which raises when the tape lid release plunger is depressed.

k. A start stop lever with a free-wheeling position to facilitate insertion or removal of tape.

l. Five level tape handling facilities with provisions for modification to accomodate six, seven or eight level tapes.

m. Tape-out pin, either four characters in advance of, or in line with the tape sensing pins.

n. A tight tape switch for stopping tape and transmission when the tape becomes tangled or the tape slack is taken up.

The signaling code used is the five-unit Baudot, start-stop code which consists of current and no-current intervals or pulses. A marking pulse is a measured interval of time during which current flow is permitted through the closure of a contact. A spacing pulse is a measured interval of time during which the flow of current is interrupted through the opening of a contact. The transmission pattern for a complete character consists of a start pulse (always spacing), five code pulses - any one of which may be either marking or spacing, and a stop pulse (always marking). The start and stop pulses are to keep the receiving apparatus in synchronism with the transmitter.

3.0 OPERATING CONDITIONS

The following operating conditions need to be fulfilled before the Transmitter Distributor begins tape transmission:

a. AC Power switch in its "ON" position.

b. Current applied to the distributor and sensing clutch trip magnet circuits and the motor power circuit at the base connector terminals.

c. Tape inserted in the transmitter, tape lid closed, and the start-stop lever in its start position.

d. Place the line-test switch in either TEST or LINE position depending upon requirements. (Requirements as determined by the operator.)

e. Press the tran. start button on the control panel and transmission of the message will begin.

4.0 D. C. ELECTRICAL CIRCUITS (Figure 3-4)

There are two DC circuits that pass through the LBXD-4 transmitter distributor components.

1. Signal line circuit.
2. Clutch magnet circuit.

4.1 Signal Line Circuit

The signal line enters the transmitter distributor through the storing switch 14 point connector to the contact terminal plate, through the 5 adjustable contact screws and out through the 14 point connector to a terminal board external to the transmitter distributor. Continuing from the terminal board through the distributor block 14 point connector into the distributor block contact terminals and through the 6 adjustable contacts back out through the 14 point connector re-entering the other side of the signal line. In this manner the transmitter distributor is connected in series with the signal line and all line current will flow through the storing switch and distributor block contacts whenever the path is complete.

4.2 Storing Switch Circuit

When the sensing cam sleeve rotates and a character in a tape has been sensed by the sensing pins, the mark pulses will have their circuits completed, from the contact screws in the storing switch terminal plate, through the contact levers, contact springs, contact spring terminal

plates and then back to the 14 point connector. The space pulses for a character will have an open circuit because their contact levers will not be moved against the contact screws in the storing switch terminal plate. In order to have a good electrical circuit, the contact springs are screwed to a threaded projection of the contact levers. The other end of the contact springs are screwed on to contact spring terminal plates. The contact spring terminal plates have wires attached between them and the 14 point connector.

4.3 Distributor Block Circuit

When the distributor cam sleeve rotates, the contact rockers follow their cams and allows their contacts to close with the contact screws and the character that is in the storing switch will be transmitted into the signal line. The circuit continues from the contact rockers through the rocker level guides which are connected by springs to the spring holder terminals. The terminals have a shunt bar across them with a single wire going to the distributor block 14 point connector and on to the signal line.

4.4 Clutch Magnet Circuit

The DC current for this circuit is supplied by the rectifier in the ASR cabinet. There are three paths of current flow.

1. Sensing clutch magnet
2. Distributor clutch magnet
3. Tape switches

4.5 Sensing Clutch Magnet Circuit

The DC path for this circuit is from the rectifier to the 14 point connector through the sensing clutch magnet then back to the connector which is next to the storing switch connector. This circuit continues, after leaving the transmitter distributor to the start relay contacts which must be closed before the sensing clutch magnet can be energized to start the sensing cam sleeve to rotating.

4.6 Distributor Clutch Magnet Circuit

The DC path for this circuit is from the rectifier through the Transmitter Distributor and a storing switch connector. The path continues through the auxiliary "B" contact in the storing switch, then leaves the Transmitter Distributor through the storing switch connector. (The auxiliary "B" contact is closed by a cam surface on the sensing cam sleeve after sleeve rotation of approximately 270 degrees from the stop position.) This DC path re-enters the Transmitter Distributor through a 14 point connector mounted next to the storing switch connector. The path then continues from the connector to the distributor clutch magnet and then returns to the connector. After leaving the connector, the circuit reaches a ground terminal.

4.7 Tape Switches

The DC for this circuit enters the Transmitter Distributor at the 14 point connector next to the storing switch connector and continues to the end-of-tape contacts and returns to the connector. The circuit then leaves the Transmitter Distributor to go to a distant terminal connection and then returns to re-enter the same 14 point connector but through a different point. The path continues through the tight tape contacts and then leaves the Transmitter Distributor through the 14 point connector. This circuit continues, after leaving the Transmitter Distributor, to the transmitter stop contacts on the control panel.

5.0 OPERATIONAL FUNCTIONS

5.1 Sensing Shaft (Figure 3-19, Timing Chart)

The sensing clutch will engage and begin to rotate the sensing cam sleeve when the sensing clutch magnet is energized. The sensing clutch drum gear is driven by the idler gear which is driven by the distributor clutch drum gear. The sensing and the distributor shafts operate at the same speed.

5.1.1 Clutch Tripping (Figure 3-5)

As the sensing clutch trip magnet is energized, its armature and armature extension bail are attracted to the magnet core, thus releasing the latching extension of the lower trip lever. The lower trip lever and the upper trip lever pivot on their shaft and the upper trip lever releases the clutch shoe lever from the stop lug on the clutch cam disk. The cam disk on the clutch is connected to the cam sleeve and engagement of the clutch starts the sensing cam sleeve rotating.

5.1.2 Clutch Engagement (Figure 3-6)

Clutch engagement is accomplished by releasing the lower end of the clutch shoe lever, B. The upper end of the clutch shoe lever pivots about its ear, C, (which bears against the upper end of the secondary shoe) and moves its ear, D, and the upper end of the primary shoe toward the left until the shoe makes contact with the drum at point E. As the drum turns counter-clockwise, it drives the primary shoe downward so that it again makes contact with the drum, this time at point F. There, the combined forces acting on the primary shoe cause it to push against the secondary shoe at point C. The lower end of the secondary shoe then bears against the drum at point H. The revolving drum acts to drive this shoe upward so that it again makes contact with the drum at point I. Since the forces involved are multiplied at each of the preceding steps, the final force developed at point I is very great. This force is applied to the lug J on the clutch cam disk to cause it to turn in step with the drum.

5.1.3 Clutch Reset (Figure 3-5)

As the sensing cam sleeve starts its rotation, the reset extension of the lower trip lever rises to the peak of its cam to place the upper trip lever in the path of the clutch shoe lever.

Should the magnet remain energized, the armature will remain attracted to the magnet core and the armature extension bail will be prevented from latching the lower trip lever. Then, as the cam continues to rotate, the reset extension of the lower trip lever will ride to the low part of its cam and permit the upper trip lever to pivot out of the path of the clutch shoe lever. The cam will continue to rotate thus, until the trip magnet is no longer energized.

When the clutch trip magnet circuit is interrupted, the armature and armature extension bail will be released. Then, as the reset extension of the lower trip lever rides to the high part of its cam, the latching extension will be latched by the armature extension bail to hold the upper trip lever in the path of the clutch shoe lever. As the clutch shoe lever strikes the upper trip lever, the inertia of the clutch will cause it to rotate a slight additional amount and permit the clutch latch lever to fall into the notch in the cam disk. In this position, the clutch shoe lever is held in proximity to the stop lug on the clutch cam disk.

5.1.4 Clutch Disengagement (Figure 3-7)

Disengagement is accomplished by bringing together lug A on the clutch cam disk and the lower end of the clutch shoe lever B. The upper end of lever B pivots about its ear C and allows its other ear D to move toward the right. The upper spring then pulls the two shoes together and away from the drum to stop rotation of the clutch and cam sleeve.

5.1.5 Tape Feeding Action (Figure 3-8)

As the sensing cam sleeve rotates, a roller on the rear feed lever rides to the high part of its cam, moving the lower extension of the front feed lever downward. The feed levers actuate a feed pawl assembly which then engages a tooth on the feed wheel to rotate the feed wheel one space. As the feed wheel rotates, the detent lever roller will move into the hollow between two teeth and hold the feed wheel in position. With the

continued rotation of the sensing cam sleeve, the feed lever roller rides to the low part of its cam and the feed pawl rises to move past the next tooth where it is in position for the next cycle.

5.1.6 Tape Sensing Action (Figure 3-9)

At the start of the sensing cam sleeve rotation, the sensing pins are in their downward position, withdrawn from the tape, and the storing switch contacts are arranged in accordance with the code combination of the previously sensed character.

5.1.7 Pusher Bail (Figure 3-10)

As the pusher bail roller rides to the peak of its cam, the pusher bail moves the pusher levers to the right, thus stripping any previously selected pusher levers from the shoulders of their sensing pins. Then, as the pusher bail roller rides to the indent of its cam, the pusher bail is withdrawn from the pusher levers to permit the levers to rest against their sensing pins.

5.1.8 Sensing Bail (Figure 3-11)

The sensing bail rollers move into the indent of their cams and the right end of the sensing bail rises to permit the sensing pins to rise and sense the code perforations in the tape. If the code level sensed by a pin is not perforated, travel of the pin is blocked by the tape and the pusher lever remains to the right of its associated sensing pin shoulder. If the code level is perforated, the pin is free to rise through the perforation sufficiently to permit the top of the pusher lever to drop under the shoulder of the sensing pin. Further rotation of the sensing cam sleeve will move the sensing bail rollers to the peak of their cams and start the right end of the sensing bail, the sensing pins and the selected pusher levers will move downward.

5.1.9 Latch Bail (Figure 3-12)

As the latch bail roller rides to the peak of its cam, the lower end of the latch bail will be moved to the left to actuate the latch levers. The lower end of the latch levers are moved to the right to release any previously latched slides and the slides will start to rise under the tension of their springs. If its pusher lever has not been selected, the slide is free to rise to its unoperated position. If its pusher lever has been selected, and moved downward by the sensing bail, the pusher lever will hold the slide down. Then, as the latch bail roller rides to the indent of its cam, the lower end of the latch bail will move to the right, permitting the latch levers to latch the slides in their operated position.

5.1.10 Storing Switch (Figure 3-13)

In its unoperated or upward position, the slide holds the contact lever upward and the contact open. In its downward position, the slide permits the contact lever to move downward and close the contact. Thus, the code combination of the sensed character is stored in an arrangement of the storing switch contacts, and will be transmitted sequentially over the signal circuit on the next cycle of the distributor cam sleeve.

5.2 Distributor (Figure 3-2, 3-3)

5.2.1 Distributor Shaft

There are two helical gears mounted on the distributor shaft (Figure 3-2). The rear one is in the distributor shaft driving gear. The gear mounted next to the clutch is the clutch drum gear. The clutch drum gear, through an idler gear, causes the sensing clutch drum gear to rotate the sensing and distributor shafts at the same speed. As the distributor clutch trip magnet (Figure 3-3) is energized, the distributor clutch will engage and rotate in a manner similar to that of the sensing clutch (as previously described), causing the distributor cam sleeve to rotate.

5.2.2 Distributor Contacts (Figures 3-4, 3-14, and 3-15)

The contacts of the storing switch assembly will have been arranged in conformance with the code combination of the last character sensed by the sensing mechanism. Then, as the distributor cam sleeve (Figure 3-7) continues its rotation, the cam follower levers will be actuated by their cams to open and close the distributor contacts for measured intervals of time. Operation of the distributor contacts (in series with the storing switch contacts) will generate a signal pattern corresponding to the code combination of the previously sensed character. Distributor contact numbers 2, 3, 4, 5, and 6 correspond to the 1, 2, 3, 4, and 5 numbered pulses of any character that will pass through the distributor contacts. Distributor contact number 7 corresponds to the stop pulse of any character transmitted. Distributor contact number 9 represents the auxiliary "C" contact which is not presently used by the FAA.

5.3 Controls

5.3.1 Start-Stop Lever Action (Figures 3-16 and 3-17)

The Start-Stop Lever Bail is spring loaded in such a way as to keep the Start-Stop Lever normally operated to the right or clockwise direction. This position of the Start-Stop Lever is called the "RUN" position. While in this position, the Start-Stop and Tight Tape Switch contacts are closed, and the Feed Pawl and Feed Wheel Detent are resting against the Feed Wheel Ratchet. By manual operation of this lever, two other positions are provided to control certain functions of the Transmitter-Distributor. The two positions other than the "RUN" are the "STOP" and "FREE-WHEELING".

As the Start-Stop Lever is moved counter-clockwise to the center or "STOP" position, it cams the Start-Stop Lever Bail against its spring tension, moving the bail in a clockwise direction. The Start-Stop Lever Bail acts upon a Yield Bail through spring tension, pulling the Yield Bail

in a counterclockwise direction. As the Yield Bail is rotated in this direction, it carries the Start-Stop Slide to the right. The right hand movement of this Slide Arm opens a pair of contacts of the Start-Stop and Tight Tape Switch. Actuation of the switch opens the Sensing Clutch Magnet Circuit to de-energize the magnet and stop the rotation of the sensing cam sleeve.

Free-Wheeling (Figure 3-17) - When the Start-Stop Lever is moved to the left, "Free-Wheeling" position, the lever cams the Start-Stop Lever Bail an additional distance and an extension of the bail disengages the feed pawl and detent lever from the feed wheel to permit the wheel to rotate freely. Also, the Start-Stop Lever Bail extension operates an extension of the Tape Out Pin Depresser Bail to depress the tape-out pin and permit the tape to pass freely under the tape lid.

5.3.2 Tape-Out (Figure 3-17)

The contacts of the end-of-tape switch are in the DC circuit from the local rectifier and connected in series with the tight tape switch, transmitter stop switch, start relay, and several other sets of contacts before the circuit is completed. A set of start relay contacts is in series with the sensing clutch trip magnet. When the end-of-tape contacts open; the start relay will de-energize opening the sensing clutch magnet circuit to stop the transmission.

5.3.3 Tape Lid (Figures 3-2 and 3-18)

When the red plastic tape lid release plunger is depressed, it operates the plunger bail. The latching extension of the plunger bail releases the tape lid latching post permitting the post spring to move the post downward and the tape lid upward. Manually depressing the tape lid causes the latching post to move upward above the latching extension of the plunger bail. The latching extension of the bail then moves under the post to hold the post up and the tape lid closed.

6.0 SUMMARY

As the sensing clutch trip magnet is energized, the clutch will trip and the sensing cam shaft will start rotating.

As the sensing clutch and cam sleeve rotates it will advance the tape, sense the tape, store the sensed character in the storing switch, and operate auxiliary contacts "A" and "B".

The auxiliary "B" contact will close to energize the distributor clutch trip magnet and the distributor contacts will operate to distribute a pattern of code pulses over the signal line (corresponding to the combination reposing in the storing switch from the previously sensed character).

In continuous transmission, the sensing cam will have started its next cycle while the actions controlled by the distributor cam sleeve are taking place. These motions will continue until the sensing clutch trip magnet circuit is interrupted (as by the exhaustion of tape or by pushing the stop button), whereupon, the sensing clutch will disengage and the transmitter will be stopped in the idle position.

MODEL 28 ASR

CHAPTER FOUR

ELECTRICAL CIRCUITRY

INDEX

MODEL 28 ASR

CHAPTER FOUR

ELECTRICAL CIRCUITRY

1.0 GENERAL CIRCUITRY (FIGURE 4-1)

The following basic units of the Model 28 ASR set contain components of the electrical circuit covered in this chapter. They are: The Electrical Service Unit and Cabinet, Keyboard-Typing Unit-Perforator, Relay Control Group, Control Panel, and Transmitter-Distributor.

The set is self-contained and may be used for message transmission as well as message reception.

1.1 ELECTRICAL SERVICE UNIT AND CABINET (FIGURE 4-1)

The components of the Electrical Service unit are mounted on a basic chassis located behind the Keyboard-Typing Unit-Perforator in the cabinet. The convenience receptacle, fuse, and power switch are shown at the upper right in the drawing of Figure 4-1. In order to permit closer fusing of the set, the convenience receptacle is placed directly across the incoming power leads, ahead of the fuse. The power switch is operated from a knob on the front of the cabinet just below and to the right of the keyboard. This knob connects through an extension shaft to the power switch. The fuse, a 6 1/4 ampere, type MDX, Slo-Blo, supplies power to the "Maintenance On" terminal of the copy light switch. The power switch supplies power to the motor circuit, the "Normal On" terminal of the Copy Light Switch, the Line Shunt Relay, auxiliary line shunt relay, the signal bell circuit, the primary of the local DC power supply transformer, and the primary of the copy light step-down transformer.

1.1.1 Copy Light Circuit

The copy light switch and copy lights are located in the cabinet dome. The copy light step-down transformer is mounted on the rear cabinet wall, to the left of the Electrical Service Unit. When the copy light switch is turned to "Maintenance On," the copy light will light even though the power switch

is off. In the "Off" position, no power is applied to the copy lights. In the "Normal On" position, the lights shine only when the power switch is on. The two 6.3 volt, double contact, bayonet base type, lamps are connected in parallel.

1.1.2 Line Shunt Relay Circuit

The line shunt relay is located at the left end of the Electrical Service Unit and can be identified by its black bakelite cover. With the power switch on, the contacts are open, and the signal line is connected to the line winding of the relay. With the power switch in the off position, the contacts are closed, causing the signal line to be shorted by the line shunt relay. With the signal line shorted, the line relay may be removed for servicing without opening the signal line. Electrical interlocks in the cable connector sockets of the typing unit and the keyboard perforator, de-energize the line-shunt relay when either plug is disconnected from its receptacle. This prevents an open condition of the signal line should the plugs be removed from their receptacles during operation, either accidently or for the removal of the associated unit for maintenance.

1.1.3 Auxiliary Line Shunt Relay Circuit

An auxiliary line shunt relay is used to prevent an open condition of the signal line in event the transmitter-distributor cable connector is removed during operation or if the AC power is disconnected. An electrical interlock in the distributor connector of the transmitter-distributor de-energizes the auxiliary line shunt relay when the plug is disconnected from its receptacle.

1.1.4 DC Power Supply Circuit

The DC power supply, located near the center of the Electrical Service Unit, uses two silicon diodes to provide full wave rectification with an output of 115 volts DC at 300 Ma. It furnishes the DC voltage for the

selector magnet current and line relay bias current in the printer unit for the magnets of the sensing and distributor clutches in the transmitter-distributor, for the relay control group and DC control relay, and for the local test loop in the ASR cabinet. The DC power supply is protected against overloading by a 375 Ma, type AGC fuse in its output circuit.

1.1.5 Signal Bell Circuit (Figure 4-1)

The signal bell is located on the underside of the cabinet just below the typing unit. Receiving the signal bell code on the line will cause the signal bell stunt box contacts to close momentarily and energize the bell.

1.1.6 Line Relay

The line relay used with the Model 28 ASR set, 33 RY (Automatic Electric Co's Number 203), was covered in a previous course and no further discussion is deemed necessary in this course.

1.2 KEYBOARD-TYPING UNIT-PERFORATOR (FIGURE 4-1)

1.2.1 Motor Circuit (Figure 4-1)

The motor provides the motive power for most of the mechanical operations. The motor is a two-pole, single-phase, capacitor start 1/12 horsepower, 3600 RPM, synchronous unit. A motor starting relay and capacitor together with a thermal cutout switch are mounted in a compartment on the underside of the motor unit. To avoid loss of receiving margin, the frequency of the power source feeding this motor must be maintained within plus or minus .45 cycles. Commercial power is maintained well within these limits, but when the set is operated on emergency power at the field station this limit may be exceeded unless care is taken. In Figure 4-1, the current path is to the coil of the motor start relay, through the operate winding of the motor, the contacts of the thermal cutout, and the heating element of the thermal cutout. The

starting current will be approximately 12 amperes and will cause the motor start relay contacts to close. The closing of these contacts connects the starting capacitor and start winding into the circuit. As the motor comes up to operating speed, the current drawn by the motor drops to approximately 3 amperes and the motor start relay contacts open. The opening of the motor start relay contacts takes the starting capacitor and starting winding out of the circuit. In case of a motor overload, the contacts of the thermal cutout will open the electrical circuit to the motor.

1.2.2 Open Line Light Circuit (Figure 4-1)

A light, for the indication of an open line, is located behind a transparent red plastic button on the front left side of the cabinet dome and connects through a flasher to contacts on the open line relay. Whenever an open line condition exists, the open line light will flash alternately on and off. This circuit will be discussed in greater detail under the open line relay in the relay control group. The lamp is identical to those used for copy lights.

1.2.3 Backspace Switch and Magnet Circuit (Figure 4-1)

The backspace magnet is located in the perforator and is controlled by the operation of a microswitch, the backspace switch, mounted on the keyboard beneath the tape backspace key. Depressing the tape backspace key energizes the backspace magnet, causing the tape being perforated to back up one character, placing the last perforated character under the tape punch. The backspace provides a convenient method for the correction of errors that are made while preparing a tape. The usual procedure, when an error is made, is to backspace the tape, obliterate the error by depressing the Letters key, and continuing with the tape preparation.

1.2.4 Selector Control (Figure 4-1)

The selector control knob is located on the front of the cabinet, just under the perforator. Three positions of the knob provide for the selection of either of three modes of operation, Keyboard Position (K), Keyboard-Tape Position (K-T), and Tape Position (T). The selector control knob is linked to a portion of the perforator, and to the selector switch. Only the electrical changes for each of the three positions of the selector control knob will be discussed here; the mechanical changes have been discussed in a previous chapter.

With the selector control knob in Keyboard Position (K), operation of the keyboard will cause transmission directly to the line, with the typing unit producing a copy.

With the selector control knob in Keyboard-Tape Position (K-T), the same operations will be performed as in Keyboard Position; in addition, a perforated tape will be produced.

With the selector control knob in Tape Position (T), operation of the keyboard will produce perforated tape only. The typing unit is then free to receive incoming traffic over the circuit, or the tape being produced may be fed to the transmitter-distributor for transmission to the circuit.

The two-position selector switch linked to the selector control knob controls the end-of-line light and will be discussed under "End-of-Line Light Circuit."

1.2.5 End-of-Line Switch (Figure 4-1)

The end-of-line switch is physically located in the character counter and is dependent upon the character counter for its mechanical operation. When the right margin of copy is reached while operating in some of the three modes of operation, the end-of-line switch will be closed by the character counter. Electrically, the end-of-line switch is part of the end-of-line light circuitry and the two will be discussed more fully in article 1.3.7 of this chapter.

1.2.6 Margin Switch (Figure 4-1)

The margin switch is a microswitch mounted on the ASR base just under the spring drum on the front plate of the typing unit. When receiving from the line, or when in the Keyboard or Keyboard-Tape position, the typing unit in printing from the left to right margin causes the spring drum to turn clockwise. A switch cam plate, mounted on the spring drum, turns with it; when the right margin is reached, the margin switch will close. This circuit will also be discussed under End-of-Line Light Circuit.

1.2.7 End-of-Line Light Circuit (Figure 4-1)

The End-of-Line light is located on the front right side of the cabinet dome, and when lit, shines through a transparent red plastic button. The lamp is 6.3 volt and the same type as the copy lights.

With the selector control knob in the Keyboard Position, the copy light circuit will be from one side of the copy light step-down transformer secondary to one side of the margin switch. When the right margin is reached, the margin switch will close, completing a circuit through contacts 1 and 2 of the selector switch, to one side of the end of line light. The other side of the light is connected to the opposite side of the copy light step-down transformer secondary.

With the selector control knob in Keyboard-Tape Position, the position of the selector switch is the same as in Keyboard Position. The "End-of-Line" light circuit is the same as described above.

With the selector control knob in Tape Position, selector switch contact 2 will make with contact 3. The End-of-Line light circuit will be from the transformer to the "End-of-Line" switch, when approximately 70 characters are punched in the tape, the character counter will cause the end of line switch to close. This completes the circuit to contacts 3 to 2

of the selector switch and the end of line light, which causes the lamp to light, indicating a CR and LF should be punched into the tape.

When a CR and LF occur, the margin switch or end of line light switch will open the circuit to the light.

1.2.8 Perforator Light (Figure 4-1)

The perforator light for illuminating the tape is located just above the perforator. The lamp is 6.3 volts and is the same type as those used for the copy, end-of-line, and open line lamps. The perforator light is directly across the step-down transformer.

1.2.9 Selector Magnet (Figure 3-1)

The selector magnet on the typing unit was covered in a previous course, and no further discussion is deemed necessary.

1.2.10 Line-Test Key Circuit (Figure 4-1)

The line-test key switch is located on the left end of the Electrical Service Unit, and connects through an extension shaft to a knob just below the left side of the keyboard on the front of the console. The line-test key switches the transmitter-distributor, line relay, and keyboard signal generator contacts from the line to a test loop in the ASR cabinet. When the line-test switch is in the "Test Position," it connects these units in series with the line winding of the line relay and the line circuit of the local DC supply. A short is placed across the signal line to prevent an open line condition and eliminates the necessity for an external test loop for the ASR.

To trace the circuit with the line-test key in the "Line Position," begin with the number 1 signal line, through contacts 9 to 8 of the line test key, through the signal generator contacts, the line break switch and line jack, through the transmitter-distributor, through the line winding of the line relay to contacts 4 through 6 of the line-test key, and back to the number 2 signal line.

The keyboard off switch is across the signal generator contacts; if it is in the off position (contacts closed), the signal generator contacts are shunted, preventing direct keyboard transmission to the line. If the keyboard off switch is in the on position (contacts open), then direct keyboard transmission to the line would result.

To trace the circuit with the line-test key in the "Test Position", begin with one side of the local rectifier, then to the ground at terminal 3 to terminal 4 of the line-test key, through the line winding of the line relay, through the transmitter-distributor, line jack, line break switch, and signal generator contacts to contact 8 of the line test key. Contacts 8 to 7 of the line-test key and back to the negative side of the local rectifier. In this position, contacts 5 and 6 of the line test key short the signal line. Contacts 1 and 2 are open, so that the keyboard off switch has no effect on the keyboard operation in the test position.

1.2.11 Signal Generator Contacts (Figure 4-1)

The signal generator contacts, located on the keyboard base, are controlled by the keyboard keys, and will send out the pulses corresponding to the letter of the key depressed. This is a mechanical operation and was covered in a previous chapter. In the idle position the signal generator contact will be held mark, and the line circuit will be closed as previously described.

1.2.12 DC Control Relay and Off-Line Stunt Shift Solenoid Figure 4-1)

The DC control relay is equipped with a microswitch for controlling the off-line stunt shift solenoid. The relay is mounted in the Electrical Service Unit and the off-line stunt shift solenoid is mounted on the left end of the typing unit.

When the local-remote switch, located on the control panel, is placed in the "Remote Position," the contacts of the microswitch are placed in series with the off-line stunt shift solenoid. The contacts of the microswitch

are wired normally open and are connected to the cabinet AC voltage supply. After the coil of the relay is energized, the circuit through the stunt shift solenoid is closed by contacts on the microswitch, applying AC voltage to the stunt shift solenoid causing it to become energized and at the same time moving the suppression code bar to the right placing the printer in a print condition. The DC Control Relay coil is energized through the circuitry of the Relay control group, and will be covered in the relay control group discussion.

1.2.13 Stunt Box Contacts K-20 (Figure 4-1)

These contacts, located in the stunt box of the typing unit, will be discussed under the Relay Control Group.

1.3 CONTROL PANEL (FIGURE 4-1)

The control panel is located on the front of the Model 28 ASR console. Mounted on the panel are the keyboard off switch, the local-remote switch, line break switch, line jack, busy line light, transmission start switch, transmission stop switch, and auxiliary jack.

1.3.1 Keyboard Off Switch (Figure 4-1)

This was discussed under the Keyboard-Typing Unit-Perforator circuit.

1.3.2 Line Break Switch (Figure 4-1)

This is a non-locking, normally closed, push-button switch in series with the signal line. When depressed, the signal line will be opened and interruption of transmission on the line will occur.

1.3.3 Line Jack LPG-1 (Figure 4-1)

The line jack is in series with the signal line and is normally closed. Any equipment plugged into the line jack will be in series with the signal line circuit.

1.3.4 Auxiliary Jack LPG-2 (Figure 4-1)

The auxiliary jack wired to the cabinet terminal board is unused but is supplied for future requirements.

1.3.5 Local-Remote Switch (Figure 4-1)

The Local-Remote switch directly operates the page printer stunt shift solenoid. This solenoid shifts the printer to a print or non-print condition. In the "Local" position 110 VAC is placed across the solenoid. In the "Remote" position, the DC control relay operates the solenoid.

1.3.6 Busy Line Light (Figure 4-1)

The busy line light is a 6.3 volt lamp and the same type as those used for the copy lights, perforator light, end-of-line light and open line light. Its circuit will be discussed under the Relay Control Group.

1.3.7 Transmission Start Switch (Figure 4-1)

This is a non-locking, normally open, push-button switch. The circuit will be discussed under Relay Control Group.

1.3.8 Transmission Stop Switch (Figure 4-1)

This is a non-locking, normally closed, push-button switch. The circuit will be discussed under Relay Control Group.

1.4 RELAY CONTROL GROUP (FIGURE 4-1)

The Relay Control Group, through related circuitry, utilizes the operation of the line relay associated with a printer set to provide open and busy line alarm signals which are represented by corresponding lights mounted on the printer set. The alarm signals are used to prevent, automatically, the transmission of a message into the line when the line is busy or open, and to indicate when the line is idle for transmission to the line.

Two function box contacts located in the printer set are actuated by sequential line signals to administer start-request intelligence to the relay group. Upon receipt of these signals the relay control group permits automatic sending to the line from the transmitter-distributor if tape is available at the time and if the signal line is neither busy nor in an open condition.

As part of the console equipment, control panel mounted non-locking push buttons are provided to afford manual originations of start-request indications, when required.

The circuit configuration contains a memory provision so that if a request to start is received during a busy line condition, the request will be held in abeyance and acted upon when the line returns to an idle condition.

The relay control group is mounted on a bracket in the lower portion of the ASR cabinet. The bracket is so designed that by removing two screws at the top and loosening two at the bottom it can be folded to the front for easy access to the relay group. For ease of maintenance, the electrical interconnection is via a multiconductor cable and plug rather than a soldered in cable and terminal strip connection. This permits field maintenance personnel to exchange faulty relay groups immediately resulting in little or no loss in down time. Subsequently, the faulty unit can be repaired for future replacement purposes.

1.4.1 Theory of Operation

The following is the features required of the Relay Control Group:

1. Prevent automatic sending into either an open or busy line.
2. Retain a start-request until an idle line condition exists.
3. Provide a "start-ground" for the transmitter-distributor when:
   a. Tape is waiting to be sent.
   b. Line is neither busy nor open.
   c. A start-request is received from either a function box contact or a manual push button.

The various components that are associated with the different combinations of this relay control group will be described individually.

1.4.2 Standby Condition of Circuit (Figure 4-1)

In the standby or idle circuit condition, no pulses being received, the line relay is operated to mark causing the selector magnet to be held closed and the open line relay to be operated.

With no tape awaiting transmission in the transmitter-distributor, the tight tape switch will be closed while the end-of-tape switch contacts are open.

1.4.3 Busy Line Condition of Circuit (Figure 4-1)

Both the busy-line relay (BL) and the open-line relay (OL) are slow release relays having a release delay of about .200 seconds or approximately the length of a single code character at sixty WPM speed. In effect these relays cannot follow the signal line pulses delivered by the line relay, but once operated they remain in the energized position for a minimum of the release delay period. Because of this characteristic the BL relay operates on the first spacing pulse received from the line relay, and remains operated until transmission ceases on the signal line.

The OL relay is normally operated in that it performs its useful circuit function upon releasing. During signal transmission the OL relay remains operated, and releases only when a line break of a greater duration than a single character is received.

The BL relay operating at the break contacts 1 and 2 removes the operating ground from the start relay (ST) so that if a request to start signal is received at that moment, no start signal could be sent to the sensing clutch magnet.

The make contacts 3-4 provide a voltage return for the busy line lamp which burns as an indication of line condition to the keyboard operator.

With transmission ended, and after a pause of approximately 200 milliseconds, the BL relay releases thereby restoring the operating ground to the automatic control circuit and extinguishing the BL lamp.

1.4.4 Open Line Condition of Circuit (Figure 4-1)

The open-line (OL) relay because of its slow release characteristic has not been released during reception of line signals through the line relay. However, the OL relay will release when the line relay remains spacing for a period of approximately 200 milliseconds as would occur in the example of: a defective signal line or a received line break from another station.

When the OL relay releases the transfer contacts 3, 4, and 5, remove the return path of the 6 volt AC BL lamp circuit so that it cannot burn; meanwhile, these contacts provide the 6 volt AC return for the OL lamp which burns in a blinking manner. The OL lamp blinks because it is in series with a thermal flasher device to indicate to the attendant that an open-line condition exists.

The make contacts 6 and 7 remove the lock-up ground from relay RS-1 (request to start relay) so that should a request to start be received during an open-line condition the relay will be de-energized and prevent automatic transmission when the line is closed. Contacts 6 and 7 also remove the lockup ground from the ST relay (Start Relay) so that the transmitter-distributor will stop.

1.4.5 Transmitter Distributor Sending (Figure 4-1)

The origination of an automatic transmitter-distributor sending cycle is considered to be at the time the attendant places tape to be sent in the tape gate of the desired transmitter-distributor. At this time the end-of-tape contacts close and prepare the relay group to operate by providing battery for relays ST and RS-1.

At this point a request to start is required and may be furnished from either:

1. Manual start push button (if during an uncontrolled portion of the circuits operation), or
2. Function box contact K-20 (if during a scan controlled portion of the circuits operation).

When the request to start grounds the RS-1 lead, the relay operates momentarily by the current flowing from ground at K-20 (or at the manual start push button) through relay RS-1, end-of-tape and tight tape contacts to battery.

When relay RS-1 operates, it locks up to ground via RS-1 contacts 1 and 2 ST contacts 5R and 6R and OL make contacts 6 and 7. (If the open-line relay OL had been released because of line trouble or a break, relay RS-1 would simply operate and then release.) Make contacts 3 and 4 provide operating ground for start relay ST via BL break contacts 1 and 2. (If the busy line BL relay had been operated the start relay ST would not have been operated.) Relay ST operates on current flowing from ground through RS-1 make contacts 3 and 4, BL break contacts 1 and 2, ST coil, via stop lead (STP-1), manual stop push button, tight tape contacts and end-of-tape contacts to battery.

When Relay ST operates, the continuity transfer contacts 4R-6R lock up to ground through the OL make contacts 6 and 7 so that subsequent automatic transmission from the controlled transmitter-distributor will not (when the BL relay operates) interfere with the station's own transmissions. Immediately thereafter, at the 5R and 6R contacts, the lock-up ground is removed from the RS-1 relay, thereby releasing it. At the make contacts 2L and 3L an operating ground is provided for the DC control relay so that the printer will shift into the print case thereby providing a copy of its out going transmission. The make contacts 4L and 5L provide operating ground to start lead (ST-1) thereby operating the sensing clutch magnet to start

transmission of the transmitter-distributor. Upon completion of tape transmission, the trailing end of the tape clears the tape gate and opens the end of tape contacts. When the end of tape contacts open operating battery is removed from the stop lead (STP-1) thereby allowing the ST relay to release and return the circuit to the standby condition (prepared for a new cycle of operation).

The operators selection of the manual stop push button will also remove the operating battery from the stop lead (STP-1) with the same results as described in the above outline.

MODEL 28 ASR EQUIPMENT

CHAPTER FIVE

M-28 REPERFORATOR-TRANSMITTER

MODEL 28 ASR EQUIPMENT

CHAPTER FIVE

M-28 REPERFORATOR-TRANSMITTER

1.0 INTRODUCTION

Telecommunication requirements have increased vastly during recent years due to the increased air traffic density and related data transmission. As the operational requirements are changed, so must the related equipment be modified or replaced to accomplish given objectives. Improvements in telecommunications service has mandated the retirement of older types of equipment and replacement by more reliable and faster types. High speed computer techniques are now beginning to enter the field of telecommunications in order to obtain more rapid and accurate operation. Every effort is being made to facilitate the flow of air traffic and related data as this has a direct effect upon the efficient dispatch and control of public and private transportation. Telecommunications requirements may be expected to grow exponentially during the next few years.

A part of the new look in the telecommunications system has already been covered in the Model 28 R/O and the Model 28 ASR equipments and it has been seen how improvements in operating speed and the utilization of a call up system will greatly improve the flow of traffic. Integration of local and area circuits has not been considered previously; however, this is vital when efficient, long distance, circuit to circuit, transmission is required. For instance the routing of a transcontinental message (and return confirmation) must be routed through a minimum of six area circuits, the greater part of which will have high traffic density. Transmission of the relay information will take place whenever a circuit is momentarily idle or under the control of the scanning station during a certain period of time. Transmission to and from the relay point must be accomplished automatically and quickly without tape handling for efficient operation. The discussion that follows is a brief general description of that equipment and the method in which it operates.

2.0 GENERAL DESCRIPTION: (Figure 5-1)

The Model 28 Reperforator-Transmitter Set has been designed for high speed automatic reception and transmission of relay messages from one closed circuit to another. Operation of the equipment is completely automatic in the sense that manual tape handling operations are not necessary, and in that reception and re-transmission of relay information is governed by the conditioning code received.

Figure 5-1 illustrates a front view of the equipment cabinet and shows the general overall appearance of the equipment. It will be noted that similiar equipment resides in both the left and right hand positions and that each equipment has its individual control. It is necessary that two reperforators and transmitters be used due to each reperforator transmitter being a unilateral device, receiving from one circuit and transmitting to the other. Thus, if automatic relay operation is desired from either circuit into the other, two equipments are required.

The Model 28 Reperforator-Transmitter Set consists of a group of integrated components to accomplish a reperforator-transmitter function. However, the design of the equipment is such that an interchange of different units may be accomplished, without cabinet or chassis modification to change the operating characteristics or speed for other specific purposes. This equipment is used with modification on the Automatic Data Interchange System equipment which is designed for an input/output of 100 to 600 words per minute or vice versa permitting extremely fast and efficient operation for center usage and in lieu of existing Message Diversion System equipment.

2.1 Method of Operation (Figure 5-6)

To those already familiar with relay stations and their operation it will become apparent by referring to Figure 5-6 that the Reperforator-Transmitter system operates in a similiar manner to the older reperforator-transmitter (FRXD) relay station. For those not already familiar with such a system it will be noted that the Model 28 Reperforator-Transmitter equipment acts as a link or bridge between two discrete circuits.

Information from the circuit 8023 shown on the left is forwarded to the relay station "ACC" upon scan. All messages within and around the circuit 8023 will be performed without effecting the Model 28 Reperforator-Transmitter equipment. Whenever a relay message is desired to pass through circuit 8024 to some remote point, station "ACC" is called by one of the stations on circuit 8023 and preceeded by an "X" (i. e. "XACC"). The relay station will be thus conditioned and the message information that follows will be entered into circuit 8024 without manual operation or tape handling.

2. 2 Typing Reperforator Set (Figures 5-3, 5-4)

The Typing Reperforator is an electro-mechanical apparatus which records messages on standard 11/16" perforator paper tape. The recording is performed in the form of printed characters and as serial combinations of chadless tape perforations. Messages being received by the Typing Reperforator Set are derived from the signal line in the form of electrical pulses. Electrical impulses thus are translated into the required mechanical actions to type and re-perforate the received information. The printed characters on the tape margin greatly simplify tape handling by eliminating the necessity of reading and mentally decoding the coded perforations.

The typing reperforator may be considered as one assembly of the Model 28 Reperforator-Transmitter equipment and is physically located to the rear of the tape handling stand. Electrical power is supplied through two electrical connectors, one being a 32-point connector, the other being a 4-point connector. Mechanical power is supplied by means of a fiber gear which is driven from a motor mounted on the tape handling stand. Only one motor is used on the Model 28 Reperforator-Transmitter equipment for the typing reperforator, transmitter-distributor and tape-reel drive.

The selector mechanism is similiar to that in the Model 28 R/O Printer and has a variable range finder to permit operation of the equipment under varying line distortion conditions. Printing of characters upon the tape is accomplished by means of a rotary bakelite typewheel, which incidently

may be easily replaced to permit different letter figure combinations. The type wheel may be considered to be the equivalent of the type box on the Model 28 R/O Printer. The selection and transfer mechanisms function so that the axial and/or rotary positioning will be in accordance with the character selected. The actual printing is performed by the operation of a hammer on the underside of the tape and which forces the tape in contact with the typewriter ribbon and feedwheel. Operation of the perforator is quite similiar in almost all respects to the perforator found in the Model 28 ASR equipments.

While it is possible to utilize the typing reperforator without variable feature devices, (special devices for specific application), some of these will be found within all standard FAA equipment, others may be utilized only for special applications.

Non-interfering Blank Tape Feed Out

Provides a means for the typing reperforator to feed out a predetermined length of blank tape to facilitate tape handling.

Code Reading Contacts

Reads the code combinations being perforated by the typing reperforator and established circuits corresponding to the five code elements. This consists of five switch fingers operated by the selector mechanism and are to be used in the future for high speed digital computer data processing.

Timing Contacts

When connected to external circuits provide electrical pulses which may be synchronized with the code reading contacts and utilized for special applications as the above.

Letters Figures Contact

Furnishes a remote signal to indicate whether the typing reperforator is in the letters or figures condition.

Signal Bell Contact

Provides an electrical pulse to operate an audible alarm when the unit receives the "S" code combination in the figures position.

The typing reperforator may be utilized with not only the Model 28 Reperforator-Transmitter equipments but may replace, in certain instances, the perforator within the Model 28 ASR equipments. In such cases the punching (and also printing) operation may be performed from either signal line pulses or operation of the Model 28 ASR keyboard.

2.3 Transmitter Distributor (LAXD1) (Figure 5-5)

The LAXD1 Transmitter-Distributor equipment is very similiar in many respects to that previously studied in Chapter Three in that it is a combined tape reader and transmitter-distributor. The main feature which distinguished the LAXD1 from the LAXD4 is the pivoted reading head. The pivoted reading head makes possible the reading of either loose tape, such as will be contained within the storage bin, or reading the last character from tight tape and then stopping. A unique feature of the pivoted head tape reader is the tape out pin. This pin is located approximately one-half character to right of the sensing pins and is retarded by one-half character.

Stopping of the transmitter-distributor can be accomplished either by means of the tape out pin or the actuating of the last character contacts located near the pivoted head. When the tape stops feeding from the punch, the pivoted head climbs the tape and reads the last character, The extension, on the yoke of the pivoted head, actuates the last character switch which removes power from the sensing clutch magnet.

The physical appearance of the LAXD1 and LAXD4 Transmitter-Distributors are similiar although it will be noted that no top plate is necessary and is not used on the LAXD1. In addition electrical connections are made by means of one 32-point connector and one 2-point connector. Although it has not been previously mentioned, this equipment is capable of operating continuously in excess of 200 words per minute, rather simply, by cam sleeve and gear changes only.

2.4 Tape Handling Stands (Figure 5-2)

The tape handling stands are mounted within the cabinet and are used for supply and take up of perforator paper (standard 11/16"). In addition a tape storage bin is provided in which a tape is temporarily stored during such times of reception and subsequent transmission to a new circuit that is not busy. Two large 11/16" reels are provided for supply and take-up of the tape and are motor driven through a friction clutch, thus permitting variable speed drive. On the top of each tape handling stand is located a reperforator-transmitter base on which the reperforator-transmitter is located just above the drive motor. Electrical connections are made to the base of the unit by means of three 14-point electrical connectors. A track is provided for the tape handling stands to be slid in and out of the cabinet for maintenance access.

2.5 Control Panels (Figure 5-7)

The two control panels are located on the top portion of the reperforator-transmitter cabinet. The panel on the left is labeled "RT Left", the one on the right "RT Right". Each control panel has its separate ON/OFF motor switch and START/STOP push button switches. The four lamps used for supervisory control are as follows:

a. Broken Tape Lamp
b. Bin Full Lamp
c. Winder Full Lamp
d. Tape Out Lamp

2.6 Electrical Circuitry (Figure 5-8)

The basic electrical circuitry of a typical Reperforator-Transmitter may be seen by referring to Figure 5-8 and may be seen to be quite straightforward. The full wiring diagram is rather complex as each electrical connection is brought from each individual equipments to two telephone type termination strips in which electrical interconnections and terminations are made. This feature permits almost unlimited application (particularly for special purposes) with a minimum of effort for all types of equipment users.

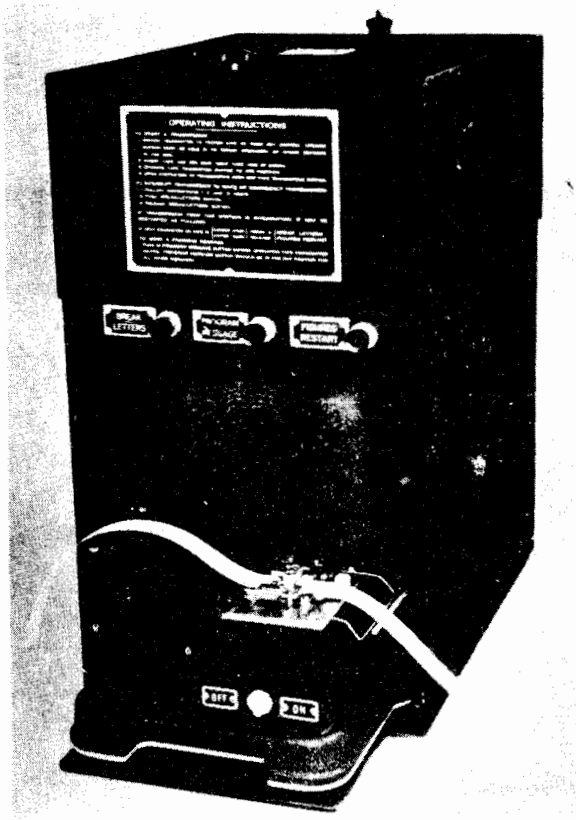
The drive motor is a two pole, single phase, capacitor start, 1/12 th horsepower, 3600 RPM, synchronous induction motor. The motor starting capacitor and relay operate in a similiar manner to that discussed in Chapter Four, paragraph 1.4.1.

The Electrical Service Unit is located in the rear of the cabinet and is accessable by opening the rear doors and swinging the vertical chassis forward. The Electrical Service Unit contains the line relays, power supply, copy light transformers and the control relays. The control relays are labled "AF", "Z", "AG", and "Y" and are used in conjunction with the Model 28 ASR equipment for Reperforator-Transmitter control.

MODEL 28 ASR EQUIPMENT

CHAPTER SIX

AUTOMATIC STATION IDENTIFICATION DEVICE



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CHAPTER SIX

AUTOMATIC STATION IDENTIFICATION DEVICE

1.0 INTRODUCTION

The Automatic Station Identification Device (ASID) is designed for use in conjunction with the Transmitter-Distributor on various teletypewriter circuits associated with the FAA facilities.

The purpose of the ASID Unit is to identify the sending station at the beginning of each regular message transmission by transmitting the station identification letters. This usually consists of three letter characters such as OKC (Oklahoma City).

There are features such as: preventing the starting of a transmission at a time when the circuit is in use by any other station; manually breaking the transmission of another station on the circuit, under emergency conditions, and sending the identification letters of the breaking station; and providing a means of automatically transmitting certain characters ahead of Program Transmission messages. These features will be dealt with throughout the chapter.

2.0 PRELIMINARY INSTRUCTIONS FOR AUTOMATIC STATION IDENTIFICATION DEVICE

Figure 6-1 shows the device in place above the transmitter distributor base. Figure 6-2 shows the device with the cover removed and the relays raised to the inspection position. It is readily seen that the principal component is the group of relays.

2.1 Relay

A relay is an electromagnetically operated device for opening and closing electrical circuits. The component parts of the relay are identified in Figure 6-3. The contacts springs are comprised of Armature springs which are moved by the Armature when the relay is energized; and Make and Break springs which are stationary. The

contact springs on each relay are numbered in order, beginning with the spring nearest the heelpiece which is designated No. 1 and proceeding outward in sequence. In the case of relays with two spring pileups, the letter "T" is appended to the numbers of the springs in the top pileup, and the letter "B" to those in the bottom pileup. Thus, 1-T denotes the inside spring of the top pileup, and 2-B denotes the second spring in the bottom pileup.

2.2 Time Delay Circuits

The time of operation or release of a relay may be controlled to a considerable extent by the selection of the proper winding valves; by the use of non-inductive resistors, or condensers connected in parallel with the winding; and by the use of copper-sleeved coils. Refer to ASID schematic, WD-70740. Relay (OL) is provided with a copper sleeve at one end of the coil core, which gives it a slow-release characteristic and should have a 200 ms time delay. Relay (BK) has a copper sleeve the full length of the core, under the winding, and should have a 300 ms time delay. Relay (LB) is made slow-to-release by the condenser connected in parallel with its winding. By using a 20 mfd condenser a time delay of 300 ms is established in this circuit.

2.3 Tape Lock Out

An electromagnetic solenoid and plunger, referred to as Tape Lock Out (TLO), is located under the transmitter-distributor base. When this solenoid is energized, its plunger moves out of engagement with the operating arm of the tape transmitter and permits stepping of the tape. When de-energized the plunger takes a position to block the travel of the operating arm and thereby prevents stepping of the tape.

2.4 Coloring Instructions

To facilitate tracing of the various relay circuits of the Automatic Station Identification Device, a system of color coding has been devised. For

this reason the schematic diagram WD-70740 which is a part of the material supplied, should be colored as in the following sections.

NOTE: IN COLORING CIRCUITS, COLOR THROUGH CONTACTS AS IF THEY WERE CLOSED.

2.4.1 Special Coloring Instructions

The following relays should be colored SOLID RED. The windings of relays (CT), (ST), (OL), (LB), (CP), (TT), and (TLO). These relays remain operated during the time that the message tape is being stepped through the transmitter-distributor unit until the completion of the tape transmission once that they have been operated.

The entire top strip of the two strips representing the transmitter-distributor commutator and the stop segment of the lower strip should be colored red.

2.4.2 Signal Line Circuit Coloring

The circuit beginning at (line #2); commutator strip; across the line with arrowheads representing the distributor brushes; (SP) segment of the commutator; (BK) 1-2; through w/SS; to (line#1). This circuit is SOLID RED.

2.4.3 Relay (SS) By-Pass Circuit Coloring

This circuit should be colored DOTTED RED. Midway between the (SP) segment and (BK) 1, commence and go to the right to (BP) 1B-2B; (CP) 1B-2B; through the (TGL) "OFF"; to (line #1). This circuit provides a direct short across (SS) when (TGL) is in the "OFF" position and prevents operation of (SS) until the (TGL) is placed in the "ON" position.

2.4.4 Main Operating Ground Circuit Coloring

The following circuit should be colored SOLID GREEN. From (-120) at (ST); w/ST; (CO) 2-1; (OL) 5-4; (SS) 3-4; (PK) 6-5; w/OL; 500 ohm resistor; to (-120) at (OL). Start at (SS) 3; through (TGL) "ON", (ET); (LB) 3-4; to ground. Continue from (LB) 3; (CP) 3T-2T; to ground. Continue from (CP) 3T; (BP) 6T. Start at (ST) 5 to (TT) 3T-4T to ground. Solid green circuit is designated as the main operating ground circuit.

2.4.5 Counting Chain Battery Circuit Coloring

The following circuit should be colored SOLID ORANGE. Starting at (-120) below (TT); (TT) 2B-1B; (8) 4T-3T; (7) 4-3; (6) 4T-3T; (5) 4T-3T; (4) 4T-3T; (D) 10T-11T; (3) 4-3; (D) 7B-8B; (2) 4-3; (D) 7T-8T; (1) 4T to the top side of w/#1.

2.4.6 Counting Chain Pulsing Ground Circuit

The following circuit should be colored SOLID BROWN. Starting at the side of w/#1 to (D) 2T-1T; (CP) 4T-5T; (SS) 5-7; (ST) 2-1. Starting midway between (SS) 7 and (ST) 2 color this line to (CCP) 5B-6B.

2.4.7 Tape Lock Out Solenoid Operating Circuit

The following circuit should be colored SOLID BLUE. Start to the right of (TLO) at (-120); through the 700 ohm resistor; w/TLO; (TT) 5T-6T; (BP) 3T-4T-5T; to midpoint (OL) 4 and (ST) 4. This is the operating circuit for (TLO).

2.4.8 Counting Chain Relay Locking Circuit Coloring

The following circuit should be colored SOLID YELLOW. Start at (TT) 1T; (8) 1T; (7) 1; (6) 1T; (5) 1T; (4) 1T; (3) 1; (1) 1T; 1000 ohm resistor; (CO) 3-4; (OL) 3-2; to ground. This is the counting chain relay locking circuit.

2.4.9 Clutch Trip Electromagnet Circuit Coloring

The following circuit should be colored DOTTED PURPLE. Start at (AC) 4; through fuse; (ST) 8-7; Tight Tape switch; 175 ohm resistor; w/CT; end at (AC) 3. This is the operating circuit of the clutch trip electromagnet.

2.4.10 Relay (LB) Operating Circuit Coloring

The following circuit should be colored DOTTED ORANGE. From (-120) between (SS) and (LB); 500 ohm resistor; w/LB; (SS) 1-2 to ground. This circuit provides the ground for operating (LB) when (SS) is released or pulsing rapidly.

2.4.11 Even Numbered Relay Ground Circuit Coloring

The following circuit is to be DOTTED BLUE. From (-120) between (P) and (1); through w/#2P; (P) 3; (1) 2B; (3) 9; (5) 2B; (7) 7. This circuit is used to supply ground for operation of the even numbered counting chain relays when the odd numbered counting chain relays are operated.

2.4.12 Odd Numbered Relay Ground Circuit Coloring

The following circuit is to be colored DOTTED GREEN. From (CP) 6T; (P) 2-1; (2) 8; (4) 2B; (6) 2B; 35-40 of terminal block "B", (8) 2B. This circuit is used to supply ground for operation of the odd numbered counting chain relays when (P) is released.

2.4.13 Operating Circuit Number One Winding Relay (P) Coloring

The following circuit should be colored SOLID PURPLE. From (SS) 6; w/#1P; 3000 ohm resistor; (1) 5T; (3) 5; (5) 5T; and (7) 5. This circuit is used to supply battery to the #1 winding of (P) when the odd numbered counting chain relays are operated.

2.4.14 Transmitter-Distributor Motor Operating Circuit Coloring

The following circuit should be colored SOLID BLACK. From (AC) 4 through motor (M); out (AC) 3. This is the operating circuit for the transmitter-distributor motor.

3.0 DESCRIPTION AND PURPOSES OF THE AUTOMATIC STATION IDENTIFICATION DEVICE

The following material is a concentrated effort to set forth the description and purposes of the Automatic Station Identification Device. Complete familiarity with normal operations of this unit is essential to a thorough understanding of its electro-mechanical functions. With only twenty relays contained in this unit, it is suggested that the student learn names and function of each as well as the sequence of operation for each type of transmission.

3.1 Functions of the Automatic Station Identification Device

a. To identify the station any time it interrupts, or enters the signal line.

b. To alert the Message Diversion Equipment

c. To provide positive breaking of the transmitter station by another station having priority traffic.

d. To prevent transmissions to an open signal line.

e. To prevent accidental transmissions to a busy signal line.

f. To minimize disputes of several stations desiring to use the signal line simultaneously.

3.2 Types of Addresses Defined

a. Short Address:

LETTERS Function, Identification Letters, SPACE Function.

b. Long Address, Letters Restart:

LETTERS Function, CARRIAGE RETURN Function, LINE FEED Function, Identification Letters, SPACE Function.

c. Long Address, Figures Restart:
LETTERS Function, CARRIAGE RETURN Function, LINE FEED Function, Identification Letters, SPACE Function, FIGURES Function.

d. Program Message Address (Message Diversion Condition Code): CARRIAGE RETURN Function, CARRIAGE RETURN Function, LETTERS Function, Identification Letters, SPACE Function.

3.3 Conditions of Stop of the Unit When Restart Will Be Normal Short Address

a Operating of Toggle Switch to "OFF".

b. End-of-Tape contacts open to stop transmission.

c. Failure of relay operating DC power - unit will restart when power is restored.

3.4 Conditions of Stop of the Unit When Restart Will Require Use of The Restart Keys and Long Address Transmitted

a. AC power failure.

b. Push key cabinet circuit open.

c. Tight tape contacts open.

d. Incorrect brush speed or hindered brush travel.

e Open line condition existing for period exceeding approximately 200 milliseconds.

f. Poor brush contact.

3.5 Relays of the Unit and Their Functions

a. (SS) Stop Segment:

1. Furnishes energizing pulses to (LB) and (OL) alternately while the unit is transmitting.

2. Furnishes energizing pulses to (LB) when the signal line is busy provided the (TGL) is in the "ON" position.

3. Serves as the coupling unit between the signal line and the Automatic Station Identification Device.

4. Changes the position of (P) on each release operation while the counting chain is in progress.

5. Furnishes pulses for operating the counting chain relays on each energizing operation.

b. (ST) Start:

1. Furnishes operating ground through (SS) to (P) and the counting chain relays.
2. Furnishes locking ground for (CP).
3. Starts the unit by closing the circuit to the cluth trip electromagnet in the transmitter-distributor unit.

c. (P) Prime:

1. Directs pulsing ground from (SS) to odd or even numbered relays to achieve sequential operation of the counting chain.
2. Closes the operating circuit of (CP).

d. (CP) Common Pulse:

1. When unoperated provides the operating circuit to the first counting chain relay to be operated.
2. Transfers the pulsing ground supplied by (SS) from the first counting chain relay to be operated to the rest of the counting chain.
3. Prevents breaking of local transmission.
4. Prevents open line condition from operating (CO) when the local unit is idle.
5. When operated provides the holding ground for (OL), (ST), and (TLO).

e. (OL) Open Line:

1. To stop transmission of the unit by providing ground for (CO) relay if the signal line current is interrupted for more than approximately 200 milliseconds.
2. Stops transmission of local unit when lock-out key in the pushkey cabinet is depressed longer than approximately 200 milliseconds.
3. To remove the holding ground from the counting chain relays in the event of open line condition or in a normal stop sequence.

f. (BK) Break:

1. To break the signal line when the BREAK-LETTERS KEY is depressed. (Will not break local transmission).

2. Operates (BP) when BREAK-LETTERS Key is depressed and (CO) unoperated.

3. Has slow release characteristic of approximately 300 milliseconds to insure positive break of sending station (OL relay release) even though the BREAK-LETTERS Key is only depressed momentarily.

4. To provide Long Address (Letters Restart) when the (TGL) is in the "OFF" position and the BREAK-LETTERS Key is depressed in attempting to enter a busy line either accidentally or intentionally.

g. (LB) Line Busy

1. Supplies starting ground to (OL) to initiate transmission.

2. Prevents transmissions into an open signal line.

3. Prevents transmissions into any busy signal line.

4. Provides original ground for operating (ST) and (CP).

5. Remains energized during transmissions due to pulsing of (SS). If brushes stopped due to AC power failure (SS) operates, (LB) releases and operates (CO) if the brushes stop on the STOP segment of the transmitter-distributor ring, and transmission will cease. (Clutch trip released stopping distributor).

h. (CO) Cut-out:

1. To stop the unit whenever conditions call for Long Address.

2. Establishes circuit for the operation of (BP) if operated or (BK) if (CO) is not operated when the restart keys are depressed.

3. Opens (ST) relay circuit.

4. Opens locking circuit to counting chain relays thus allowing their release when Letters or Figures Restart is desired.

5. If released has no effect on BREAK-LETTERS start.

i. (BP) By-pass:

1. Operated only after pressing BREAK-LETTERS or FIGURES RESTART keys.

2. Removes short circuit on (SS) when breaking line with (BK) relay.

3. Released on normal start thus by-passing the counting chain relays (2) and (3).

4. Breaks circuit when operated to (TLO) to prevent premature starting of tape until address completed and (TT) operates.

5. Establishes restart ground shorting (TGL) and also shorts out tight tape contacts making identification mandatory after restart regardless of the position of (TGL).

6. Releases original locking circuit of (CO) so that upon the release manually of the restart keys (CO) will release.

7. Prevents reoperation of (D) when either FIGURES-RESTART or BREAK-LETTERS keys released on long address start if the PROGRAM MESSAGE Key is depressed.

j. (D) Diverter:

1. When operated changes the sequence of counting chain relays from (1), (4), (5), etc., to (3), (2), (1), (4), (5), etc.

2. When operated changes the coding of relay (3) from LINE FEED to CARRIAGE RETURN Function.

k. (FS) Figures Shift:

1. Operated only when FIGURES RESTART key is depressed, providing (CO) is operated.

2. When operated causes relay (8) to be included in the counting chain which causes transmission of Figures Function.

3. Completes circuits to operate (BP) when FIGURES RESTART Key is depressed.

4. Allows (TT) to be operated as an odd numbered relay instead of even numbered as in normal start.

l. (1) Identification Counting Chain Relay #1:

1. Operates on all types of addresses.

2. Supplies LETTERS Function to the line.

3. Prepares #1 winding of (P) and releases (#2) relay when PROGRAM MESSAGE address is being transmitted.

m. (2) Identification Counting Chain Relay #2:

1. Operates on all starts but normal start.

2. Supplies CARRIAGE RETURN function to the signal line.

3. Releases the previously operated counting chain relay.

4. Removes battery from the #1 winding of (P).

n. (3) Identification Counting Chain Relay #3:

1. Operates on all starts but normal start.

2. Supplies LINE FEED Function on BREAK-LETTERS or FIGURE restarts.

3. Supplies CARRIAGE RETURN Function on PROGRAM MESSAGE address when (D) is operated.

4. Releases relay (#2) on restarts and prepares the #1 winding of (P).

o. (4) Identification Counting Chain Relay #4:

1. Operates on all types of addresses.

2. Supplies the first station identification letter.

3. Releases previously operated counting chain relay.

4. Removes battery from the #1 winding of (P).

p. (5) Identification Counting Chain Relay #5:

1. Operates on all types of addresses.

2. Supplies the second station identification letter.

3. Releases the previously operated counting chain relay and prepares the #1 winding of (P).

q. (6) Identification Counting Chain Relay #6:

1. Operates on all types of addresses.

2. Supplies the third station identification letter.

3. Releases previously operated counting chain relay.

4. Removes battery from the #1 winding of (P).

r. (7) Identification Counting Chain Relay #7:

1. Operates on all types of addresses.

2. Supplies SPACE Function to the signal line.

3. Releases previously operated counting chain relay and prepares the #1 winding of (P).

s. (8) Identification Counting Chain Relay #8.

1. Operates only in counting chain when FIGURES RESTART Key is depressed.

2. Supplies the FIGURES Function to the signal line.

3. Releases the previously operated counting chain relay.

t. (TT) Tape Transmission.

1. Completes circuit to operate (TLO).

2. Connects distributor segments to transmitting tongues of the transmitter-distributor.

3. Completes counting chain relay sequence and breaks common counting chain battery circuit.

4. Releases (BP), (D), and (FS) if operated by the use of the restart keys.

5. Removes protective ground.

3.6 Special Function Devices

a. (TLO) Tape Lock Out Solenoid:

1. Restricts the movement of the operating lever in the transmitter distributor to prevent the message tape from stepping until station identification is completed.

b. (CT) Clutch Trip Electromagnet:

1. When operated allows the rotation of the transmitter-distributor brushes.

3.7 Panel Keys

a. Break Letters Key:

1. To break the signal line and send LETTERS RESTART address when the (TGL) is off or if the line is busy depending upon whether the break is accidental or intentional.

2. To transmit a restart in the lower case after a signal line condition exists that calls for a LETTER RESTART. (This feature is seldom used to restart once transmission commences. Normal procedure is to reposition tape and then depress break-letters key).

b. Program Message Key:

1. When depressed operates (D).

2. Depressed only when the Message Diversion Equipment diversion condition code is required.

c. Figures Restart Key (Page 10, Section 3.47):

1. When depressed causes operation of (FS) to include (8) in the counting chain sequence. Providing (CO) is operated.

2. To transmit on restart in the upper case after a signal line condition exists that calls for a FIGURES RESTART. (This feature is seldom used in actual practice.)

3.8 Terminal Blocks (Refer to WD-70740)

a. Terminal Blocks "A" and "B":

1. Terminal 1 through 10 code relay #4.

2. Terminals 11 through 20 code relay #5.

3. Terminals 21 through 30 code relay #6.

4. Terminals 31 through 40 provide connection for either two or three letter station identification.

5. Terminal 41 through 60 are unused at present but allow for possible future changes.

b. Ten Point Terminal Block:

1. Terminals 1 and 2 supply signal line to the unit.

2. Terminals 3 and 4 supply 110 v AC to the unit for operation of the transmitter-distributor motor and clutch trip electromagnet. Terminal 4 is the ungrounded side of AC.

3. Terminals 5 and 6 provide external means of opening the (OL) relay circuit to prevent switching of the unit from one circuit to another once operation commences. These are included to make it impossible to transmit. the identification to one circuit and the message text to another.

4. Terminals 7 and 8 are unused in present application of the unit.

5. Terminals 9 and 10 supply 110v DC to the unit for relay operating voltage. Negative DC connected to terminal 9 and positive DC connected to terminal 10.

c. Thirty-Two Point Clare Strip:

1. All connections between the Automatic Station Identification Device and the Transmitter-Distributor are terminated on this strip.

4.0 CIRCUIT OPERATION OF THE AUTOMATIC STATION IDENTIFICATION DEVICE (Normal Start and Normal Stop)

The following discussion concerns the sequence of operation of the Automatic Station Identification Device in accomplishing a normal start and normal stop transmission. In connection with this discussion two things must be kept in mind. First, DC line current of 60 millamperes is available at all times at terminals 1 and 2 of the ten-point connection block; second, relays (LB) and (OL) are slow to release relays having time constants of approximately 300 milliseconds and 200 milliseconds, respectively. During the discussion reference should be made to drawing WD-70740 for the purpose of circuit tracing.

4.1 Application of AC Power

In initiating operation of the unit, AC must be applied to the motor through the terminals (AC#3), motor (M), and out (AC#4).

4.2 Conditions for Tape Transmission

To transmit to the signal line a message tape must be placed in the transmitter-distributor, the tape retaining lid closed, thus closing the end-of-tape contacts (ET) by mechanical operation of the contact pin. As long as the toggle switch (TGL) remains "OFF" (SS) will be shorted via the circuit from (Line 1); (TGL) "OFF"; (CP) 2B-1B; (BP) 2B-1B; through the (SP) segment of the distributor; through the transmitter-distributor brushes, and out (Line 2) or the dotted red circuit of the drawing.

4.3 Application of DC Relay Power for Relay Operation

When DC is applied to the unit (LB) will operate through the circuit ground; 100 ohm resistor; (SS) 2-1; 100 ohm resistor; w/LB; 500 ohm resistor; to battery or the dotted orange circuit. All other relays in the unit are released for the present.

4.4 Relay (SS) Initial Operation

Operate (TGL) to "ON" position thereby breaking the dotted red circuit and connecting from (Line 1); w/SS; (BK) 2-1; (SP); T-D brushes; and out (Line 2) or the solid red circuit of the drawing. When the solid red circuit is completed, (SS) operates, (SS) 3-4 and (SS) 5-7 make and (SS) 2-1 and (SS) 6-7 break. After a time delay of approximately 300 milliseconds (LB) will release due to the condenser across it discharging. The release of (LB) applies ground to the green circuit from (LB) 4-3; (ET); (TGL) "ON"; 100 ohm resistor; (SS) 3-4; 100 ohm resistor; (PK) 6-5 (if the push-key cabinet is supplied or through the terminals short-circuited); w/OL; 500 ohm resistor; to battery, thus operating (OL).

4.5 Relay (OL) Operations

Operation of (OL) completes the green circuit from ground at (LB) 3-4; (ET); (TGL) "ON"; (OL) 4-5; (CO) 1-2; w/ST; to battery thereby operating (ST). Operation of (ST) allows it to lock on its own contacts (ST) 6-5 over the green circuit w/ST; (CO) 1-2; (ST) 6-5; (TT) 3T-4T; to ground. The purpose of the ground st (TT) 3T-4T that is labeled "Protective Ground" is to insure that at this early point, even though the (TGL) is turned "OFF", identification will be completed (this furnishes the ground to hold (OL) operated. If the tape is removed from the transmitter-distributor to open (ET) or if the (TGL) is turned "OFF", the unit will then stop when (TT) operates at the completion of the identification and removes the protective ground.

4.6 Relay (ST) Operations

Upon the operation of (ST), contacts (ST) 1-2 close and provide a ground for the brown counting chain circuit causing operation of relay (#1) via the circuit ground; (ST) 1-2; (SS) 7-5; (CP) 5T-4T; (D) 1T-2T; w/#1, (#1) 4T, (D) 8T-7T; (#2) 3-2; (D) 8B-7B; (#3) 3-4; (D) 11T-10T; (#4) 3T-4T; (#5) 3T-4T; (#6) 3T-4T; (#7) 3-4; (#8) 3T-4T; (TT) 1B-2B; to battery. The #1 winding of (P) is conditioned for operation at this time

by the operation of (#1). When (#1) operates it locks through the preliminary make contacts (#1) 2T-1T, over the yellow locking circuit (#1) 2T-1T; 1000 ohm resistor (CCL); (CO) 3-4; (OL) 3-2, to ground. Simultaneously with the operation of (ST) 1-2 it is found that (ST) 7-8 close and complete the dotted purple circuit of (CT), thus operating it through the circuit (AC#4); fuse; (ST) 8-7; tight tape switch; 175 ohm resistor; w/CT; and out (AC #3).

At this point the transmitter-distributor brushes commence the first revolution and after a few degrees rotation leave the stop segment.

4.7 First Revolution Relay Operation - Brushes on START Segment

As the brushes engage the START segment (ST), the solid red circuit is opened and (SS) releases. When (SS) releases closure of (SS) 6-7 supplies the ground for the #1 winding of (P) through the circuit (ST) 1-2, (SS) 7-6; w/#1P; 3000 ohm resistor; (#1) 5T-4T; through the orange counting chain circuit to (TT) 1B-2B; to battery and (P) operates, also the closure of contacts (SS) 1-2 complete the dotted orange circuit of (LB) and (LB) operates. Contacts (SS) 3-4 open and (OL) is de-energized but due to the slow release characteristic of about 200 milliseconds, it remains operated for the duration of the revolution which requires 132 milliseconds.

When (LB) 5-4 close, the circuit for operation of (CP) is completed from (LB) 4-5; (P) 5-4; w/CP; to battery. As soon as (CP) operates, it locks on its own contacts (CP) 6B-5B to (ST) 2-1; to ground. Since all the operating circuits have been completed and no further circuit action will occur at this point, the brushes sweep over the T-D segments 1 through 5 and the character set up by the contacts of (#1) relay or LETTERS Function is sent to the line. This circuit is as follows: (Line 2); T-D brushes, segments 1-2-3-4-5 in order and (#1) 6T-7T; (#1) 8T-9T; (#1) 3B-4B; (#1) 5B-6B; (#1) 7B-8B; to (Line 1).

The preceding operations compose the first revolution of the brushes and now the brushes have returned to the STOP segment preparatory to starting on the second revolution.

4.8 Second Revolution Relay Operation - Brushes on STOP Segment

Again (SS) operates and contacts (SS) 2-1 open the (LB) circuit but (LB) does not release due to the slow release characteristic. At the same time the (LB) circuit is opened, (OL) gets a holding impulse from battery through w/OL; (PK) 5-6 (if used); (SS) 3-4; 100 ohm resistor; (TGL) "ON"; (ET); (CP) 3T-2T and (OL) achieves a slow release feature by virtue of the copper slug on the lower end of the (OL) winding which affects the rate at which the current departs from (OL). (OL) will not release between pulses from (SS) due to the slow release characteristic of about 200 milliseconds as compared to the time lapse of 132 milliseconds for one revolution of the brushes (minus the STOP impulse).

The actions of (LB) and (OL) will be repeated throughout the following discussion and therefore no further mention of this will be made. However, do not fail to keep these operations in mind or confusion will result.

When (SS) operates, contacts (SS) 6-7-5 close at one instant by virtue of being make-before-break contacts, and thereby (P#2) winding is energized through (SS) 5-7 making before (SS) 7-6 break the circuit to (P#1) winding and (P) remains operated. (w/#1P is the operating winding and w/#2P is the holding winding). The operate winding circuit is from (ST) 1-2; (SS) 7-6; w/#1P; (#1) 5T-4T to counting chain battery at (TT); the holding winding circuit is from (ST) 1-2; (SS) 7-5; (CP) 5T-6T; (P) 2-3; w/#2P; to battery at (P). The two windings of (P) are wound in such fashion as to aid each other.

At this time the circuit to (#4) relay has also been completed from (ST) 1-2; (SS) 7-5; (CP) 5T-6T; (P) 2-3; (#1) 2B-1B; (CP) 4B-3B; w/#4; to

counting chain battery at (TT). As (#4) operates three things occur; first, (#4) locks in on its own contacts (#4) 2T-1T; (CO) 3-4; (OL) 3-2; to ground; second, (#1) releases due to loss of battery by opening of (#4) 4T-3T; third, the circuit to (P #1) is broken at (SS) 6-7 being opened by operation of (SS). The circuit to (P#1) is further broken by the release of (#1) opening (#1) 4T-5T.

All operating circuits have been completed at this point and the brushes now move to the START segment and (SS) releases. The (P #2) winding ground circuit is opened by the removal of ground when (SS) 7-5 open and thus (P) is released initially as a result of this operation. (P) remains released due to the #1 winding battery circuit being removed as described in the preceding paragraph even though (SS) 6-7 are closed. All operating circuits have again been acted upon this time and the brushes sweep over the T-D segments 1-2-3-4-5 in that order as was described in the first revolution and send the first identification letter by the closing of contacts of relay (#4) and coded on the "A" block terminals 1 through 10.

4.9 Third Revolution Relay Operation - Brushes on STOP Segment

At the completion of the second revolution the brushes return to the STOP segment and once again (SS) operates. As (SS) operates contacts (SS) 7-5 close and the circuit to relay (#5) is completed from (ST) 1-2; (SS) 7-5; (CP) 5T-6T; (P) 2-1; (#4) 2B-1B; to w/#5 and counting chain battery at (TT). As (#5) operates it locks on its own contacts (#5) 2T-1T through the yellow circuit to (OL) 3-2 to ground. Simultaneously contacts (#5) 3T-4T break and remove battery from (#4) and thereby releases (#4). Closure of (#5) 5T-4T at this time prepares an operating path for (P#1) winding to energize.

Since all operating paths have been acted upon at this point the brushes now move to the start segment and allow (SS) to release. Closure of (SS) 7-6 now energizes the (P#1) winding through the path just prepared and (P) operates.

The brushes now rotate to the impulse segments and traverse them to send the character set up on (#5) relay and the "A" block terminals 11 through 20 and this character is the second station identification letter sent out on the line.

4.10 Fourth Revolution Relay Operation - Brushes on STOP Segment

The brushes continue their revolution and once again reach the STOP segment and (SS) is operated. Also action of the (SS) make-before-break contacts 5-6-7 causes (P) to hold operated now through the (#2P) winding. Also at this time relay (#6) is operated through the circuit (ST) 1-2; (SS) 7-5; (CP) 5T-6T; (P) 2-3; (#5) 2B-1B; w/#6; to battery at (TT). As soon as (#6) operates, relay (#5) releases by (#6) 3T-4T opening and removing battery from (#5). Relay (#6) locks in on its contacts (#6) 2T-1T. The circuits are now completed or prepared and the brushes rotate to the START segment and (SS) is released thereby opening the circuit of (#2P) and (P) releases as (SS) 7-5 open. Now the brushes sweep the T-D segments 1 through 5 and the third station identification letter is sent to the line in the same manner the first and second station identification letters were but now by the action of the contacts of relay (#6) and the coding of "A" block terminals 21 through 30.

4.11 Fifth Revolution Relay Operation - Brushes on STOP Segment

At the end of this revolution, the brushes contact the STOP segment again and thereby cause the operation of (SS) and the operating path for (#7) is from (ST) 1-2; (SS) 7-5; (CP) 5T-6T; (P) 2-1; (#6) 2B-1B; terminal block "B" terminals 39-34; w/#7; to battery at (TT). As (#7) operates, contacts (#7) 4-3 open and thereby allow the release of (#6). At the same time (#7) locks operated through (#7) 1-2 to the yellow locking circuit to ground at (OL) 3-2.

Closure of (#7) 4-5 prepares the circuit for (#1P) winding. As soon as the brushes reach the START segment and (SS) releases, (P) will operate. The brushes sweep over the segments 1 through 5 and transmit the character of relay (#7) to the line - in this instance the character is a SPACE Function.

4.12 Sixth Revolution Relay Operation - Brushes on STOP Segment

Once again the brushes reach the STOP segment and (SS) operates and (P) remains operated since the (#2P) winding is now energized through (ST) 1-2; (SS) 7-5; (CP) 5T-6T; (P) 2-3; to battery at (P). Also the circuit for (TT) is completed from (P) 2-3 through (#7) 7-6; (FS) 2-1; (#8) 1B; w/TT; to battery at (TT).

As (TT) closes it locks through (TT) 2T-1T to the yellow locking circuit to ground at (OL) 3-2. Also (#7) is released by (TT) 2B-1B opening to remove battery from (#7).

Immediately after (TT) operates, the circuit is completed to (TLO) through battery at (TLO); 700 ohm resistor; w/TLO; (TT) 5T-6T; over the blue circuit to (OL) 4; (TGL) "ON"; (ET); to ground at (CP) 3T-2T.

The brushes continue to rotate to the START segment and (SS) releases. When contacts (SS) 7-5 open the circuit to (#2P) winding and (P) releases. Since (TT) has removed battery from the counting chain, any further operations of (SS) will not be recognized by the chain and all that (SS) will do is follow the line, pulsing as the brushes reach and leave the STOP segment of the T-D. (Note: The pulsing of (SS) continues to provide holding pulses to maintain (OL) and (LB) operated for duration of tape transmission.)

As soon as (TLO) operates, the operating arm of the transmitter-distributor may now follow the operating cam on the mainshaft and normal T-D action will result and allow the tape originally placed in the T-D to step and the message will be transmitted to the line.

4.13 Relay Operation for Normal Stop Condition

In order to follow the sequence of operation for a normal stop of the Automatic Station Identification Device, assume the message tape has been transmitted completely and the (ET) contacts have opened. When this takes place, the circuit of (ST) is opened and (ST) releases. As (TLO) is also held by the ground at (CP) 2T-3T which (ET) breaks, (TLO) also releases.

(ST) releasing allows contacts (ST) 7-8 to open and breaks the AC circuit to (CT) thereby allowing it to release. Release of (CT) allows the armature of the clutch trip to engage the stop lug on the T-D mainshaft and stop the brushes on the STOP segment of the distributor portion and (SS) operates.

Opening of (ST) 1-2 removes the holding ground for (CP) and allows (CP) to release at this time.

By this time approximately 200 milliseconds have elapsed and since (OL) (due to open ground circuit) did not receive its normal pulse, releases allowing (OL) 3-2 to open and open the yellow locking circuit holding (TT), and (TT) releases.

(LB) now releases due to a time lapse of approximately 300 milliseconds since the line current is holding (SS) operated and the (LB) operating circuit is broken by (SS) 1-2 being open.

As long as (TGL) is "ON", (LB) will stay unoperated due to continuous signal line current through the winding of (SS) keeping (SS) operated and the operating circuit of (LB) open.

Now the (TGL) is operated to the "OFF" position and (SS) releases due to the completion of the dotted red circuit shorting (SS). When (SS) releases (LB) will operate and this condition will prevail until a new tape is inserted in the unit for transmission and the (TGL) operated to the "ON" position.

If the (TGL) is not turned to the "OFF" position and the line becomes busy, (LB) will operate on the first release of (SS) and remain so until (SS) ceases pulsing and the line again becomes idle. When the line becomes idle, (LB) will release after a time lapse of about 300 milliseconds. The preceeding discussion has covered the sequence of operation of the relays and circuits of the Automatic Station Identification Device in achieving a normal start and normal stop of the unit.

5.0 RELAY OPERATIONAL SEQUENCE OF THE AUTOMATIC STATION IDENTIFICATION DEVICE (Tabular Form)

This tabular form of the relay operational sequence of the Automatic Station Identification Device is offered to provide a rapid resume of the operation of the unit. The material is divided into the operational sequence per revolution of the transmitter-distributor brushes and further sub-divided into the position of the brushes on the STOP and START segment of the transmitter-distributor commutator ring.

5.1 First Revolution of the Brushes

a. Brushes on the STOP segment

AC power on, motor operates as long as AC is applied.

DC relay operating power on, (LB) operates for the first time.

(ET) closed, (TGL) "ON".

(SS) operates for the first time.

(LB) releases for the first time.

(OL) operates.

(ST) operates and locks through its own contacts.

(#1) operates and locks through its own contacts.

(CT) operates and allows the transmitter-brushes to start rotation.

b. Brushes on the START segment

(SS) releases for the first time.

(P) operates for the first time due to #1 winding being energized.

(LB) operates for the second time.

(OL) remains operated due to slow release characteristic.

(CP) operates and locks through its own contacts.

As the brushes sweep segments 1 through 5 to the T-D commutator ring the character of (#1) relay is transmitted to the signal line.

5.2 Second Revolution of the Brushes

a. Brushes on the STOP segment

(SS) operates for the second time.

(P) remains operated but through the #2 winding now energized.

(4) operates and locks through its own contacts.

(1) releases.

b. Brushes on the START segment

(SS) releases for the second time.

(P) releases for the first time.

As the brushes sweep segments 1 through 5 of the T-D commutator ring the character of (#4) relay is transmitted to the signal line.

5.3 Third Revolution of the Brushes

a. Brushes on the STOP segment

(SS) operates for the third time.

(5) operates and locks through its own contacts.

(4) releases

b. Brushes on the START segment

(SS) releases for the third time.

(P) operates for the second time due to #1 winding being energized.

As the brushes sweep segments 1 through 5 of the T-D commutator ring the character of (#5) relay is transmitted to the signal line.

5.4 Fourth Revolution of the Brushes

a. Brushes on the STOP segment

(SS) operates for the fourth time.

(P) remains operated but through #2 winding now energized.

(6) operates and locks through its own contacts.

(5) releases.

b. Brushes on the START segment.

(SS) releases for the fourth time.

(P) releases for the second time.

As the brushes sweep segments 1 through 5 of the T-D commutator ring the character of (#6) relay is transmitted to the signal line.

5.5 Fifth Revolution of the Brushes

a. Brushes on the STOP segment

(SS) operates for the fifth time.

(7) operates and locks through its own contacts.

(6) releases.

b. Brushes on the START segment

(SS) releases for the fifth time.

(P) operates for the third time due to #1 winding being energized.

As the brushes sweep segments 1 through 5 of the T-D commutator ring the character of (#7) relay is transmitted to the signal line.

5.6 Sixth Revolution of the Brushes

a. Brushes on the STOP segment.

(SS) operates for the sixth time.

(P) remains operated but through the #2 winding now energized.

(TT) operates and locks through its own contacts.

(7) releases.

(TLO) operates.

b. Brushes on the START segment

(SS) releases for the sixth time.

(P) releases for the third time.

Tape begins stepping through the T-D and is transmitted to the line as sensed by the contact fingers and contact tongues and screw connections of the T-D.

5.7 Relay Operational Sequence for Normal Stop

a. Message tape ends in transmitter-distributor

(ET) opens.

(ST) releases.

(TLO) releases.

(CP) releases.

(CT) releases and allows brushes to rotate until stopped by the stop lug on T-D mainshaft which places brushes on STOP segment.

(OL) releases.

(TT) releases.

(SS) operates due condition of stop dictated by (CT) stop arm.

(LB) releases after approximately 300 millisecond delay.

(TGL) "OFF" which places short circuit across (SS).

(SS) releases due to short placed across it by (TGL) "OFF".

(LB) operates due to release of (SS) completing ground circuit.

6.0 TROUBLE ANALYSIS FOR AUTOMATIC STATION IDENTIFICATION DEVICE

The following tests can be made to determine the exact symptoms of trouble that may arise in transmitting with the Automatic Station Identification Device. This list is not necessarily complete, but can be relied upon in the majority of cases to assist in locating troubles.

Generally it would be convenient to be able to observe the transmitted material on a perforated tape by monitoring transmissions with a reperforator. Since the reperforator equipment is not found in a great many communications stations, these tests may be performed with a type bar page printer as a monitor. All test to be performed on dummy test circuit and not on regular live circuit.

6.1 Test to Determine if the Automatic Station Identification Device Will Give a Complete Identification Upon Entering a Signal Line

This test can be accomplished by placing a test tape in the transmitter-distributor, turning the toggle switch to "ON", wait for the Automatic Station Identification Device to enter the line (start transmission of the identifier), and then turning the toggle switch to "OFF" before completion of the identification. If operation of the unit is normal the complete identification will appear on the printer. This same test may be made by turning the toggle switch to "ON", closing the end-of-tape switch with the finger and then removing the finger before complete identification appears on the printer. Again the transmission should continue until the identification has been completed. An important thing to keep in mind in either method of testing is that the identification must be started before attempting to stop transmission. This is due to the fact (LB) must release to start transmission and occurs 300 milliseconds after (TGL) is turned to "ON" position.

6.2 Test to Determine if Automatic Station Identification Device Will Send Into a Busy Line

To perform this test, depress the SPACE BAR or LETTERS key and manually trip the keyboard clutch throwout lever of the monitor printer and hold until test is accomplished. This will simulate busy line condition. Operate the toggle switch to "ON" position. This operation places w/SS in series with the line and thus (SS) will pulse and not allow (LB) to release which is necessary to start transmission from the unit. If the SPACE BAR or LETTERS key and keyboard clutch throwout lever of the printer is now released (LB) will release after a time lapse of 300 milliseconds and the Automatic Station Identification Device will begin normal start transmission.

6.3 Test to Determine if Automatic Station Identification Device Will Send into an Open Line

This test is similar to sending into a busy line, in that if the signal line is open (SS) will not operate to open (SS) 1-2 to allow release of (LB) to provide start ground for (OL). Also, contacts (SS) 3-4 are open due to (SS) not operating thus preventing operation of (OL) through the start ground normally supplied by (LB) releasing.

6.4 Test to Determine if the Automatic Station Identification Device Will Stop Due to an Open Signal Line Condition

This test is performed while transmission of a test tape several inches in length is in progress. As the test tape is stepping through the transmitter-distributor, open the signal line by depressing the LINE BREAK KEY on the monitor printer (or by some other available means if the LINE BREAK KEY has been disabled). This will cause the release of (SS) and open (SS) 3-4. After a time lapse of approximately 200 milliseconds (OL) will release and transmission from the transmitter-distributor should cease immediately. This time occurs in approximately two revolutions of the T-D brushes. Upon closure of the line, transmission

will not resume until after the depression and release of the BREAK-LETTERS or FIGURES RESTART keys. If a restart is made it may be noted that possibly one or two characters are missing from the copy of the transmission received on the monitor printer. This is a normal occurance caused by the brush rotation during the 200 millisecond time lapse required to cause release of (OL).

6.5 Test for Normal Operation of Front Panel Keys

During the transmission of a message tape it is possible to depress any one of the three panel keys on the front of the Automatic Station Identification Device without causing interruption or garble of the transmission. To test, place a test tape in the transmitter-distributor and depress any one or all of the panel keys as the tape is stepping through the transmitter-distributor. The copy on the monitor printer should not be affected nor should the operation of the transmitter-distributor be disturbed in any way.

6.6 Test to Determine if Automatic Station Identification Device Will Perform Normal Break Letters Restart

To make this test, simulate busy line condition by depressing the SPACE BAR of the monitor printer. Place a tape in the transmitter-distributor and turn the toggle switch "ON". Now depress and hold the BREAK-LETTERS panel key and the signal line should open causing the monitor printer to run "open". Release the SPACE BAR and BREAK-LETTERS panel key in that order. After a time lapse of 300 milliseconds (BK) will release and a Letters Restart address will be obtained. This address consists of LETTERS Function, CARRIAGE RETURN Function LINE FEED Function, Station Identification Letters, SPACE Function, and Message Tape.

6.7 Test to Determine if Automatic Station Identification Device Will Perform Normal Figures Restart

Start transmission with a test tape in the transmitter-distributor, and open line by depressing LINE BREAK KEY on the monitor printer (or

by other means if LINE BREAK KEY has been disabled). After the transmission from the transmitter-distributor has ceased, depress the FIGURES RESTART panel key, release the panel key and observe monitor printer to determine that entire heading is present; namely, LETTERS Function, CARRIAGE RETURN Function, LINE FEED Function, Station Identification Letters, SPACE Function, Figures Function and Message Tape.

6.8 Test to Determine if Automatic Station Identification Device Will Supply Program Message Heading (Message Diversion System Condition Code)

The Program Message heading is used to precede a message that is too be diverted (or relayed) by the Message Diversion System Equipment. As this "condition code" is comprised of non-printing functions, a method has been devised to determine if the code transmitted is complete.

The normal heading for Program Messages will consist of CARRIAGE RETURN Function, CARRIAGE RETURN Function, LETTERS Function, Station Identification Letters, and SPACE Function. If the platen of the monitor printer is placed in the upper case prior to transmission, all of the address will be visually monitored. To determine if the second CARRIAGE RETURN Function is being added, place a finger lightly on the Carriage Return Lock Bar of the printer and, as the CARRIAGE RETURN Function is received by the printer, a slight movement of the Carriage Return Lock Bar will be felt. (In order to become accustomed to the feel of this operation, place a finger on the Carriage Return Lock Bar, and strike the CARRIAGE RETURN KEY of the printer several times in rapid succession.)

Now depress the PROGRAM MESSAGE panel key and turn on the transmitter-distributor. If the Program Message address is being transmitted in its entirety, a double pulse of the Carriage Return Lock Bar will be detected prior to the station identification letters being printed on the monitor printer page.

7.0 SIMULATED TRANSMISSION OF AUTOMATIC STATION IDENTIFICATION DEVICE BY MANUAL OPERATION

This material is presented as a rapid, efficient way to observe the step-by-step action of the Automatic Station Identification Device at such speed all operations can be observed and accounted for.

If these instructions are accurately followed there will be few troubles in the unit that cannot be localized rapidly and action initiated to clear them by further special methods.

A few words of caution should be inserted here. In manually testing to determine if a relay operated or released, grasp the relay armature at the pivot point and try to move the armature in a direction parallel to the pin. If the relay is operated no movement will be noted; if the relay is unoperated, the relay armature will move slightly depending upon the amount of play. The testing for the above conditions should be done on each of the relays of the unit after each step in any of the procedures to determine if relays have released or operated when not supposed to. This procedure will preclude the overlooking of unwanted actions of the unit.

7.1 Conditions for Normal Start (Short Address)

a. All power off; AC, DC, and signal line. (TGL) "OFF", (ET) open.

b. DC and signal line power on; (LB) operates.

c. (TGL) "ON", Tight tape and end-of-tape contacts closed; (LB) releases; (OL), (ST), (#1) and (SS) operate.

d. Hold (OL) in and open line. (P), (LB), (CP) operate; (ST) and (#1) remain operated; (SS) releases. (CT and rest of counting chain would operate if AC were tuned on).

e. Continue to hold (OL) and hold (LB) for all future operations.

f. Close line; (#4) and (SS) operate; (CP), (ST) and (P) remain operated; (#1) releases. (CP) and (ST) should lock operated for remaining steps.

g. Open line; (P) releases; (SS) releases.

h. Close line; (SS) operates; (#5) operates; (#4) releases.

i. Open line; (SS) releases; (P) operates.

j. Close line; (SS) operates; (#6) operates; (#5) releases.

k. Open line; (SS) releases; (P) releases.

l. Close line; (SS) operates; (#7) operates; (#6) releases.

m. Open line; (SS) releases, (P) operates.

n. Close line; (SS) operates; (TT) operates; TLO operates; (#7) releases; (P) remains operated.

o. Open line; (SS) releases; (P) releases.

p. Closing and opening line operates and releases (SS). This simulates tape transmission.

q. Close line; (SS) operates; open (ET); (ST), (CP), (TLO) release; remove block from (OL); (OL); (TT) release. Remove block from (LB); (LB) releases.

r. (TGL) "OFF"; (SS) releases; (LB) operates.

7.2 Conditions for Letters Restart (Long Address - Lower Case)

a. All power off; AC, DC, and signal line (TGL) "OFF", (ET) open.

b. DC and signal line on: (LB) operates.

c. (TGL) "ON", tight tape and end-of-tape contacts closed; (LB) releases; (OL), (ST), (#1), and (SS) operate.

d. Manually operate (CO); (ST) and (#1) release; (CO) locks operated.

e. Depress BREAK-LETTERS panel key; (BP) operates.

f. Release BREAK-LETTERS key; (CO) releases; (ST) and (#1) operate; (BP) remains operated.

g. Hold (OL) and open line; (SS) releases; (P), (LB), and (CP) Operate.

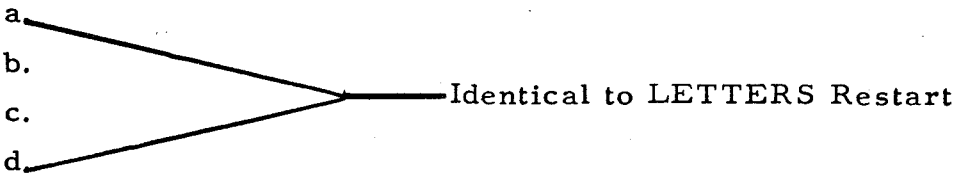
h. Continue to hold (OL) and hold (LB) during all future operations.

i. Close line; (SS) operates; (#2) operates; (#1) releases.

NOTE: Further opening and closing of line operates the counting chain through relays (#3), (#4), (#5), (#6), (#7), (TT) and (TLO). The operation of (TT) releases (BP) in addition to its normal function. (Now ready for tape transmission.)

7.3 Conditions for Figures Restart (Long Address-Upper Case)

a.
b.
c.
d.



e. Depress FIGURES RESTART panel Key; (FS), (BP), operate.

f. Release FIGURES RESTART key; (CO) releases, (ST) and (#1) operate; (FS) and (BP) remain operated.

g. Hold (OL) and open line; (SS) releases; (P), (LB), and (CP) operate.

h. Continue to hold (OL) and hold (LB) for all future operations.

i. Close line; (SS) operates; (#1) releases.

NOTE: Further opening and closing of line operates the counting chain through relays (#3), (#4), (#5), (#6), (#7), (#8), (TT), and (TLO). The operation of (TT) releases (BP) and (FS) in addition to its normal function. (Now ready for tape transmission.)

7.4 Conditions for Program Message (Message Diversion System Condition Code)

a. All power off; AC, DC, and signal line.

b. (TGL) "OFF", tight tape and end-of-tape contacts closed.

c. Signal line power on; DC on; (LB) operates.

d. Depress PROGRAM MESSAGE panel key; (D) operates.

e. (TGL) "ON"; (SS), (OL), (ST), (#3) operate; (LB) releases.

f. Hold (OL) and open line; (SS) releases; (LB), (P), (CP) operate.

g. Continue to hold (OL) and hold (LB) during all future operations.

h. Close line; (SS) operates; (#2) operates; (#3) releases.

i. Open line; (SS) and (P) release.

j. Close line; (SS) operates; (#1) operates; (#2) releases.

k. Open line; (SS) releases; (P) operates.

l. Close line; (SS) operates; (#4) operates; (#1) releases.

NOTE: Further opening and closing of line operates the counting chain through (#5), (#6), (#7), (TT), and (TLO). The operation of (TT) releases (D) in addition to its normal function. (Now ready for message tape transmission).

7.5 To Test Proper Operation of (LB) Circuit

a. Manually accomplish Normal Start through step o.

b. Open line; (SS) releases; (P) releases.

c. Release (LB); close line; (SS) operates; (LB) releases; (CO) operates; (ST), (CP), (TT), and (TLO) release.

7.6 To Test Proper Operation of (OL) Circuit

a. Manually accomplish Normal Start through step o.

b. Close Line; (SS) operates.

c. Release (OL); open line; (SS) releases; (OL) releases; (CO) operates; (ST), (CP), (TT), and (TLO) release.

Since (LB) and (OL) are both slow release relays it is to be noted that some possible reactions to incorrect operation with respect to time are;

a. If (LB) does not release during the initiation of a normal start, the unit cannot start as no starting ground will be furnished through (LB) 3-4.

b. If either relay releases prematurely, (CO) will be operated thus stopping the unit in such manner and condition that it can only be started by use of one of the restart panel keys.

8.0 TIME - SEQUENCE OPERATION NOTES

8.1 Normal Start (Short Address)

AC, DC, ON (LB) energized, (ET) closed

↓

TGL "ON"

↓

(SS) operates, (LB) releases, (OL) operates, (ST) operates/locks and (1) operates/locks

↓

(CT) operates

↓

TD Brushes on Start Segment (open circuit to SS)

↓

(SS) releases, (P) operates (#1w), (LB) operates, (OL) holds and (CP) operates

↓

TD Brushes traverse segments 1 thru 5 and transmit letters code combination as set up by relay (1).

↓

TD Brushes on Stop Segment

↓

(SS) operates, (P) holds (#2w), (4) operates/locks and (1) releases

↓

TD Brushes on Start Segment

↓

(SS) and (P) release

↓

TD Brushes traverse segments 1 thru 5 and transmits 1st identification combination set up by relay (4).

↓

TD Brushes on Stop Segment

↓

(SS) operates, (5) operates/locks and (4) releases

↓

TD Brushes on Start Segment

↓

(SS) releases and (P) operates (#1w)

↓

TD Brushes traverse segments 1 thru 5 and transmit 2nd identification code combination set up by relay 5.

↓

TD Brushes on Stop Segment

↓

(SS) operates (P) holds (#2w), 6 operates/locks and 5 releases

↓

TD Brushes on Start Segment

↓

(SS) and (P) release

↓

TD Brushes traverse segments 1 thru 5 and transmit 3rd identification code combination set up by relay (6).

↓

TD Brushes on Stop Segment

↓

(SS) operates, (7) operates/locks, and (6) releases

↓

TD Brushes on Start Segment

↓

(SS) releases, and (P) operates (#1w)

↓

TD Brushes traverse segments 1 thru 5 and transmit space code combination as set up by relay (7).

↓

TD Brushes on Stop Segment

↓

(SS) operates, (P) holds (#2w), (TT) operates/locks, (7) releases and TLO operates

↓

TD Brushes on Start Segment

↓

(SS) and (P) release

↓

TD Brushes traverse segments 1 thru 5 and transmit first code combination as determined by tape perforation. Tape will then start stepping thru the TD and code signals will be transmitted to the line in accordance with conventional TD operation. (SS) will continue to pulse and provide holding pulses to relays (LB) and (OL) for normal line conditions.

End of Message Tape in TD

↓

(ET) opens; (ST) releases, (TLO) releases, (CP) releases, (CT) releases and stops travel of TD Brushes, (OL) releases, (TT) releases, (SS) operates and (LB) releases after approximately 300 milliseconds.

↓

TGL "OFF"

↓

(SS) releases and (LB) operates

↓

Unit ready for recycle when required.

8.2 Program Message Address

Program Message Key depressed, AC and DC ON, (LB) operated ET closed and (D) operated

↓

TGL "ON"

↓

(SS) operates (LB) releases, (OL) operates, (ST) operates/locks, (CT) operates and (3) operates/locks

↓

TD Brushes on Start Segment

↓

(SS) releases, (P) operates (#1w), (LB) operates and (CP) operates

↓

TD Brushes traverse segments 1 thru 5 and transmits first carriage return code combination set up by relays (D) and (3)

↓

TD Brushes on Stop Segment

↓

(SS) operates, (P) holds (#2w), (2) operates/locks and (3) releases

↓

TD Brushes on Start Segment

↓

(SS) and (P) release

↓

TD Brushes traverse segments 1 thru 5 and transmit second carriage return code combination set up by relay (2)

↓

TD Brushes on Stop Segment

↓

(SS) operates, (1) operates/locks and (2) releases

↓

TD Brushes on Start Segment

↓

(SS) releases and (P) operates (#1w)

↓

TD Brushes traverse segments 1 thru 5 and transmit letters code combination as set up by relay (1)

↓

TD Brushes on Stop Segment

↓

(SS) operates, (P) holds (#2w), (4) operates/locks and (1) releases

Refer to the outline covering functional operation for the conditions of a Short Address to determine the sequence of operation for the remainder of the counting chain relays. It will be found that operation of the two addresses are identical past relay (4) with the exception that operation of relay (TT) de-energizes the (D) relay; however, relay (D) will be re-energized at the end of the message text if the program message key is left in the depressed condition.

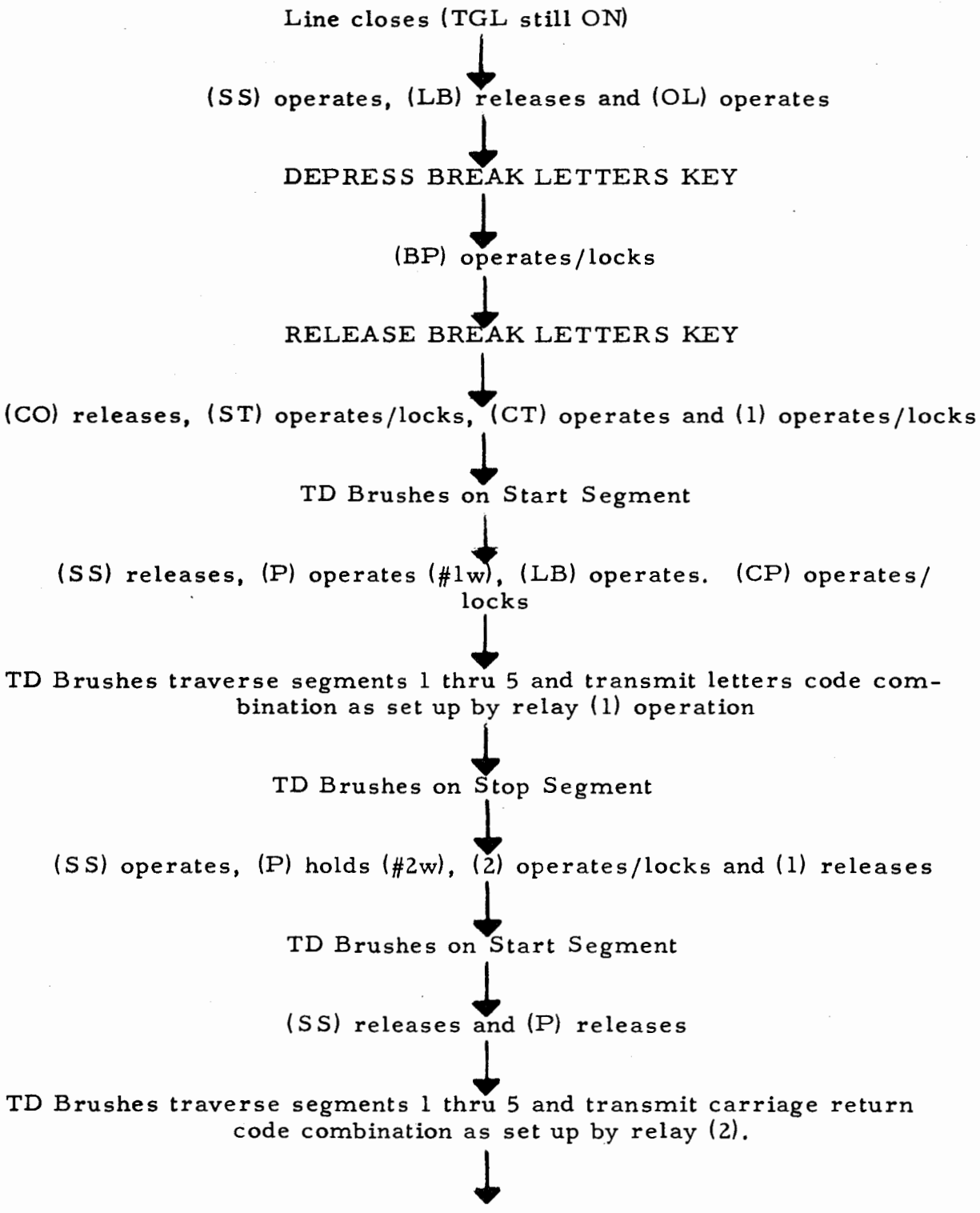
8.3 Letters Restart (Long Address)

LINE break during transmission

↓

(SS) releases, (OL) releases, (TT) releases, (TLO) releases, (CO) operates, (ST) releases (CP) and (CT) release.

↓


Line closes (TGL still ON)
(SS) operates, (LB) releases and (OL) operates
DEPRESS BREAK LETTERS KEY
(BP) operates/locks
RELEASE BREAK LETTERS KEY
(CO) releases, (ST) operates/locks, (CT) operates and (1) operates/locks
TD Brushes on Start Segment
(SS) releases, (P) operates (#1w), (LB) operates. (CP) operates/ locks
TD Brushes traverse segments 1 thru 5 and transmit letters code combination as set up by relay (1) operation
TD Brushes on Stop Segment
(SS) operates, (P) holds (#2w), (2) operates/locks and (1) releases
TD Brushes on Start Segment
(SS) releases and (P) releases
TD Brushes traverse segments 1 thru 5 and transmit carriage return code combination as set up by relay (2).

TD Brushes on Stop Segment

↓

(SS) operates, (3) operates/locks and (2) releases

↓

TD Brushes on Start Segment

↓

(SS) releases and (P) operates (#1w)

↓

TD Brushes traverse segments 1 thru 5 and transmit line feed code combination as set up by relay (3)

↓

TD Brushes on Stop Segment

↓

(SS) operates, (P) holds (#2w), (4) operates/locks and (3) releases

↓

TD Brushes on Start Segment

Refer to the outline covering functional operation for the conditions of a Short Address to determine the sequence of operation for the remainder of the counting chain relays. It will be found that the operation of the two addresses are identical past relay (4) with the exception that the operation of relay (TT) de-energizes the (BP) relay in the case of a long address.

8.4 Letters Break (Long Address)

TGL "OFF"

↓

(SS) Released and (LB) operated

↓

DEPRESS BREAK LETTERS KEY

↓

(BK) operates, line opens, (BP) operates/locks

↓

RELEASE BREAK LETTERS KEY

↓

(BK) releases, line closes, (SS) operates, (LB) releases, (OL) operates, (ST) operates/locks, (CT) operates, and (1) operates/locks

↓

TD Brushes commence first revolution. Action of counting chain duplicates that of a Letters Restart (long address). However, all relays will drop out upon operation of (TT) which removes the protective ground.

CONDITION OF BREAK LETTERS WHEN BREAKING ANOTHER STATION TO SEND PRIORITY TRAFFIC

TGL "ON"

↓

(SS) pulsing (following distant station code impulses) and relay (LB) operated

↓

DEPRESS AND RELEASE BREAK LETTERS KEY

↓

(BK) operates, line opens for at least 300 milliseconds (distant station (CO) relay operates and stops his transmission). (BP) operates/locks.

↓

(BK) releases, line closes, (SS) operates, (LB) releases, (OL) operates, (ST) operates/locks, (CT) operates and (1) operates/locks.

↓

TD Brushes commence first revolution. Action of counting chain duplicates that of a Letters Restart (long address).

NOTE: To make the above conditions to apply in the case of a Figures Restart type of long address, merely keep in mind that depression of the Figures Restart Key will initiate very similar relay operation plus operation of the (FS) relay which will cause relay (8) to operate in the counting chain directly after operation of relay (7) and before operation of (TT) relay.