TELETYPE model 28 THE LEADERSHIP LINE

BULLETIN 258B

DESCRIPTION AND PRINCIPLES OF OPERATION

MODEL 28 TRANSMITTER DISTRIBUTOR LXDJ, LXDBJ, LXDC

TELETYPE® CORPORATION
SUBSIDIARY OF Western Electric Company INC.
CHICAGO, ILLINOIS, U. S. A.

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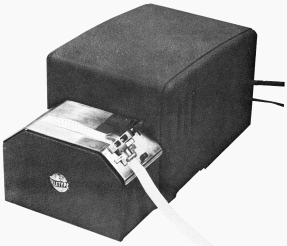

Transmitter Distributor – Self Contained Unit
(Fixed Head – Single Contact)

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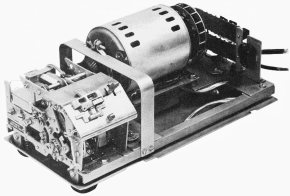


Figure 1-1 Transmitter Distributor LXD4 And Base LXD83
(Self Contained Unit With Covers Removed)

SECTION 1

DESCRIPTION

1. INTRODUCTION

1.a. The Model 28 Fixed Head - Single Contact Transmitter Distributor provides means for translating code combinations, perforated in a paper tape, into electrical pulses and transmitting these pulses in the form of a five-unit, start-stop permutation code to one or more receiving stations. Features incorporated in the design of the unit include the all steel internal expansion clutch, sensing pins located in line with the axis of the feed wheel, longer travel of the sensing pins, increased number of feed pins engaging the feed holes in the tape and minimum maintenance. Section 1 of this bulletin presents a brief description of the physical characteristics and functions of the unit. Section 2 describes the principles of operation with a step by step accounting of the events occuring in a complete cycle.

1.b. Reference in the text to left, right, front or rear apply to the unit in its normal operating position as viewed from the front or operator's position. Pivot points are shown in the drawings by circles or ellipses which are solid black to indicate fixed points.

2. GENERAL

2.a. The Model 28 Transmitter-Distributor Unit is an electromechanical device using a single cam shaft to initiate and sequentially perform the functions of sensing the intelligence stored in the tape. An electrical contact is linked to certain mechanisms to translate the intelligence sensed into pulses of current (marking) and no current (spacing). The unit will accept a five level tape of 11/16 or 7/8 inch width either chadless or fully perforated. The tape may be inserted without lifting the tape lid by moving the start-stop lever to the free wheeling position. Otherwise, the feed wheel is detented and the tape-out pin extended so that the tape is blocked from sliding under the lid.

2.b. The unit is arranged so that the components are readily accessible for adjustment or replacement. In the same manner, new features or mechanisms may be installed with a minimum amount of disassembly. Either 60 milliampere or 20 milliampere operation may be used.

2.c. The Self Contained Set consists of a transmitter-distributor unit — LXD, a base — LXDB, a set of gears to accommodate the desired speed — 60, 75, 100 W.P.M., a motor unit — LMU, and a cover — LXDC. In Automatic Send-Receive Sets using the LXD the transmitter distributor mounts on an extension of the LCXB base located in the Automatic Send-Receive Cabinet. The motive power is obtained from the A.S.R. motor through a power take-off shaft and intermediate gears for the desired operating speed (60, 75 or 100 W.P.M.).

3. PHYSICAL DESCRIPTION

3.a. The mechanisms of the transmitter distributor are supported between three vertical plates (front, center, and rear) which are separated a fixed distance by spacers or tie bars. The cam shaft is located in the lower right section of the unit with the outer race of each ball bearing clamped to the respective front and rear plate. Motive power to the shaft is controlled by the clutch located on the rear end of the shaft and the clutch trip magnet assembly attached to the rear plate. See Figure 1-3. As the clutch trip magnet is energized, the clutch mechanism is allowed to engage the outer drum that is rotating continuously, transmitting its motion to the cam shaft. The top of the unit is enclosed by three formed plates — the tape guide plate, the top plate and the cover plate. With tape in the transmitter distributor, movement of the start-stop lever to the right operates contacts to energize the clutch trip magnet which releases the main bail and the clutch. The main bail causes the sensing fingers to sense the tape perforations and initiates the tape feed operation. The clutch is engaged to start the cam shaft rotating. Transfer levers associated with the sensing pins cause the transfer bail to be shifted to the right or left in accordance with the intelligence sensed. The transfer bail in turn moves the signal generator toggle link and contacts to their marking or spacing position. Thus the perforations for each character in the tape are read and pulses, number 1 through 5, are generated sequentially. The tape is advanced to the next character and the cycle repeated. Operating speeds of 60, 75 or 100 words per minute are obtained by use of interchangeable gears.

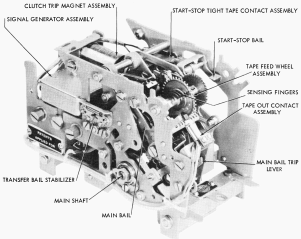


Figure 1-2 LXD4 Transmitter Distributor for ASR or Self Contained Units (Cover Plate, Top Plate and Tape Guide Plate Removed)

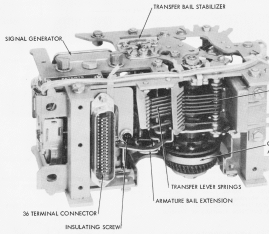


Figure 1-3 Transmitter Distributor (LXD4) - Bottom View

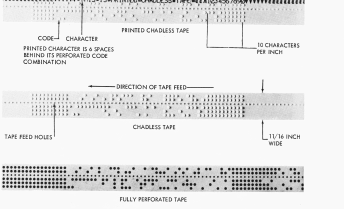


Figure 1-4 Standard Five Level Perforated Tapes

3.a.(1) Special Features

3.a.(1)(a) Accommodates either chadless or fully perforated five level tape. Figure 1-4.

3.a.(1)(b) A control lever with start-stop and free-wheeling positions. The latter position permits free wheeling of the tape feed wheel which facilitates insertion or removal of tape.

3.a.(1)(c) A pair of adjustable guides are provided for aligning and locating 11/16 or 7/8 inch tape over the feed wheel. Figure 1-5.

3.a.(1)(d) An index line has been scored in the tape guides 0.600" (six characters) ahead of the sensing pins to aid in aligning tape start position.

3.a.(1)(e) A tight tape device on the tape lid stops transmission if the tape becomes taut or tangled.

3.a.(1)(f) A tape-out pin located to the right of the sensing pins stops transmission if there is no tape in the sensing head. (The pin is normally advanced 4 characters from the sensing pins. However, it may be placed in line with them).

3.a.(1)(g) A spring loaded tape lid that snaps open when the red tape lid button is depressed.

Figure 1-5 Tape Guide Plate

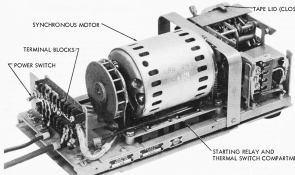


Figure 1-6 Self Contained Unit Showing Synchronous Motor (LMU3)

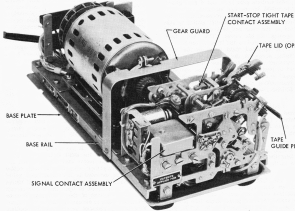


Figure 1-7 Self Contained Transmitter Distributor - Covers Removed

3.a.(1)(b) A quick disconnect 36 terminal connector plug which aligns with its mate on the base and facilitates making electrical connections as well as simplifying handling during servicing. Figure 1-3.

3.a.(1)(c) A nylon insulating screw mounted on the connector bracket and adjusted to align with and actuate the "Line Shunt Switch" on the LXDB3 Base. See Paragraph 3.b.(1)(a).

3.a.(2) Physical Data

Approximate dimensions of transmitter:

Width - - - - - 7-1/2 inches
Depth - - - - - 3-3/8 inches
Height - - - - - 5 inches
Weight - - - - - 7 pounds

3.b. Base Assemblies

3.b.(1) Base Assembly for Self-Contained Units - Figure 1-6.

3.b.(1)(a) The LXDB3 Base Assembly supports the transmitter distributor, motor unit, intermediate gear train and a gear guard. Two terminal blocks are mounted across the rear of the base to provide connections for the equipment. The motor "on-off" switch is also located at the rear and is accessible through an opening in the cover. The "Line Shunt Switch" is mounted on the front of the base so that it is operated (held open) by the nylon insulating screw on the bottom of the LXD4 Transmitter Distributor when the LXD4 is placed in position on the base. The switch is designed to close the signal line circuit when the transmitter distributor is removed from the LXDB3 Base.

3.b.(1)(b) The base consists of two channel iron rails on which the units are mounted. The rails in turn are mounted to a base plate by means of four vibration mounts which serve to reduce noise and vibration.

3.b.(2) In A.S.R. Sets the LXD Transmitter Distributor is mounted on the base provided in the Automatic Send-Receive Set.

3.c. The LXDC Top Cover for the self-contained unit, appropriately finished, rests in position over the motor and intermediate gear train. A front panel snaps into position in front of the transmitter. In A.S.R. sets the LXD requires only a front panel which slides into place.

4. ELECTRICAL CHARACTERISTICS

4.a. Control Circuit

4.a.(1) The control circuit (clutch trip magnet) is capable of operating from 115 volts AC ± 10% and 120 volts DC ± 10% or 90 volts DC ± 10% with suitable external resistance.

4.a.(2) The tight tape, tape-out and manual control mechanisms operate contact assemblies which are in series with the clutch trip magnet assembly. Actuation of any one of these devices opens the clutch trip magnet circuit which causes the clutch to be disengaged and the transmitter goes into an idle line condition.

NOTE: Overload protection must be provided external to the unit.

4.b. Signal Circuit

4.b.(1) The Signal Contacts in the transmitter signal generator may operate on 60 milliamperes ± 10% or 20 milliamperes ± 10% direct current.

4.b.(2) The signalling code most generally transmitted is the five unit, start-stop neutral code consisting of current and no current intervals, or pulses. See figure 1-8. A marking pulse is a measured interval of time during which current flow is permitted through 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 necessary to keep the receiving telegraph apparatus in synchronism with the transmitter.

4.c. Power Circuit - for self-contained units. The motor in the self-contained unit requires 115 volt AC ± 10%, 60 cycles, single phase. This capacitor start, 3600 R.P.M. synchronous motor is located on the base behind the intermediate gear train. It has a combination hand wheel and fan on the shaft at the rear end of the motor. The motor starting relay and capacitor, together with the thermal cutout switch, are mounted in a compartment below the motor. The manual reset thermal cutout switch is designed to open the motor circuit when the windings of the motor may become overheated due to excessive load on the motor. Vibration is reduced by the use of resilient mounts at each end of the motor which isolate it from its supporting cradle.

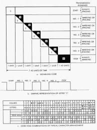


Figure 1-8 Start-Stop Signaling Code

5. OPTIONAL FEATURE

(Available as a factory installed option (LXD5) or as a kit for field installation.)

A modification to adapt the LXD for operation in association with the horizontal tabulator or vertical tabulator on an LP Printer. It enables the opening of the LXD Clutch Magnet circuit for a period of approximately 120 degrees to stop the transmitter when reading either LETTERS or FIGURES code combination following upper case "O" combination for horizontal tabulation, upper case "J" combination for vertical tabulation or upper case "Z" combination for page feed-out. The modification consists of a train of parts, a sensing bail, a transfer arm and an operating arm, serving to operate the LXD transmitter stop contact since opening of the transmitter stop contact on the LP unit occurs too late in the operating cycle to stop the LXD on the proper character. See Figure 1-9.

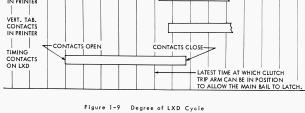


Figure 1-9 Degree of LXD Cycle

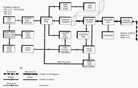


Figure 2-1 Functional Block Diagram of LXD

SECTION 2

PRINCIPLES OF OPERATION

1. GENERAL

In the following description of the sequence of operations of the Model 28 Single Shaft Transmitter Distributor, the LXD is assumed to be operating under normal conditions:

1.a. External portions of the transmitter-distributor circuits completed (i.e. correct source of operating potential across both control circuit and signal generating circuit as covered in Section 1).

1.b. Start-stop lever in its off (center) position.

1.c. Driving motor running and the LXD in the idle line condition (clutch disengaged and main shaft stationary).

1.d. Tape in the transmitter-distributor guide plate with the lid closed.

2. OPERATING SEQUENCE

2.a. Push the start-stop lever to its right (RUN) position. The camming surface of the start-stop lever allows the start-stop bail to move upward. As the bail pivots on its mounting, the left extension of the bail moves away from the bakelite portion of the swinger of the start-stop tight-tape contact assembly. Thus the contact is closed to complete the clutch trip magnet circuit, energize the magnet and pull the armature up. The armature bail extension cams the main bail latch lever about its pivot post to release the main bail.

2.b. The main bail swings upward due to the

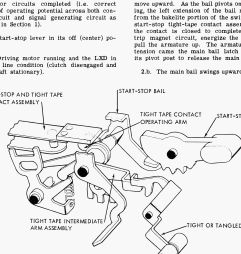


Figure 2-2 Start-Stop and Tight Tape Switch Mechanisms

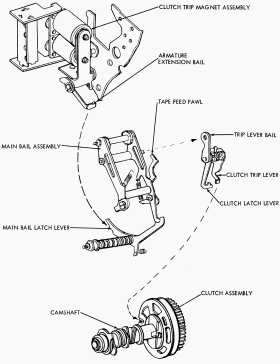


Figure 2-3 Function Control Mechanism

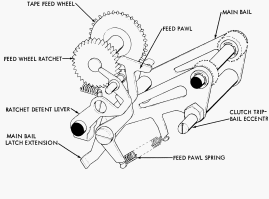


Figure 2-4 Tape Feed Mechanism - Rear View

tension of the main bail spring and initiates the actions as follows:

2.b.(1) The feed pawl is raised one tooth on the feed wheel ratchet. Figure 2-4.

2.b.(2) The clutch trip lever moves away from its latch when the eccentric post on the spring biased main bail cams the clutch trip bail; the trip bail in turn moves the clutch trip lever. (The eccentric on the main bail rides in the slot of the clutch trip bail so that when the main bail is released the clutch trip bail is also released by the interconnection.) Figure 2-3.

2.b.(3) The sensing fingers, responding to the action of their springs, follow the main bail and are raised from below the tape in the tape guide plate. If one or more of the sensing fingers encounter a perforation in the tape the fingers will extend through the perforations until the projections on the sensing fingers strike the bottom of the main bail spacer post. The sensing fingers that extend through the tape move their associated transfer levers upward so that they are brought above the line of action of the blade on the locking bail. If any of the sensing fingers do not sense a perforation in the tape the associated transfer levers remain stationary and their extensions remain below the line of action of the locking blade on the locking bail. Fig. 2-6.

2.c. During the movement of the main bail, the clutch trip bail pivots on its axis and pushes the clutch trip lever away from the shoe release lever to engage the clutch and start the main shaft rotating. (Figure 2-3).

2.d. As the cam sleeve continues its rotation, the high part of the locking bail cam moves away from the locking bail and permits the locking bail to be pulled upward by its spring. In its upward travel, the locking blade of the bail is positioned between the lower extensions of the selected transfer levers and locks them in position. Figure 2-5.

2.e. Further rotation of the main shaft moves the lobe of the start cam into position and shifts its transfer lever downward. Since the start transfer lever has no sensing finger, the lever is always in the spacing position. The start transfer lever's upper finger hooks the upper side of the transfer bail and causes it to move clockwise. (NOTE: All transfer levers except the start and stop are arranged

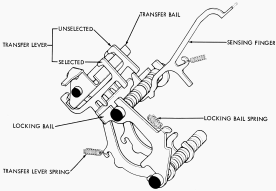


Figure 2-5 Locking Bail and Transfer Lever Mechanisms

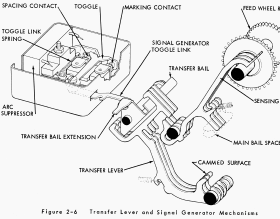


Figure 2-6 Transfer Lever and Signal Generator Mechanisms

to move in two directions. The forked end of these five levers can be moved from the spacing position to the marking position by the associated sensing levers. The transfer levers are also moved downward and to the right in a sequence that is timed to attain the transfer bail in accordance with the T.42 unit transmission pattern. See Figure 1-8.) The transfer bail extension moves the signal generator toggle link which causes the toggle to open the marking contact and close the spacing contact in the signal generator circuit assembly. (Figure 2-8). The extension, in moving to the spacing position, moves the marking latch on the stabilizer (Figures 1-3 and 2-7) out of its way and continues its travel far enough to let the spacing latch fall into the latching position simulating a detent action.

2.f. As the shaft rotates further, the cam for the first pulse moves its transfer lever downward and toward the right. Depending on the position of the transfer lever finger (upper fork engaging bail - spacing; lower fork engaging bail - marking), the transfer bail is rotated if the pulse to be transmitted is not the same as the preceding pulse. If the preceding pulse is the same no action occurs because the bail has been previously rotated. If the preceding pulse was different, the extension on the transfer bail moves the toggle link and causes the toggle to open the closed contact and close the open contact.

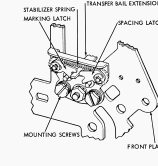


Figure 2-7 Transfer Bail Stabilizer

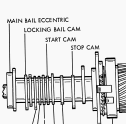


Figure 2-8 Clutch Camshaft Assembly

2.g. The second, third, fourth and fifth pulses are generated in the same manner as the first. The action is repeated as each cam moves its associated transfer lever, in sequence, as described in Paragraph 2.f.

2.h. The stop pulse cam follows the fifth pulse cam as the main shaft is completing its cycle. Again the action is the same as that for the first pulse except that, since the stop pulse bail no sensing finger and its transfer lever is blocked, its lower finger always broke the transfer bail resulting in a marking pulse on the completion of each character.

2.i. As the cam for the first pulse starts its action, the drive arm eccentric (Figure 2-10) starts to cam the drive arm downward. The drive arm pulls on the eccentric stud of the main bail causing the main bail to pivot downward to complete the operations initiated when the main bail was originally released (Paragraphs 2.a. and 2.h.).

2.i.(1) The main bail in pivoting downward withdraws the sensing fingers that are extended.

2.i.(2) It pulls down on the tape feed pawl advancing the tape to the next set of perforations.

2.i.(3) The main bail is moved to the latching position, however, it does not latch since tape is still in the tape head and the

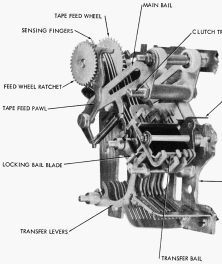


Figure 2-9 Front Plate Assembly - Rear View

latch is held in the scrutching position by the armature bail extension.

3.j. The tape feed pawl advances the tape feed ratchet one tooth against the action of the ratchet detent roller. The tape feed ratchet is part of the tape feed wheel. The tape feed wheel advances the tape one character. The ratchet detent roller bears between two teeth on the ratchet and serves to hold the feed wheel and tape in position during the sensing portion of the operating cycle. Figure 2-4.

3.k. Since the clutch trip ball does not latch, the drive arm moves again to its upper position. In so doing, repetition occurs when the main bail swings upward and the main shaft starts to rotate, until the unit runs out of tape.

3. STOPPING THE ACTION

3.a. The code sensing fingers cannot differentiate between a no tape condition and a LETTERS combination; therefore, the unit operates as if five perforations were sensed and goes through the actions previously described. However, the tape out sensing pin features sensas that there is no tape in the tape guide plate. The tape-out pin moves upward to lift the swinger of the tape-out contact assembly and open the clutch trip magnet circuit.

3.b. Since the tape-out contacts are in series with the start-stop light-tape contacts, the clutch trip magnet becomes de-energized and releases its armature. This permits the armature extension to pivot out of the blocking position and allow the main bail latch to be moved by its spring. Figures 2-3 and 3-11.

3.c. As the main bail is latched the clutch trip lever blocks the clutch shoe lever. When the clutch is blocked the inertia of the mechanism causes the clutch to rotate far enough to permit its latch to fall into the notch on the clutch cam disk.

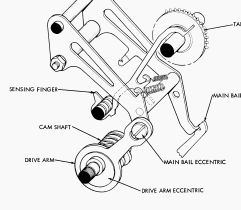


Figure 2-10 Main Bail and Drive Arm Mechanism

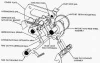


Figure 2-11 Free Wheeling and Tape Out Mechanism

4. CLUTCH OPERATION

4.a. Clutch engagement (Figure 2-12A) is accomplished by releasing the lower end of lever B. The upper end of lever B 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 counterclockwise, 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 G. 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 succeeding step, 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. The cam disk on the clutch is connected to the cam shaft imparting rotary motion to the cam assembly.

4.b. Clutch disengagement (Figure 2-12B) 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 the other ear D to move toward the right. The upper spring then pulls the two shoes together and away from the drum.

5. TAPE LID OPERATION

5.a. When the tape lid button is pressed, the shaft portion of the button presses against the tape lid plunger bail extension causing the bail to pivot. The bail, in pivoting, moves its latching extension from under the tape lid latching post permitting the post to swing downward under action of its spring. Since the latching post is mounted on the tape lid behind the pivot point and below the tape guide plate E (tape guide is made part of the tape lid) to swing upward (open) when the post swings downward. Figure 2-13.

5.b. The tape lid is closed manually by pressing it against the tape position. When the tape lid is closed, the latching post swings

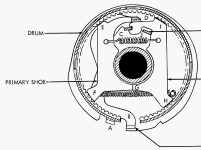


Figure 2-12A Clutch - Engaged

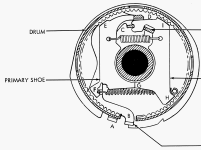


Figure 2-12B Clutch - Disengaged

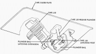


Figure 2-12 Tape Lid Mechanism - Bottom View

up and cams the latching extension out of its way until it passes the end of the extension which then is pulled under the post, by spring action, latching the post and tape lid.

6. START-STOP LEVER.

6.a. To start transmission - See Section 2, Paragraph 2.a.

6.b. To stop transmission. When the control lever is pushed to its center or stop position, the cam surface of the lever cams the control lever bail causing the bail to pivot. As the bail pivots, its extension cams the swinger pad upward on the start-stop contact assembly opening the contacts. This breaks the circuit to the clutch magnet assembly causing the armature to be released to its unattracted position. Figure 2-2.

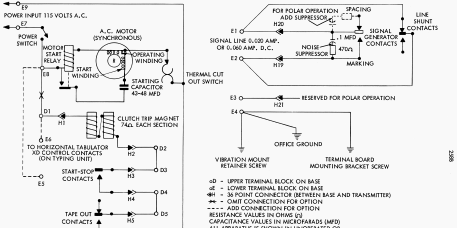
6.c. Free wheeling feed wheel. (Figure 2-11). The control lever is operated the same as in 6.b. except that the lever is pushed to the extreme left position and the extension on the start-stop bail pushes the feed pawl and the ratchet detent roller away from the feed ratchet allowing the feed wheel to rotate freely. The bail extension also cams the intermediate bail extension arm which rotates the intermediate bail. The intermediate bail, in rotating, permits the spring loaded tape-out pin depressor bail to follow. The depressor bail, with its operating mechanism, is mounted on a bracket. The bracket is, in turn, mounted on the front plate. The result of this camming action is the depressing of the tape-out sensing pin to a flush or below flush condition relative to the tape guide plate. This permits free passage of the tape under the tape lid.

7. TIGHT OR TANGLED TAPE raises the tight tape bail arm (Figure 2-2). The bail pivots and its extension cams the tight tape intermediate arm assembly on which is secured the tight tape arm. When the arm assembly is cammed, the associated tight tape arm lifts the swinger of the start-stop, tight tape contact assembly upwards and opens the clutch trip magnet circuit. Transmission stops.

8. TAPE-OUT SENSING PIN (Figure 2-11) is located on the tape guide plate to the right and slightly forward of the five tape sensing fingers. With the tape-out pin in the depressed position, the swinger on the tape-out contact assembly is released and its contacts closed. The unit will then transmit if the series wired start-stop tight tape contacts are closed. Therefore, when tape is in the unit with the tape lid closed, the tape holds the tape out sensing pin in the depressed position and allows the unit to run. When no tape is sensed the spring loaded sensing pin travels upward and into a hole provided in the tape lid. An extension on the pin engages the swinger on the tape out contact assembly pushing the swinger up opening its contacts. This inter-

rupts the clutch magnet circuit so that transmission ceases.

9. ELECTRICAL CIRCUITS in the transmitter distributor are the clutch trip magnet circuit and the signal circuit. The clutch trip magnet circuit consists of the clutch trip magnet coils in series with the start-stop, tape loop and tape-out contact assemblies. The signal circuit consists of the transmitter signal generator contacts wired to provide neutral operation.



CLUTCH TRIP MAGNET WIRED FOR A.C. OPERATION. IF D.C. IS USED LIMIT CURRENT TO 0.100 AMP BY USE OF EXTERNAL RESISTANCE. FOR 120 VOLT D.C. AN EXTERNAL RESISTANCE OF 1000/5 IS REQUIRED. FOR 50 VOLTS D.C. AN EXTERNAL RESISTANCE OF 330/5 IS REQUIRED.

Figure 2-14 Schematic Wiring Diagram of Self Contained Transmitter Distributor