BR8604

Handbook for

TELEPRINTER TGN SERIES

(SUPERSEDES BR 8604 DATED DECEMBER 1978)

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TELEPRINTER, TGN SERIES

AND

INTERFACE UNIT, TELEPRINTER

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BR 8604
Original

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TELEPRINTER TGN4

AND

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CATEGORY 1 - PURPOSE

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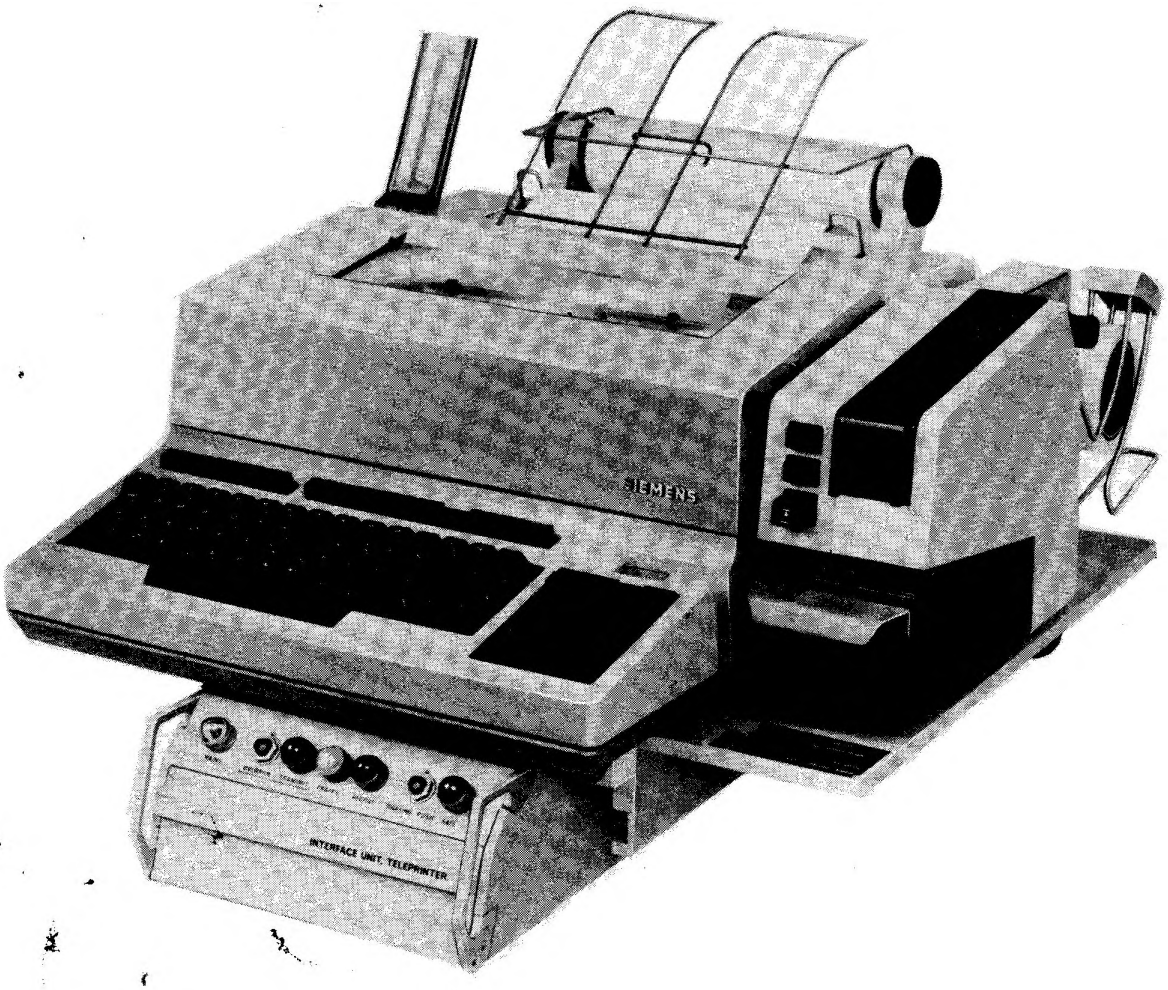

FRONTISPIECE

TELEPRINTER, TGN 4
WITH BASE PLATE AND INTERFACE UNIT

TELEPRINTER, TGN SERIES

AND

INTERFACE UNIT, TELEPRINTER

SUMMARY OF DATA

PURPOSE

The TGN Series are electronic page teleprinters for Naval Communication to replace Teleprinter No 12 and Semi Electronic Teleprinter Outfit TGJ. They are designed to operate using ITA Code No 2 and conform to the internationally agreed standards for telegraph communications.

NOMENCLATURE

The basic teleprinter outfit is known as TGN(1) with Variants (2), (3) and (4).

TGN(1)	- Teleprinter	-	Receive only.
TGN(2)	- Teleprinter	-	Receive only with Paper Tape Punch (Reperforator).
TGN(3)	- Teleprinter	-	Transmit/Receive with Paper Tape Reader. (Auto Transmitter)
TGN(4)	- Teleprinter	-	Transmit/Receive with Paper Tape Punch and Paper Tape Reader.

NOTE BR 8604 deals only with TGN(4) as it includes all variants.

SPECIFICATIONS

Signalling Speed	-	50, 75 or 100 bauds 100 bauds - Local Mode
Signal Characteristics	-	Transmitter output voltage ± 6 V, ± 1 V Transmitter source impedance, less than 100 ohms Receiver input resistance, nominal 6000 ohms Receiver input capacitance, less than 2500 pF
Receiving Capabilities	-	Stop-start-telegraph signal, one start element, five character code elements and a stop period of one to one and a half elements. Start elements of less than 2 ms are rejected.
Character Release Mode	-	Minimum gap between call pulses, 7 code elements
Pulse Release Mode	-	Minimum length of call pulse, 1½ code elements Maximum length of call pulse, 5 code elements
Deviation From Rated Signalling Speed	-	<1%
Receive Margin	-	Better than 40%, when operating at 75 bauds

Transmit Distortion	- <3%
Power Supply	- 115 V 60 Hz or 240 V 50 Hz. Adjustable by means of a rotary switch on the Power Supply Module
Power Drawn Without/ With Attachments	- In Standby condition 30/35 VA - In Operational condition 80/120 VA
Printer	
Number of Copies	- 1 original and 3 carbon copies
Ink Ribbon	- 13 mm wide typewriter ribbon (DIN Standard 2103)
Type Style	- Upper and lower case letters type front OCR-B
Maximum Line Length	- 72 characters but normally adjusted to 69 characters
Character Pitch	- 10 characters per inch
Line Pitch	- Adjustable between 3, 4½ or 6 lines per inch
Teleprinter Paper	- Roll diameter 89 mm or 120 mm width 216 mm
Paper Supervision	- End of paper contacts
Keyboard	- 4 row model
End of Line Warning	- Audible warning after 59th character has been printed or stored
Paper Tape Punch	- Can be operated attached directly to teleprinter
Paper Tape	- Roll diameter 203 mm, width 17.5 mm
Dimensions	
Width	- 415 mm, with Paper Tape Punch 527 mm
Height	- 285 mm, with 89 mm diameter paper roll
Depth	- 585 mm, with 89 mm diameter paper roll
Weight	- TGN(1) 17 kg - TGN(2) 24 kg - TGN(3) 19 kg - TGN(4) 24 kg
Reliability	
MTBF	- With Paper Tape Reader and Punch >5000 hours
MTTR	- Single fault <15 minutes
Maintenance	- Repair by module replacement

GENERAL

Establishment List: S1888.

Installation Specification: B1425.

Maintenance Schedules: 5545 (STMA)
9-2439-000 (SMA).

INTERFACE UNIT, TELEPRINTER

PURPOSE

This unit is used to interface the Teleprinter, TGN Series with other cryptographic telegraph systems, both on ships and ashore. When operational it is mounted beneath the teleprinter.

MAIN FUNCTIONS

(1) Modulates and demodulates signals transmitted and received by the teleprinter.

(2) Provides a facility for morse key operation.

(3) Provides a facility enabling the use of a format generator (Literaliser).

(4) Allows operation of the teleprinter by either a tone or dc character release pulse.

(5) Supplies main voltage to associated teleprinter.

SPECIFICATIONS

1 kHz Tone Signal Characteristics

Output level	-	0 dBm ± 1 dB
Input level	-	0 dBm ± 10 dB
Output frequency	-	1 kHz ± 3 Hz
Input frequency	-	1 kHz ± 20 Hz
1 kHz Oscillator	-	frequency stability ± 5 Hz per three months
Input/Output line impedance	-	nominal 600 ohms
Output Distortion	-	<3%.

MAINS SUPPLY

240 V 50 Hz or 115 V 60 Hz via an interlocked selector switch.

TELEPRINTER TGN4

AND

INTERFACE UNIT, TELEPRINTER

CATEGORY 2A - GENERAL DESCRIPTION

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CHAPTER 1

GENERAL DESCRIPTION

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Paragraph

CHAPTER 1

GENERAL DESCRIPTION

INTRODUCTION

1 The TGN Series are electronic teleprinters to replace the Teleprinter No 12 and Semi Electronic Teleprinter Outfit TGJ. They are designed to operate using ITA Code No 2 and conform to the internationally agreed standards for telegraph communications.

NOMENCLATURE

2 The series is comprised of the following variants:

TGN(1) - Teleprinter - Receive only.
TGN(2) - Teleprinter - Receive only with Paper Tape Punch. (Reperforator)
TGN(3) - Teleprinter - Transmit/Receive with Paper Tape Reader. (Auto Transmitter)
TGN(4) - Teleprinter - Transmit/Receive with Paper Tape Punch and Paper Tape Reader. (Auto Transmitter)

NOTE BR 8604 relates to the TGN(4) and therefore includes all the variants.

CONSTRUCTION

3 The teleprinter is made up of self contained modules, which can be easily replaced using only a screwdriver, without the need for mechanical or electrical adjustments. The self contained modules are interconnected with the mother board by means of plugs and sockets and accommodated under a compact desk type cover. The TGN(4) is made up of the following modules:

Basic Electronics Board

4 This is the central electronic control unit of the teleprinter. It acts as a control, transmitting and receiving functions to be performed, as a central distributor for signalling criteria and the operating voltages to the teleprinter. It processes information for connected modules, eg Paper Tape Punch and Paper Tape Reader, interpreting and matching before distribution. The Basic Electronics is in the form of a printed circuit board consisting of:

(1) A two layer plated through circuit board.

(2) Electronic components including film and transistor - transistor logic circuitry, MOS and discrete components and a crystal.

(3) Plug-in connectors (pin blocks) for connecting the modules.

(4) A diagnostic connector for fault location.

Special Function Module Board

5 This enables the teleprinter to be modified to the various operating conditions. By means of appropriate programming, ie insertion of diodes and wire straps, specific machine functions can be selected for the teleprinter.

Keyboard

6 This is essentially a mechanical assembly, controlled by the Keyboard control and buffer. Each key of the Keyboard is fitted with a contact which closes when the key is depressed. The contact is of the crosspoint type with a gold plated surface, located in the key cover. The assignment of the key positions to the code combinations is made in the Keyboard and implemented in the Basic Electronics Board.

Printer

7 The teleprinter is fitted with an impact type printer, capable of printing up to 15 characters/s (100 bauds at 7 unit). The type carrier is a print wheel made of a hard wearing plastic in the shape of a spoked disc. The print types are fitted to the tips of the spokes. A stepping motor rotates the print wheel to the appropriate printing position, taking the shortest angle of rotation. When the type is in the print position, a hammer is actuated by an electromagnet and strikes the type, producing an impression of the character on the paper via the ink ribbon.

8 A second stepping motor moves the Printer carriage with the printing mechanism along the print line via a toothed belt. Reversing the direction of rotation of this stepping motor causes the Printer carriage to run smoothly to the beginning-of-line position. A third stepping motor is used for the line feed function. The motion of the carriage is used to advance the ink ribbon. Magnetic systems position the ink ribbon for printing and for making the last character printed visible.

Switch Module

9 This controls the settings for line spacing, print force and signalling speed. On the module there are three vertically aligned switches:

(1) Top switch - Line spacing.
This is a three position switch marked 1 - 1.5 - 2.
1 - Single line spacing
1.5 - 1½ line spacing
2 - Double line spacing.

(2) Centre switch - Print force.
This is a two position switch.
Left position of switch - Single copy
Right position of switch - Up to four copies.

(3) Bottom switch - Signalling speeds.
This is a three position switch.
Left position of switch - 50 bauds
Centre position of switch - 75 bauds
Right position of switch - 100 bauds.

Power Supply

10 This generates the necessary operating voltages for the teleprinter from the ac power supply. These voltages are as follows:

(1) +5 V for the integrated modules.

(2) +12 V for the lamps in the control buttons.

(3) -12 V for the MOS modules.

(4) +40 V for the electromagnets and stepping motors.

Paper Tape Punch

11 This produces a punched paper tape copy of signals received or generated by the teleprinter. The Punch switches off automatically when it recognises the end of tape condition, stopping the teleprinter. The Punch is of modular construction.

Paper Tape Reader

12 The information on the punched tape is read photo-electrically by means of luminescence diodes and photo-transistors. A sprocket wheel driven by a stepping motor feeds the tape forward one character pitch. When the Reader is switched on, the tape is fed forward either one character at a time or continuously. A taut tape switch interrupts the tape feed if the tape becomes too taut, preventing damage to the tape.

Teleprinter Control Button Module

13 This module consists of the control and indicator elements for the device functions, such as unblocking the Keyboard, setting the Paper Tape Punch to continuously on or actioning a carriage return and line feed.

Line Matching Module Board

14 This is a printed circuit board which converts the internal voltage level of the teleprinter to the level on the line. DC decoupling between the line and teleprinter takes place on this board.

Control Module Board

15 This is a printed circuit board containing the digital electronics for the switching functions. It interprets the signals from the manual controls to generate the necessary signals for the next functional sequence, depending on the particular control function to be enabled.

Line Control Button Module

16 This works in conjunction with the Control Module Board. It comprises the controls and indicators for the switching functions, such as the Call/Alarm button, Local button and Line button.

INTERFACE UNIT, TELEPRINTER

17 Used to interface the Teleprinter TGN Series with other cryptographic telegraph systems, both on ships and shore. When operational it is mounted beneath the teleprinter.

18 Its main functions are:

(1) Modulates and demodulates signals transmitted and received by the teleprinter.

(2) Provides a facility for morse operation.

(3) Enables a format generator (Literaliser) to be used.

(4) Allows operation of the teleprinter by either a tone or dc character release pulse.

(5) Supplies mains voltage to associated teleprinter.

CHAPTER 2

PRINCIPLE OF OPERATION

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ILLUSTRATION

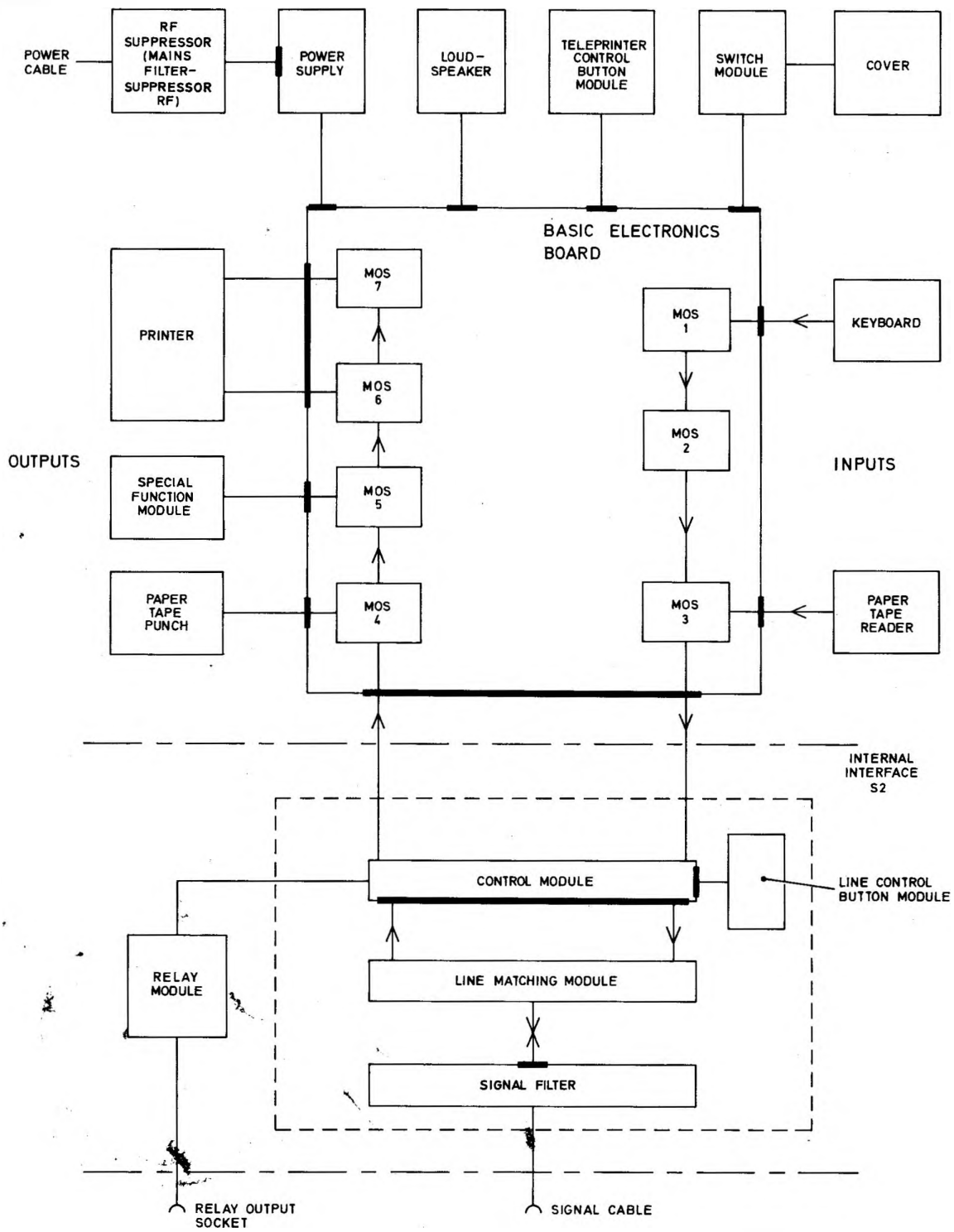

FIG. 2A.2.1

TGN4

BLOCK DIAGRAM

CHAPTER 2

PRINCIPLE OF OPERATION

TRANSMISSION

Figure 2A.2.1

1 Information received by the teleprinter from the Keyboard or Paper Tape Reader is fed as input information to the Basic Electronics board. A control device ensures that only one of the input units is in control at any one time, the remaining one being blocked.

2 If the information is input through the Keyboard by depressing a key, a precoded combination is passed to the Keyboard control in MOS1 module, where the information is properly encoded to conform to ITA Code No 2. The information then passes through the Keyboard buffer in MOS1 module and is sent to the Send control in MOS2 module. In the Send control, the appropriate case shift signal, ie "Letters" or "Figures" is automatically generated and sent before the character. This information is then sent to the transmitter in MOS3 module, which supplements the code combinations by adding start and stop elements to form complete telegraphic signals. These are transmitted in bit serial form to MOS3 module at preset time intervals.

3 MOS3 module also contains the Paper Tape Reader control, which ensures that when the Reader is in operation, the information recorded on the punched tape is read, converted to telegraphic signals and transferred to the transmitter. The information to be transmitted is sent via the internal interface, through the Control module to the Line Matching module. In Half Duplex operation, the information having reached the Control module, is then transferred back to the Basic Electronics board and the output units to obtain a monitoring copy. Information for transmission is fed via the Line Matching module to the Protector, where radio interference voltages are filtered out.

RECEPTION

4 Information received by the teleprinter is recorded by the Printer and if required, by the Paper Tape Punch.

5 Incoming information passes through the Protector, where radio interference voltages are filtered out and overvoltages removed, before being fed to the Line Matching module. This converts the line level to the internal signal level, before feeding it to the Control module then on to the Basic Electronic board.

The Receiver in MOS4 module converts the serial information into parallel information, which is forwarded to the Paper Tape Punch. At the same time the information is transferred to the Decoder in MOS5 module, which interprets the received information and adds it to the commands necessary to operate the Printer. This information is then forwarded to the Printer control in MOS6 module, which derives the number of stepping pulses required for the stepping motor to rotate the print wheel to the correct print position and when the print hammer is to be triggered.

6 MOS6 module also controls the Carriage Drive and Line Feed control in MOS7 module, which generates the pulse sequence for carriage feed, carriage return and line feed. Characters received during the carriage return traverse action are held by the buffer in MOS6 module.

OPERATING MODES

7 The teleprinter is designed for On-line and Local modes of control, which are called the Operating conditions, to distinguish them from the Standby condition.

Standby Condition

8 In this condition, the control electronics is still connected to its voltage supply, so it can receive control signals. The input and output units are blocked, the copy lighting and blower are switched off and all stepping motors and magnets de-energised.

Operating Conditions

9 In the Operating conditions, a distinction is made between Idle and Printing conditions.

(1) Idle. In this condition, the teleprinter is ready to operate when either the Local or On-line mode is activated. The Keyboard and Printer are released and other input and output units can be activated. The blower and copy light are switched on.

(2) Printing. This is the same as the Idle condition except that at least one input or output unit is in operation. If there is a break of more than 70 s in signal traffic and the Continuous Line button has not been pressed, the teleprinter will revert to the Idle condition.

Local Mode

10 This mode is activated by pressing the Local button on the Line Control Button module. In Local mode, the following functions can be carried out:

(1) Typing the text via the Keyboard.

(2) Preparation and correction of the punched tape.

(3) Duplication of punched tape.

In the Local mode, the information is fed from the input units via the Basic Electronics board to the Control module and back to the Basic Electronics board and output units. An incoming signal will cause the Paper Tape Reader and Punch to stop automatically and the On-line mode to be activated.

On-line Mode

11 The On-line mode is activated by an incoming signal or by pressing the Call/Alarm button on the Line Control Button module. The information being transmitted passes from the input units via the Basic Electronics board and Control and Line Matching modules for transmission. In Half Duplex operation, the information to be transmitted is also passed to the output units, to produce a Local record.

12 When the teleprinter receives information, it comes in from the Line Matching and Control modules and the Basic Electronics to the output units. During On-line operation in The Half Duplex Mode, an incoming message may break in on the transmission.

TELEPRINTER TGN4

AND

INTERFACE UNIT, TELEPRINTER

CATEGORY 2B - OPERATING INSTRUCTIONS

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CHAPTER 1

OPERATOR'S CONTROLS

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ILLUSTRATION

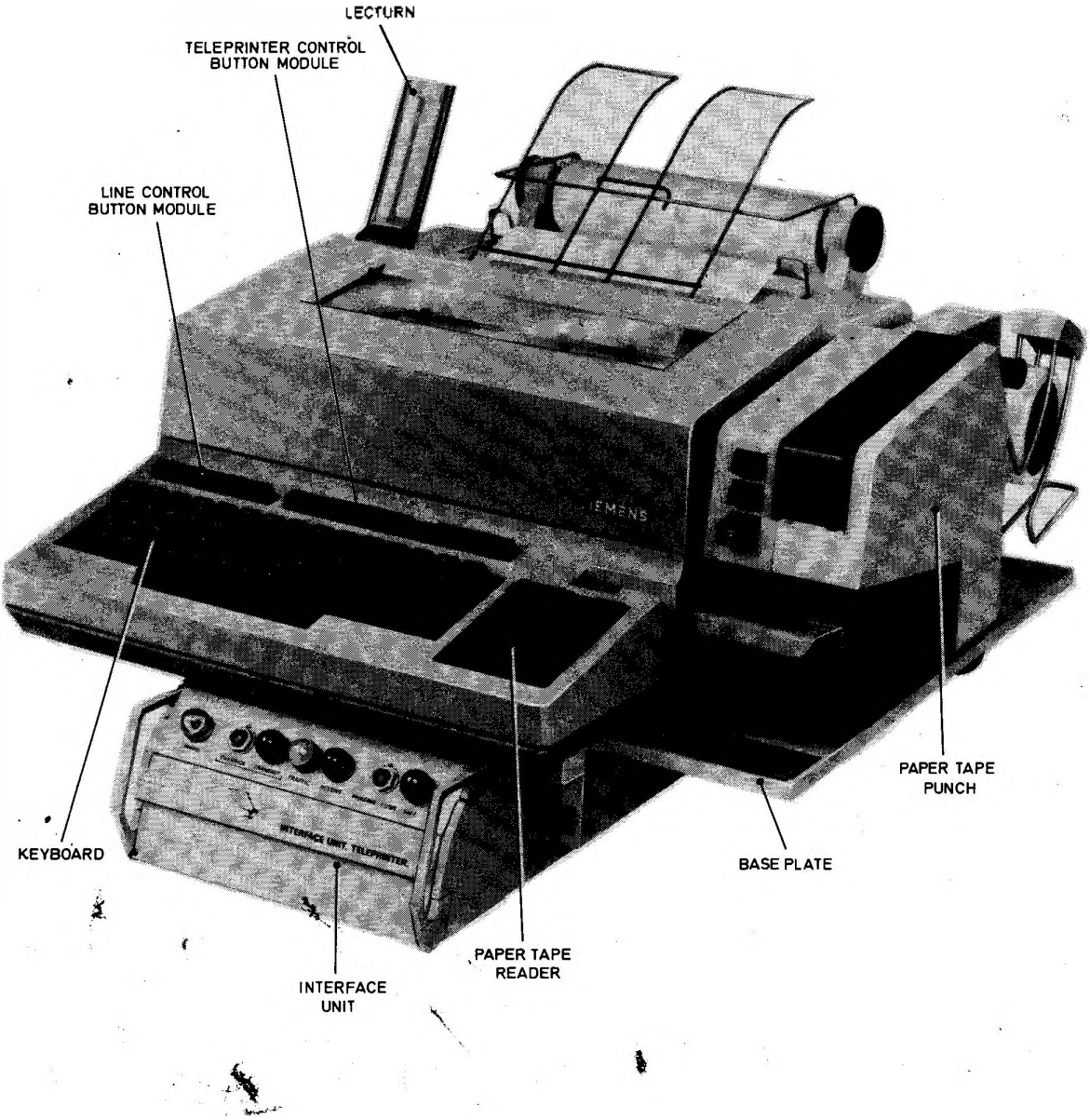


FIG.2B.1.1 TELEPRINTER TGN 4 MODULES

CHAPTER 1

OPERATOR'S CONTROLS

GENERAL

1 This chapter describes the controls (keys and buttons) on the teleprinter and interface unit that the operator would have to use in his normal course of duty. All the controls mentioned are readily accessible to the operator, without lifting the lid or removing the covers.

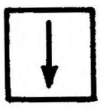
2 It is not necessary for the operator to remove the cover from the teleprinter, as the operator can carry out all the duties required of him by just lifting the lid. Certain printed circuit boards within the teleprinter, carry static sensitive devices which can be damaged by just touching them. It is therefore of vital importance that if a teleprinter develops a defect, the operator does not try to remedy the defect, but informs the maintainer.

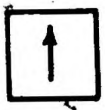
CONTROLS - TGN4

Keyboard

3 The Keyboard is a four row model, laid out as shown on Figure 2B.1.1. Besides the standard characters on the Keyboard, the following additional ones are included:

(1)  Blank of Null Character Key (Paper Tape Punch only).

(2)  Letter Shift Key.

(3)  Figure Shift Key.

Repeat Key.

(4)  Repeats last key pressed for as long as the Repeat Key is held down or until end of line is reached.

Alarm Bell Key.

(5)  When in On-line mode, pressing this key causes an alarm to sound and the Call Lamp button to illuminate on receiving teleprinter.

(6)  Line Feed Key.

(7)  Carriage Return Key.

Teleprinter Control Button Module

4 These are situated above and to the right of the Keyboard. There are nine buttons in this module, but numbers two and seven, counting from the left, are not used and left blank. The functions assigned to the manual buttons and indicators are denoted by symbol plates on the controls as follows:

(1) 

Unlock Keyboard Button.

Blocking of the Keyboard causes the Unlock Keyboard button to illuminate under the following conditions:

a. Keyboard buffer is full, caused by maximum typing speed being exceeded.

b. The Printer has reached the end-of-line position.

In both cases, further typing is ineffective. In a. the Keyboard is released by pressing the Unlock Keyboard button and in b. by pressing the Carriage Return key.

(2) 

Carriage Return/Line Feed Button.

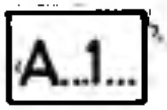
a. Pressed once, (lamp illuminates), changes Punch ON/OFF to ON (if not already ON), inhibits page copy to allow corrections to be made on paper tape.

b. Pressed twice (lamp goes out), Printer carries out a carriage return and line feed action.

(3) 

Paper Feed Button (not illuminated).

As long as the button is kept depressed, the teleprinter paper is fed forward. When depressed briefly, the paper is advanced by ½ of the line spacing.

(4) 

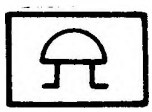
Letters/Figure Shift Button (not illuminated).

When depressed, causes the Printer to switch from the letter to the figures case or vice versa, without sending a case shift character to Line, or corrupt an incoming signal.

(5) 

Tape Punch On Button (not illuminated).

When button is depressed the Paper Tape Punch is activated provided an operating mode is selected and the Paper Tape Punch has a paper tape in place. This button overrides the On/Off control on the Paper Tape Punch.

(6) 

Call Lamp Button.

Illuminates when a distant operator is calling; alarm rings at same time. Press to switch off.

(7) 

Main Power On Indicator.

Indicates main power to teleprinter is on. Red in colour.

Line Control Button Module

5 This module is situated above and to the left of the Keyboard. It contains five illuminated pushbuttons, the lamps in the buttons indicating the functional states.

(1) 

Call/Alarm Button.

When this button is depressed, it causes the following:

a. Switches teleprinter to On-line mode.

b. Illuminates Line (Half Duplex) button.

c. Switches page copy illumination lamps on.

d. Switches fan on.

e. Operates the carriage return and line feed functions.

The Call/Alarm button flashes during the following states:

a. Teleprinter cover open, in non-operational mode.

b. Teleprinter paper run out.

c. Paper tape run out, if the Paper Tape Punch has been selected.

If after 70 seconds of depressing the Call/Alarm button the teleprinter has not been operated, it automatically switches itself off, unless the Continuous Line button has been pressed.

(2) 

Local (Off-line) Button.

Depressing this button causes the teleprinter to operate in Local conditions, enabling the following to take place:

a. Typing of text via the Keyboard.

b. Preparation and correction of the paper tape.

In this mode, the teleprinter operates at 100 bauds, irrespective of the position of the Signalling Speed switch.

(3) 

Line (Half Duplex) Button/Disconnect.

When this button is lit it indicates the teleprinter is in the On-line mode, transmit/receive state with a local record when transmitting. Depressing this button switches the teleprinter to a Non-Operational condition.

(4) 

Continuous Line Button.

Pressing this button stops the teleprinter being switched off after 70 seconds of no traffic, keeping it continuously switched to Line.

(5) 

Duplex Working Button.

Indicates that the teleprinter is in a transmit and receive state.

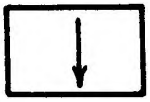
Paper Tape Punch

6 This unit only has three controls as follows:

(1) 

On/Off Button.

When switched on, this button is lit. This control can be overriden by the Tape Punch On button on the Manual Device Controls.

(2) 

Tape Feed Button.

While this button is held depressed, the tape is fed forward and punched with five holes, (Letter Shift).

(3) 

Tape Back Spacing Button.

When depressed, the tape is moved backwards mechanically by one character pitch. Back spacing should be limited to 10 character pitches to avoid pinching the edges of the holes when overpunching the tape.

Paper Tape Reader

7 On/Off Button.

(1) When pressed for a period of 1-2 seconds, the paper tape will feed continuously.

(2) When pressed briefly, the tape will be fed forward one character pitch at a time.

(3) A green indicator lamp will illuminate while the Reader is operational.

CONTROLS - INTERFACE UNIT - TELEPRINTER Figure 3.17.1

8 For normal operational purposes of the teleprinter, there are only two switches and indicator lamps that are of interest to the operator.

Switches

9 (1) Mains On Switch

Connects Mains supply to both the Interface Unit and the teleprinter.

(2) Selector Switch

This is a three position switch, controlling the functioning of the Interface Unit. For normal operational purposes, the switch will be to RATT. In this position, the Interface Unit modulates and demodulates signals transmitted and received by the teleprinter.

Lamps

10 (1) Mains Lamp

Indicates that the mains supply of 240 V 50 Hz or 115 V 60 Hz is being applied to the Interface Unit and associated teleprinter.

(2) Traffic Lamp

Lights to indicate that signal traffic is present on the receive lines to the teleprinter.

11 The remainder of the switches, lamps and monitoring sockets are used either when the teleprinter is in a crypto system or by the maintainer. More information on these can be found in Category 3, Chapter 17 of this handbook or in the systems handbook.

Flash Message

12 To operate UK/US Bell Alarm (Upper case JSJS), press the Figure Shift + symbol key (upper case) then the Bell symbol key (upper case J) then the Apostrophe key ' (upper case S). Repeat the Bell symbol and the Apostrophe key alternately for as long as necessary.

CHAPTER 2

OPERATING INSTRUCTIONS

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ILLUSTRATIONS

CHAPTER 2

OPERATING INSTRUCTIONS

GENERAL

1 This chapter describes the procedures to operate the teleprinter in its different forms of control. It also describes how to adjust line spacing, print force and signalling speed; how to replace items such as paper roll and paper tape, ink ribbon and print wheel.

OPERATING PROCEDURES

Preparing a Punched Tape in Local Mode

2 (1) On the Line Control Button module, press the Local button, (which should light). This will cause the following to happen:

a. Printer carriage travels to the start-of-line position.

b. Paper is advanced one line.

c. Page copy light is switched on.

(2) Press On/Off button, (which should light) on the Paper Tape Punch OR the Tape Punch On button on the Manual Device Controls.

(3) Type the message, which is printed on the page copy and punched into tape.

(4) On completion of typing, on the Paper Tape Punch, press Tape Feed button until the five hole combination appears five times on paper tape.

(5) Tear off punched tape (upwards).

(6) On the Line Control Button module, press the Line button. Lamps in Local button and Paper Tape Punch On/Off button will go out.

Editing a Punched Tape

3. Should a mistake be made whilst preparing a punch tape, the following procedure should be carried out to correct it.

(1) Insert paper tape into Reader.

(2) On the Line Control Button module, press the Local button.

(3) Press the On/Off button on the Paper Tape Punch OR the Tape Punch On button on the Teleprinter Control Button module.

(4) Press the On/Off button on the Reader to run the tape, stopping it just before the incorrect characters on the tape, as indicated on page copy.

(5) Briefly press the On/Off button on the Reader, stepping the tape until the incorrect character is positioned above the reading point.

(6) Type the required corrections.

(7) Switch off Paper Tape Punch.

(8) Pressing the On/Off button on the Reader and single shot the tape until the incorrect character(s) appear on the page copy.

(9) Switch on the Paper Tape Punch.

(10) Switch on the Reader.

(11) Clear tape by using the Tape Feed button on the Punch.

(12) Tear off tape and check corrections by inserting it into the Reader, press the ON/OFF button and check the page copy.

Transmitting via the Tape Reader

4 (1) Open the tape cover on the Reader.

(2) Insert the prepared paper tape (arrow on Reader indicates direction of paper feed and white line, first character to be read), ensuring that the feed wheel engages correctly into the tape feed holes.

(3) Close the tape cover on the Reader.

(4) Press the Call/Alarm button on the Line Control Button module, which causes the following:

a. Switches teleprinter to On-line mode.

b. Lights Line button and DX button if DX button is switched on (depressed).

c. Printer carriage travels to start-of-line position.

d. Paper is advanced by one line.

e. Page copy light is switched on.

f. Fan is switched on.

(5) On the Reader, press the On/Off button for at least two seconds, causing the tape to run and a page copy to be printed.

Receiving a Message

5 On receiving the first character of the transmitted message, the teleprinter will be made operational, causing the following:

(1) Line button is lit. DX is lit, if depressed.

(2) Page copy light is switched on.

(3) Printer carriage travels to start-of-line position.

(4) Paper is advanced by one line.

Teleprinter will now produce page copy and a punched paper tape, if the Paper Punch On button on the Teleprinter Control Button module has been depressed.

ADJUSTMENTS

6 The Switch module controlling the settings for line spacing, print force and signalling speed is positioned on the right-hand side of the teleprinter under the lid, behind the paper pressure lever. On the module are three vertically aligned switches:

(1) Top switch - Line spacing

(2) Centre switch - Print force.

(3) Bottom switch - Signalling speeds.

Line Spacing

7 This is a three position switch, marked 1 - 1.5 - 2:

1 - Single line spacing
1.5 - 1½ line spacing
2 - Double line spacing.

Print Force

8 This is a two position switch.

(1) Left position of switch - Single copy

(2) Right position of switch - Up to four copies.

Signalling Speeds

9 This is a three position switch.

(1) Left position of switch - 50 bauds.

(2) Centre position of switch - 75 bauds.

(3) Right position of switch - 100 bauds.

REPLACEMENT

Teleprinter Paper Roll

10 Indication that the end of roll is approaching, is given by a coloured stripe appearing on the edge of the paper and moving diagonally across as it gets closer to the end. The paper roll should be replaced at the earliest opportunity, before the next message is received or sent. Should the roll run out whilst operating, the Call/Alarm button on the Line Control Button module will flash and the teleprinter will stop. Replacement of the paper roll should be carried out as follows:

(1) Unclip and swing the paper roll retaining frame to the rear and the deflection frame to the front.

(2) Press the lid locking buttons and lift the lid to the open position.

(3) Move the paper pressure lever backwards.

(4) Close the lid.

(5) Unlatch the paper roll carrier on both sides, by turning the black locking caps, ¼ turn towards the Keyboard.

(6) Lift out the paper roll carrier and pull the rest of the paper backwards and lift out of the teleprinter.

(7) Remove the paper roll carrier from the old paper roll.

(8) Push the paper roll carrier into the new paper roll, until it makes contact with the wire clip, as indicated in Figure 2B.2.2. The wire clip fits into the outer groove of the paper carrier, Figure 2B.2.1.

(9) Place the new paper roll into its holder on the teleprinter. The ring shaped collar on the paper carrier should rest in the groove of the left-hand hand roll holder, Figure 2B.2.2.

(10) Rotate the paper roll holder to latch into slot on right-hand side of the paper roll carrier, Figure 2B.2.2.

(11) Latch both ends of paper carrier into holder.

(12) Feed paper over the pull relief rod and through the slot in the lid. Figure 2B.2.3.

(13) Depress the lid locking buttons and open lid.

(14) Feed paper under side guides and platen, until it reappears. Figure 2B.2.3.

(15) Move paper pressure lever to the front.

(16) Swing paper pressure rod upwards.

(17) Rotate platen knob, feeding paper under paper pressure rod.

(18) Swing paper pressure lever back to operational position.

(19) Close teleprinter lid and move paper deflecting frame back to operational position.

NOTE Figure 2B.2.4 shows diagrammatic view of paper run in teleprinter.

unch Paper Tape

l Indication that the end of roll is approaching is given by colour stripes appearing on the edges of the paper. The paper tape must be replaced before the next essage is sent or received. Should the tape run out whilst operating, the Call/Alarm utton on the Line Control Button module will flash and the teleprinter will stop. eplacing the paper tape roll should be carried out as follows:

(1) On the Paper Tape Punch, swing the guide upwards clear of the paper roll.

(2) Tear off the paper tape and remove the old tape roll from core.

(3) Press the Tape Feed button on the Punch, until the remaining paper tape has run out of the Punch.

(4) Place the new paper tape roll on the core, so that the tape is fed from the top of the roll and swing guide back into position. Figure 2B.2.5.

(5) Feed the paper tape under the guide hinge roller into the Paper Tape Punch, until it has reached the beginning of the tape guide, viewed through transparent cover.

(6) Open the Paper Tape Punch cover and press on the tape gate, which swings upwards. Figure 2B.2.6.

(7) Continue to feed the paper tape into the tape guide until it emerges from the front of the Punch. Figure 2B.2.6.

(8) Press on top of tape gate, latching it, causing automatic feed by 32 letter shifts.

(9) Close cover and tear off (upwards) the punched tape.

(10) Pull out the chad waste box and empty.

Ink Ribbon

12 (1) Swing paper deflecting frame to the front.

(2) Press in lid locking buttons and open lid.

(3) Press the printing mechanism release lever and swing mechanism up, releasing the printing mechanism release lever enabling mechanism to latch. Figure 2B.2.7.

(4) Press the ribbon spool levers backwards and lift the ribbon spools off their guide pins. Figure 2B.2.7.

(5) Remove the ink ribbon from the lateral guide and then pull the ribbon upwards and out of the guide plate slot.

(6) Attach free end of new ribbon to an empty spool, ensuring that the ribbon will not pull free at end of ribbon run. Place one ribbon spool in position on its guide and drive pins.

(7) Insert ink ribbon in the first lateral guide on the ribbon fork and then in the guide plate slot. Figure 2B.2.8. Insert ribbon into second lateral guide.

(8) Place second ribbon spool onto its guide and drive pins.

(9) Press the printing mechanism release lever backwards and swing the mechanism downwards until it latches in its operating position.

(10) Close cover and swing paper deflecting frame back into its operational position.

Print Wheel

13 (1) Swing the paper deflecting frame to the front.

(2) Press in lid locking buttons and open lid.

(3) Press the printing mechanism release lever backwards and swing the mechanism upwards, releasing the printing mechanism release lever enabling mechanism to latch.

(4) Disengage the ribbon guide fork, by pushing ribbon guide fork release lever on left-hand prong of fork to the left, Figure 2B.2.9 and lift fork upwards at the same time.

(5) On the print wheel. depress the wire clip and remove the print wheel by pulling it in a rearward direction off its spindle. Figure 2B.2.10.

(6) Replace the new print wheel, pushing it onto its spindle until it locks. The driver on the spindle must engage in the correct opening on the print wheel. Figure 2B.2.10.

(7) Swing the ribbon fork guide downwards, ensuring it locks into its operating position.

(8) Press the printing mechanism release lever backwards and swing the mechanism downwards, ensuring that it locks into its operational position.

(9) Close the lid.

(10) Swing the paper deflecting frame back into its operational position.

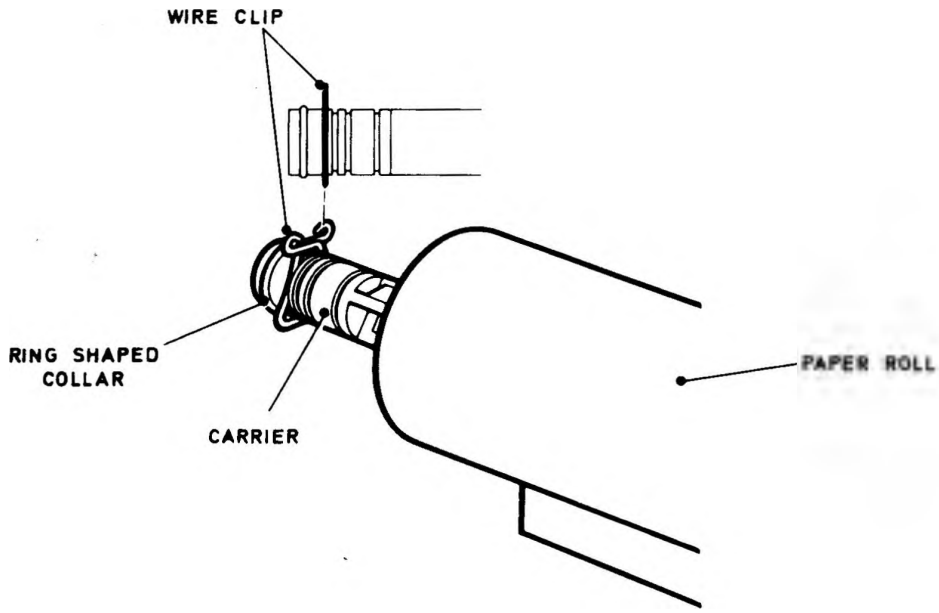

FIG. 2B. 2.1 PAPER ROLL CARRIER

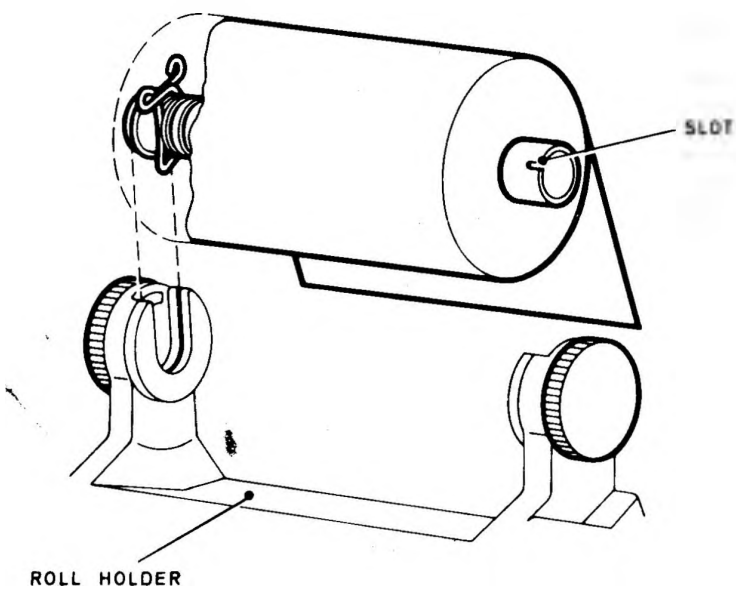

FIG. 2B. 2.2 PAPER ROLL HOLDER

FIGS. 2B. 2.1&2

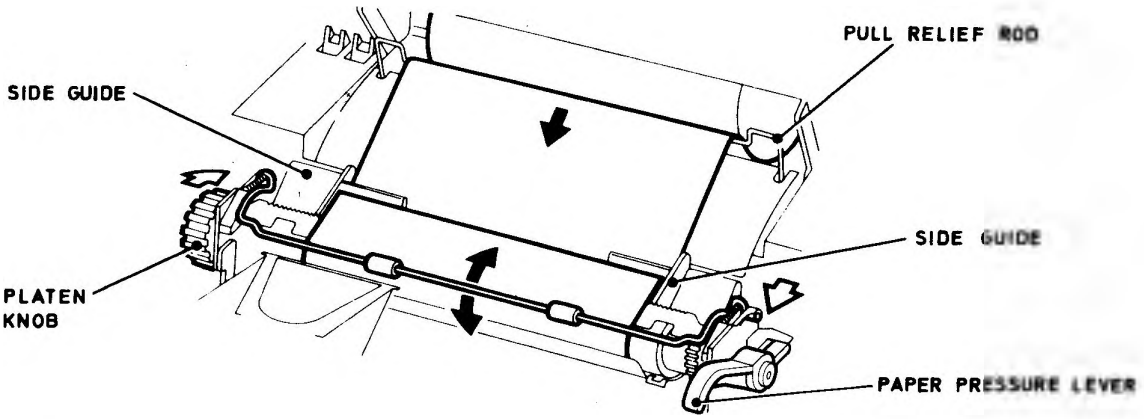

FIG. 2B.2.3 INSERTING PAPER

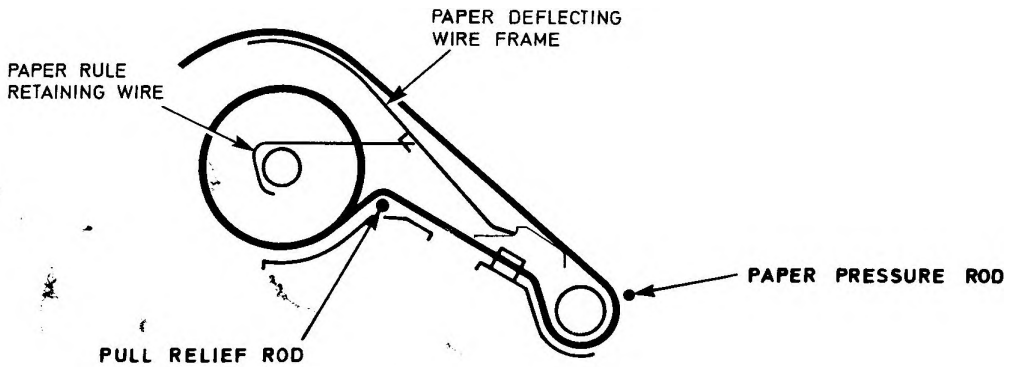

FIG. 2B.2.4 PAPER RUN – DIAGRAMATIC VIEW

FIGS. 2B.2.3 & 4

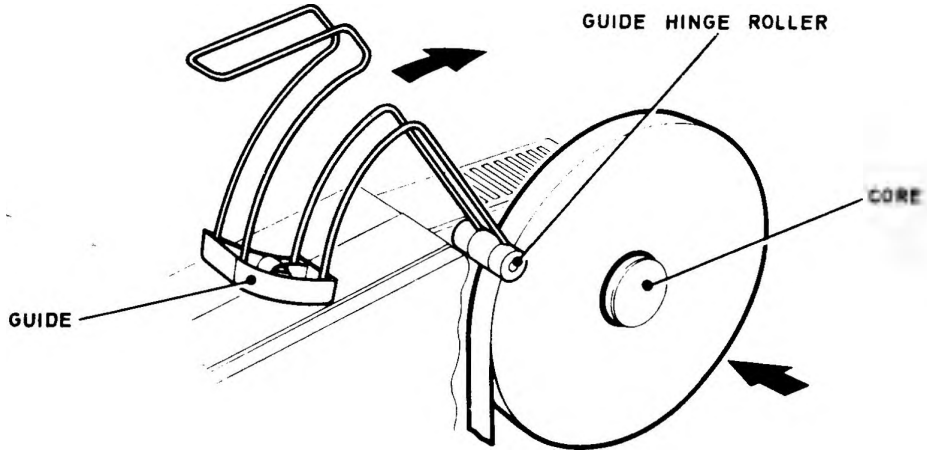

FIG. 2B. 2.5 REPLACING PAPER TAPE ROLL

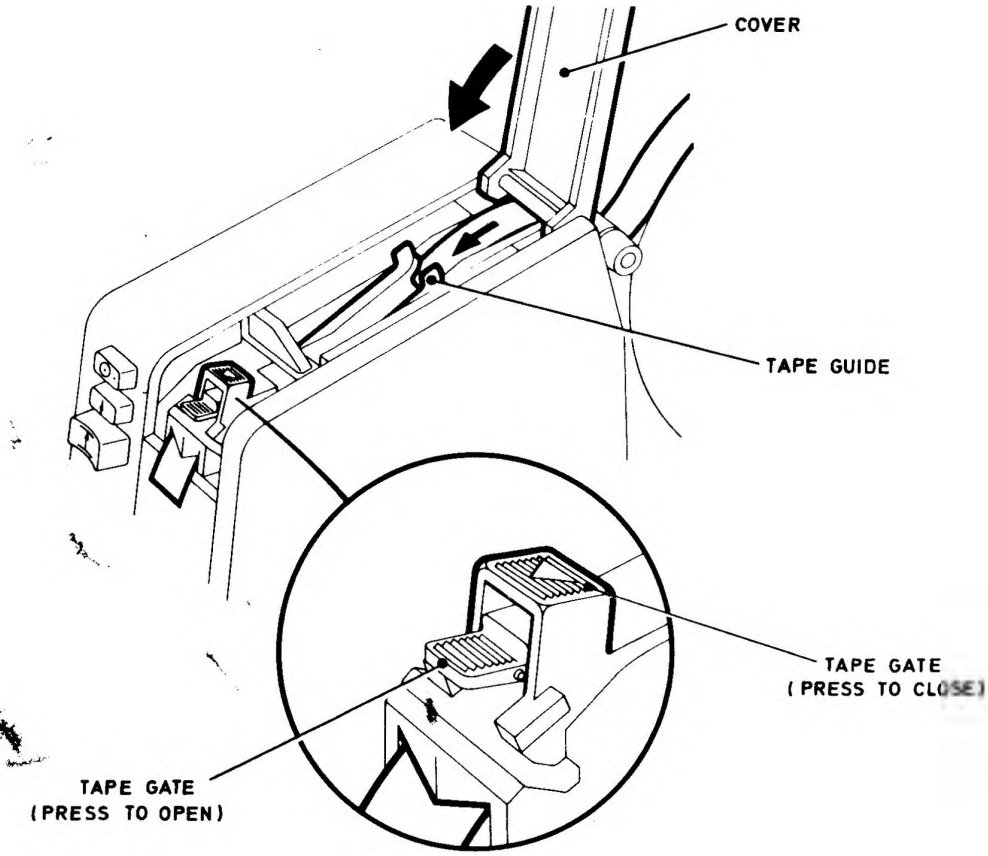

FIG. 2B. 2.6 FEEDING PAPER TAPE INTO PUNCH

FIGS. 2B. 2. 5 & 6

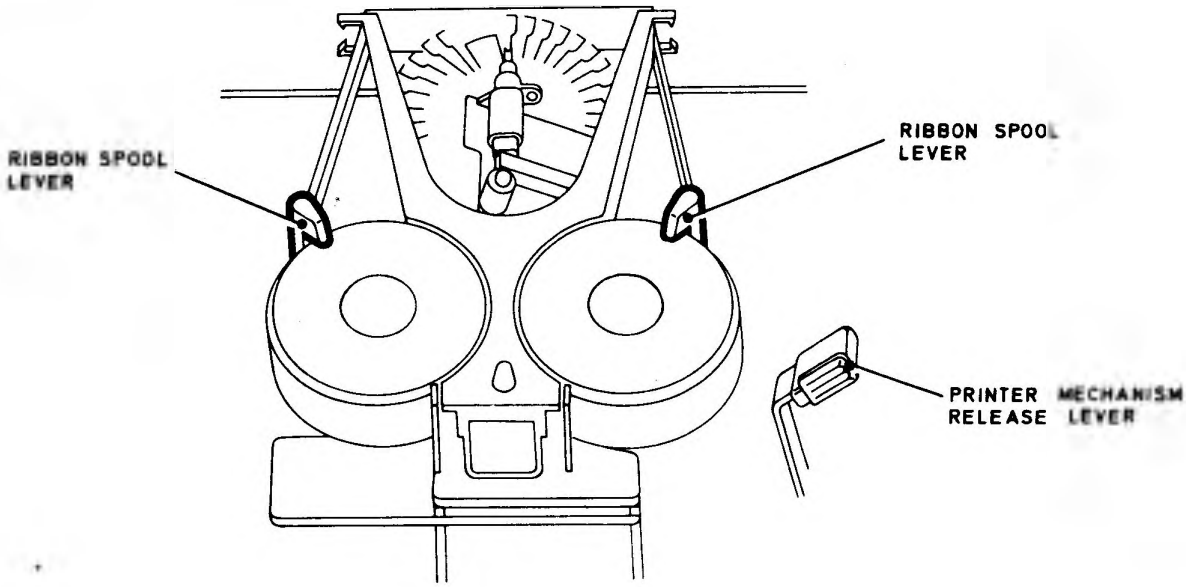

FIG. 2B. 2.7 PRINTER MECHANISM

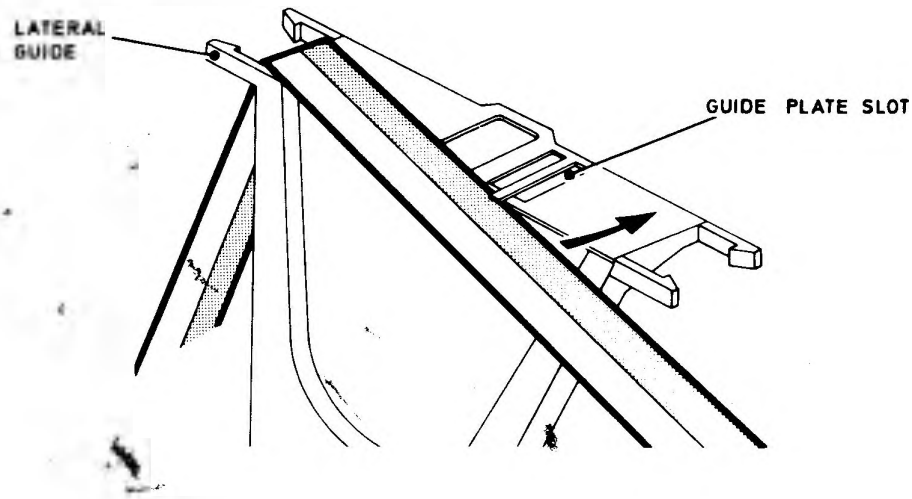

FIG. 2B. 2.8 RIBBON GUIDE PLATE

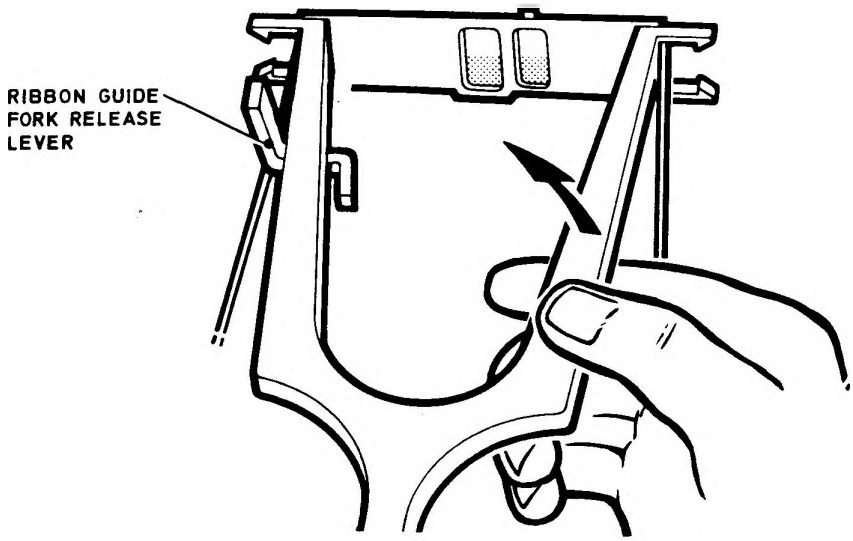

FIG. 2B. 2.9 RIBBON GUIDE FORK

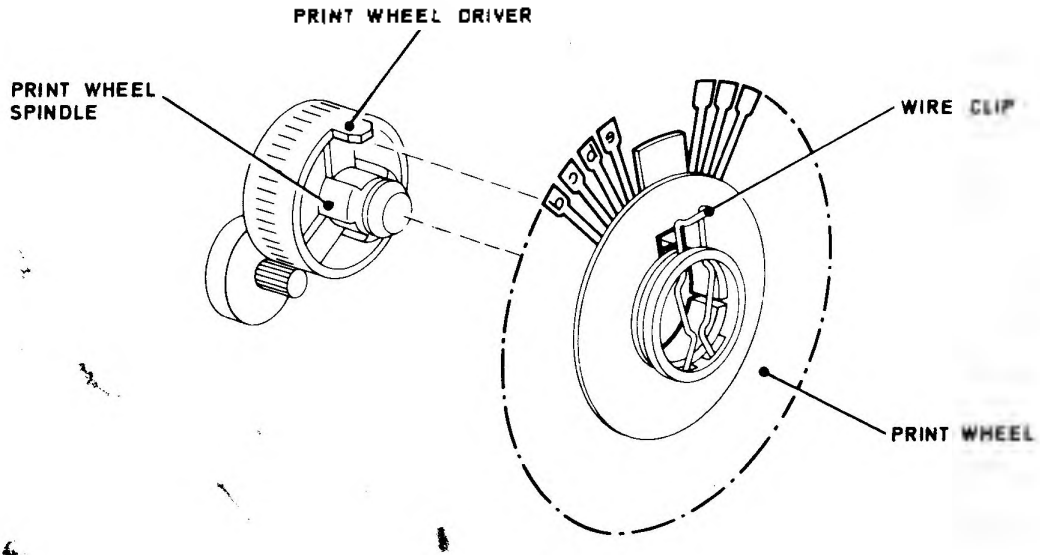

FIG. 2B. 2.10 PRINT WHEEL DRIVE

TELEPRINTER TGN4

AND

INTERFACE UNIT, TELEPRINTER

CATEGORY 3 - TECHNICAL DESCRIPTION

CONTENTS

C H A P T E R 1

G E N E R A L I N F O R M A T I O N

CONTENTS

ILLUSTRATIONS

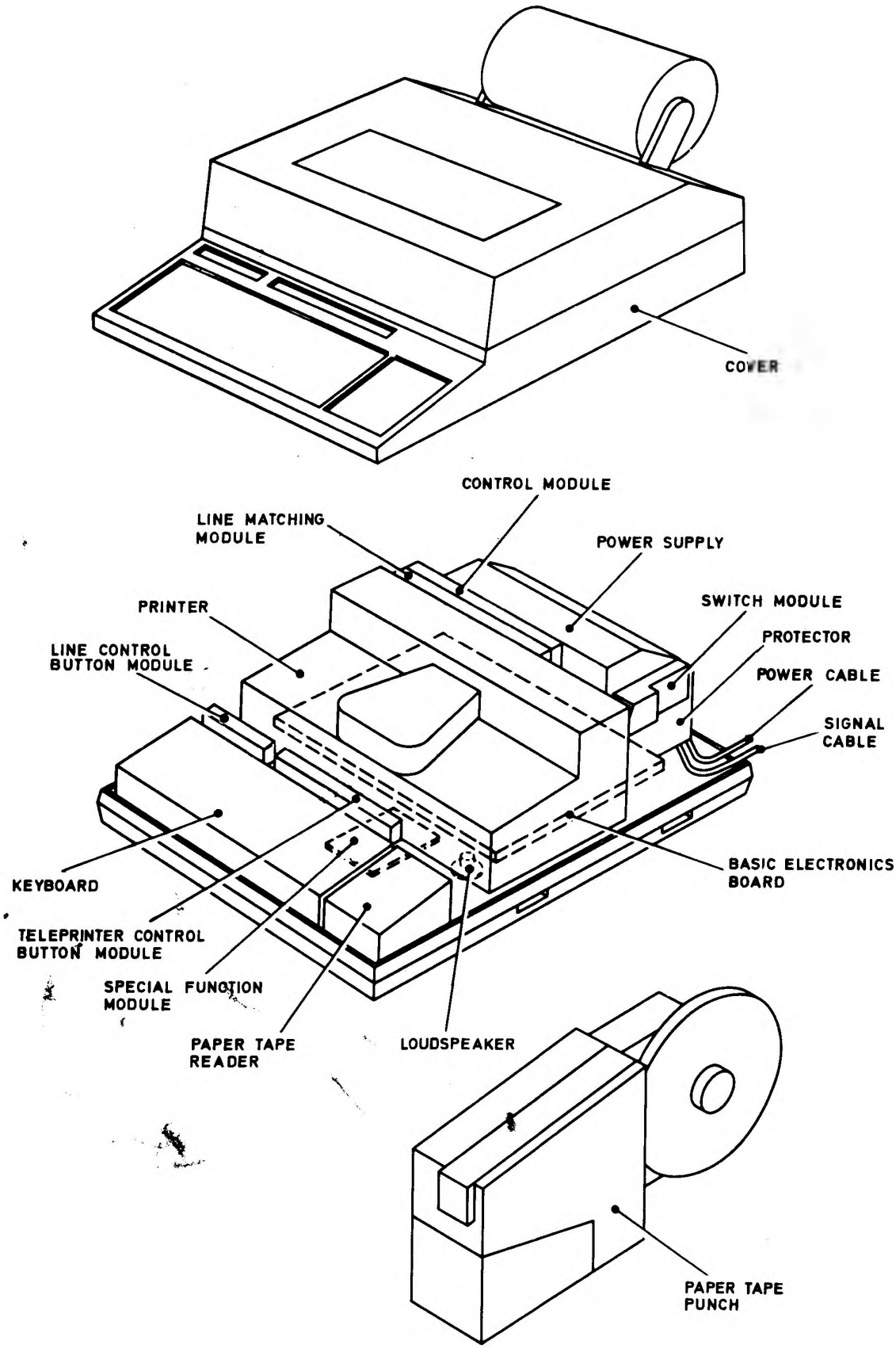

FIG. 3.1.1. TGN4 MODULE LAYOUT

CHAPTER 1

GENERAL INFORMATION

INTRODUCTION

1 The TGN4 is an electronic page teleprinter for Naval Communication to replace the Teleprinter No 12 and Semi Electronic Teleprinter Outfit TGJ. It is designed to operate using 5-bit codes ITA Code No 2. It conforms to the internationally agreed standards for telegraph communications and is capable of working with existing teleprinters.

2 The teleprinters mechanical parts have been reduced to a minimum by the use of electronic components. It is made up of self contained modules which can be easily replaced using only a screwdriver, without the need for mechanical or electrical adjustments. This results in an almost maintenance free teleprinter, that is quiet in operation.

3 The TGN4 is an impact printer, using a print wheel of wear resistant plastic, which is easily replaced. It produces a neat print on normal teleprinter paper, as well as three legible copies.

CONSTRUCTION

4 The teleprinter is made up of self-contained modules interconnected by means of plugs and sockets, accommodated under a compact desk type cover. The TGN4 is made up of the following modules.

Cover

5 The Cover consists of light-weight, injection moulded, plastic parts. It carries the paper roll holder and houses the lamps which illuminate the print position.

Basic Electronics Board

6 The Basic Electronics board is the central control unit for all logic functions. It consists of a printed circuit board and includes the Transmitter, Receiver, Keyboard and Printer controls, the controls for the operating modes and the paper tape devices. The Basic Electronics board is predominantly based on MOS technology.

Special Function Module

7 The Special Function module enables the selection of certain functions from different options available to the teleprinter, to be easily selected. It consists of a printed circuit board equipped with diodes and links, according to the functions selected.

Keyboard

8 The Keyboard consists of individual keys assembled on a mounting board. The keys are connected to a printed circuit board through diodes and links. The electronic coding is implemented in the Basic Electronics board.

Printer

9 The printable letters, figures and symbols are arranged on a print wheel of special wear resistant plastic. This is rotated to the print position by a stepping motor. Printing takes place via an electronically controlled print hammer, the print wheel being stationary. Two motors are used, one for line feed and the other for carriage feed. When the direction of rotation of the latter is reversed, it also performs the carriage return function. The print force is adjustable and an indication is given to the operator when the end of paper is approaching.

Teleprinter Control Button Module

10 This module consists of the control and indicator elements for the device functions, such as unblocking of the Keyboard or setting the Paper Tape Punch to continuously ON.

Switch Module

11 Located on the Switch module is a multiple switch used to control the print force, the line spacing and signalling speed. It also includes the lid contact which indicates whether the Cover is open or closed.

Power Supply Module

12. The Power Supply module provides all the voltages and currents required for the operation of the teleprinter. Protection facilities against short circuiting and excessive heat generation ensures reliable operation of the Power Supply.

RF Suppressor

13 This module ensures that any radio interference on the power line is suppressed. It also protects the power supply against external interference such as over voltage.

Loudspeaker

14 Incoming calls and end of line audible signals are given over a loudspeaker.

Paper Tape Punch

15 This produces a punched paper tape copy of the signals received or generated by the teleprinter. The paper tape is 17½ mm (11/16 in.) wide. It is capable of being operated either attached directly to the teleprinter or mounted up to one metre (39.37 in.) cable length away.

Paper Tape Reader

16 This employs a photo-electric reading method, the tape being fed forward continuously or by one character at a time. A sprocket wheel driven by a stepping motor, feeds the tape forward.

Control Module

17 This module is part of the internal line interfacing system. It consists of a printed circuit board containing the digital circuits for the switching functions.

Line Control Button Module

18 The Line Control Button module works with the Control module in the internal line interfacing system. It is made up of the controls and indicators for the switching functions, such as the Call/Alarm button, Line button and Local (Off-line) button.

Line Matching Module

19 This is a printed circuit board which converts the internal voltage level of the teleprinter to the level of the line.

Protector

20 This module ensures that the radio interference suppression satisfies the required specifications. It also provides protective facilities against over-voltage on the telegraph line.

Relay Unit

21 This unit contains switch contacts, operated by the teleprinter logic circuits, which provide a remote monitoring facility.

CHAPTER 2

PRINCIPLE OF OPERATION

CONTENTS

ILLUSTRATION

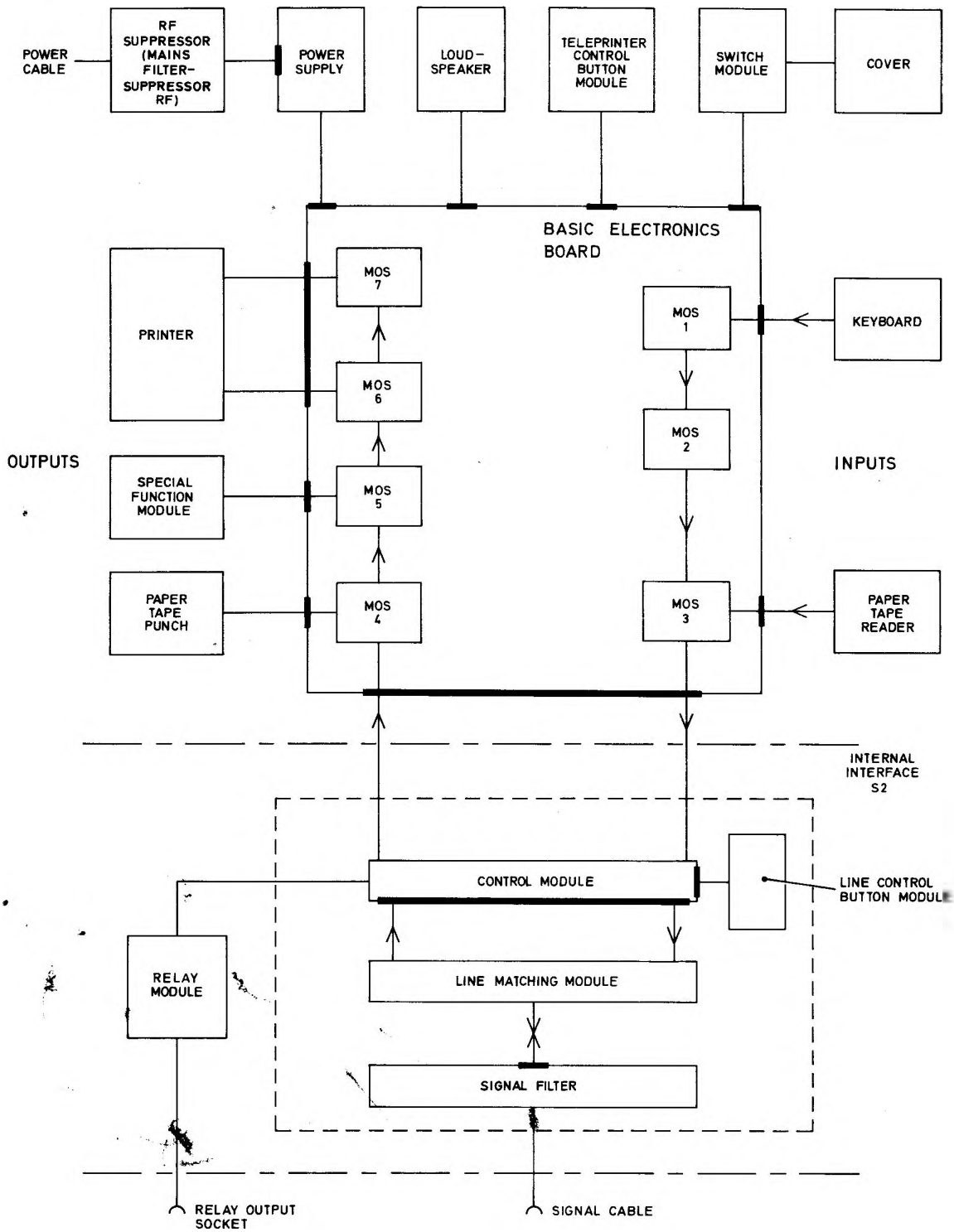

FIG. 3.2.1

TGN4
BLOCK DIAGRAM

CHAPTER 2

PRINCIPLE OF OPERATION

TRANSMISSION

1 Information received by the teleprinter from the Keyboard or the Paper Tape Reader is fed as input information to the Basic Electronics board. A control device ensures that only one of the input units is in operation at any one time, the remaining one being blocked.

2 If the information is input through the Keyboard, by depressing a key, a precoded combination is passed to the Keyboard control in MOS1 module, where the information is properly encoded to conform to ITA Code No 2. The information then passes through the Keyboard buffer in MOS1 module and is sent to the Send control in MOS2 module. In the Send control, the appropriate case shift signal, ie "Letters" or "Figures" is automatically generated and sent before the character. This information is then sent to the transmitter, which supplements the code combinations by adding start and stop elements to form complete telegraphic signals. These are transmitted in bit-serial form to the MOS3 module at preset time intervals.

3 The MOS3 module also contains the Paper Tape Reader control, which ensures that when the Reader is in operation, the information recorded on the punched tape is read, converted to telegraphic signals and transferred to the transmitter. The information to be transmitted is sent via the internal interface S2, to the Control module on its way to the Line Matching module. In Half Duplex operation, the information having reached the Control module, is transferred back to the Basic Electronics board and the output units to obtain a monitoring copy. Information for transmission is fed via the Line Matching module to the Protector, where radio interference voltages are filtered out.

RECEPTION

4 Information received by the teleprinter is recorded by the Printer and if required, by the Paper Tape Punch.

5 Incoming information passes through the Protector, where radio interference voltages are filtered out and overvoltages removed, before being fed to the Line Matching module. The Line Matching module converts the line level to the internal signal level, feeds it to the Control module which switches the signal via the internal interface to the MOS4 module on the Basic Electronics board. The Receiver in MOS4 module converts the serial information into parallel information, which is forwarded to the Paper Tape Punch. At the same time, the information is transferred to the Decoder in MOS5 module, which interprets the received information and adds it to the commands necessary to operate the Printer. This information is then forwarded to the Printer control in the MOS6 module, which derives the number of stepping pulses required for the stepping motor to rotate the print wheel to the correct print position and when the print hammer is to be triggered.

6 The MOS6 module also controls the carriage drive and line feed control in MOS7 module which generates the pulse sequence for carriage feed, carriage return and line feed. Characters received during the carriage return traverse action are held by a buffer in MOS6 module.

OPERATING MODES

7 The teleprinter is designed for On-line and Local modes of control. They are called the operating conditions to distinguish them from the standby conditions.

Standby Condition

8 In this condition, the control electronics is still connected to its voltage supply, so it can receive control signals. The input and output units are blocked, the copy lighting fan and blower are switched off and all stepping motors and magnets de-energised.

Operating Conditions

9 In the operating condition, a distinction is made between Idle and Printing condition.

(1) Idle. In this condition the teleprinter is ready to operate when either the Local or On-line mode is activated. The Keyboard and Printer are released and other input and output units can be activated. The blower and print position lights are switched on.

(2) Printing. This is the same as the Idle condition except at least one input or output unit is in operation. If there is a break of more than 70 seconds in the signal traffic and the Continuous Line button has not been pressed, the teleprinter will revert to the Idle condition.

Local Mode

10 This mode is activated by pressing the Local (Off-line) button, which is included in the Line Control Button module. In the Local mode, the following functions can be performed:

(1) Typing of text via the Keyboard.

(2) Preparation and correction of punched tape.

(3) Duplication of punched tape.

In the Local mode, the information is fed from the input units via the Basic Electronics board to the Control module and back to the Basic Electronics board to the output units. An incoming call causes the Paper Tape Reader and Punch to stop automatically and the On-line mode to be activated.

On-line Mode

11 The On-line mode is activated by an incoming call or by pressing the Call button, which is on the Line Control Button module. The information being transmitted passes from the input units via the Basic Electronics board and the Control and Line Matching modules to the signal cable. In Half Duplex operation, the information to be transmitted is also passed to the output units, the same as in Local mode.

12 When the teleprinter receives information, it comes in via the Line Matching and Control modules and the Basic Electronics to the output units. During On-line operation in the Half Duplex mode, an incoming message may break in on the transmission.

CHAPTER 3

BASIC ELECTRONICS BOARD

CONTENTS

ILLUSTRATION

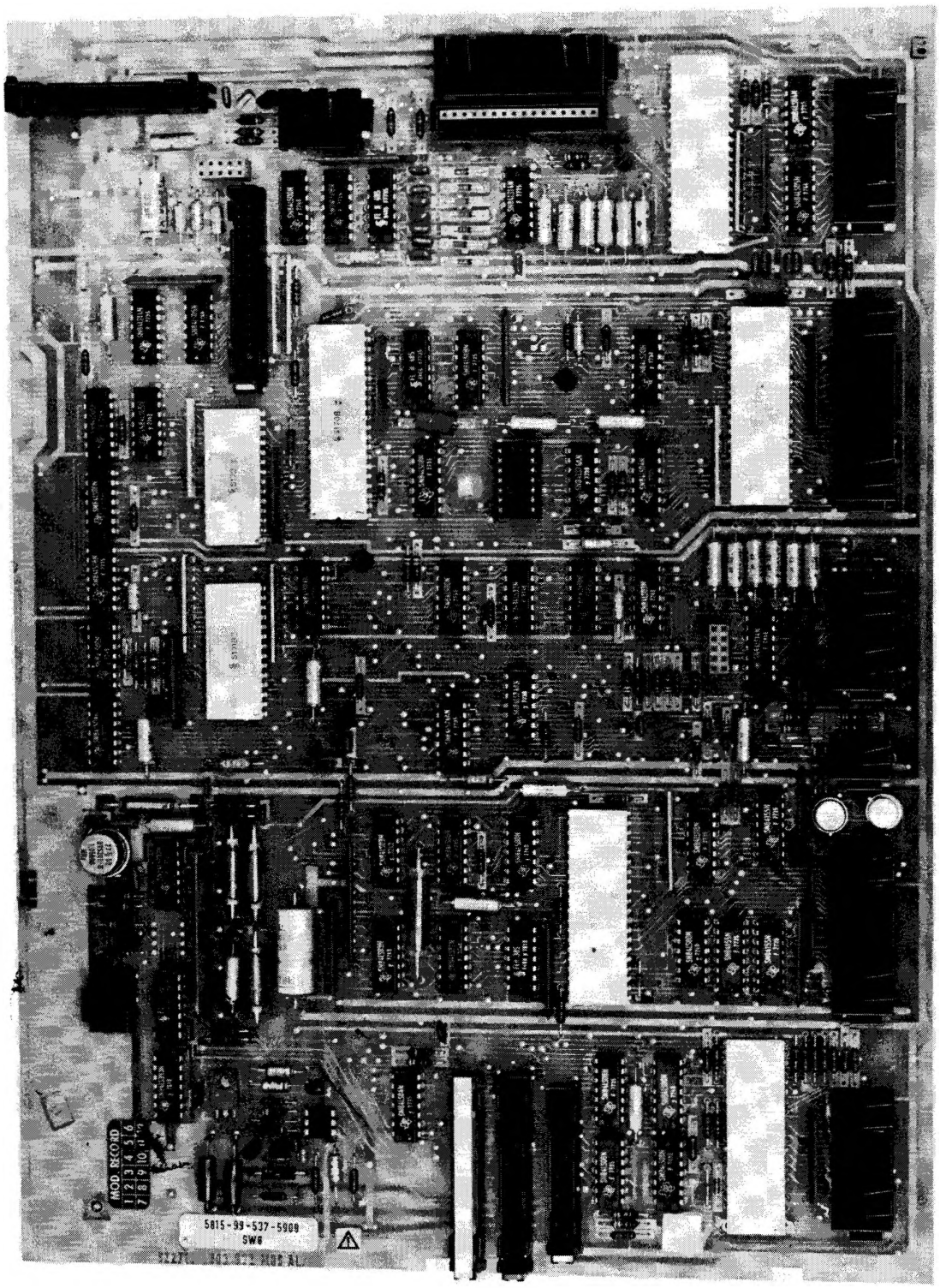

FIG.3.3.1 BASIC ELECTRONICS BOARD
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CHAPTER 3

BASIC ELECTRONICS BOARD

GENERAL INFORMATION

Figure 3.3.1

1 The Basic Electronics board is the central electronic control unit of the teleprinter. It acts as a control, transmitting and receiving functions to be performed, as a central distributor for signalling criteria and for the operating voltages to the teleprinter. It processes information for connected modules, eg Paper Tape Punch and Paper Tape Reader interpreting and matching before distribution.

2 The Basic Electronic board is in the form of a printed circuit board consisting of:

(1) A two-layer, plated through circuit board.

(2) Electronic components including seven MOS components, film and TTL circuitry, discrete components and a crystal.

(3) Plug-in connectors (pin blocks) for connecting the modules.

(4) A diagnostic connector for fault location.

PRINCIPLE OF OPERATION

Figure 3.3.2

3 The overall function of the Basic Electronic board can be split into two sub-functions, sending and receiving. The send side consists of the Transmitter and controls for the input modules, while the receive side is made up of the Receiver and controls for the output modules. The sides are designed in such a way that they function entirely independently of each other (Full Duplex method).

4 The individual functional sequences are mainly under the control of the seven MOS modules. Each MOS module contains the control for a particular input or output module:

(1) MOS1 module is the control for the Keyboard.

(2) MOS2 module is the Send control.

(3) MOS3 module is the control for the Paper Tape Reader.

(4) MOS4 module is the control for the Paper Tape Punch.

(5) MOS5 module is the control for the Special Function Module.

(6) MOS6 module and 7 are the controls for the Printer.

Functional units such as the Transmitter, Receiver and the co-ordinating controls are integrated into some of the above mentioned MOS modules. Information is interchanged bit-serially between the MOS modules, so as to minimise the number of terminal pins in the individual modules. Only the timing pulse generator, the ready control for interface S2 and the matching circuits are not implemented in MOS technology.

Keyboard Control

5 The Keyboard control MOS1 module interprets the actuation of the keys via a scanning circuit and generates the appropriate code combination. It also incorporates the 12 character buffer required to accommodate rapid keying. More detailed information on the Keyboard can be found in Chapter 5.

Send Control Figure 3.3.3

6 The Send control MOS2 module contains the following function blocks, which are largely independent of each other:

(1) Automatic letters/figures shift.

(2) Selection pulse generator.

(3) Bell signal generator.

Automatic Letters/Figure Shift

7 Operation of the automatic Letters/Figure Shift key automatically inserts the case shift characters:

Letters (↓) or Figures (↑), which are necessary due to the dual assignment of the 5-bit code (letters and figures case). The character arriving from the Keyboard control is first checked in the Case Shift Signal control, to determine whether it belongs to the letters or figures case, ie it is compared with the character sent or received previously. If no case identity is found, a command is sent to the case shift inserter and this prefixes the appropriate shift character to the information.

8 The case shift signal also ensures that the correct shift signal is given before transmission of the first character, during the following states:

(1) At the start of a message transmission.

(2) After the machine is switched on.

(3) After selection is completed.

9 The automatic letters/figures shift is inhibited when:

(1) A command character assigned to both shifts is given, eg carriage return or line feed.

(2) The letters or figures shift signals themselves are applied.

Transmitter With Tape Reader Control Figure 3.3.4

10 This MOS circuit (MOS3 module) consists of the following functional units.

(1) Information and command ORing logic.

(2) Transmitter.

(3) Paper Tape Reader control.

(4) Stepping motor control.

(5) Feed hole detector.

(6) Break-in detector.

Information and Command ORing Logic

11 In this unit the code combinations read by the Paper Tape Reader are injected into the information circuit in the send direction. Depending on which of the two modules is activated, the information from the Keyboard or Paper Tape Reader is transferred to the Transmitter.

Transmitter

12 A shift register incorporated in the Transmitter converts the information offered in bit parallel format by one of the two input modules (Keyboard or Tape Reader) into serial form. In addition, the five information elements are supplemented with a start element (1.0 unit length) and a stop element (1.5 unit length) to form a telegraph character. The clocking rate of the shift character corresponds to the set telegraph speed. The start-stop distortion of the Transmitter is determined only by the deviation of the timing pulse rate (crystal controlled oscillator) and is very slight (approximately 0.3%).

Paper Tape Reader Control

13 The Paper Tape Reader control co-ordinates the switching criteria for the Paper Tape Reader. It can be switched on or off by pressing the On/Off button. If the button is pressed for less than 250 ms, only one character is read, but if the button is pressed for longer than 250 ms, then Paper Tape Reader remains switched on. The Reader is switched off by pressing the button again. The Reader is switched off at the end of a tape or when a distant station breaking in is recognised (see Paragraph 16). When the Taut Tape switch operates, the operation of the Reader is only interrupted for as long as the tape is taut.

Stepping Motor Control

14 This supplies the stepping motor with the pulses it requires to feed the tape forward. A status signal from the Transmitter and the status of the tape Reader control determines the appropriate pulses to be transferred to the Reader. These pulses are amplified in the Reader and then used to control the stepping motor.

Feed Hole Detector

15 The feed hole track in the tape is scanned continuously while the Reader is in operation. The Reader recognises that the end of the tape has been reached when there is no longer an alteration of light and dark in the tape. Feed hole scanning lags eight feed hole pitches behind code hole scanning, so that the end of tape signal can only be given when the ninth code perforation is being scanned. This signal causes the Reader control to switch the Reader off.

Break-in Detector

16 This circuit recognises when telegraph characters transmitted by a distant station are breaking in on a message transmission from a home station and switches the Reader off. Breaking-in by the distant station is recognised whenever start polarity of the character breaking-in occurs during the stop element of the transmitted character.

Receiver With Paper Tape Punch Control — Figure 3.3.5

17 This MOS circuit (MOS4 module) includes the following functional units:

(1) Receiver.

(2) Paper Tape Punch control.

(3) Pulse generator for Paper Tape Punch magnets.

Receiver

18 The function of the Receiver is to derive the exact information from the received pulses, which are frequently heavily distorted during transmission. It also has to convert the information arriving in a bit serial form to a parallel format. For this purpose, the received telegraph character, beginning with the start element is written into a shift register, the clocking rate corresponding exactly to the telegraph speed. The moment of shifting the character always occurs in the middle of the element. During the stop element, the received information is available in parallel format for a short time for further processing. The shift register is then erased and prepared for reception of the next character.

19 The crystal controlled timing pulse generator ensures that the synchronising error of the Receiver is less than 0.01%. The timing error, which arises due to the arriving telegraph character being out of syncronisation with the timing pulse is less than 1%. This produces a receive margin of more than ± 48%.

Paper Tape Punch Control

20 This circuit block generates commands for the Paper Tape Punch. The Punch (described in Chapter 10) can be operated manually by pressing the On/Off button. The Punch can also be switched on by means of the Tape Punch On button in the Teleprinter Control Button module. This causes the Punch to be switched on continuously and is not switched off automatically by an incoming call, as is the case when it is activated by means of the On/Off button.

21 When a new roll of Paper Tape is being loaded into the Punch, the accuracy of the code hole spacing in the Paper Tape is important. Once the tape gate is closed, the Punch control causes the tape to be fed through and punched automatically 32 times with letter shift code combination (5 holes). A letter shift code combination is also punched for as long as the Tape Feed button is pressed. The Punch is turned off whenever the tape has run out.

Pulse Generator for the Paper Tape Punch Magnets

22 This circuit uses the received information to generate the control pulses for the magnet amplifiers. The manner in which it does this is dependent on the set telegraph speed and how the Punch was activated. The magnet amplifiers control the punch magnets and tape feed magnet, which drive the punch pins and sprocket wheel respectively. The operation of the punch pins is staggered in time, so as to reduce the punching noise. The time taken to punch one character and feed the tape forward is dependent on the set telegraph speed:

(1) 120 ms at 50 bauds.

(2) 90 ms at 75 bauds.

(3) 70 ms at 100 bauds.

Decoder

23 The Decoder (MOS5 module) assigns the associated machine command to each received telegraph character and the information for positioning the print wheel. Typical machine commands are printout, printout suppression, line-feed, carriage return etc. More detailed information can be found in Chapter 4 on the Special Function module.

Information and Command ORing Logic

11 In this unit the code combinations read by the Paper Tape Reader are injected into the information circuit in the send direction. Depending on which of the two modules is activated, the information from the Keyboard or Paper Tape Reader is transferred to the Transmitter.

Transmitter

12 A shift register incorporated in the Transmitter converts the information offered in bit parallel format by one of the two input modules (Keyboard or Tape Reader) into serial form. In addition, the five information elements are supplemented with a start element (1.0 unit length) and a stop element (1.5 unit length) to form a telegraph character. The clocking rate of the shift character corresponds to the set telegraph speed. The start-stop distortion of the Transmitter is determined only by the deviation of the timing pulse rate (crystal controlled oscillator) and is very slight (approximately 0.3%).

Paper Tape Reader Control

13 The Paper Tape Reader control co-ordinates the switching criteria for the Paper Tape Reader. It can be switched on or off by pressing the On/Off button. If the button is pressed for less than 250 ms, only one character is read, but if the button is pressed for longer than 250 ms, then Paper Tape Reader remains switched on. The Reader is switched off by pressing the button again. The Reader is switched off at the end of a tape or when a distant station breaking in is recognised (see Paragraph 16). When the Taut Tape switch operates, the operation of the Reader is only interrupted for as long as the tape is taut.

Stepping Motor Control

14 This supplies the stepping motor with the pulses it requires to feed the tape forward. A status signal from the Transmitter and the status of the tape Reader control determines the appropriate pulses to be transferred to the Reader. These pulses are amplified in the Reader and then used to control the stepping motor.

Feed Hole Detector

15 The feed hole track in the tape is scanned continuously while the Reader is in operation. The Reader recognises that the end of the tape has been reached when there is no longer an alteration of light and dark in the tape. Feed hole scanning lags eight feed hole pitches behind code hole scanning, so that the end of tape signal can only be given when the ninth code perforation is being scanned. This signal causes the Reader control to switch the Reader off.

Break-in Detector

16 This circuit recognises when telegraph characters transmitted by a distant station are breaking in on a message transmission from a home station and switches the Reader off. Breaking-in by the distant station is recognised whenever start polarity of the character breaking-in occurs during the stop element of the transmitted character.

Receiver With Paper Tape Punch Control — Figure 3.3.5

17 This MOS circuit (MOS4 module) includes the following functional units:

(1) Receiver.

(2) Paper Tape Punch control.

(3) Pulse generator for Paper Tape Punch magnets.

Receiver

18 The function of the Receiver is to derive the exact information from the received pulses, which are frequently heavily distorted during transmission. It also has to convert the information arriving in a bit serial form to a parallel format. For this purpose, the received telegraph character, beginning with the start element is written into a shift register, the clocking rate corresponding exactly to the telegraph speed. The moment of shifting the character always occurs in the middle of the element. During the stop element, the received information is available in parallel format for a short time for further processing. The shift register is then erased and prepared for reception of the next character.

19 The crystal controlled timing pulse generator ensures that the synchronising error of the Receiver is less than 0.01%. The timing error, which arises due to the arriving telegraph character being out of syncronisation with the timing pulse is less than 1%. This produces a receive margin of more than ± 48%.

Paper Tape Punch Control

20 This circuit block generates commands for the Paper Tape Punch. The Punch (described in Chapter 10) can be operated manually by pressing the On/Off button. The Punch can also be switched on by means of the Tape Punch On button in the Teleprinter Control Button module. This causes the Punch to be switched on continuously and is not switched off automatically by an incoming call, as is the case when it is activated by means of the On/Off button.

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23 The Decoder (MOS5 module) assigns the associated machine command to each received telegraph character and the information for positioning the print wheel. Typical machine commands are printout, printout suppression, line-feed, carriage return etc. More detailed information can be found in Chapter 4 on the Special Function module.

Printer Control

Figure 3.3.6

24 The Printer control in MOS6 and MOS7 is made up of the Print Unit control and Carriage Travel/Line Feed control.

Print Mechanism Control

25 The received information arriving from the Decoder, which includes the commands for the operation of the Printer, is first transferred to a 5-character buffer. The buffer's function is to store the characters received during carriage return. Every character applied at the buffer output initiates a print cycle lasting 65 ms, at all three telegraph speeds. The print cycle is sub-divided into three functions:

(1) Positioning of the print wheel.

(2) Printout of the character.

(3) Carriage feed.

26 The print wheel is positioned at the start of each print cycle. This is done by transferring the applied information to the print wheel positioner. The latter contains an arithmetic unit which uses the current and previously applied information to determine the necessary sequence of pulses for controlling the stepping motor. The print wheel is thus rotated to the new print position by the shortest distance (see Chapter 6 on Printer). Once the print wheel is in position, the command generates a printing pulse for the hammer magnet, which causes the hammer to hit a print wheel spoke, printing the positioned character.

27 After the character is printed, a command to the Carriage Travel Feed control causes the Printer carriage to be fed forward one character spoke. When the code combination for carriage return or line feed is received, the command control derives further commands for the Carriage Travel/Line Feed control. The synchroniser ensures the print wheel is accurately positioned. Should there be a loss of synchronisation, a synchronising run is started.

28 The ink ribbon control employs two magnets to move the ribbon to one of two positions, depending on the operational event taking place.

(1) Printing for message reception.

(2) Character visibility position (lowering of the ribbon below the print line).

Carriage Travel/Line Feed Control

29 This unit controls the carriage movement and line feed of the Printer. The Carriage Feed control generates a train of three pulses per column for the column feed function of the printer carriage. These pulses are transferred to the carriage motor via carriage motor control 2.

30 An acceleration and deceleration program with increasing and decreasing frequency respectively, are included in the program memory to control the acceleration and deceleration of the stepping motor. When a line feed is to be executed, the Line Feed control sends the appropriate number of stepping motor pulses to the line feed motor via line motor control 3. The number of stepping motor pulses is dependent on the line spacing set on the Switch module.

(1) Four pulses are required for 1 line spacing.

(2) Six pulses are required for 1½ line spacing.

(3) Eight pulses are required for 2 line spacing.

Timing Pulse Supply

31 The timing for the teleprinter is derived from a crystal controlled oscillator with a frequency of 2.112 MHz. All time dependent functions within the Basic Electronic board, including the MOS components which require a two phase timing pulse, are derived from the timing pulse supply.

Interface S2 to the Line Interfacing Equipment

32 Interface S2 represents the line of demarcation between the device control functions and the line interfacing system. Interface S2 is the point via which:

(1) The send and receive data is interchanged.

(2) The signalling criteria is transferred for the operating mode control of the teleprinter, eg Local, On-line, Half Duplex and Full Duplex modes.

(3) The alarm criteria, eg bell signal and end of tape condition.

(4) The signals for distant station selection are transmitted.

The line interfacing equipment must also be supplied with the following operating voltages:

(5) +12 V ± 5% max 650 mA.

(6) -12.8 V ± 5% max 580 mA.

(7) +5 V ± 5% -3% max 700 mA.

Diagnostic Connector

33 A socket connected to appropriate test points is provided on the Basic Electronic board, as a quick means of checking the supply voltages and important signalling criteria. The test points can be checked by a Diagnostic Unit, which has a a light emitting diode indicator. It is also possible to check the test points using conventional test instruments. The following criteria is brought to the socket connector:

Supply Voltages

(1) 0 V.

(2) +5 V.

(3) +12 V.

(4) -12 V.

(5) +40 V.

Signalling Criteria

(6) Send data.

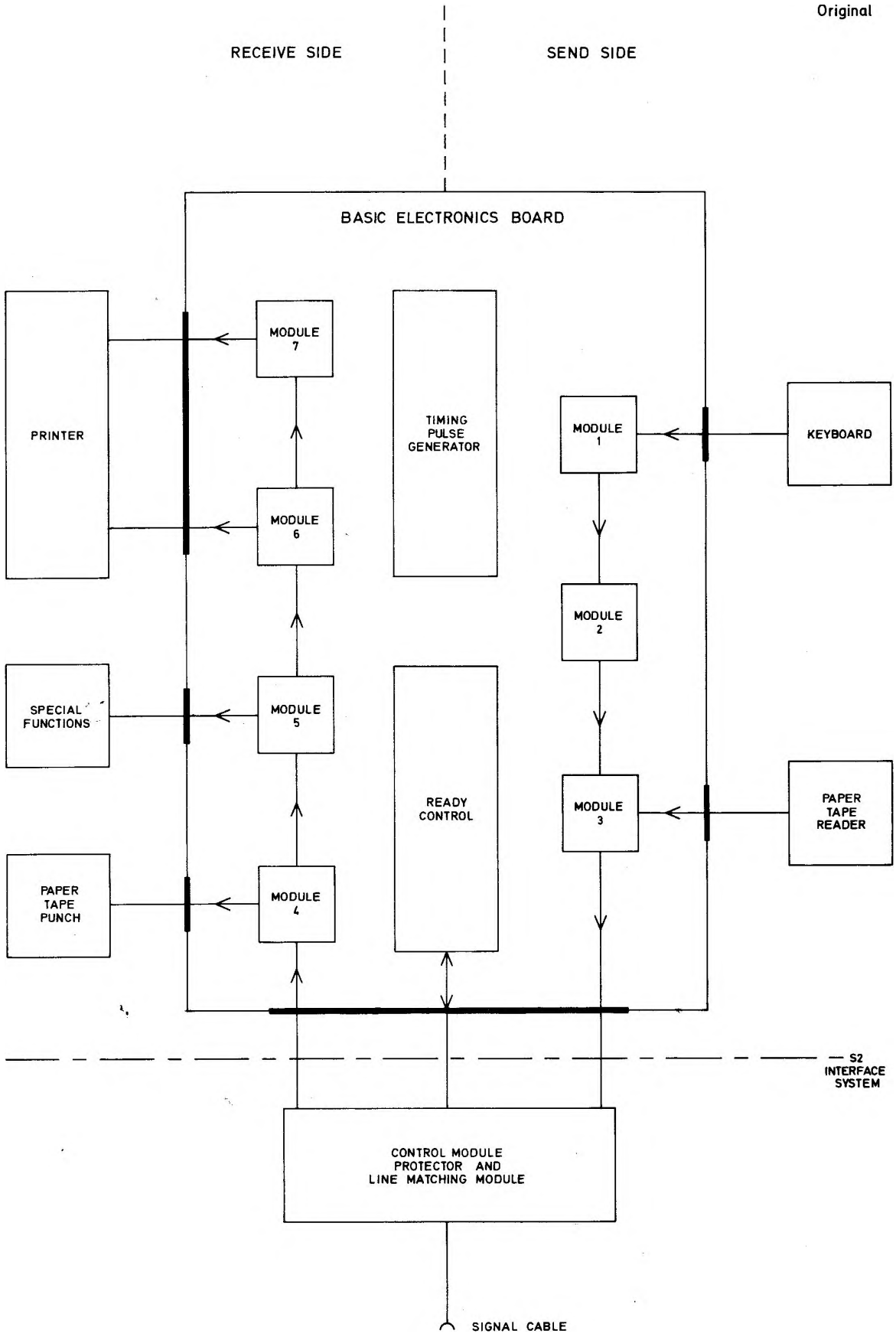
(7) Receive data.

(8) Punch pulses for the Punch, tracks 1 to 5.

(9) Punch pulses for the Punch, feed hole track.

(10) Tape feed pulse for the Punch.

(11) Print pulse for the Printer.



BASIC ELECTRONICS BOARD
BLOCK DIAGRAM

FIG.3.3.2

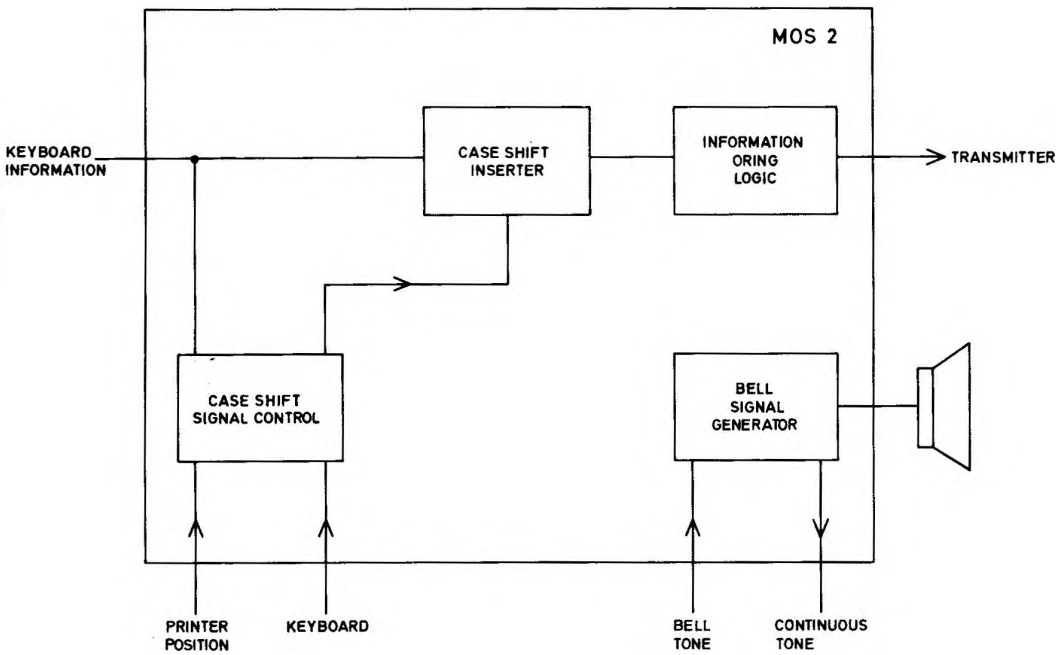
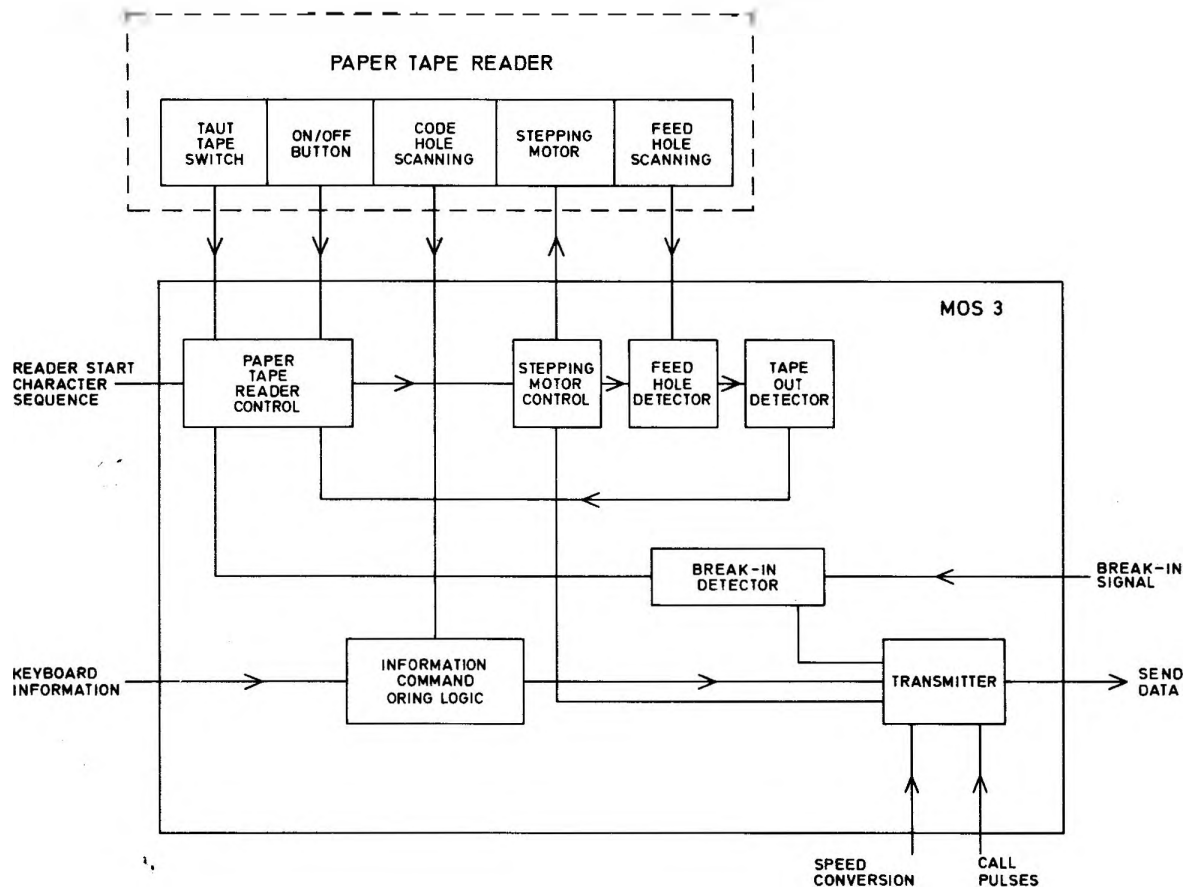


FIG. 3.3.3

SEND CONTROL

MOS MODULE 2 BLOCK DIAGRAM



TRANSMITTER WITH PAPER TAPE READER CONTROL FIG. 3.3.4

MOS MODULE 3 BLOCK DIAGRAM

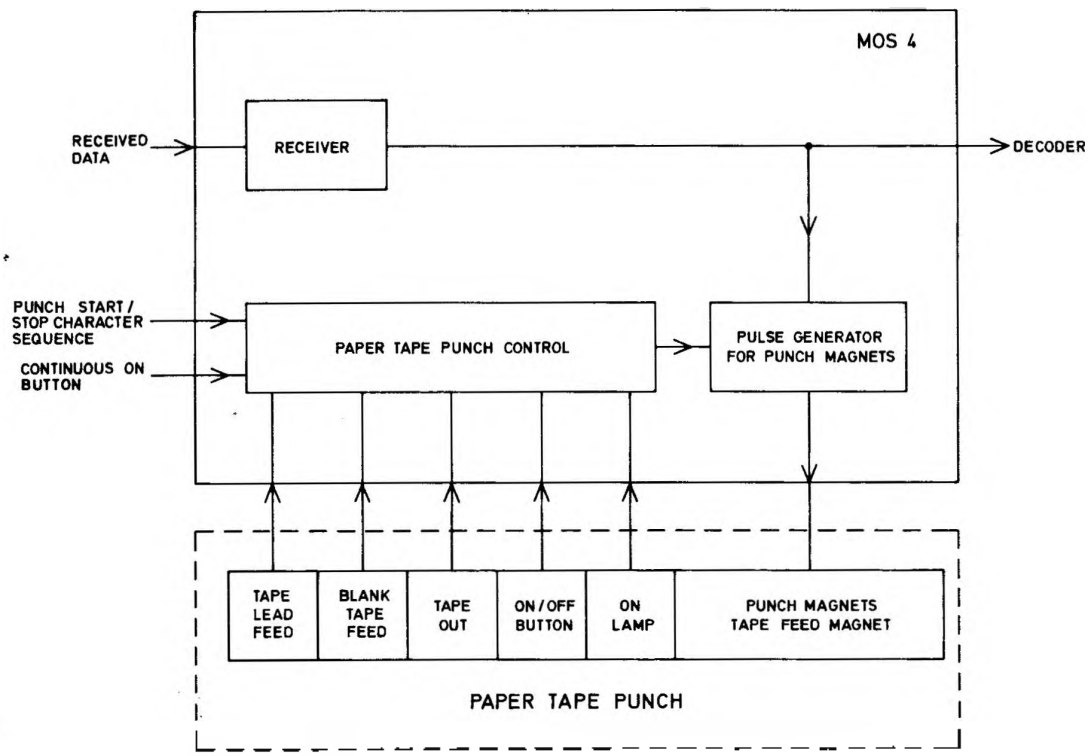
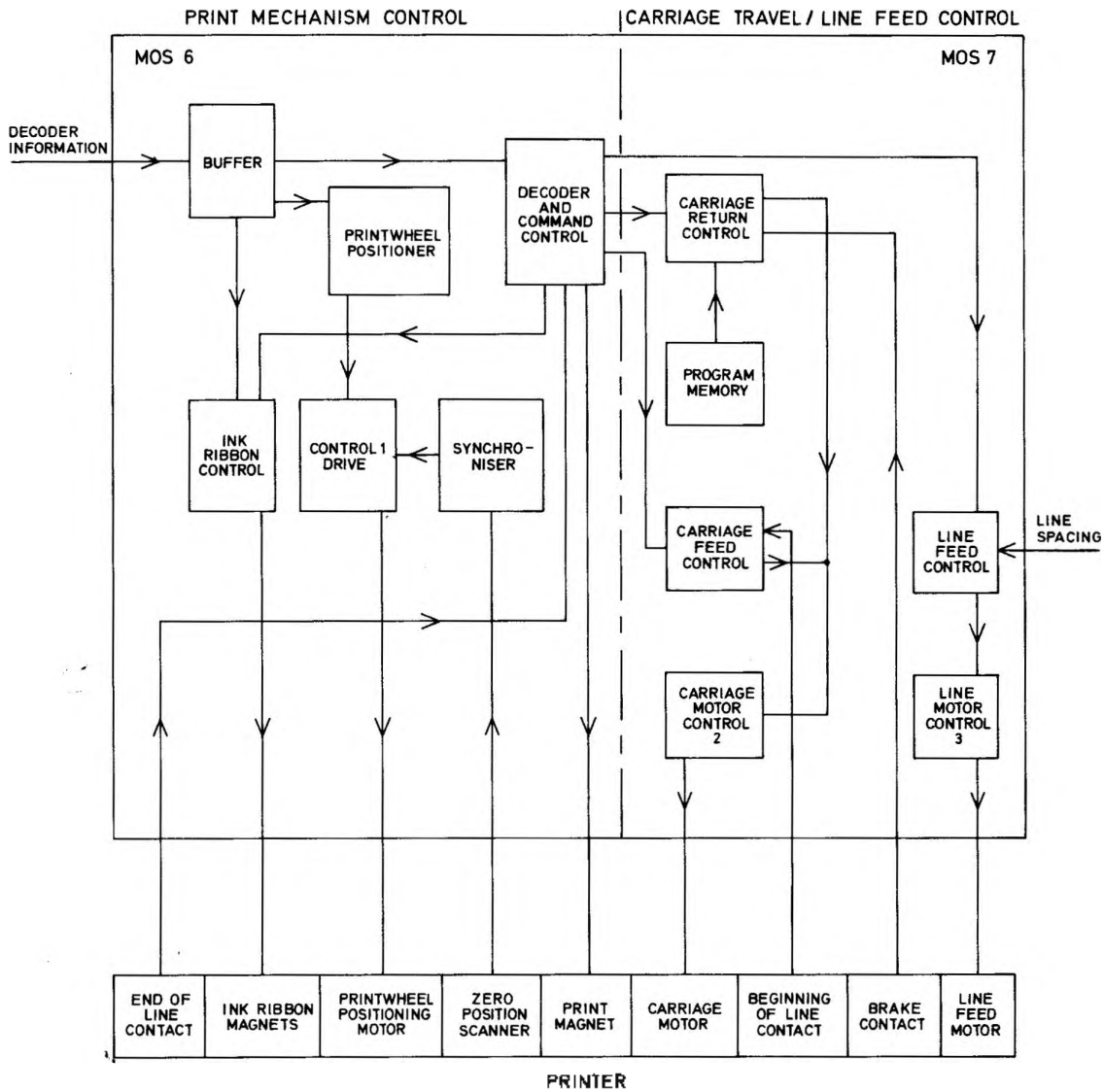


FIG. 3.3.5 RECEIVER WITH PAPER TAPE PUNCH CONTROL
MOS MODULE 4 BLOCK DIAGRAM



PRINTER CONTROL

FIG. 3.3.6

MOS MODULE 6 AND MOS MODULE 7 BLOCK DIAGRAM

CHAPTER 4

SPECIAL FUNCTION MODULE

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ILLUSTRATIONS

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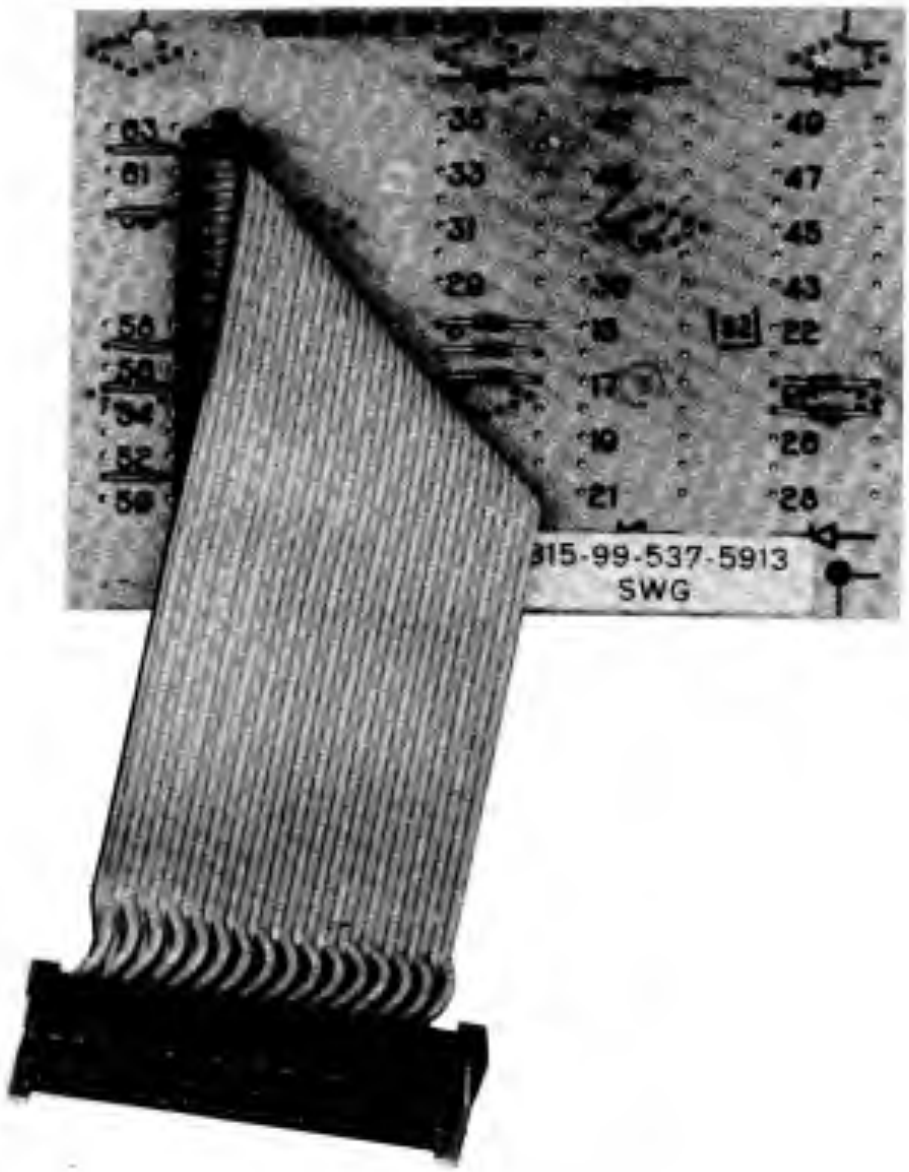


FIG.3.4.1 SPECIAL FUNCTION MODULE
5815-99-537-5913

CHAPTER 4

SPECIAL FUNCTION MODULE

GENERAL INFORMATION

Figure 3.4.1

1 The Special Function module enables the TGN Series to be modified to the various operating conditions. By means of appropriate programming, ie insertion of diodes and wire links, specific machine functions can be selected for the teleprinter.

2 The Special Function module is in the form of a plug-in printed circuit board, with diodes and wire links inserted in it. It can take up to 49 diodes, which form a 7 x 7 matrix and 14 wire links. The mounting positions are numbered so that the functions allocated to the diodes or wire links can be easily identified.

3 Information stored in the Special Function module is examined by the Basic Electronics module. To do this, the diode matrix is accessed by the decoder (MOS5) while the wire links act on the Keyboard control (MOS1), the Send control (MOS2), the punch control (MOS4) and the Print control (MOS6).

Diode Matrix With Decoder (MOS5)

Figure 3.4.2

4 The function of the Decoder is to allocate the teleprinter signals arriving from the Receiver to the associated machine function; ie the Decoder supplies the information for setting the print wheel and determines which machine commands, eg print, column feed, etc must be carried out. Allocation of the teleprinter signals to the different functions is variable and can be fixed through the diode matrix of the Special Function module.

5 In the teleprinter, Read-Only Memory (1) supplies the machine functions for the 64 possible teleprinter signals, ie the basic functions. As soon as the Character Store (1) has accepted the teleprinter signal arriving from the Receiver, the corresponding basic function is present at the output of Read-Only Memory (1), in the form of a code word. At the same time, the scanner, controlled by 66 kHz timing pulses, starts scanning the 49 mounting positions on the diode matrix. Parallel to this, the 49 positions of Read-Only Memory (2) are scanned. In Read-Only Memory (2) each diode position is assigned a specific code combination with predetermined change information, in relation to the basic information contained in Read-Only Memory (1).

6 The code combination from Read-Only Memory (2) is compared, in a code comparitor circuit, with the teleprinter signal being applied. If the code combination is the same as the teleprinter and at the same time, notification of the insertion of a diode is received, the change information present at the output of Read-Only Memory (2) is transferred to the buffer. If all 49 locations of the Read-Only Memory (2) are scanned, the entire basic function change is held in the buffer in the form of a second code word. By combining the two code words from Read-Only Memory (1) and the buffer, the definitive machine function is generated and fed to the appropriate points in the teleprinter.

7 In certain cases, specific machine functions can also be initiated by the receipt of a number of identical teleprinter signals (code sequence). This is achieved by the received teleprinter signal (Character Store (1)) and the preceding signal (Character Store (2)), being stored and compared. If the two signals are similar, the received signal is entered into a shift register. When the specified number of

identical, consecutive signals has been attained, the code sequence recognition circuit emits a signal. Combined with the information from the scanner, the signal addresses the relevant location in Read-Only Memory (2). The ensuing procedure, ie transfer to buffer and generation of the definitive function has already been described. After receipt of an entire code sequence, the information in the shift counter is deleted together with the next signal, which does not belong to the code sequence.

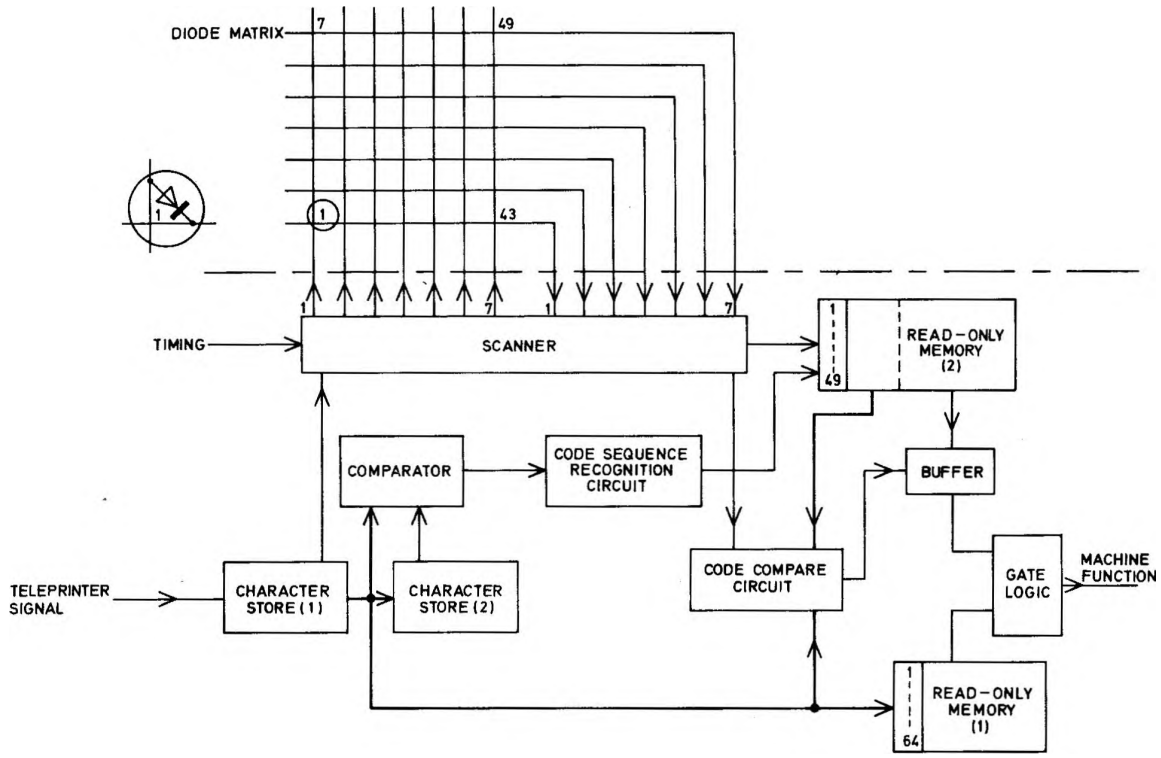
Wire/Diode Links

8 By inserting wire links into specific positions on the plug-in printed circuit board, different machine functions can be selected for the teleprinter. The following table gives machine functions for diodes and wire links fitted in the TGN Series:

TABLE 3.4.1

TGN SERIES DIODE AND WIRE LINK TABLE

TGN4	TGN3	TGN2	TGN1	FUNCTION	LINK-(W) DIODE-(V)
X	X	X	X	Automatic CR/LF at the end of each line, effective only when receiving.	W 57
X	X			Overprintlock after 69 characters. (Stops overprinting)	W 55
X		X		End of tape signal via Contact 4	W 59
X	X	X	X	End of paper signal via Contact 3	W 62
X	X	X	X	Print suppression (Figure Shift D)	V 8
X	X	X	X	Feed suppression (Figure Shift D)	V 9
X	X	X	X	Print suppression (Figure Shift J - Bell)	V 24
X	X	X	X	Feed suppression (Figure Shift J - Bell)	V 25
X	X	X	X	Bell Signal Stored	W 51
X	X			Punching or Recording No Answer Back Start	V 10



DIODE MATRIX WITH DECODER
MOS MODULE 5 BLOCK DIAGRAM

FIG. 3.4.2

CHAPTER 5

KEYBOARD

Paragraph

TABLE

ILLUSTRATIONS

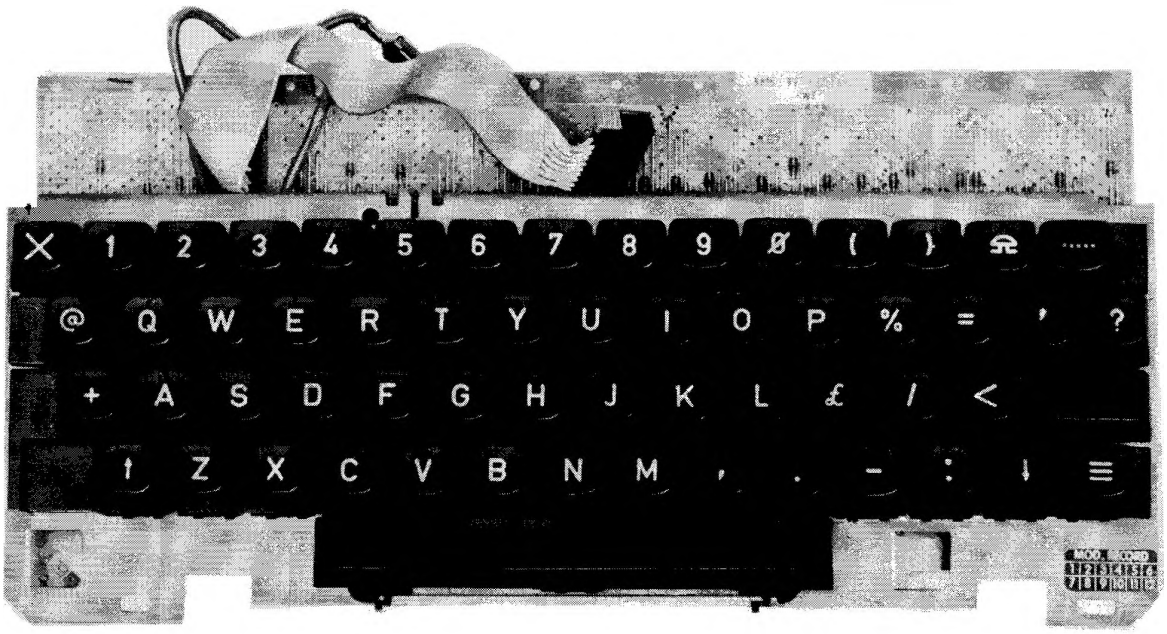


FIG. 3.5.1

KEYBOARD
5815-99-537-5922

C H A P T E R 5

K E Y B O A R D

GENERAL INFORMATION

Figure 3.5.1

1 This is essentially a mechanical assembly, controlled by the Keyboard control and buffer. Each key of the Keyboard is fitted with a contact which closes when the key is depressed. The contact is of the crosspoint type with a gold plated surface, located in the key cover. The assignment of the key positions to the code combinations is made in the Keyboard. The key assignment is selected by inserting diodes and wire links of varying lengths. The Keyboard control and buffer uses MOS technology and is contained in the Basic Electronics module.

PRINCIPLES OF OPERATION

Figure 3.5.2

2 A 6-bit binary counter, called the character generator, counts continuously from 0 to 63. Each of these binary numbers represents the bit combination for a telegraph character, the first five bits forming the actual character and the sixth bit indicating whether the character belongs to the letters or the figures case, including symbols.

3 Each key in the Keyboard is connected to an X and a Y conductor, assigning it to a code combination or telegraph character. As the character generator cycles, the scanner checks all the contacts one by one to check whether any are closed. Each contact is scanned once per millisecond. At the same time the bit combination associated with the key is present at the input of the Keyboard buffer. By pressing for instance, the E key, the X2 and Y8 conductors are shorted via the wire link and diode. If the character generator arrives at the bit combination 000001 during one of its cycles and if the E key is still depressed, the character E is signalled by means of a pulse to the key actuation recogniser.

4 As a safeguard against malfunctions and to avoid bouncing of the key contact being interpreted as multiple keying of a character, the key actuation recogniser waits until the character generator has completed its second cycle since the E key was depressed, before sending the enable pulse, which causes the bit combination to be transferred to the Keyboard buffer. Bouncing of the key contacts for up to 30 milliseconds is admissible (usually they are one or two milliseconds long). This safeguard makes the generation of undesired garbled characters impossible, even with the fastest keying bursts.

Keyboard Buffer

5 As it is sometimes possible to key in characters faster than they can be sent to line, the Keyboard is assigned a buffer with a twelve character capacity. All keyed-in characters pass through this Keyboard buffer, before being passed at maximum speed and in correct sequence to the Transmitter. As long as information is stored in the buffer, the Paper Tape Reader cannot be activated.

6 If in exceptional cases, the twelve character capacity of the Keyboard buffer is insufficient, the Keyboard is inhibited electronically, rendering further keying ineffective. This condition is indicated by a lamp in the Unlock Keyboard button in the Teleprinter Control Button module of the teleprinter. Depressing this button, causes the Keyboard to become operable again.

Letters/Figures Shift

7 The dual assignment of the 5-bit code makes case shift characters necessary for differentiating from figures or symbols. The case shift characters are Letters shift (↓) and Figures shift (↑). The case shift characters are generated at the beginning of a message transmission and when changing from letters to figures or vice versa. Characters such as carriage return and line feed are effective in both the letters and figures case.

Character Counter, End-of-Line Warning

8 The character counter counts all keyed-in characters which result in the printer moving forward one column space. After the 59th character, the counter triggers an audible signal which announces the approaching end of the line.

Character Repetition

9 When the Repeat key (.....) is depressed, the last character entered is repeated as long as the key is depressed. If a different character is keyed in while the Repeat key is depressed, the new character is repeated until the key is released.

Line to Line Selection

10 Line to line selection is via the Keyboard. During the selection process, all the keys on the Keyboard are ineffective with the exception of the figure keys. Only when the connection is established is the Keyboard released.

TABLE 5.1

CODE TABLE

Decimal No.	Binary No. Information bits 2^5 2^4 2^3 2^2 2^1 2^0 ← Code combination of telegraph character → 5 4 3 2 1	Key connection Diode to X ... Wire strap to Y ...	Telegraph character as per CCITT No. 2 No.	Letters	Decimal No.	Binary No. Information bits 2^5 2^4 2^3 2^2 2^1 2^0 ← Code combination of telegraph character → 5 4 3 2 1	Key connection Diode to X ... Wire strap to Y ...	Telegraph character as per CCITT No. 2 No.	Letters
0	0 0 0 0 0 0	X7 - Y8	32		32	1 0 0 0 0 0	X7 - Y4	32	
1	0 0 0 0 0 1	X8 - Y8	5	E	33	1 0 0 0 0 1	X8 - Y4	5	3
2	0 0 0 0 1 0	X1 - Y1	28	*)	34	1 0 0 0 1 0	X1 - Y5	28	≡ (LF)
3	0 0 0 0 1 1	X2 - Y1	1	A	35	1 0 0 0 1 1	X2 - Y5	1	-
4	0 0 0 1 0 0		31	*)	36	1 0 0 1 0 0	X3 - Y5	31	
5	0 0 0 1 0 1	X4 - Y1	19	S	37	1 0 0 1 0 1	X4 - Y5	19	,
6	0 0 0 1 1 0	X5 - Y1	9	I	38	1 0 0 1 1 0	X5 - Y5	9	8
7	0 0 0 1 1 1	X6 - Y1	21	U	39	1 0 0 1 1 1	X6 - Y5	21	7
8	0 0 1 0 0 0	X7 - Y1	27	*)	40	1 0 1 0 0 0	X7 - Y5	27	< (CR)
9	0 0 1 0 0 1	X8 - Y1	4	D	41	1 0 1 0 0 1	X8 - Y5	4	
10	0 0 1 0 1 0	X1 - Y2	18	R	42	1 0 1 0 1 0	X1 - Y6	18	4
11	0 0 1 0 1 1	X2 - Y2	10	J	43	1 0 1 0 1 1	X2 - Y6	10	
12	0 0 1 1 0 0	X3 - Y2	14	N	44	1 0 1 1 0 0	X3 - Y6	14	,
13	0 0 1 1 0 1	X4 - Y2	6	F/%	45	1 0 1 1 0 1	X4 - Y6	6	*)
14	0 0 1 1 1 0	X5 - Y2	3	C	46	1 0 1 1 1 0	X5 - Y6	3	:
15	0 0 1 1 1 1	X6 - Y2	11	K	47	1 0 1 1 1 1	X6 - Y6	11	(
16	0 1 0 0 0 0	X7 - Y2	20	T	48	1 1 0 0 0 0	X7 - Y6	20	5
17	0 1 0 0 0 1	X8 - Y2	26	Z	49	1 1 0 0 0 1	X8 - Y6	26	+
18	0 1 0 0 1 0	X1 - Y3	12	L	50	1 1 0 0 1 0	X1 - Y7	12	)
19	0 1 0 0 1 1	X2 - Y3	23	W	51	1 1 0 0 1 1	X2 - Y7	23	2
20	0 1 0 1 0 0	X3 - Y3	8	H/£	52	1 1 0 1 0 0	X3 - Y7	8	*)
21	0 1 0 1 0 1	X4 - Y3	25	Y	53	1 1 0 1 0 1	X4 - Y7	25	6
22	0 1 0 1 1 0	X5 - Y3	16	P	54	1 1 0 1 1 0	X5 - Y7	16	ø
23	0 1 0 1 1 1	X6 - Y3	17	Q	55	1 1 0 1 1 1	X6 - Y7	17	1
24	0 1 1 0 0 0	X7 - Y3	15	O	56	1 1 1 0 0 0	X7 - Y7	15	9
25	0 1 1 0 0 1	X8 - Y3	2	B	57	1 1 1 0 0 1	X8 - Y7	2	?
26	0 1 1 0 1 0	X1 - Y4	7	G/@	58	1 1 1 0 1 0	X1 - Y8	7	*)
27	0 1 1 0 1 1		30	*)	59	1 1 1 0 1 1	X2 - Y8	30	†
28	0 1 1 1 0 0	X3 - Y4	13	M	60	1 1 1 1 0 0	X3 - Y8	13	.
29	0 1 1 1 0 1	X4 - Y4	24	X	61	1 1 1 1 0 1	X4 - Y8	24	/
30	0 1 1 1 1 0	X5 - Y4	22	V	62	1 1 1 1 1 0	X5 - Y8	22	=
31	0 1 1 1 1 1	X6 - Y4	29	↓	63	1 1 1 1 1 1		29	*)

*) for special functions

Characters which are effective on both the figures and letters side, eg CR, LF etc need be coded once only, leaving the second combination free for special functions.

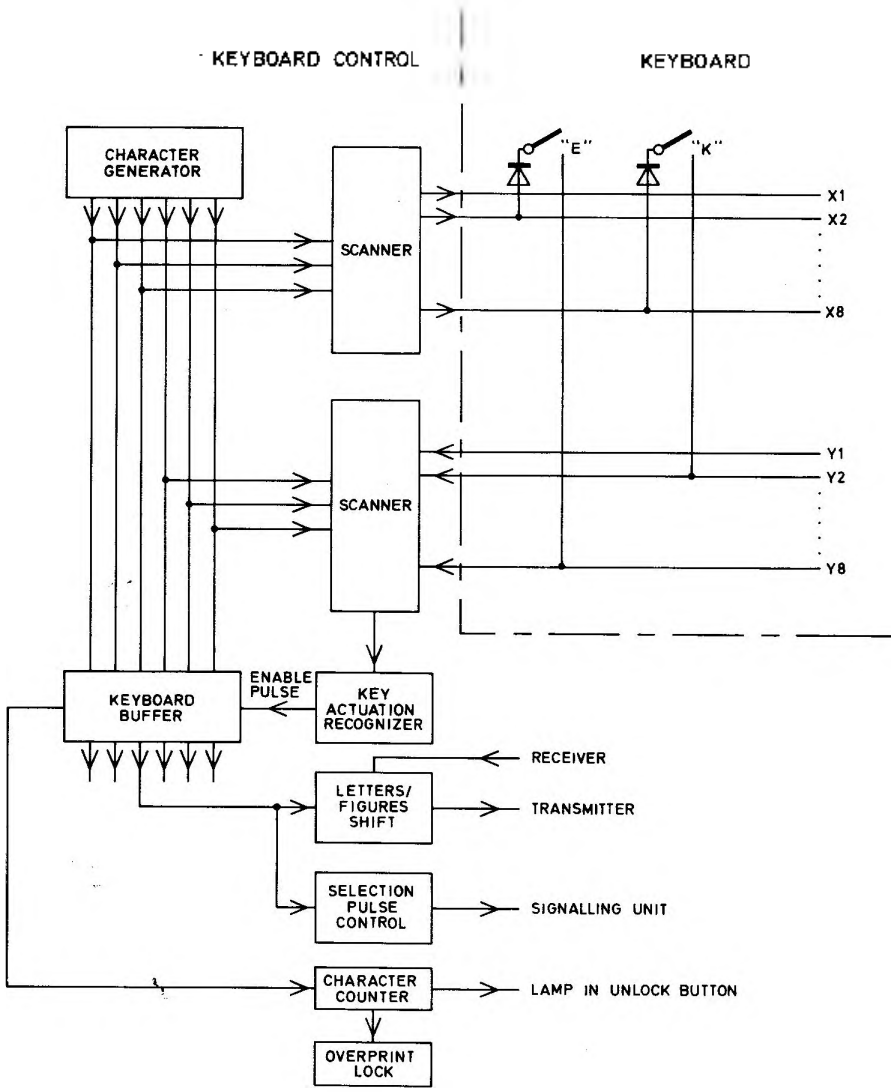


FIG. 3.5.2 ELECTRONIC CODING OF TELEGRAPH CHARACTERS
BLOCK DIAGRAM

CHAPTER 6

PRINTER

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ILLUSTRATIONS

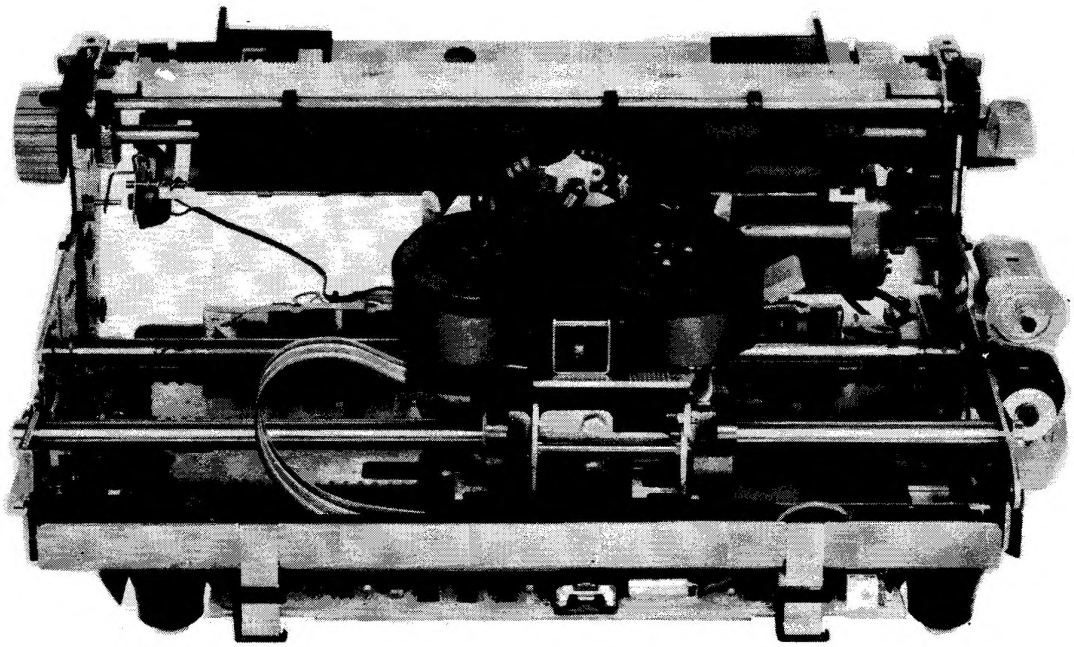


FIG.3.6.1

PRINTER
5815-99-537-5925

CHAPTER 6

PRINTER

GENERAL INFORMATION

Figure 3.6.1

1 The TGN4 is equipped with an impact type printer, which can print 15.4 character/s. The type carrier is a print wheel, made of very hard wearing plastic in the shape of a spoked disc. The printing types are fitted to the tips of the spokes. A stepping motor rotates the print wheel to the appropriate printing position, taking the shortest angle of rotation. When the type is in the print position, a hammer is actuated by an electro-magnet which strikes the type, producing an impression of the character on the paper via the ink ribbon.

2 A second stepping motor moves the Printer carriage with the printing mechanism along the print line via a toothed belt. Reversing the direction of rotation of this stepping motor causes the printer carriage to run smoothly to the beginning-of-line position. A third stepping motor is used for the line feed function.

3 The motion of the carriage is used to advance the ink ribbon. The ribbon feed direction is reversed by means of a magnet system. Two further magnet systems position the ink ribbon for printing and for making the last character printed visible.

CONSTRUCTION

Figures 3.6.2 and 3.6.3

4 The Printer is made up of: (numbers in brackets following components refer to Figures 3.6.2 and 3.6.3. annotations).

(1) Printer chassis (1).

(2) Printer carriage (2).

(3) Printing mechanism (3).

(4) Printer electronics (4).

Printer Chassis

5 The Printer chassis (1) is the supporting member of the Printer and contains:

(1) The paper feed facility, which is made up of:

a. Stepping motor (5).

b. Platen (6).

c. Paper guide (7).

d. Paper contact (8).

(2) The carriage drive facility, which is made up of:

a. Stepping motor (9).

b. Toothed belt (10).

c. Two guide rails (11).

d. End-of-line contact (12) (Switch S1, Figure 3.6.7).

e. Beginning-of-line contact (13) (Switch S3, Figure 3.6.7).

f. Braking contact (14) (Switch S2, Figure 3.6.7).

g. Operation unit counter (15).

(3) The ribbon advance facility, which is made up of:

a. Two drive cables (16).

b. Magnet for reversing direction of ribbon feed (17).

Printer Carriage

6 The Printer carriage (2) runs on two guide rails (11) by means of plain and roller bearings (18) and is linked with the stepping motor (9) by a toothed belt (10). Spindles (19) for taking up the ink ribbon are driven by ribbon drive cables (16), which run over two pulleys (20), fitted with a free wheel mechanism. Printer mechanism (3) is linked with the carriage (2) via a push fit joint (21) and is secured in the printing position by means of two securing springs (22). The printing mechanism can be easily removed by shifting the lever of the mechanical interlock (31).

Printing Mechanism

7 The printing mechanism (3) contains:

(1) Printing system (23).

(2) Print wheel (24).

(3) Stepping motor for positioning the print wheel photo-electric scanner (not shown) for exact positioning of the print wheel.

(4) Two magnets (27) for print control and for lowering the ribbon to the character visibility position.

(5) Spool carrier (28) with ribbon lifter and reversal contact.

(6) Trailing cable (29), which provides the electric contact with the printer electronics.

Printer Electronics

8 Printer Electronics (4), which is a printed circuit board located under the Printer chassis, carries the power electronics for the Printer. This includes all the control circuits and amplifiers required for the stepping motors and electromagnets. The digital section of the control, the Printer buffer for example, is to be found on the Basic Electronics board.

PRINCIPLE OF OPERATION

9 After a character is received, the stepping motor rotates the print wheel to the appropriate printing position. The character is then printed and the Printer carriage advanced by one column. As the carriage feed takes place, the print wheel is being set to the next print position.

Print Wheel Positioning — Figures 3.6.3 and 3.6.4

10 The print wheel is rotated one-pitch with each single step of the stepping motor. On the basis of the actual position of the print wheel, the Printer control on the Basic Electronics board calculates the direction of rotation and the number of pitches by which the print wheel must be rotated to reach the next printing positioning by the shortest route.

11 Special acceleration and deceleration programs are used to accelerate the print wheel from 0 to a rotational speed of 1000 pitches per second within five steps and to decelerate it to 0 again within three steps. If the displacement range is equal to or smaller than seven pitches, the rotational speed is kept to a constant 500 pitches per second.

12 In conjunction with the photo-electric scanner, the Printer control checks the position of the print wheel (actual position) with the position called for by the Printer control (address position). The concurrence of the actual with the address position of the print wheel is checked whenever:

(1) The character "E" is selected.

(2) A mode is enabled. (Non-print function.)

(3) Pause in communication.

13 This check is done when the print wheel assumes a defined position on the support (26), which has a cut-out, four pitches wide, scanned by the photo-electric scanner. If the cut-out in the support is recognised at the same time as the pulse combination assigned to the character "E" is applied to the stepping motor, the Printer control recognises that the actual and address position are in concurrence. If there is no concurrence, a synchronisation run is carried out for a maximum of 156 milliseconds. The characters received during the synchronisation run are stored in the Printer buffer.

Synchronisation Run

14 For coarse adjustment (to six characters), the stepping motor receives a synchronising signal which rotates the support with the print wheel, until the photo-electric scanner recognises the cut-out in the support. For fine adjustment to the right pitch (character "E"), the Printer control drives the stepping motor by means of six different pulse sequences. The stepping motor continues to rotate until the photo-electric scanner operates at the same instant as the pulse sequence assigned to the character "E" is recognised. The character in the printer buffer is then called and printed.

Character Visibility Position

15 In this position, the last character printed can be read. The character visibility position is assumed whenever an operating mode is enabled and in communication pauses, ie whenever 130 milliseconds have elapsed since the last character was printed. This is achieved because next to the character "E" on the print wheel, there is an open sector four pitches in width. When the print wheel is in the character visibility position, the character "E" is in the printing position, which means that the open part of the print wheel is situated immediately in front of the last character printed. Simultaneously, the visibility magnet lowers the ink ribbon to give a clear view of the copy area.

Printing of Characters — Figure 3.6.5

16 To print the positioned character, the electro-magnetically fired point hammer strikes the type against the ink ribbon. The front of the hammer has a wedge shaped indentation which fits over a corresponding projection on the type. This arrangement ensures the horizontal positioning of the type is corrected as the printing action takes place. The Printer control lessens the print force for eight small-area characters, eg the full stop, by reducing the current.

Printer Carriage Drive — Figure 3.6.7

17 A stepping motor moves the Printer carriage horizontally by means of a toothed belt, one column at a time. Three single steps of the stepping motor corresponds to one column space. A column space is 2.54 mm wide.

18 The end-of-line position can be set to the 69th or 72nd character by means of the end-of-line contact (Switch S1). The end-of-line contact is responsible for carriage feed suppression, automatic carriage return and line feed. The return of the carriage to the beginning-of-line position is achieved by reversing the direction of rotation of the stepping motor. A carriage return program contained in the Basic Electronics board brings the acceleration to about 1200 motor step/s. Twelve columns before the beginning-of-line position, a braking contact (Switch S2), operates to decelerate the stepping motor to 250 motor step/s, until the carriage comes to a halt. The beginning-of-line contact and the position of the ring counter in the stepping motor control are used for positioning the carriage in the first print column of line. The beginning-of-line contact (Switch S3), serves for coarse positioning, while the ring counter marks an exact reproducible beginning of line position.

19 The carriage return time is approximately 300 milliseconds. At a telegraph speed of 50 bauds, the carriage return is completely within the time required for the two control characters carriage return and line feed. At 75 and 100 bauds, the time required for the two control characters is only 200 milliseconds and 150 milliseconds respectively. As this time is not sufficient for a carriage return, the Printer buffer, a 5-character store, retains the characters received during the carriage return. As the Printer prints at a rate of 15.4 characters/s and receives at 13.3 characters/s when operating at 100 bauds, the Printer empties the buffer after about ten characters have been printed on a new line.

Line Feed — Figure 3.6.6

20 An intermediate gear links the stepping motor (5) with the platen (6). Four steps of the stepping motor feeds the paper forward by one line, when single spacing is set. The line spacing can be set to single, one and a half or double spacing by means of a switch in the Switch module. Brief depression (<250 ms) of a button in the Teleprinter Control Button module advances the paper by one quarter of a line. Longer actuation of this button, (>250 ms) causes the paper to be fed forward for as long as the button is depressed.

Ribbon Drive — Figure 3.6.6

21 The movement of the carriage is used to drive the ink ribbon. A magnet system is used to reverse the direction of the ribbon feed. The two ribbon drive cables (16) which are secured to the Printer chassis (1) are each led round a cable pulley (20) in the carriage to the rocker lever (30). The position of the rocker lever, makes one of the cables (16) taut and the other slack. As the carriage feed is taking place, the cable pulley (20) is turned, which via a clutch, turns the ribbon spool spindle (19) in the printing mechanism (3). The end-of-ribbon contact operates when the end of the ribbon is reached and reverses magnet system (17).

Rocker lever (30) then swings to its other position, tensioning the slack cable. During the carriage return, the cable pulleys (20) are taken out of engagement by means of a free-wheel mechanism.

Ink Ribbon Print Control and Character Visibility Position — Figure 3.6.7

22 The ink ribbon can assume three positions.

(1) Printing on the top half of the ribbon - for local working and transmission.

(2) Printing on the bottom half of the ribbon - for message reception.

(3) Character visibility position - lowering the ribbon below the level of the printed line to reveal the text just printed.

23 Two hinged armature magnets incorporated in the printing mechanism move the ribbon lifter to the required position. The two magnets are energised by the print control on the Printer electronics as follows:

(1) Printing on top half of ribbon - no magnet energised.

(2) Printing on bottom half of ribbon - magnet SW energised.

(3) Character visibility position - magnet SB energised.

Paper Control — Figure 3.6.7

24 When the paper runs out, a sensing lever built into the paper guide actuates microswitch S4. The microswitch signal is sent to the Basic Electronics board, which causes the closure of relay contacts for use external to the teleprinter, for operating an alarm or bell. It also stops the teleprinter.

Operation Unit Counter

25 One operating unit is equivalent to one hour of continuous operation at a speed of 50 bauds. The mechanical counter of the operation unit is driven via an intermediate gear of the stepping motor for column feed. During carriage return, a free-wheel mechanism uncouples the mechanical counter.

Printer Electronics — Figure 3.6.7

26 The Printer electronics is a printed circuit board located on the underside of the Printer. It carries the following amplifiers:

(1) Three AGC amplifiers for the stepping motors.

(2) One AGC amplifier for the print hammer magnet.

(3) Three amplifiers for the magnets of the ink ribbon control and ribbon drive.

In addition, the synchronising information for positioning the print wheel and the operating signals from Switches S1 to S4 are sent to the Basic Electronics via the Printer electronics. The AGC amplifiers are controlled by signals from the Basic Electronics and supply the current set by the matching operation to the stepping motors or print hammer magnet. If the amplifiers for the three magnets of the ribbon reversal mechanism are turned on, they deliver a 40 V pulse for approximately 20 milliseconds and then switch back to a holding excitation of 12 volts.

27 When an operating mode is enabled, the following functions operate automatically.

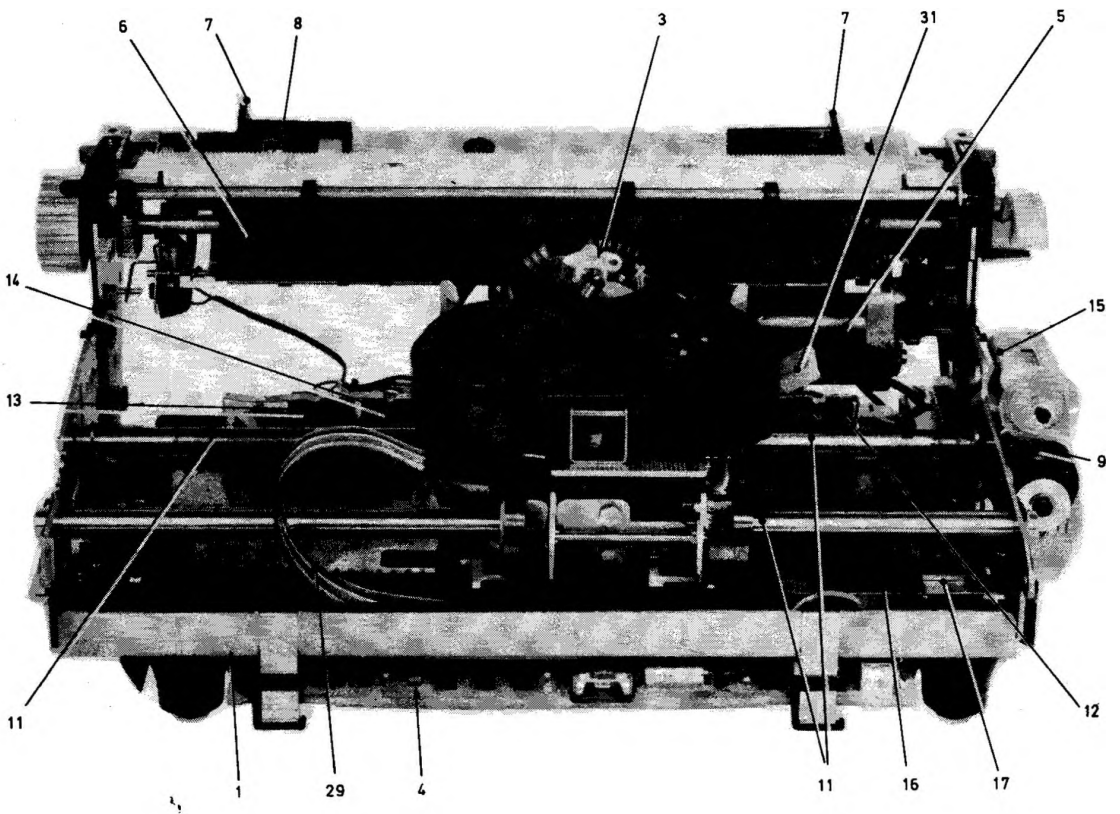
(1) Carriage return to the beginning-of-line position.

(2) Line feed by one line.

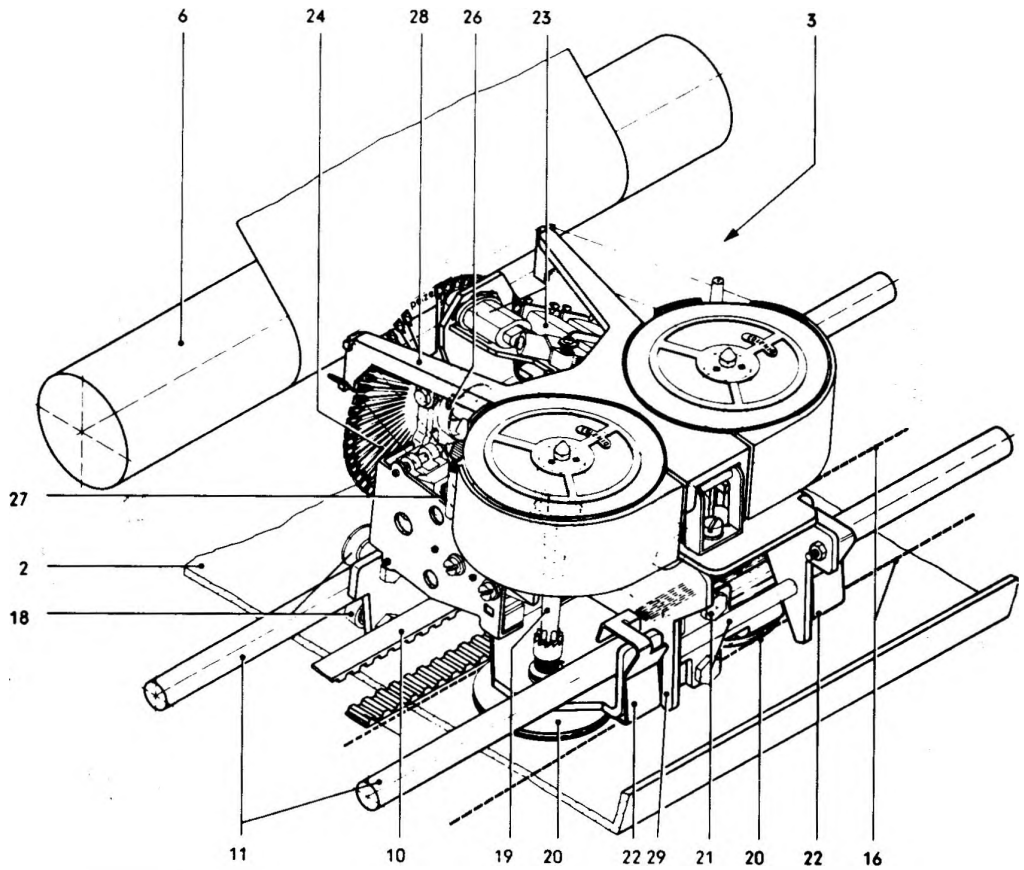
(3) Setting print wheel to character visibility position.

(4) Synchronising run - if required.

(5) Lowering ink ribbon to character visibility position.

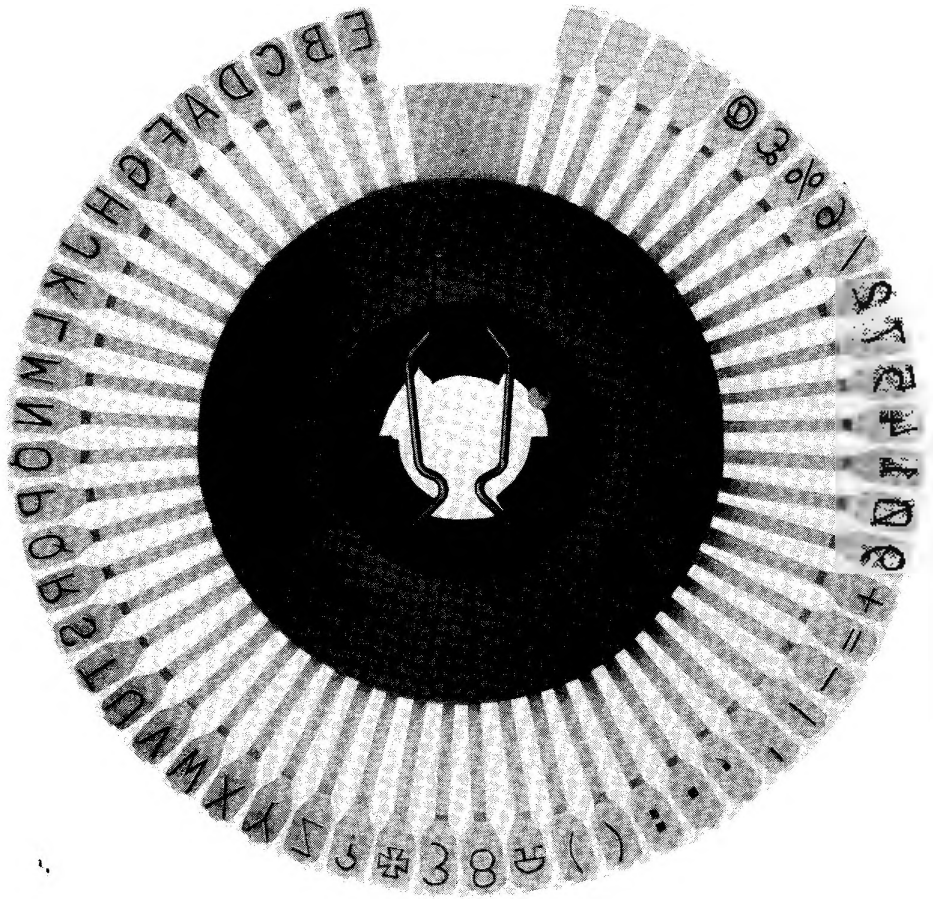


PRINTER CONSTRUCTION FIG. 3.6.2



PRINTER CONSTRUCTION

FIG. 3.6.3



PRINT WHEEL
5815-99-537-5927

FIG. 3.6.4

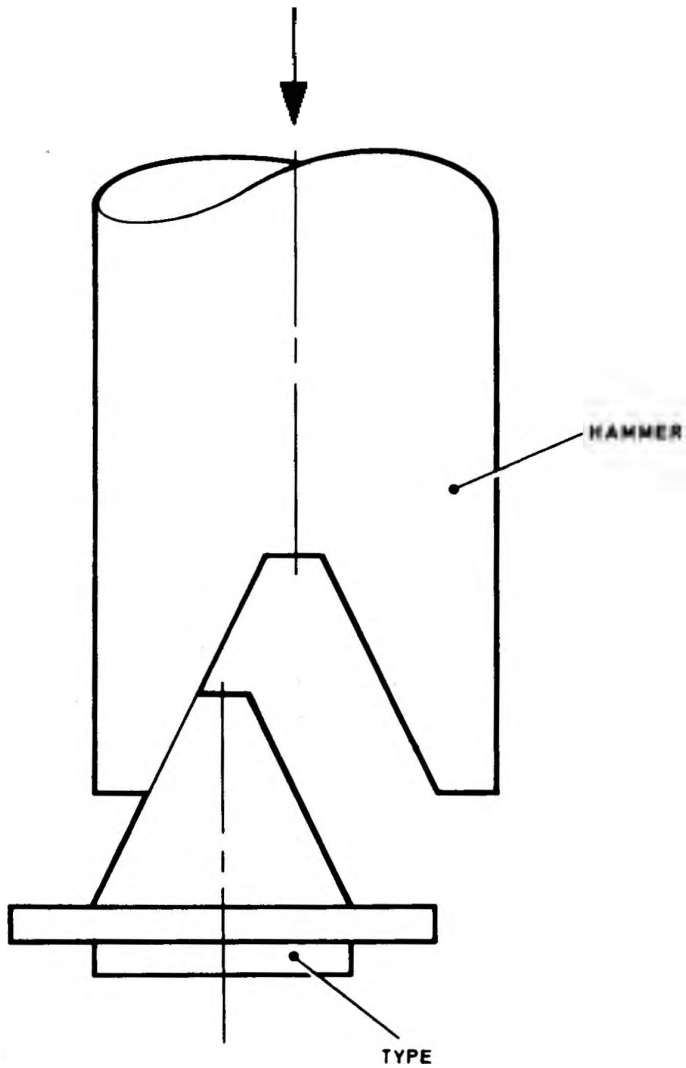
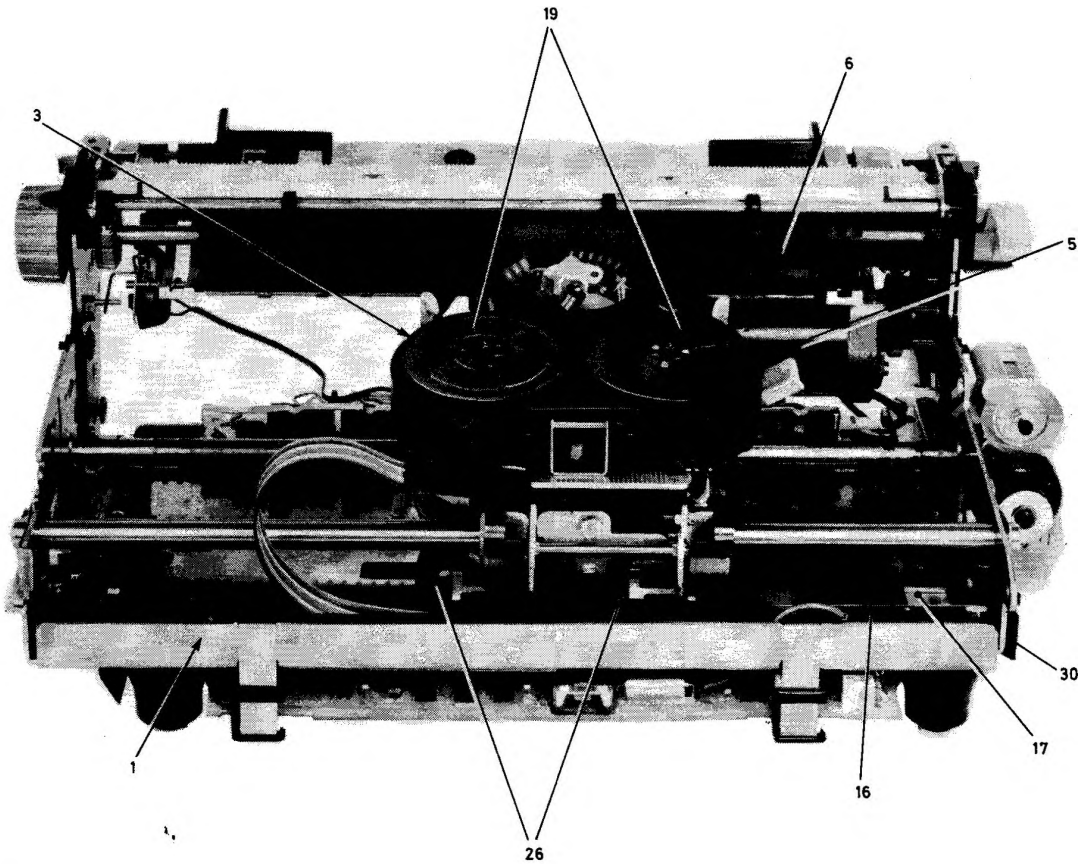


FIG. 3.6.5 PRINT HAMMER



LINE FEED & RIBBON DRIVE FIG.3.6.6

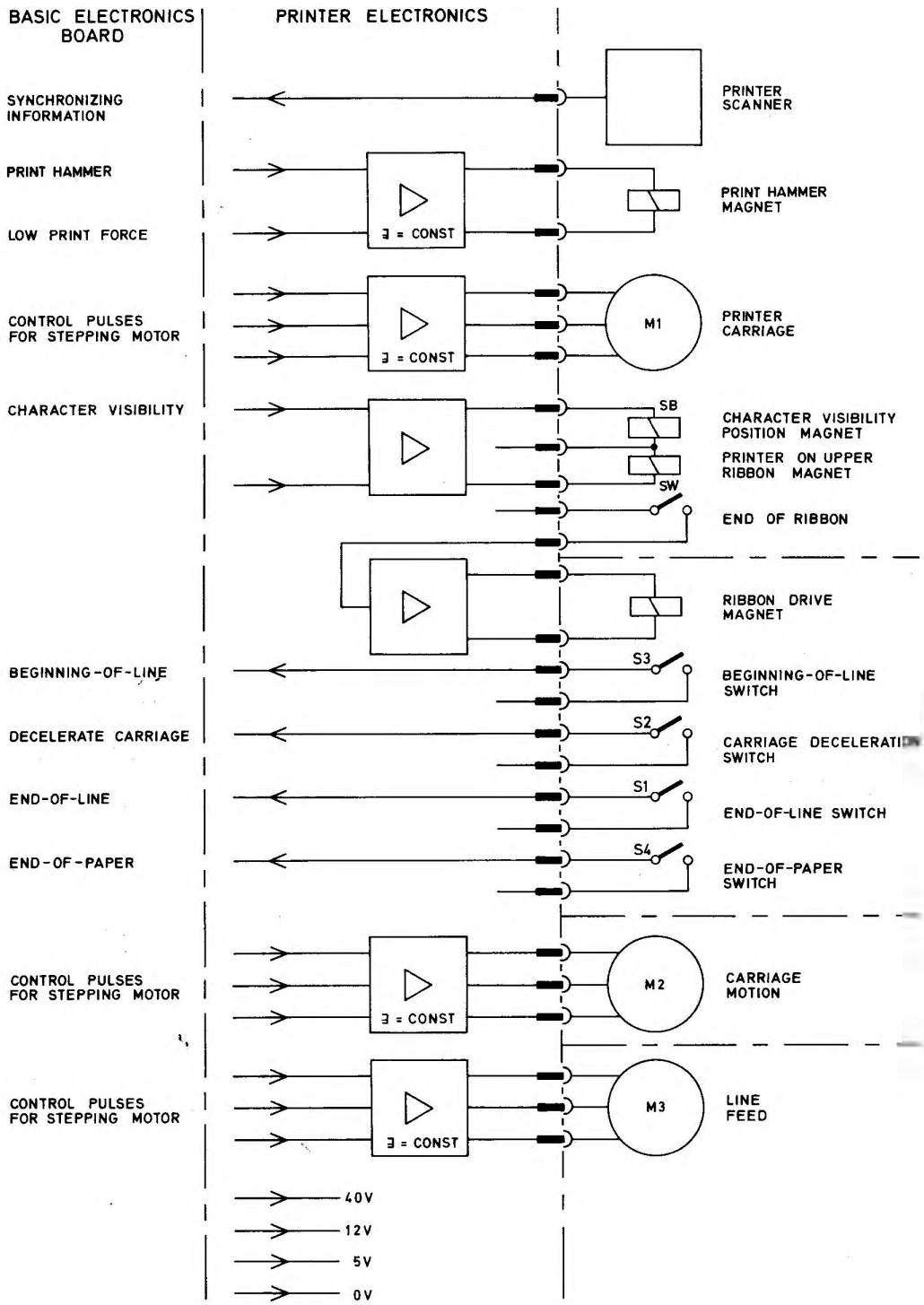


FIG. 3.6.7

PRINTER

SCHEMATIC CIRCUIT DIAGRAM

CHAPTER 7

TELEPRINTER CONTROL BUTTON MODULE

CONTENTS

ILLUSTRATION

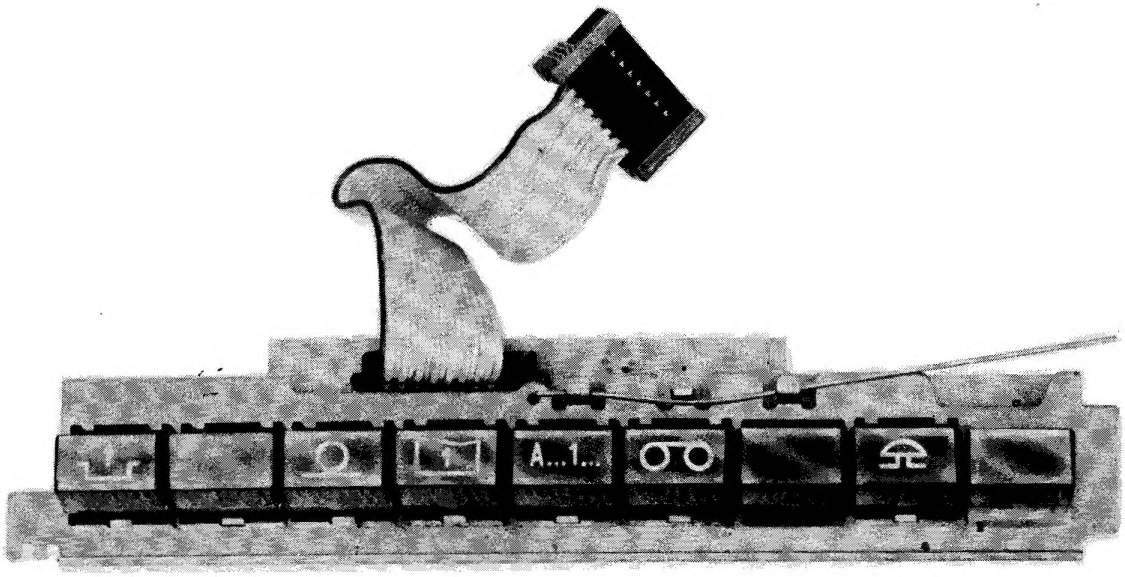


FIG.3.7.1 TELEPRINTER CONTROL BUTTON MODULE
5815-99-537-5919

CHAPTER 7

TELEPRINTER CONTROL BUTTON MODULE

GENERAL INFORMATION

Figure 3.7.1

1 The Teleprinter Control Button module can take up to seven controls and indicators. Each mounting position on the module is assigned a specific function, with the exception of the Unlock button for the Keyboard. Dummy buttons are substituted for mounting positions that are not used.

2 The manual controls and indicators are arranged in a row on a carrier plate and are connected to the Basic Electronics via a printed circuit board and flat ribbon lead. The functions assigned to the manual controls and indicators are denoted by symbol plates on the buttons.

PRINCIPLE OF OPERATION

Mounting Position 1 - Unlock Keyboard

3 This button is used to unlock the Keyboard and has the symbol  on its top surface. A lamp inside the button is lit, when the Keyboard buffer is full or the Printer has reached the end-of-line position. In both cases further typing on the Keyboard is ineffective.

4 When the Keyboard buffer is full, it can be released again by pressing the Unlock Keyboard button, When the Keyboard has reached the end-of-line position, it is released for further typing by pressing the Carriage Return key.

Mounting Position 2

5 This position is not used and is fitted with a dummy button.

Mounting Position 3 - Carriage Return/Line Feed

6 (1) Pressed once, (lamp lights) inhibits page copy to allow corrections to be made on paper tape.

(2) Pressed twice (lamp goes out), Printer carries out a carriage return and line feed action.

The button has the symbol  on its top surface.

Mounting Position 4 - Paper Feed

7 This button is used to feed the Printer paper forward and has the symbol  on its top surface. There is no lamp inside the button. The paper is fed forward for as long as the button is pressed. Brief depressions of the button causes the paper to be fed forward one quarter of a line spacing.

Mounting Position 5 - Letter/Figure Shift

8 Causes the Printer to switch from the letter to the figure case or vice versa, without sending a case shift character to line or corrupt an incoming signal. The button has the symbol A...1... on its top surface.

Mounting Position 6 - Tape Punch On

9 This button, which has no lamp fitted, is used to start the Paper Tape Punch and has the symbol o—o on its upper surface. When the button is depressed the Paper Tape Punch unit is activated, provided an operating mode is enabled and the paper tape is loaded. Every message received by the teleprinter is recorded regardless of whether the appropriate buttons on the tape punch have been operated.

Mounting Position 7

10 This position is not used and is fitted with a dummy button.

Mounting Position 8 - Call Lamp

11 This button illuminates when a distant operator is calling; an alarm rings at the same time. These indications are stopped by pressing the button. The button has the symbol  on its top surface.

Mounting Position 9

12 This position is not used and is fitted with a dummy button.

CHAPTER 8

SWITCH MODULE

CONTENTS

ILLUSTRATION

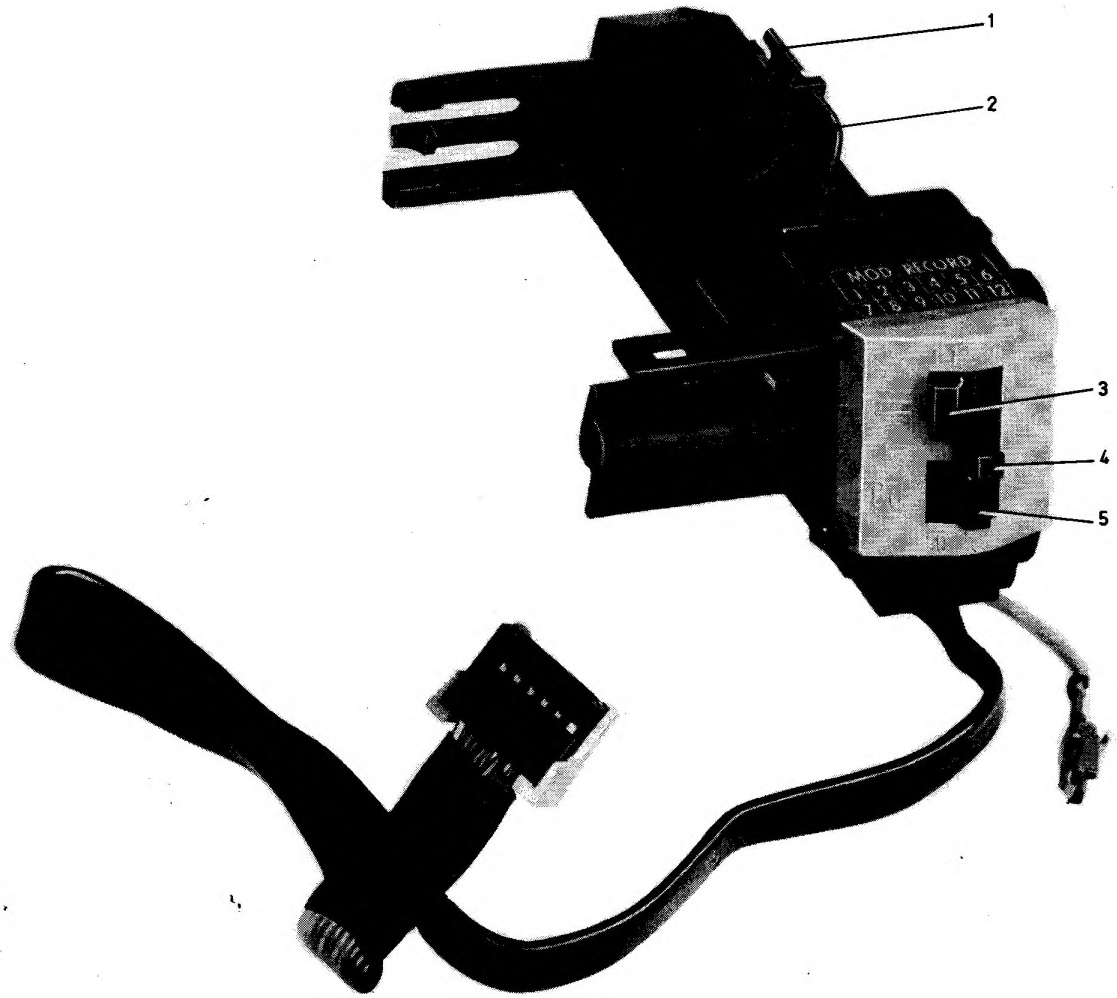


FIG. 3.8.1

SWITCH MODULE
5815-99-537-5920

CHAPTER 8

SWITCH MODULE

GENERAL INFORMATION

Figure 3.8.1

1 This contains the switches for setting the line spacing, print force and telegraph speed. The Switch module is covered with a cap, with the individual names of the switches marked on it.

2 The following are contained in the plastic cover.

(1) Switch 3 - three positions for setting the line spacing.

(2) Switch 4 - two positions for setting the print force.

(3) Switch 5 - three positions for setting telegraph speed.

(4) Lid contacts 1 and 2 - reading lamp power. Contact 1 also indicates lid position.

Line Spacing Switch

3 The switch for line spacing enables the operator to set the line spacing to three possible positions, single line, one and a half or double line spacing. The switch position is recognised by the Basic Electronics, which drives the stepping motor for line feed with the appropriate number of control pulses.

Print Force Switch

4 The print force can be adjusted in accordance with the number of plies contained in the teleprinter paper being used. There are two switch positions, the position for the higher print force being necessary when printing with two to four plies. The higher print force is achieved by means of wider current peak at the start of the control pulse for the print hammer.

Telegraph Speed Switch

5 By means of this switch, the telegraph speed can be set to 50, 75 or 100 bauds. This is achieved by changing the division ratios of the clock pulse generator.

Lid Contact

6 This signals to the control, whether the lid is open or closed. An opened lid could cause an existing connection to be broken or an incoming call not to be accepted.

Power Supply for Reading Lamps

7 Power is supplied to the reading lamps via two contact plates. This enables the teleprinter cover to be removed without having to split a plug connection.

CHAPTER 9

POWER SUPPLY

CONTENTS

ILLUSTRATIONS

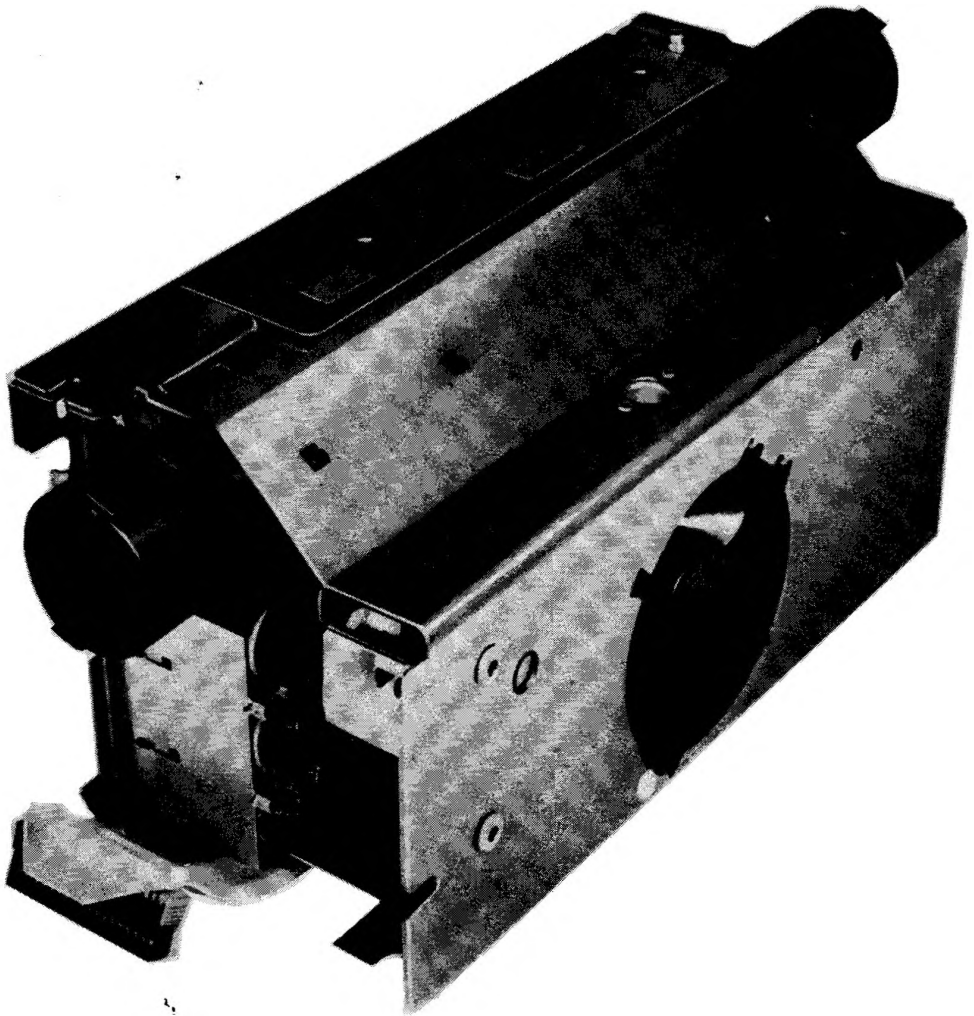


FIG. 3.9.1

POWER SUPPLY
5815-99-537-5926.

CHAPTER 9

POWER SUPPLY

GENERAL INFORMATION

Figures 3.9.1 and 3.9.2

1 The Power Supply module generates the necessary operating voltages for the teleprinter from the ac power supply. These voltages are as follows:

(1) +5 V for the integrated modules.

(2) +12 V for the lamps in the control buttons.

(3) -12 V for the MOS modules.

(4) +40 V for the electromagnets and stepping motors.

The ± 12 V is also used for supplying power to the Line Matching module, which contains a voltage converter for supplying the line voltage.

2 The Power Supply module uses a blocking chopper converter (Figure 3.9.3) which supplies current during the blocking phase of the transistor and operates with the storage transformer T, to which a dc voltage is supplied at timed intervals. The storage transformer stores energy for as long as the transistor is conducting. Only when the transistor is blocked does energy reach the output of the Power Supply module. The stored energy is determined by the inductance and the charging current reached before the transistor is blocked.

3 The output voltage is dependent on the load. When current is drawn off, the stored energy and therefore the output voltage is decreased. The Power Supply module is therefore protected against overloading in the event of a short circuit at the output.

4 The Power Supply module consists of: Figure 3.9.3

(1) Cover - which contains all the modules and essential parts of the power supply. It prevents live parts being touched and acts as a screen.

(2) Rectifier module: The ac power voltage 240 V or 115 V can be selected on this module by means of rotary switch. When it is operating with 240 V, rectification is achieved by means of a bridge circuit. For 115 V operation, a switch is made to a voltage doubler circuit.

(3) Load module is a printed circuit board which contains:

a. The storage transformer T.

b. The pre-amplifier for the switching transistor.

c. The dc converter for the fan.

d. The diodes V2 to V5.

e. Capacitors C.

f. The switching transistor V1.

PRINCIPLE OF OPERATION

Figure 3.9.3

5 The Power Supply module operates at a switching frequency of approximately 30 kHz, which is generated by an oscillating circuit consisting of a plastic foil capacitor and a winding of the storage transformer. The ac voltage applied to the Power Supply module is rectified in the rectifier module and then smoothed and stored by electrolytic capacitors. This enables the teleprinter to operate up to 10 milliseconds in the event of an interruption in mains power.

6 A resistor looped into the line, limits the surge current, enabling the Power Supply module to operate 500 milliseconds after the mains power is applied. A relay then by-passes the resistor and the rectified mains voltage is supplied at timed intervals to the storage transformer. Voltages are tapped from the secondary windings of the storage transformer, rectified and smoothed, then applied at the output of the Power Supply module.

7 In order to keep the output voltages in the required tolerance range, when the Power Supply module is subject to different loads (standby and operating states of the teleprinter), the energy supplied to storage transformer T via switching transistor V1, is controlled by means of the pre-amplifier for the switching transistor. For this purpose the storage transformer includes a measuring winding M, which forms an image of the output voltages and serves as a reference for the comparator circuit in the pre-amplifier for the switching transistor. When the power supply is under heavy load, the pre-amplifier holds the switching transistor conducting longer. This causes the storage transformer to store more energy.

8 If the mains voltage reaches values outside the acceptable range, or if the temperature of the teleprinter becomes too high, the pre-amplifier switches off the power supply. Once the out of tolerance condition is over, the supply is automatically switched on again. A voltage arrester is incorporated as a protection against the high voltage peaks which may occur in the power supply network, eg thunderstorms. In the event of a short circuit at the output of the power supply, a current limiter in the pre-amplifier of the switching transistor operates to protect the components against overloading. Once the fault has been corrected, the power supply resumes operation automatically.

9 The copy lamps (LL) in the Cover are powered by 12 V ac which is supplied via a capacitor (C) and two chokes (L) serving as dropping resistors. The dc-ac converter contained in the load module converts dc to ac under the control of the Basic Electronics. This ac voltage is used to power the fan when the teleprinter is operating.

Changing Supply Voltage (240 V or 115 V)

Figure 3.9.4

10 (1) Release screw on top of power supply and swing unit open.

(2) Turn rotary switch, located on PCB alongside fan to appropriate position.

(3) Close unit and secure.

(4) Ensure label on top of unit is showing supply voltage selected.

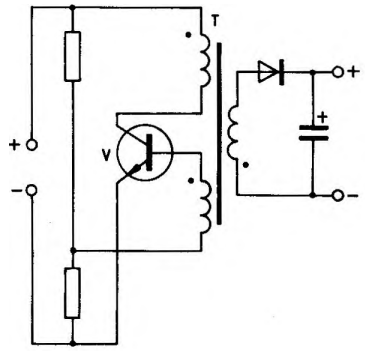
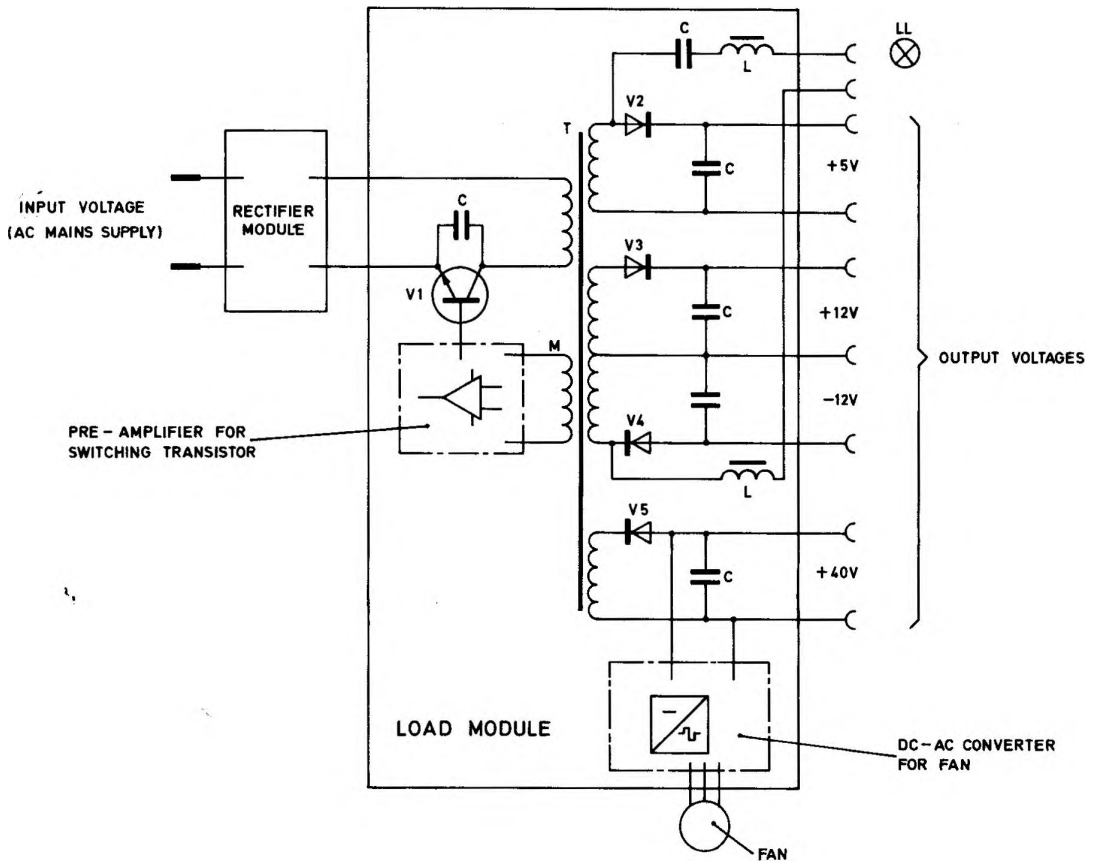


FIG. 3.9.2

CONVERTER
SCHEMATIC CIRCUIT DIAGRAM

FIG. 3.9.2



POWER SUPPLY MODULE
SCHEMATIC CIRCUIT DIAGRAM

FIG. 3.9.3

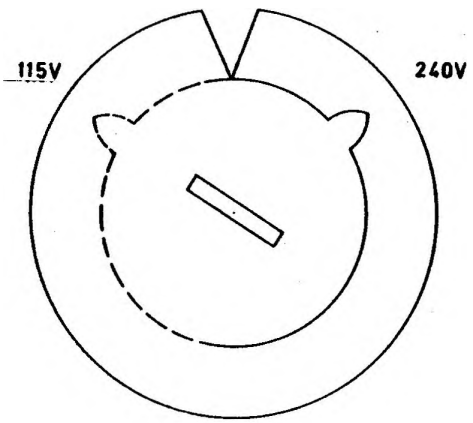


FIG 3.9.4

CHAPTER 10

PAPER TAPE PUNCH

CONTENTS

ILLUSTRATIONS

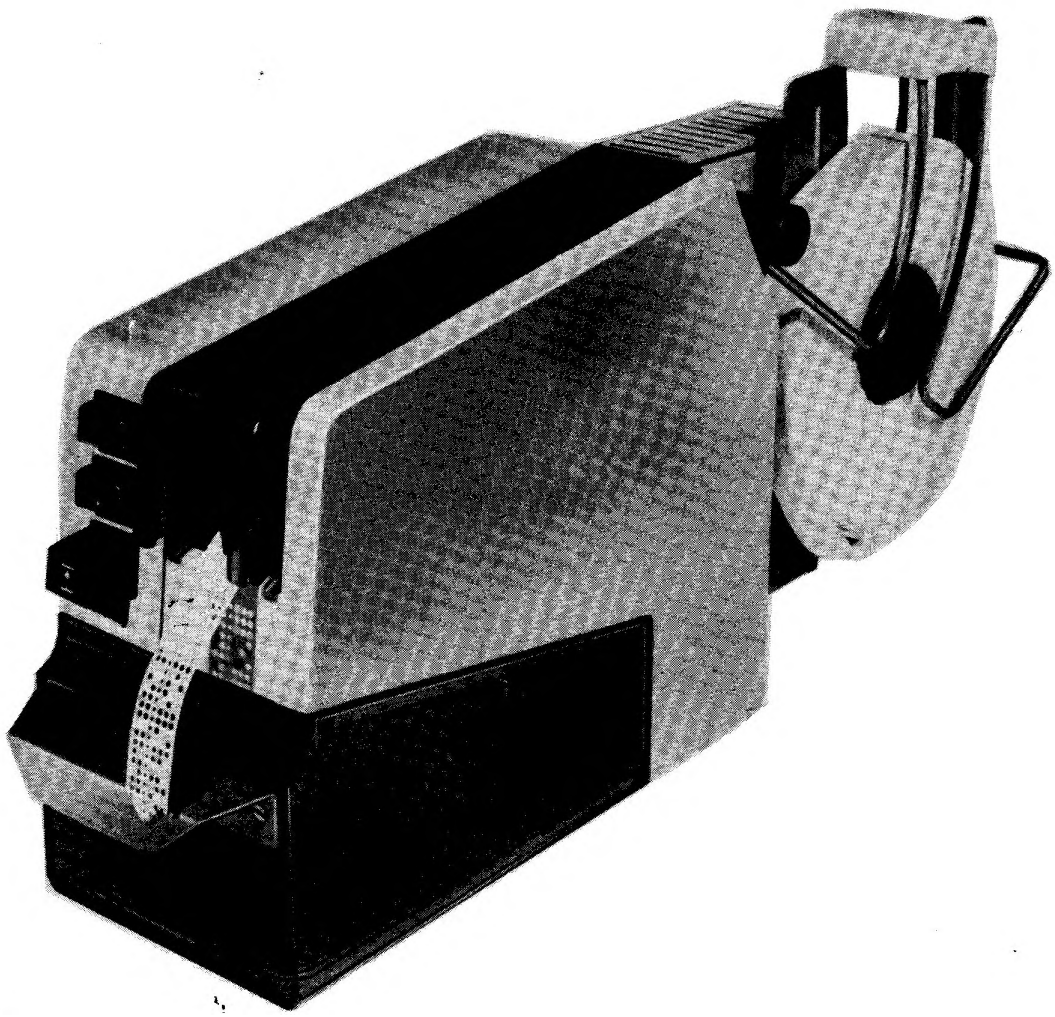


FIG 3.10.1 PAPER TAPE PUNCH
5815-99-537-5924.

CHAPTER 10

PAPER TAPE PUNCH

GENERAL INFORMATION

Figure 3.10.1

1 The punch pins of the punch block and the feed sprocket wheel are driven by rotary magnets via four joint linkages. The tape is fed forward by the pins of a sprocket wheel, which is also driven by a rotary armature magnet, ensuring accurate code hole spacing. The Paper Tape Punch is equipped with an On/Off button, a Tape Feed button and a Tape Backspacing button, which operates mechanically. The inserted tape is advanced automatically after the tape gate is closed. This produces a tape leader punched with code combination 29 (letters shift). The Paper Tape Punch switches off automatically when it recognises the end-of-tape condition.

2 The Paper Tape Punch consists of:

(1) Punch assembly (9).

(2) Punch electronics (4).

(3) Carrier plate (29).

(4) Cover (33) and lid (17).

(5) Tape holder (2) and guide (8).

(6) Chad waste box (20).

Punch Assembly

3 The punch assembly (9) is made up of the mounting frame (10) with rotary armature magnets (11), tape feed unit (25) and punch unit (14). Mounting frame (10) accommodates rotary armature magnets (11) which are linked with punch pins (36) (Figure 3.10.3) of punch block (13) (Figure 3.10.2) via the four joint linkages (35) (Figure 3.10.3). The tape feed unit (25) (Figure 3.10.2) and punch unit (14) are assembled on the mounting frame (10). Tape guide (8) is positioned on the mounting frame (10) and locked in place.

Punch Electronics

4 This is a printed circuit board incorporating the switching amplifiers for the rotary armature magnets. It includes the connectors for leads (6 and 5) which go to the Basic Electronics and the punch assembly respectively.

Carrier Plate

5 The carrier plate (29) carries the punch assembly (9), punch electronics (4) and buttons (30 to 32).

Cover and Lid

6 The cover (33) and tape holder (2) are placed on carrier plate (29) and locked in position. The lid (17) is fastened to the cover.

Tape Holder and Guide

7 The tape holder (2) has a pivoted unwinding guide (1) which guides the roll of paper tape laterally on the stationary core. The tape is fed through the gap between the hinged cover (34) and deflector (7) into the tape guide (8), which leads into the punch block (13). With the tape gate (24) open, the tape leaves the tape punch through the punch block (13), over the sprocket wheel (26) and through the tape exit (21). The tear-off ridge (22) of the tape exit (21) is arrow shaped and has sharp edges, so that when the tape is torn off by pulling upwards, the end has a V-shaped indentation and the beginning, a V-shaped point. This indicates the direction of the tape flow.

Chad Waste Box

8 This is fixed in position under the cover (33). It has the capacity to contain the cuttings from a whole roll of tape.

PRINCIPLE OF OPERATION

9 The information supplied by the Basic Electronics takes the form of TTL signals, which control the rotary armature magnets via the punch electronics (Figure 3.10.4). When a rotary armature magnet (11) (Figure 3.10.3) is energised, the armature (37) rotates away from its preset initial position until it is magnetically latched. The respective four joint linkages (35 or 15) transfers the armature torque with a relatively large stroke to punch pins (36) or to feed pawl (38) in the case of the tape feed unit (25). The punch pins (36) pierce the tape in a time staggered sequence. When the rotary armature magnets (11) are de-energised, the springs (39) pull back the back armatures (37) to their home position and the elbow leverage effect of the four joint linkage, causes the punch pins (36) to be drawn out of the tape. The sprocket wheel (26) then advances the tape by one character pitch and the feed pawl resumes its initial position.

Automatic Tape Feed-In

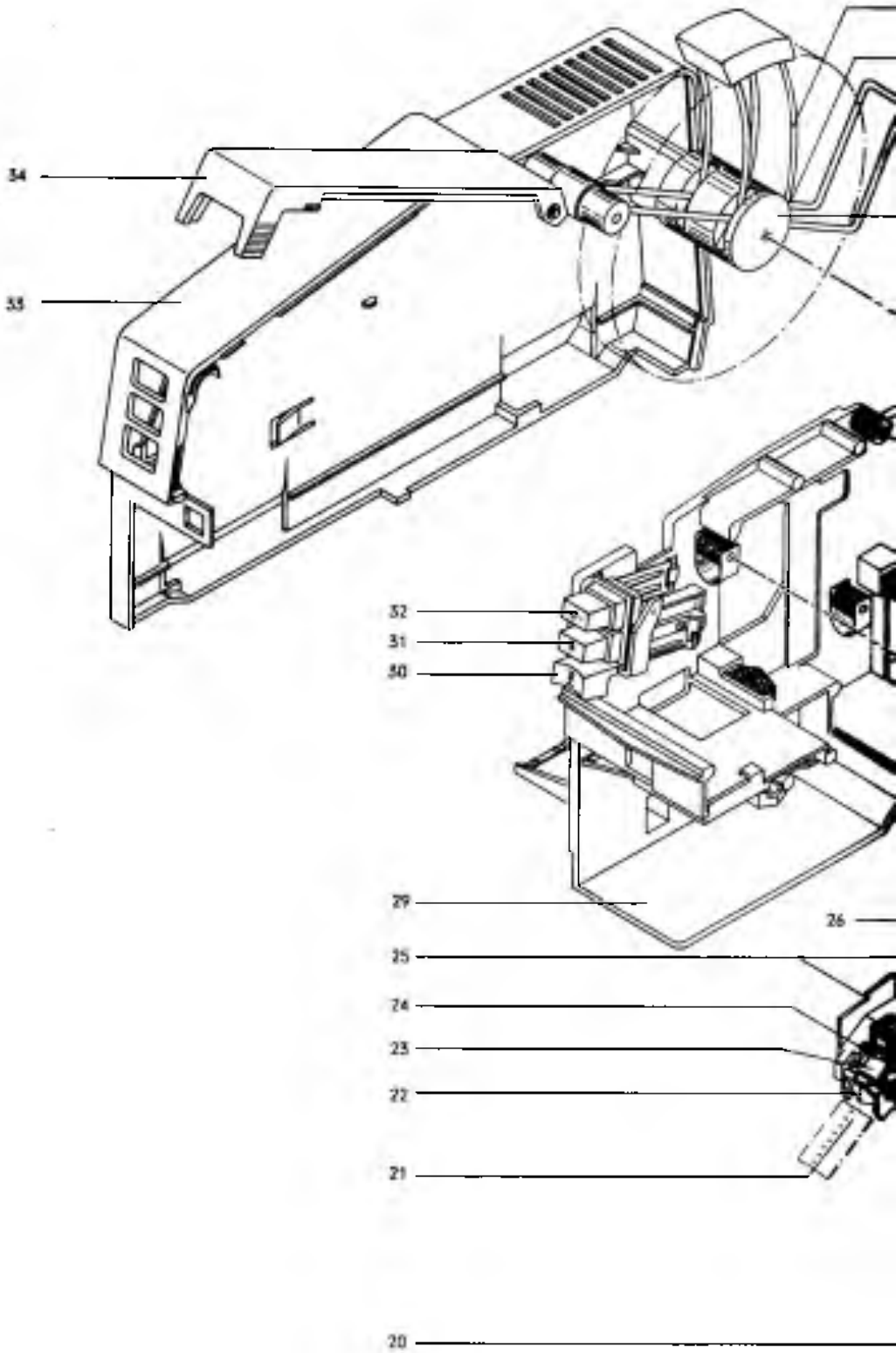
10 When the tape is inserted and the tape gate closed, the tape feeds in automatically. The Basic Electronics energises the rotary armature magnets via the Punch electronics until there is a tape leader the length of 32 character pitches punched with the "Letters" code combination 29 (ie 5 holes). At the end of the automatic tape feed-in, the On/Off button becomes operative.

Control Buttons

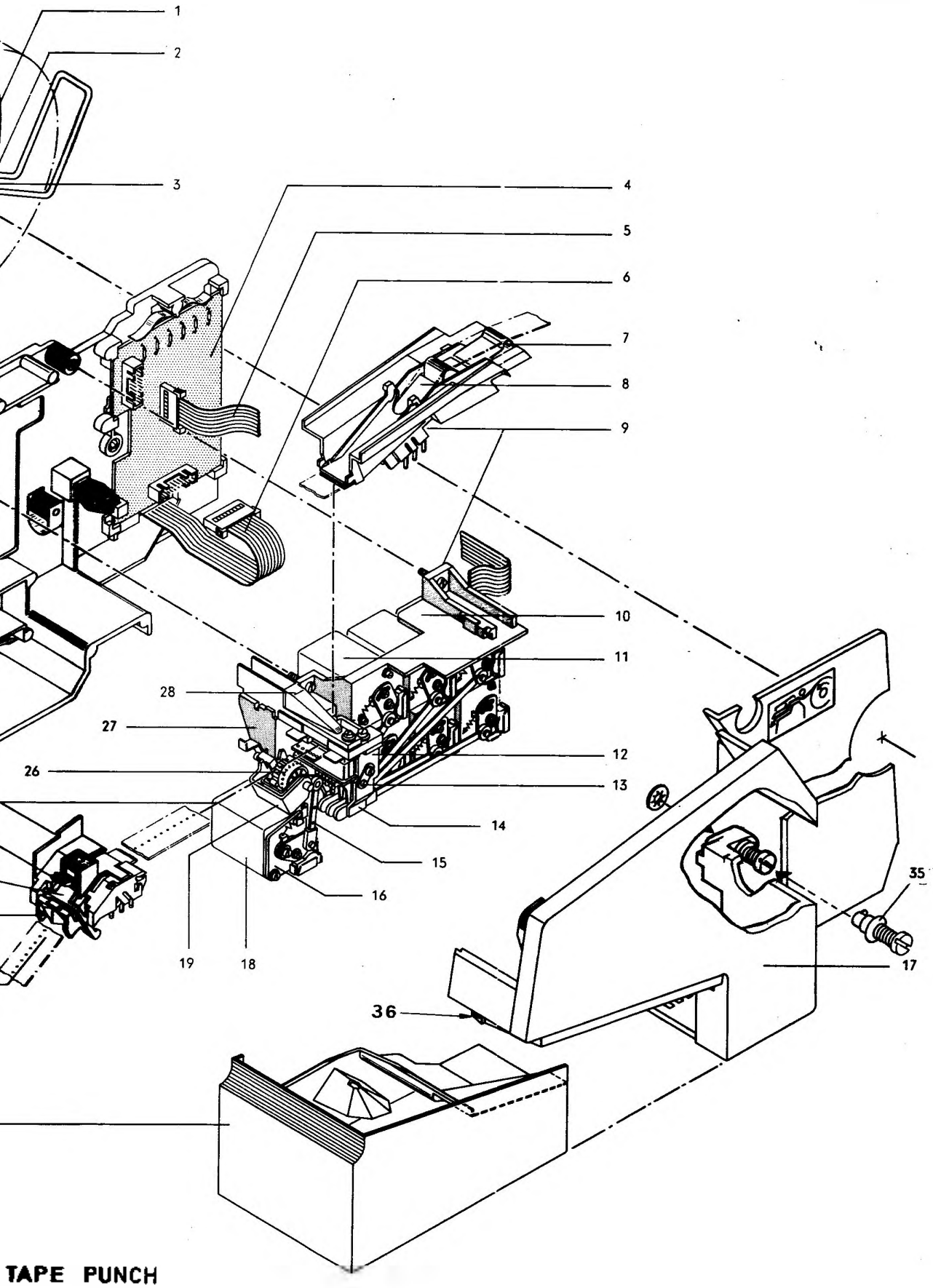
11 The Paper Tape Punch is switched on or off by pressing the On/Off button. If the Punch is switched on, the lamp in the button is lit. While the Tape Feed button is held depressed, the tape is fed forward and punched with code combination 29 (5 holes). Each time the Tape Backspacing button is pressed, the tape is moved backwards mechanically by one character pitch. Backspacing should be limited to ten character pitches to avoid pinching the edges of the holes when overpunching the tape.

End-of-Tape

12 A spring-loaded strip, which projects into the tape guide, actuates the end-of-tape contact. The contact opens when the tape runs out, switching the Paper Tape Punch off.

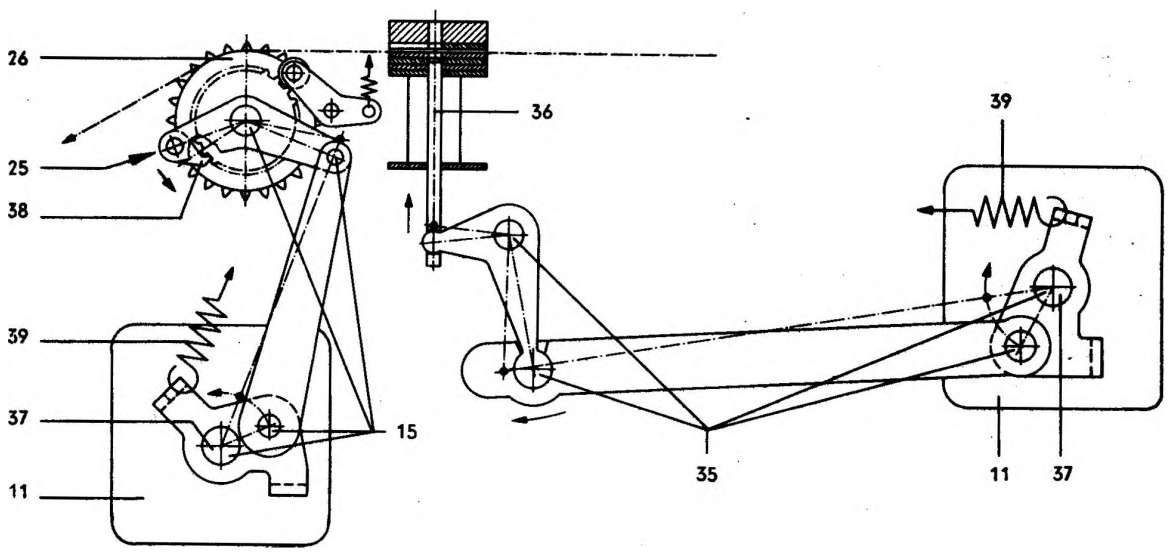


PAPER TAPE
EXPLODED V



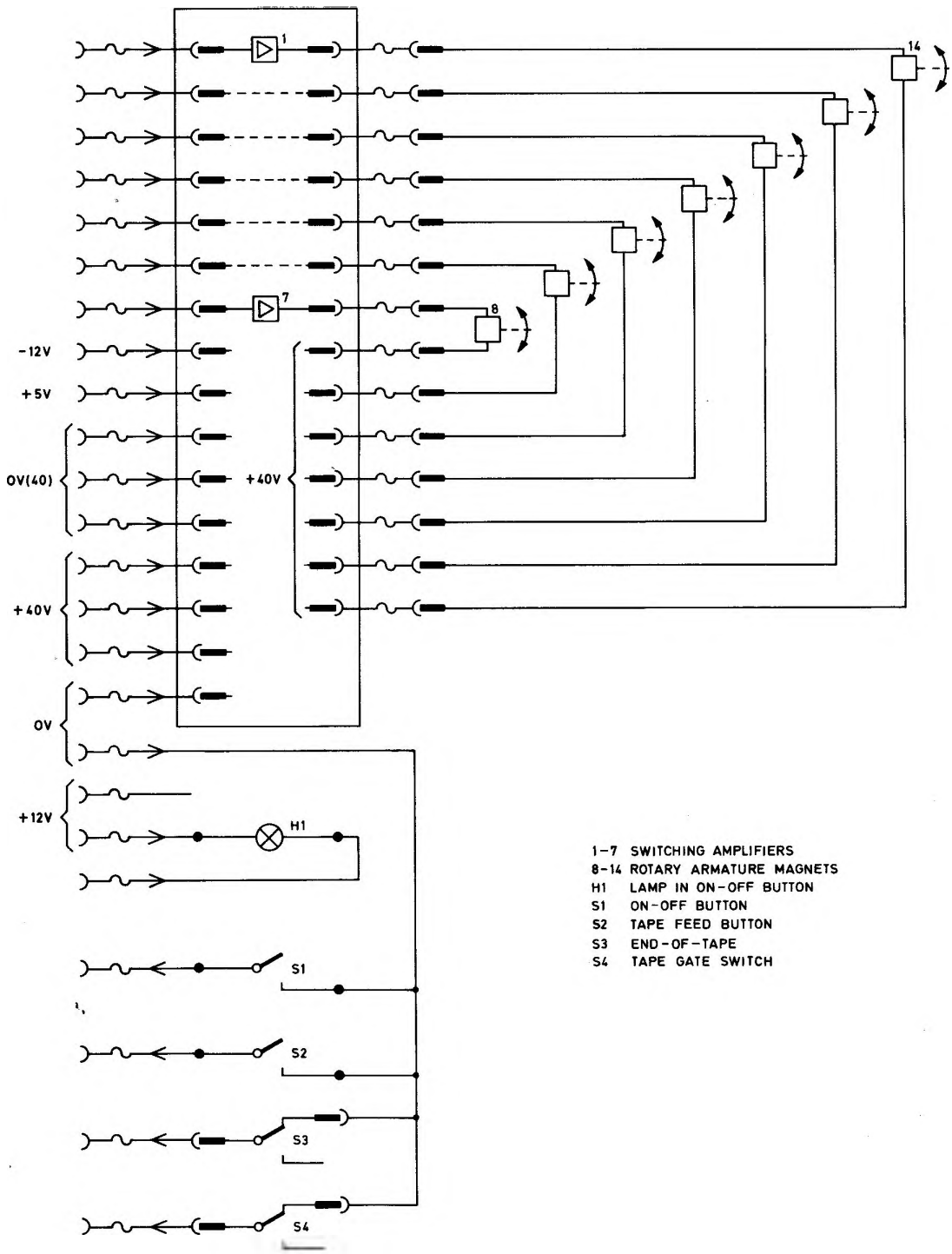
TAPE PUNCH
DED VIEW

FIG. 3.10.2



PUNCH PIN OPERATING MECHANISM

FIG. 3.10.3



1–7 SWITCHING AMPLIFIERS
8–14 ROTARY ARMATURE MAGNETS
H1 LAMP IN ON-OFF BUTTON
S1 ON-OFF BUTTON
S2 TAPE FEED BUTTON
S3 END-OF-TAPE
S4 TAPE GATE SWITCH

PAPER TAPE PUNCH
SCHEMATIC CIRCUIT DIAGRAM

FIG. 3.10.4

CHAPTER 11

PAPER TAPE READER

CONTENTS

ILLUSTRATION

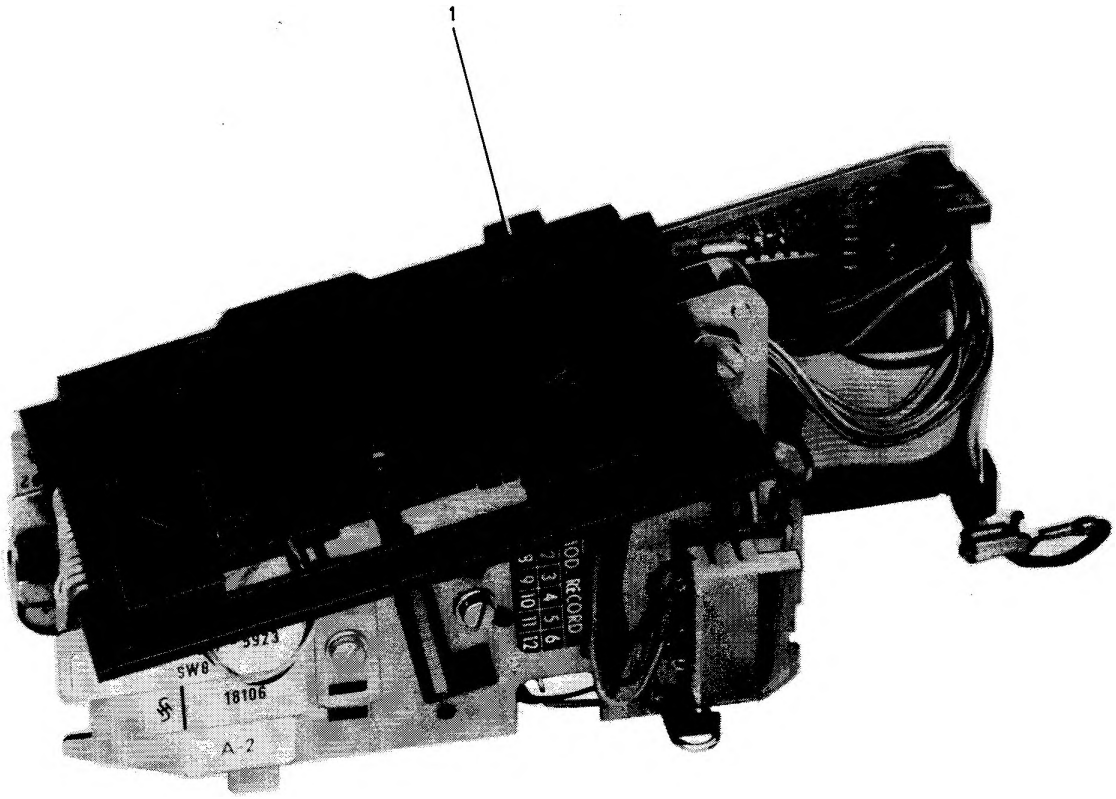


FIG.3.11.1

PAPER TAPE READER
5815-99-537-5923

CHAPTER 11

PAPER TAPE READER

GENERAL INFORMATION

Figure 3.11.1

1 The information on the punched tape is read photo-electrically while the tape is stationary, by means of luminescence diodes and photo-transistors. A sprocket wheel driven by a stepping motor then feeds the tape forward one character pitch. When the Paper Tape Reader is switched on, the tape is fed forward either one character at a time or continuously. A Taut Tape switch interrupts the tape feed if the tape becomes too taut, preventing damage to the tape.

2 The Paper Tape Reader is made up of:

(1) Drive unit.

(2) Scanning device.

(3) Reader electronics.

Drive Unit

Figure 3.11.3

3 This contains a stepping motor (7), an intermediate gear (8) and sprocket wheel (9), contained within the frame (11). Mounted on the frame is a taut tape switch (2).

Scanning Device

4 The scanning device is mounted on the frame (11) and locked in position. It contains the diode unit and transistor unit, the plastic base (6), with the tape guide (5) and hinged gate (4) which covers the tape guide channel. The diode unit containing the luminescence diodes and balancing resistors is accommodated in the tape gate (4). The transistor unit containing the photo-transistors is installed in the plastic base (6).

Reader Electronics

5 This is a printed circuit board with the amplifiers for the photo-electric currents and the drivers for the stepping motor.

PRINCIPLES OF OPERATION

Figure 3.11.4

6 When the Paper Tape Reader is switched on, the luminescence diodes emit infra-red light. With the tape gate closed and the holes punched in the tape (16) or when no tape is loaded in the Reader, this infra-red light strikes directly on the opposite photo-transistor (17) Amplifiers in the circuit amplify the photo-electric currents and pass the information to the Basic Electronics.

7 The light channels (13) in front of the photo-transistors (17) and luminescence diodes (12) produce a large light to dark ratio. These light channels are covered with glass plates (15) for protection.

Feeding the Punched Tape Forward

8 It takes four steps of the motor for the sprocket wheel to advance the tape by one character pitch. The selected transmission ratio between stepping motor and sprocket wheel gives the tape an exact rest position in relation to the reading point and provides a high tractive force for the tape.

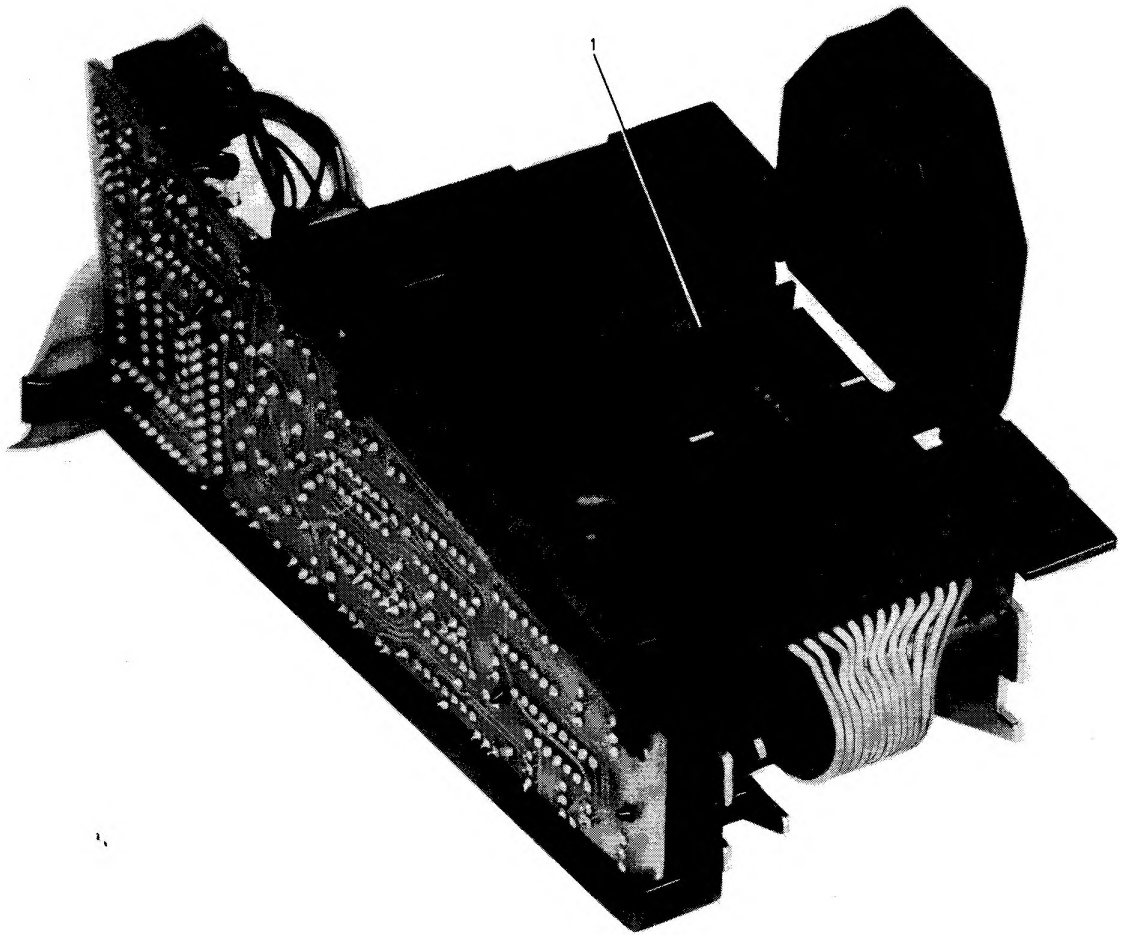
Single and Continuous Character Feed — Figures 3.11.1, 3.11.3

9 The single character feed is tripped by pressing the On/Off button (1) briefly (<250 ms). Pressing the button longer (>250 ms) produces continuous feed. A timing stage in the Basic Electronics of the teleprinter decides whether single or continuous feed is switched on. Immediately the On/Off button is pressed, a character is transferred into the Basic Electronics, where the read character is stored and processed. The transfer of the character activates the stepping motor and the tape is fed forward by another character. This completes a single character feed.

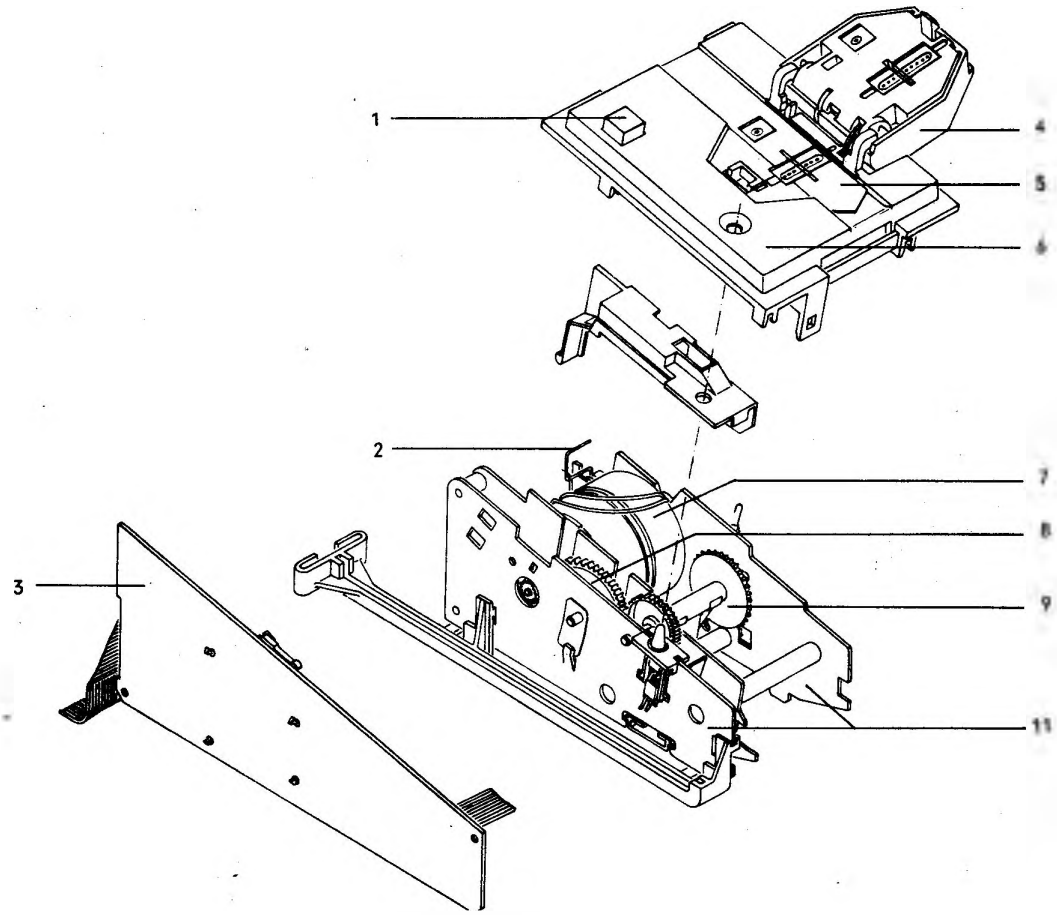
10 In continuous feed, the process of reading continues until the end-of-tape condition is recognised or a distant station breaks in on the transmission. The Reader will continue this process until it is switched off by pressing the On/Off button.

End-of-Tape Condition — Figure 3.11.2

11 The end-of-tape condition is recognised via the feed hole scanning facility (1). This facility is located eight character pitches in front of the information scanning facility in the tape feed direction. If the Reader is set for continuous feed, the end-of-tape condition is only recognised if no feed hole is sensed after nine successive light to dark changes have occurred. This ensures that the very last character on a tape is also read. When the end-of-tape condition is recognised, the Reader is switched off.

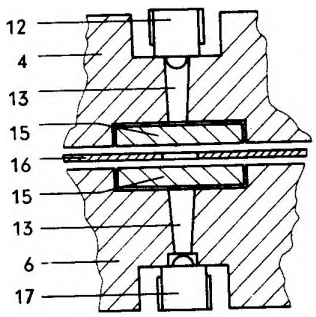


FEED HOLE SCANNING FACILITY FIG.3.11.2



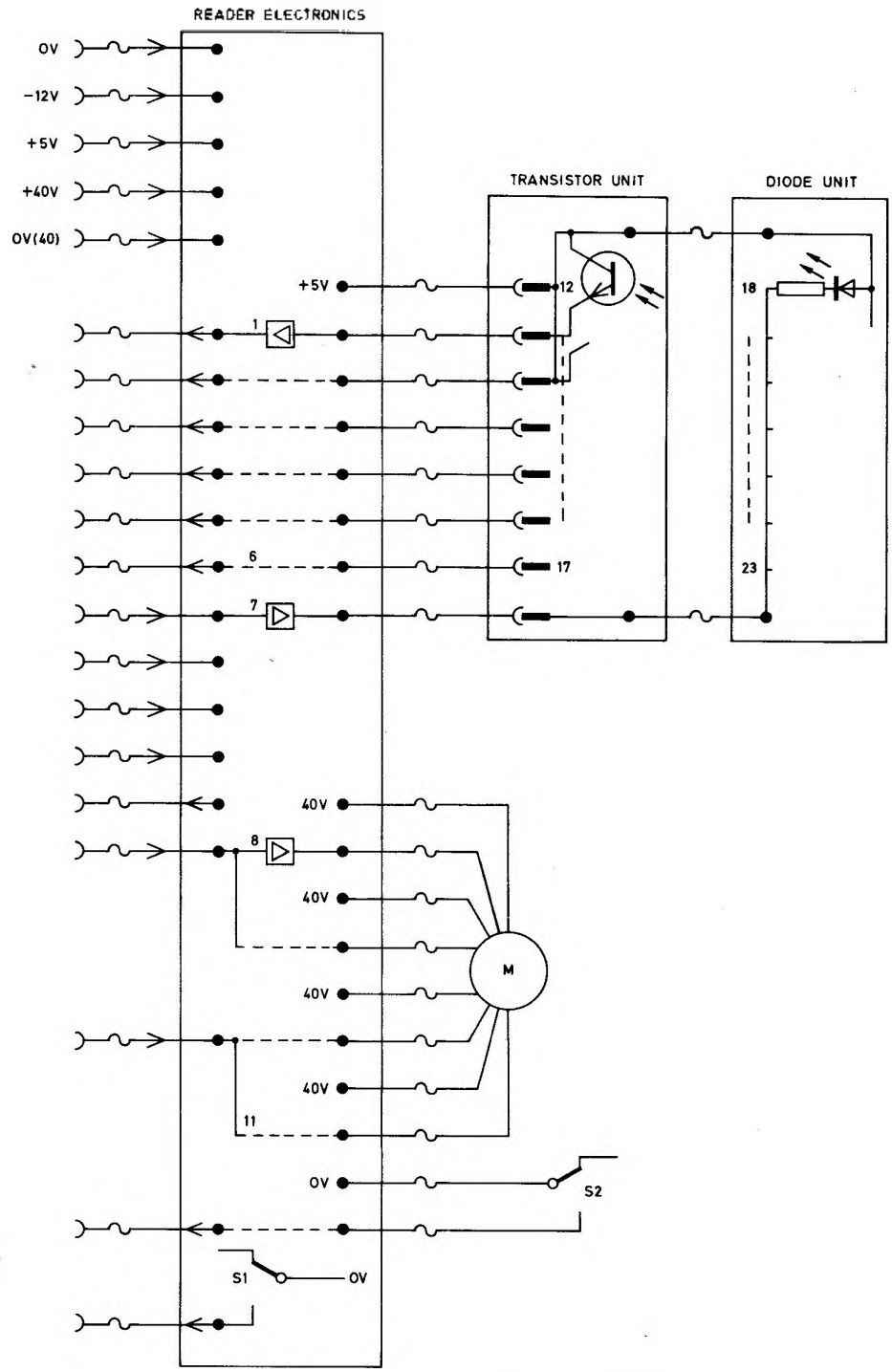
PAPER TAPE READER
EXPLODED VIEW

FIG. 3.11.3



PAPER TAPE READER
LIGHT CHANNELS

FIG. 3.11.4



1–6 READ AMPLIFIERS
7 AMPLIFIER FOR REDUCING THE LEVEL FOR THE LUMINISCENCE DIODES
8–11 AMPLIFIERS FOR CONTROLLING THE STEPPING MOTOR
12–17 PHOTOTRANSISTORS
18–23 LUMINISCENCE DIODES AND BALANCING RESISTORS
0V(40) 0V LEAD FOR 40V

M STEPPING MOTOR
S1 ON-OFF SWITCH
S2 TAUT TAPE SWITCH

PAPER TAPE READER
SCHEMATIC CIRCUIT DIAGRAM

FIG. 3.11.5

CHAPTER 12

LINE CONTROL BUTTON MODULE

CONTENTS

ILLUSTRATION

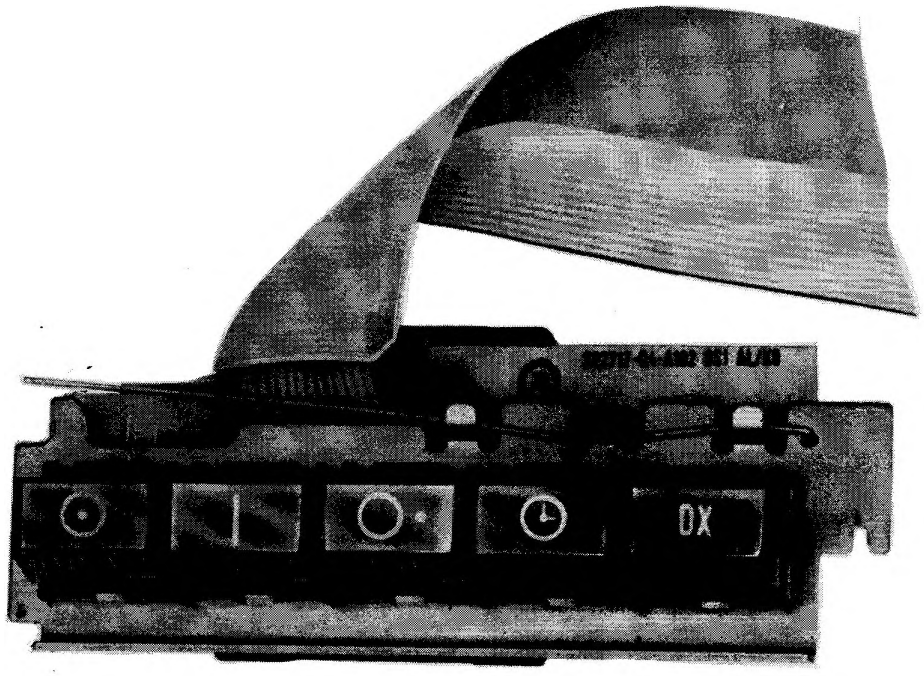


FIG. 3.12.1 LINE CONTROL BUTTON MODULE
5815-99-537-5931

CHAPTER 12

LINE CONTROL BUTTON MODULE

GENERAL INFORMATION

Figure 3.12.1

1 The Line Control Button module with the Line Matching module and Control module, form the line interfacing system. The Line Control Button module is fitted above the Keyboard on the left-hand side of the teleprinter. It contains five illuminated buttons which when pressed, enables the teleprinter to operate in different modes. The lamps in the buttons indicate its functional state.

Mounting Position 1 - Call/Alarm Button

2 When this button is depressed, it causes the following:

(1) Switches teleprinter to On-line mode.

(2) Illuminates Line (Half Duplex) button.

(3) Switches page copy illumination lamps on.

(4) Carriage return/line feed action.

The Call/Alarm button flashes during the following states:

(5) Teleprinter cover open, in non-operational mode.

(6) Teleprinter paper run out.

(7) Paper tape run out, if the Paper Tape Punch has been selected.

If after 70 seconds of depressing the Call/Alarm button the teleprinter has not been operated, it automatically switches itself off, unless the Continuous Line button has been depressed. The Call/Alarm button has the symbol  on its top surface.

Mounting Position 2 - Local (Off-line) Button

3 Depressing this button causes the teleprinter to operate in Local conditions, enabling the following to take place:

(1) Typing of text via the Keyboard.

(2) Preparation and correction of the paper tape.

In this mode, the teleprinter operates at 100 bauds irrespective of the position of the Signalling Speed switch. The button has the symbol  on its top surface.

Mounting Position 3 - Line (Half Duplex) Button/Disconnect

4 When this button is illuminated it indicates the teleprinter is in the On-line mode. Depressing this button switches the teleprinter to a non-operational condition. The button has the symbol  on its top surface.

Mounting Position 4 - Continuous Line Button

5 Depressing this button stops the teleprinter being switched off after 70 seconds of no traffic, keeping it continuously switched to Line. The button has the symbol  on its top surface.

Mounting Position 5 - Duplex Working Button

6 Indicates that the teleprinter is in a transmit and receive state. The button has the symbol DX on its top surface and lights when pressed.

C H A P T E R 13

C O N T R O L M O D U L E

CONTENTS

ILLUSTRATION

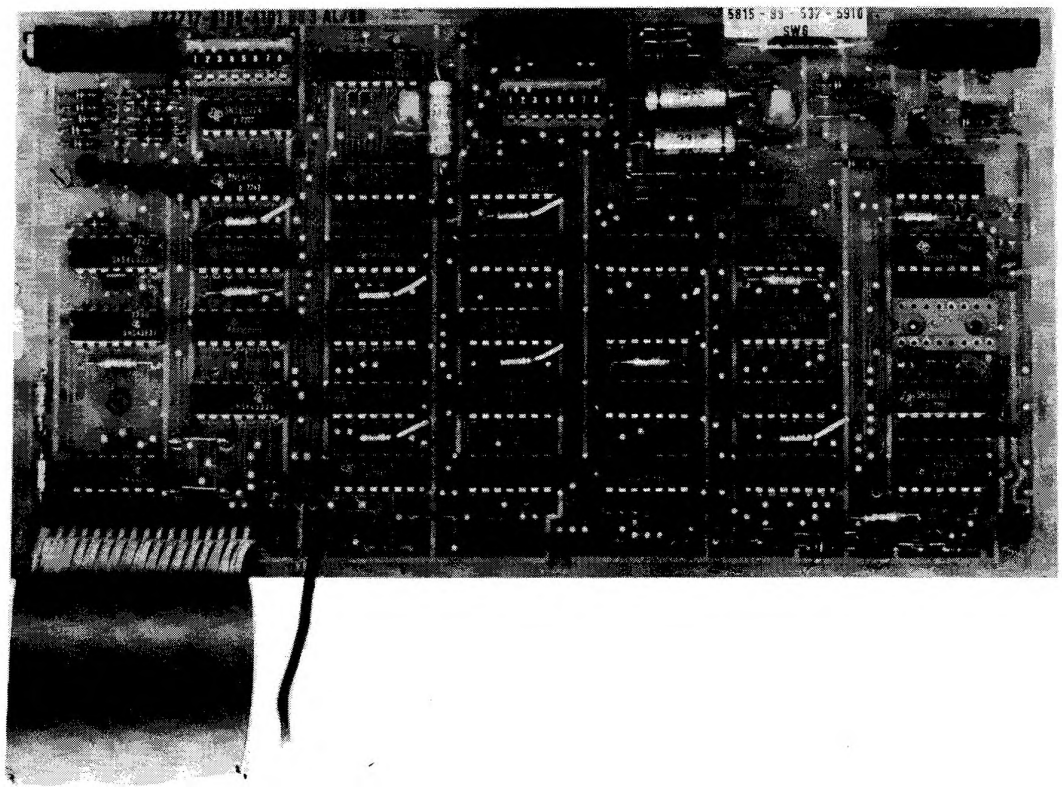


FIG. 3.13.1 CONTROL MODULE BOARD
5815-99-537-5910

CHAPTER 13

CONTROL MODULE

GENERAL INFORMATION

Figure 3.13.1

1 The Control module performs the switching orientated and operational functions of the line interface unit. It consists of a printed circuit board containing digital circuits. The Control module intercepts the signals for setting up the different forms of control from the manual controls and Line Matching modules and generates the necessary signals for the next functional sequence. These signals, depending on the particular control function to be carried out, are then passed to the Basic Electronics, Line Matching or manual controls.

PRINCIPLE OF OPERATION

Figure 3.13.2

2 The Control module uses a large scale integration MOS circuit referred to as the programmable sequential switching circuit, which includes a register for storing the operating states, two controllable timers, a main matrix and an output matrix. The control sequence is specified in the matrices and is sub-divided into operational phases, eg Standby or Operational. The input signals are combined in the main matrix with the existing operating state, so that the register status can be changed and a new operating phase entered. The signals or sequences which produce a transition from the current operating phase to a new one are specified in the main matrix. For example, a transition is made from the standby phase to the Local mode, as the result of pressing the Local button. The output signals necessary in this case, such as the status of the signal line or lamp indicators in the manual controls, are specified in the output matrix.

3 Different functions, such as the generation of the call signal, division of timing pulse and logic operations are implemented outside the programmable sequential switching circuits by means of TTL integrated circuits. Matching circuits and level converters are used to match signals to interfaces S1 to S3. The matching units include an electrical time switch which turns off the teleprinter automatically after a predetermined time of 70 seconds of non transmission or reception of the last telegraph character. This automatic operation can be rendered ineffective by pressing the Continuous Line button on the Line Control Button module. Receive only machines, which do not have manual controls, normally switch off after 70 seconds.

4 The various timing patterns, eg for transmission of a start polarity pulse are generated via frequency divider chains, keeping the specified times to within small tolerances and unchanged over the life of the printed circuit board. This means that no adjustments are necessary on this module.

Character Release (Pulse Release Mode)

5 A DIL switch unit, located in the top left-hand corner of the Control Module board, enables the teleprinter to be switched from normal operation to either a 1 kHz tone or dc character release pulse of 6 V, to operate the TGN Teleprinter Keyboard or Paper Tape Reader. Character release position of switch 5 of the DIL switch unit is in the up position.

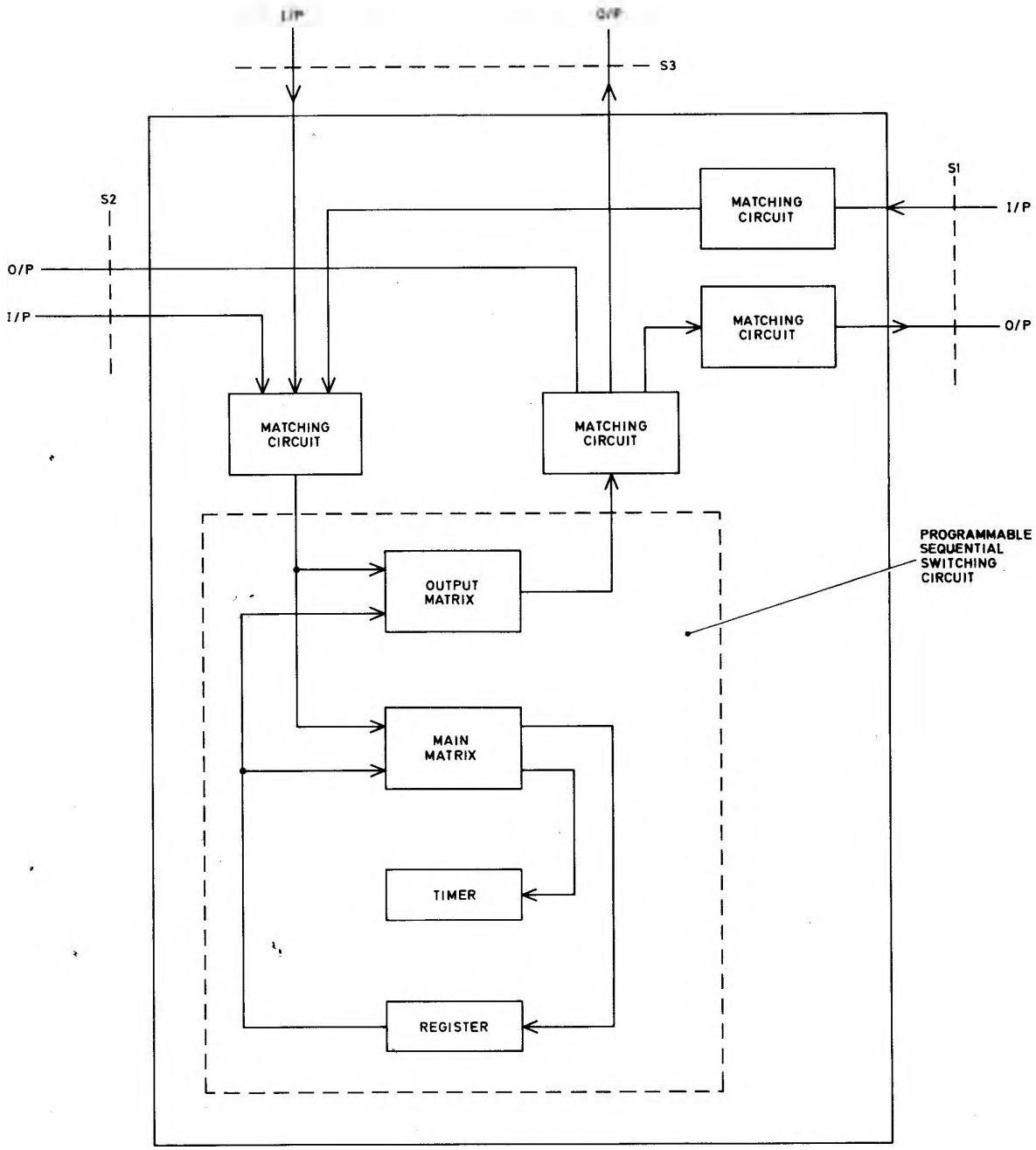


FIG. 3.13.2

CONTROL MODULE
BLOCK DIAGRAM

CHAPTER 14

LINE MATCHING MODULE AND PROTECTOR

CONTENTS

ILLUSTRATION

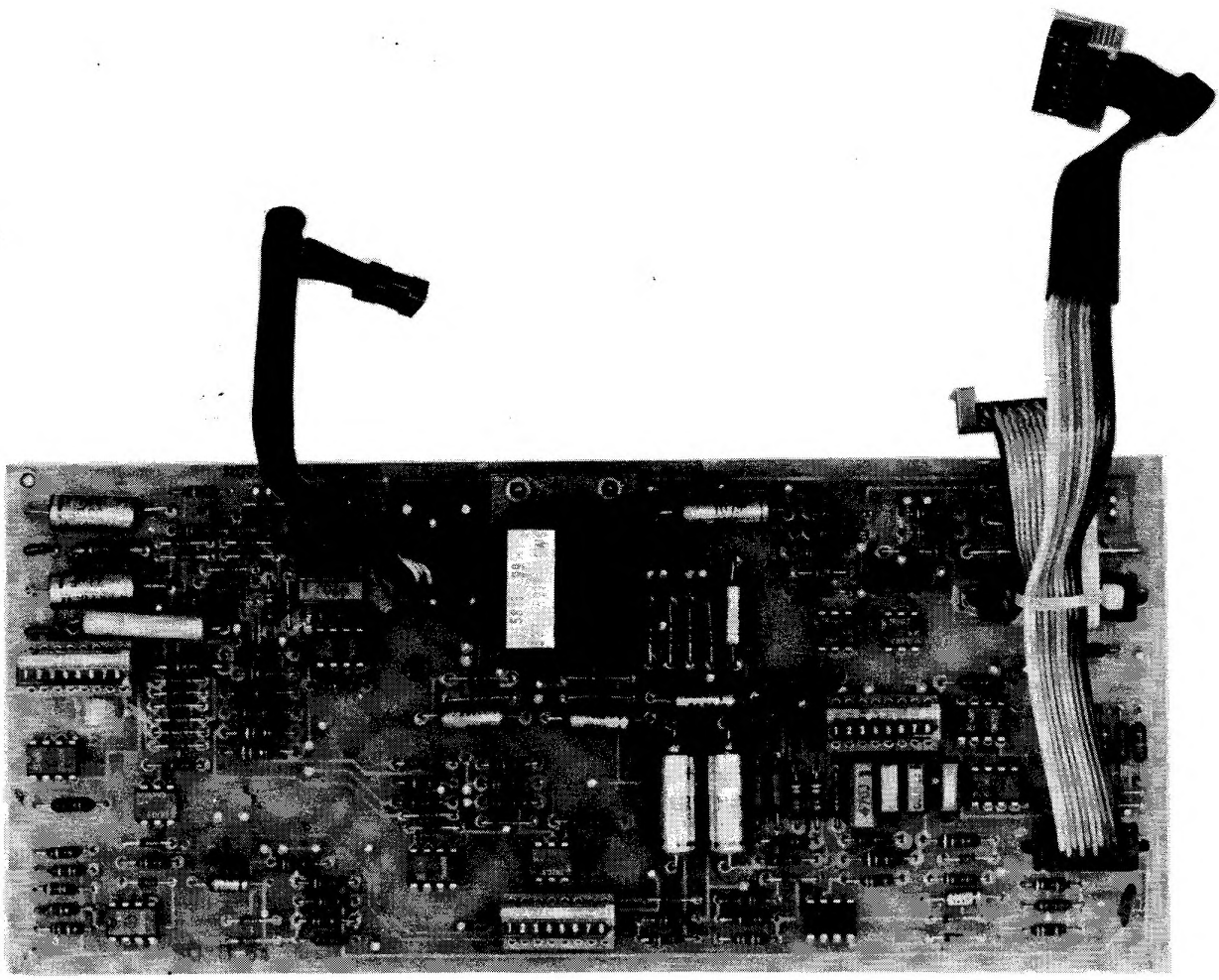


FIG. 3.14.1 LINE MATCHING MODULE BOARD
5815-99-537-5911

CHAPTER 14

LINE MATCHING MODULE AND PROTECTOR

GENERAL INFORMATION

Figure 3.14.2

1 The Line Matching module board mainly consists of analogue electronics. It converts the different levels at interfaces S0 and S0' to the teleprinter's internal voltage level and dc decouples the line circuit from the teleprinter's internal circuitry. The dc decoupler prevents mutual interference between the teleprinter and signal line.

PRINCIPLES OF OPERATION

2 The Send circuit is an electronic equivalent of the Send contact of conventional teleprinters. The receive circuit is an electronic equivalent of the selector magnet of conventional teleprinters. In the Line Matching modules for double (polar) current operation, the Send circuit regulates the current in the Send path automatically. A current limiter is included in the receive circuit.

3 With low level, double current transmission, the Receive circuits interpret the incoming signals, (which are often distorted by noise) by means of a special scanning method, suppressing noise of <2 ms on the signal line. The noise voltage filter in the Line Matching module ensures that the noise voltage values required by the telecommunication carriers are maintained. The inductance of the noise voltage filter also improves the transmission characteristics.

4 The voltage converter generates auxiliary voltages of +12 V, 0 V, -12 V supplied via interface S2. In the case of the internal power supply, the voltage converter supplies keying voltages to the Send circuit.

Protector

5 The Protector Circuit comprises the Mains Filter (Suppressor RF) and Signal Filter Unit.

6 The Mains Filter ensures, by the use of suitable components that noise voltages on the mains supply due to the teleprinter operation are kept within prescribed limits. A voltage arrestor is incorporated as a protection against random high voltage peaks which can occur in the supply.

7 The Signal Filter Unit protects the teleprinter against external surge voltages, particularly when the teleprinter is used direct to line without the Interface Unit.

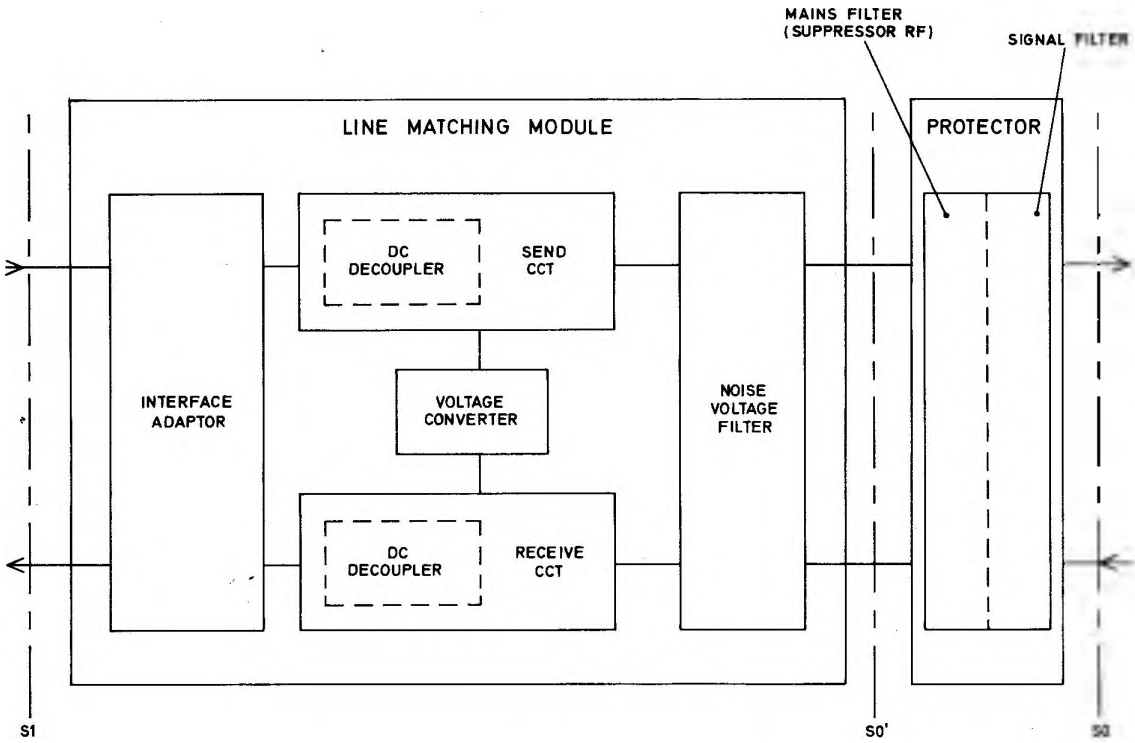
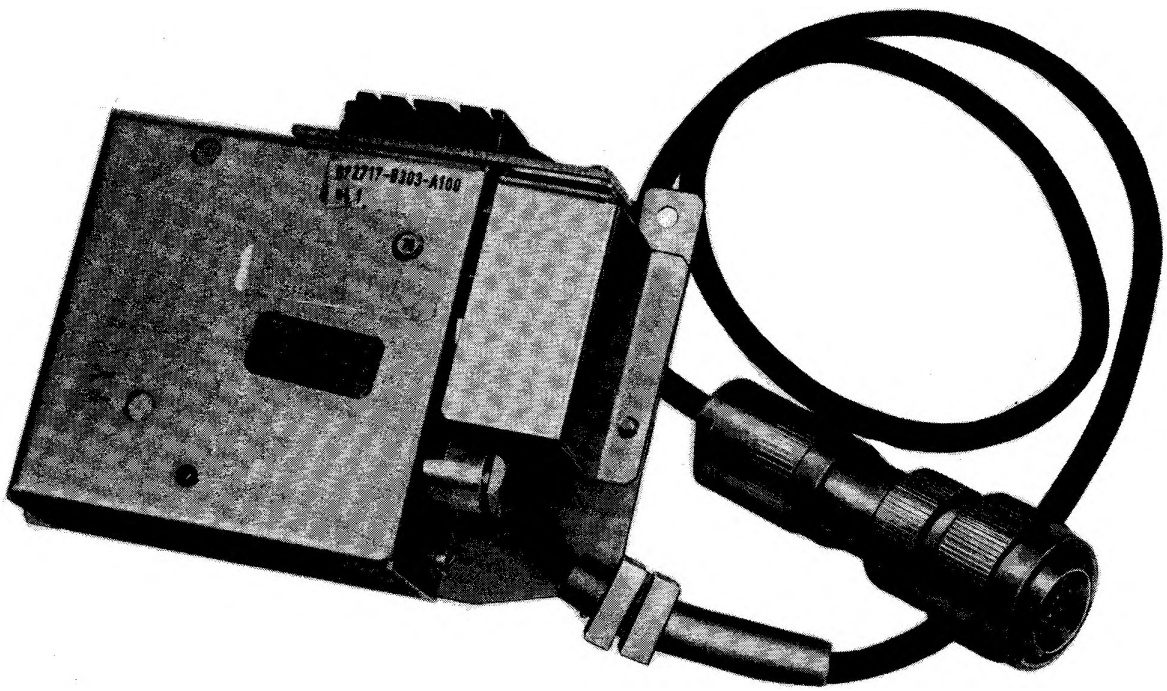


FIG. 3.14.2 LINE MATCHING MODULE AND PROTECTOR
BLOCK DIAGRAM



SIGNAL FILTER
5815-99-537-5912

FIG.3.14.3

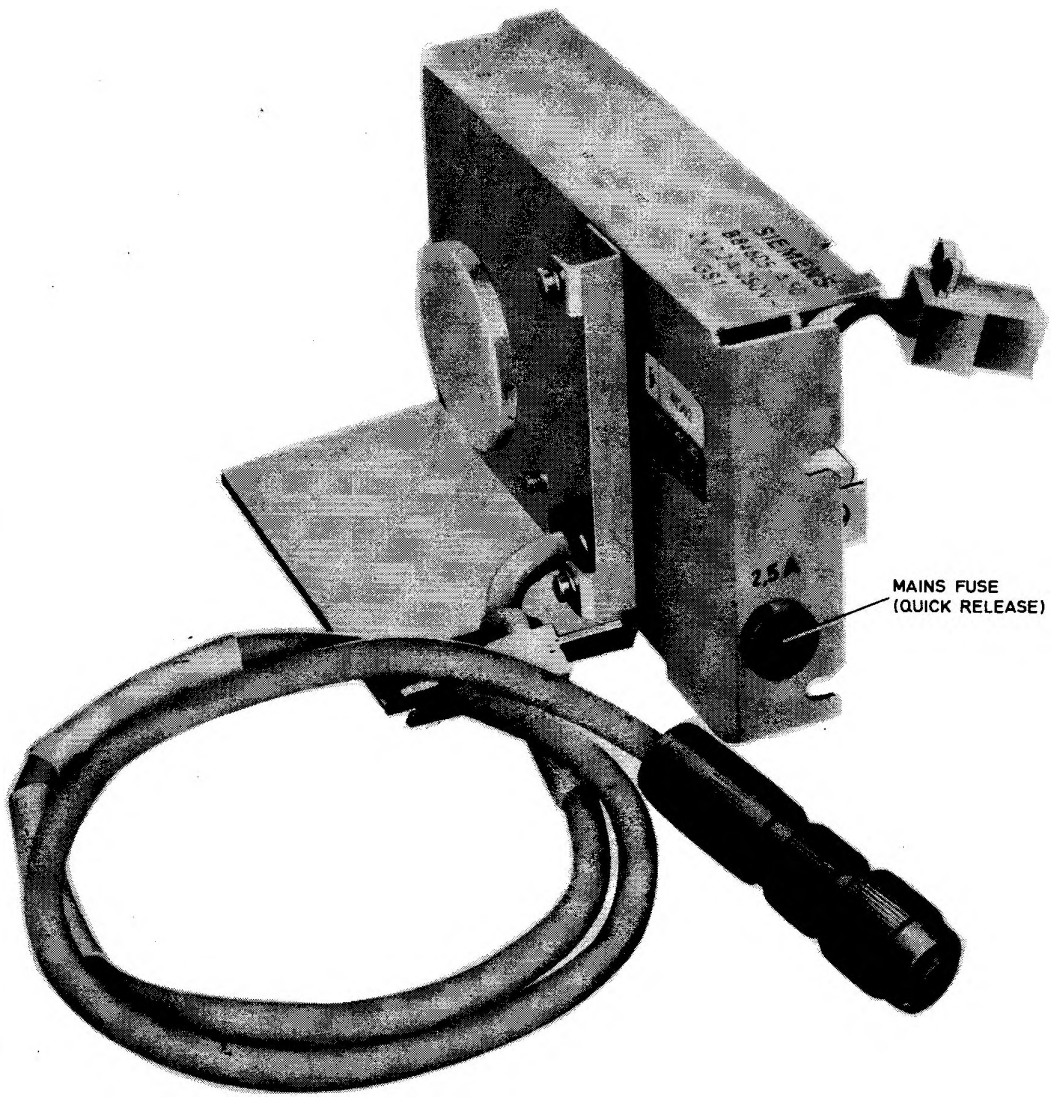


FIG.3.14.4 MAINS FILTER (SUPPRESSOR RF)
5815-99-537-5921

C H A P T E R 1 5

R E L A Y U N I T

CONTENTS

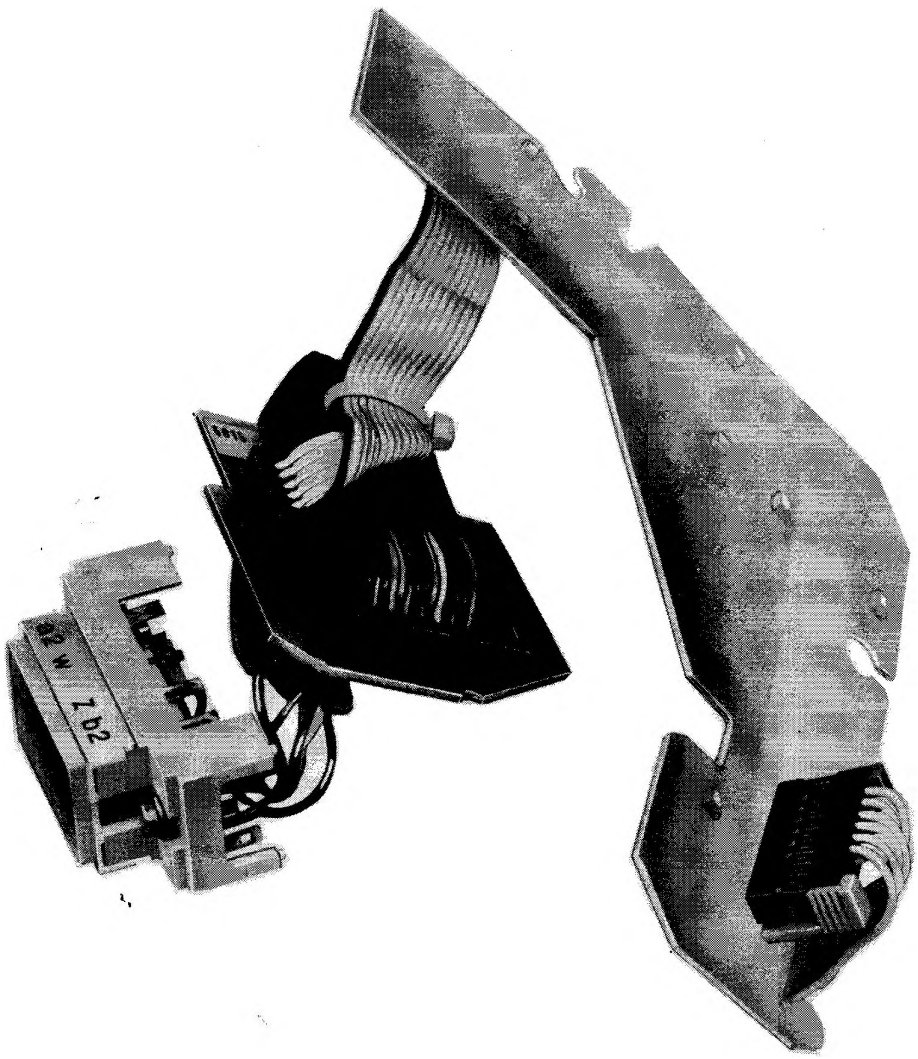


FIG. 3.15.1

RELAY UNIT
5815-99-537-9015

CHAPTER 15

RELAY UNIT

GENERAL INFORMATION

Figure 3.15.1

1 The purpose of the Relay Unit is to provide switch contacts used for the remote indication of:

(1) End of Tape Punch Roll.

(2) End of Paper Roll.

(3) Bell Key.

2 The module contains four relays with one make contact each (60 V/100 mA max), controlled by TTL level signals. The contacts are floating ie the external devices connected to the teleprinter are not powered from the teleprinter power supply.

3 The contacts are brought out via a special relay output socket (Figure 3.15.1) on the following pins:

1-2 Bell Key

3-4 Paper Roll

5-6 Tape Punch Roll.

CHAPTER 16

LOUDSPEAKER

CONTENTS

CHAPTER 16

LOUDSPEAKER

GENERAL INFORMATION

1 The purpose of the loudspeaker is to provide an audible indication of the end of line, 'bell' and an incoming message.

(1) End of Line:

During typing operations on the Keyboard a warning signal sounds after the 59th character, providing a column feed has been keyed in.

(2) Bell:

Pressing the Alarm Bell Key causes the loudspeaker to give an audible indication on the transmitting and receiving teleprinters.

(3) Incoming Message:

If the teleprinter is called, the loudspeaker sounds at a different pitch. The module consists of:

a. A loudspeaker (50 ohms, 0.1 W).

b. A connecting lead with plug.

(4) The loudspeaker is fixed by a wire clip to the base tray of the teleprinter and connected to the Basic Electronics board via a two wire, plug-ended connecting lead.

CHAPTER 17

INTERFACE UNIT, TELEPRINTER

CONTENTS

ILLUSTRATIONS

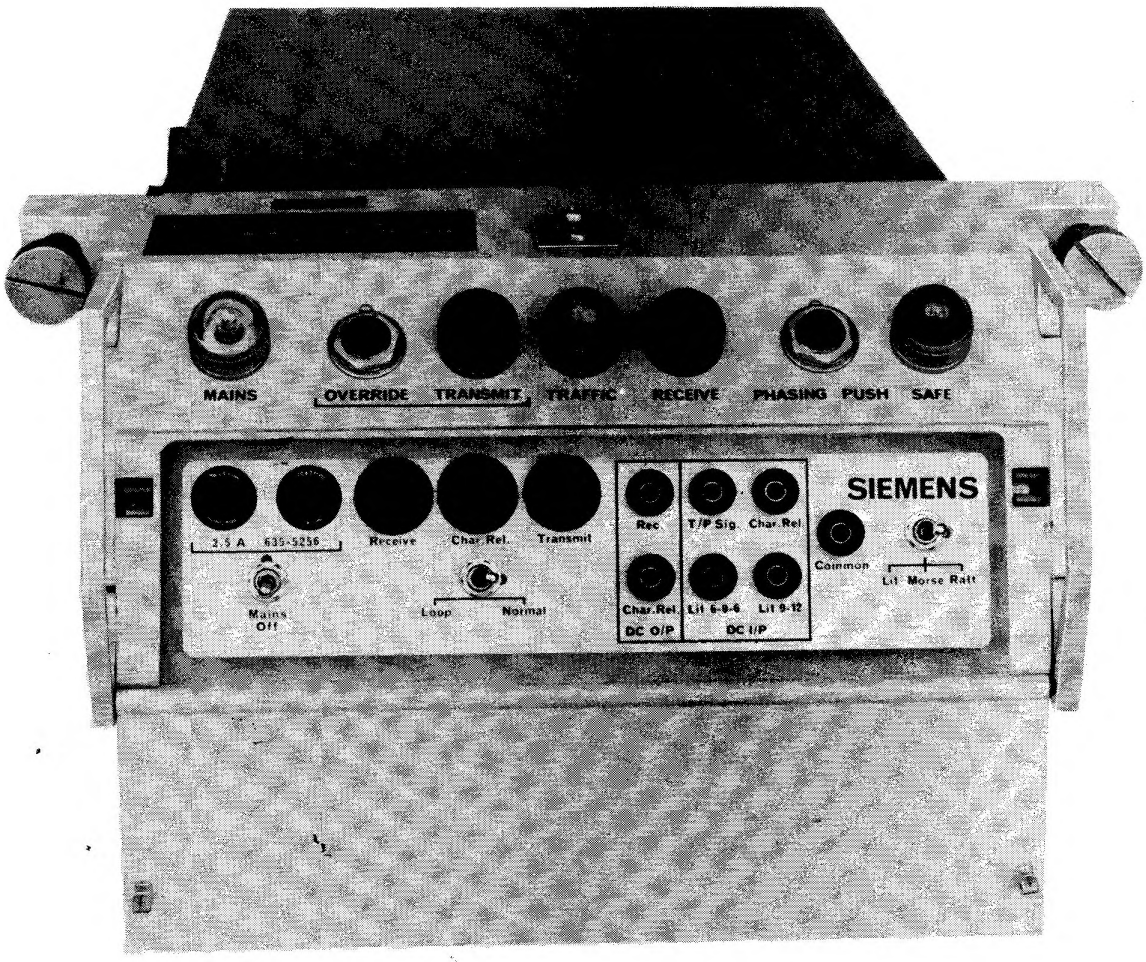


FIG.3.17.1 INTERFACE UNIT TELEPRINTER FRONT CONTROL PANEL
5815-99-537-7995

CHAPTER 17

INTERFACE UNIT, TELEPRINTER

GENERAL INFORMATION

Figure 3.17.1

1 This unit is used to interface the Teleprinter, TGN Series with other cryptographic telegraph equipment used in ships and ashore. In its operational state it is mounted underneath the teleprinter.

2 The unit comprises two printed circuit boards, the Power Supply board and the Interface board, which are secured inside an aluminium box. Underneath a hinged cover on the front of the unit are nine monitor points, two fuses and three switches. On a panel above the hinged cover are five indicator lamps and two push-button switches.

3 Electrical connections within the unit are made using flat ground plane ribbon cable; printed circuit multipin connectors being fitted to each printed circuit board.

PRINCIPLE OF OPERATION

4 . The normal operational mode of the Interface Unit is with the Selector Switch to RATT. In this mode the main function of the unit is:

(1) Tone to dc conversion - converts the telegraph signal tone of 1 kHz (keyed On-Off) to 6.0-6 V, to drive the teleprinter.

(2) DC to tone conversion - converts the 6.0-6 V telegraph signal generated by the teleprinter into a 1 kHz keyed On-Off tone signal.

The Interface Unit also supplies the mains voltage to its associated teleprinter irrespective of the position of the Selector switch.

5 With the Selector switch to LIT, a format generator (Literaliser) connected to SK3 at the rear of the unit, is used for handling special traffic in the Off-line mode.

6 By putting the Selector switch to MORSE and connecting a morse key to SK2 at the rear of the Interface Unit, morse operation can be carried out. The morse key operates on a dc voltage supplied by the Interface Unit and generates a 1 kHz On-Off Morse signal for modulation of the transmitters.

Character Release (Pulse Release Mode)

7 This allows either a 1 kHz tone or dc character release pulse of 6 V to be connected to operate the TGN Teleprinter Keyboard or Paper Tape Reader.

Switches

8 The three switches underneath the hinged cover are as follows:

(1) Mains On Switch.

Connects mains supply to both the Interface Unit and the Teleprinter.

(2) Loop/Normal Switch.

This switch is spring loaded to the Normal position. When pushed to the Loop position, the 1 kHz output line is connected to the 1 kHz input line for test purposes.

(3) Selector Switch.

This is a three position switch, controlling the functioning of the Interface Unit. RATT - Modulates and demodulates signals transmitted and received by the teleprinter. MORSE - Allows the use of a morse key, plugged into a socket at the rear of the Interface Unit. LIT - Allows the use of a format generator (Literaliser), plugged in at the rear of the Interface Unit, primarily in the Off-line mode.

9 The two push-button switches mounted on the panel above the hinged cover are:

(1) Override Push.

Pressing this spring loaded push causes the three second holding delay of the Terminal Telegraph Voice Frequency Tactical (TTVFT) to be overridden. It also shorts out the green indicator lamp marked Transmit.

(2) Phasing Push.

Pressing this spring loaded push phases in the BID 660 in preparation for transmission. This will cause the Safe lamp to light.

Indicator Lamps

10 The following indicator lamps are mounted on the panel above the hinged cover:

(1) Mains Lamp.

Indicates that a mains supply of 240 V 50 Hz or 115 V 60 Hz is being supplied to the Interface Unit and associated teleprinter.

(2) Transmit Lamp.

This lamp lights to indicate that the teleprinter signals are going to the transmitter, via the cryptographic equipment.

(3) Traffic.

Lights to indicate that traffic is present on the receive lines to the teleprinter.

(4) Receive.

Lights to indicate that traffic is being received by the teleprinter via the cryptographic equipment.

(5) Safe.

Indicates that the cryptographic equipment is ready to receive transmissions from the teleprinter. The lamp flashes with each character released.

Monitor Points

11 Monitor points for most of the input and output functions are mounted below the hinged front cover. Each socket is tallied with the signal to be monitored.

Mains Supply Selector Switch

12 This switch is mounted inside the Interface Unit on the Power Supply board. A locking plate is fitted on the switch, to stop accidental movement of the switch. A reversible label is fitted on the front of the unit, stating the supply being used - 115 V 60 Hz or 240 V 50 Hz.

Fuses

13 Two fuses (2.5 A) are mounted under the hinged cover and connected directly to the equipment side of the Mains On switch in the line and neutral cables. The same value fuses are used for either mains supply.

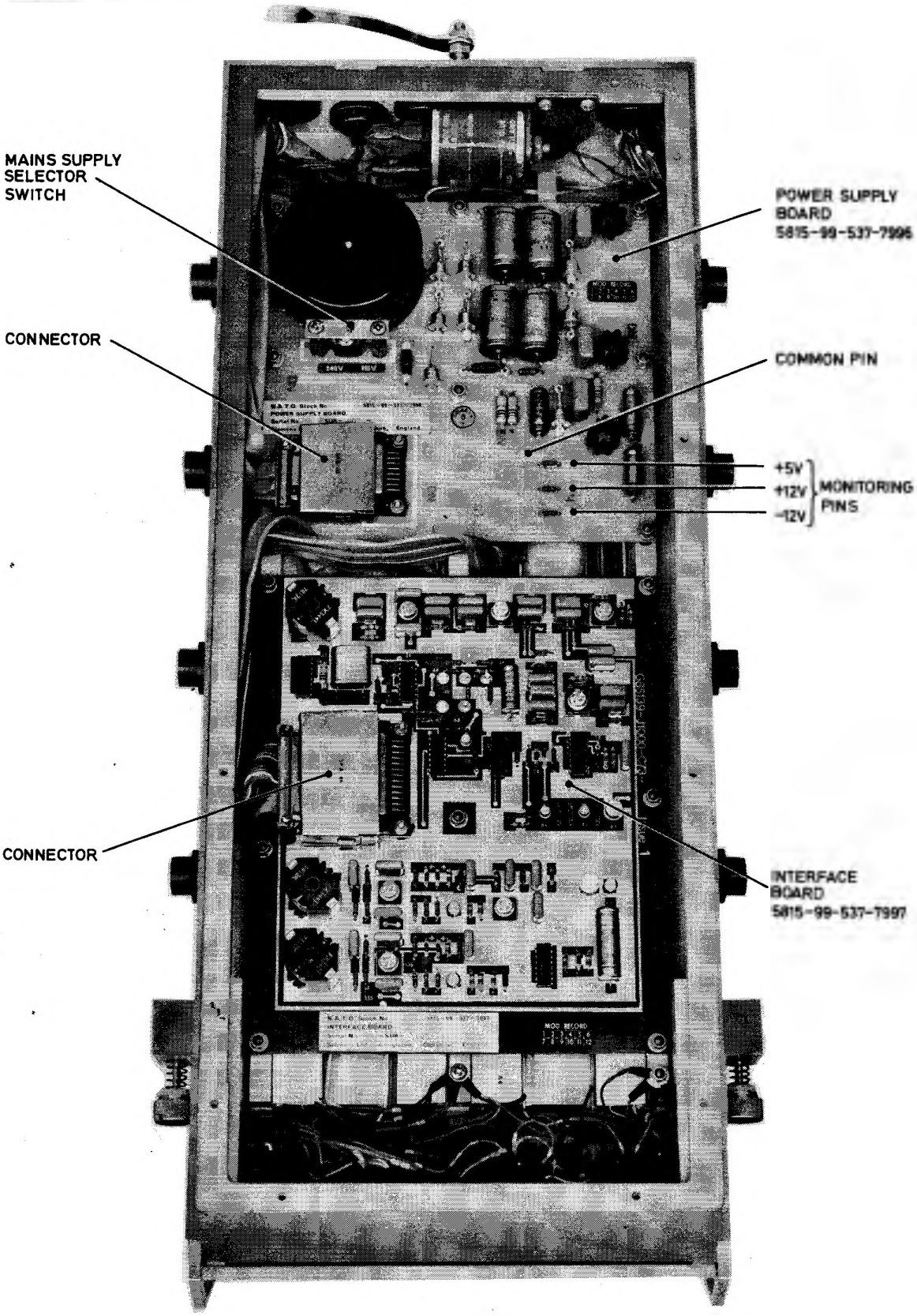
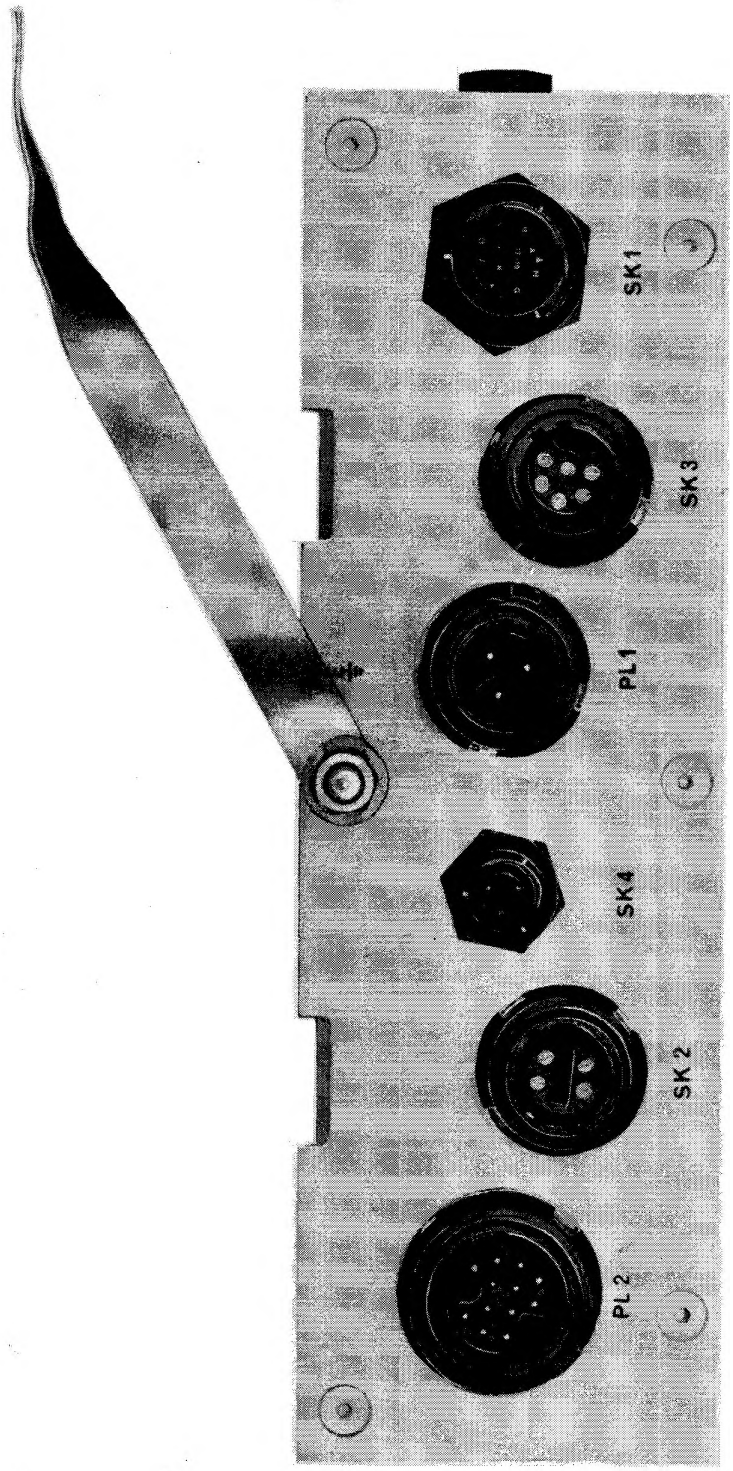
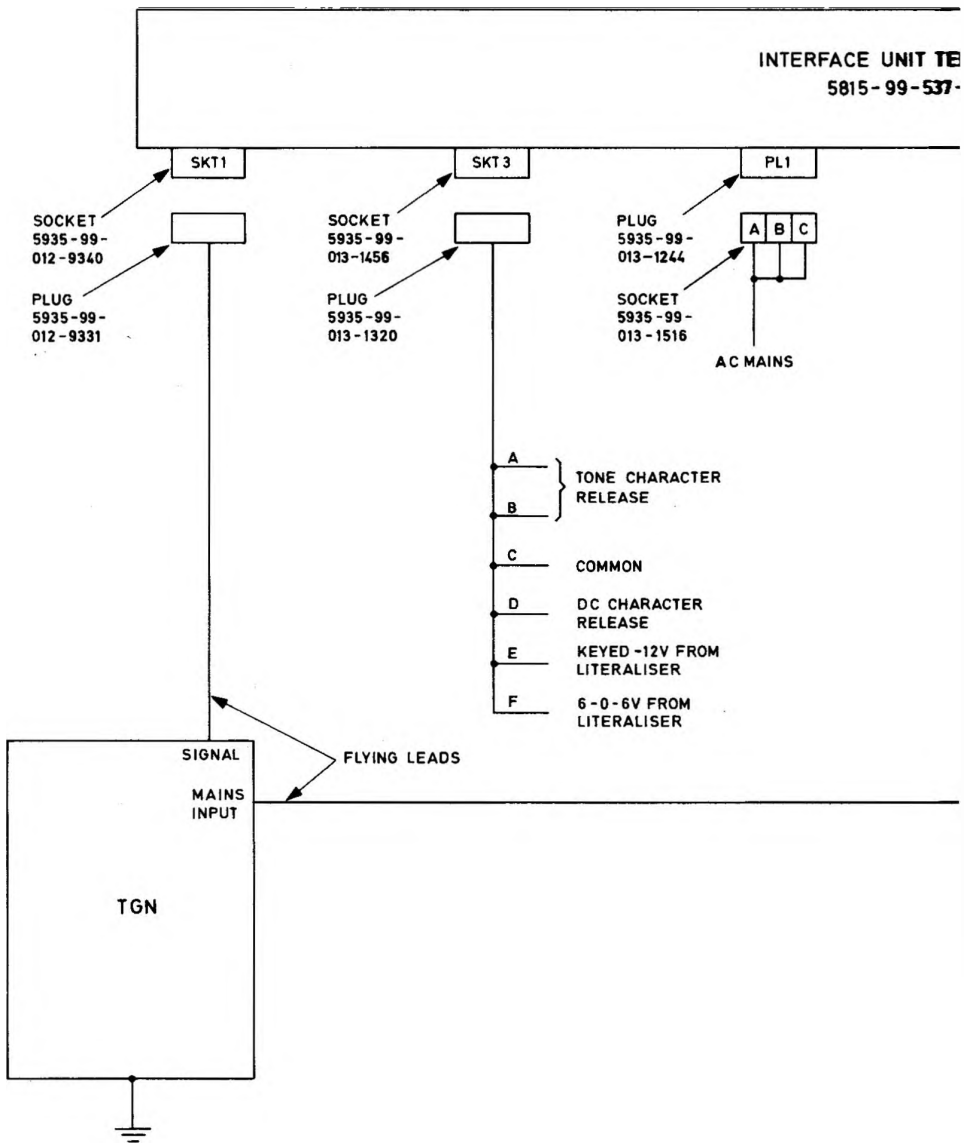
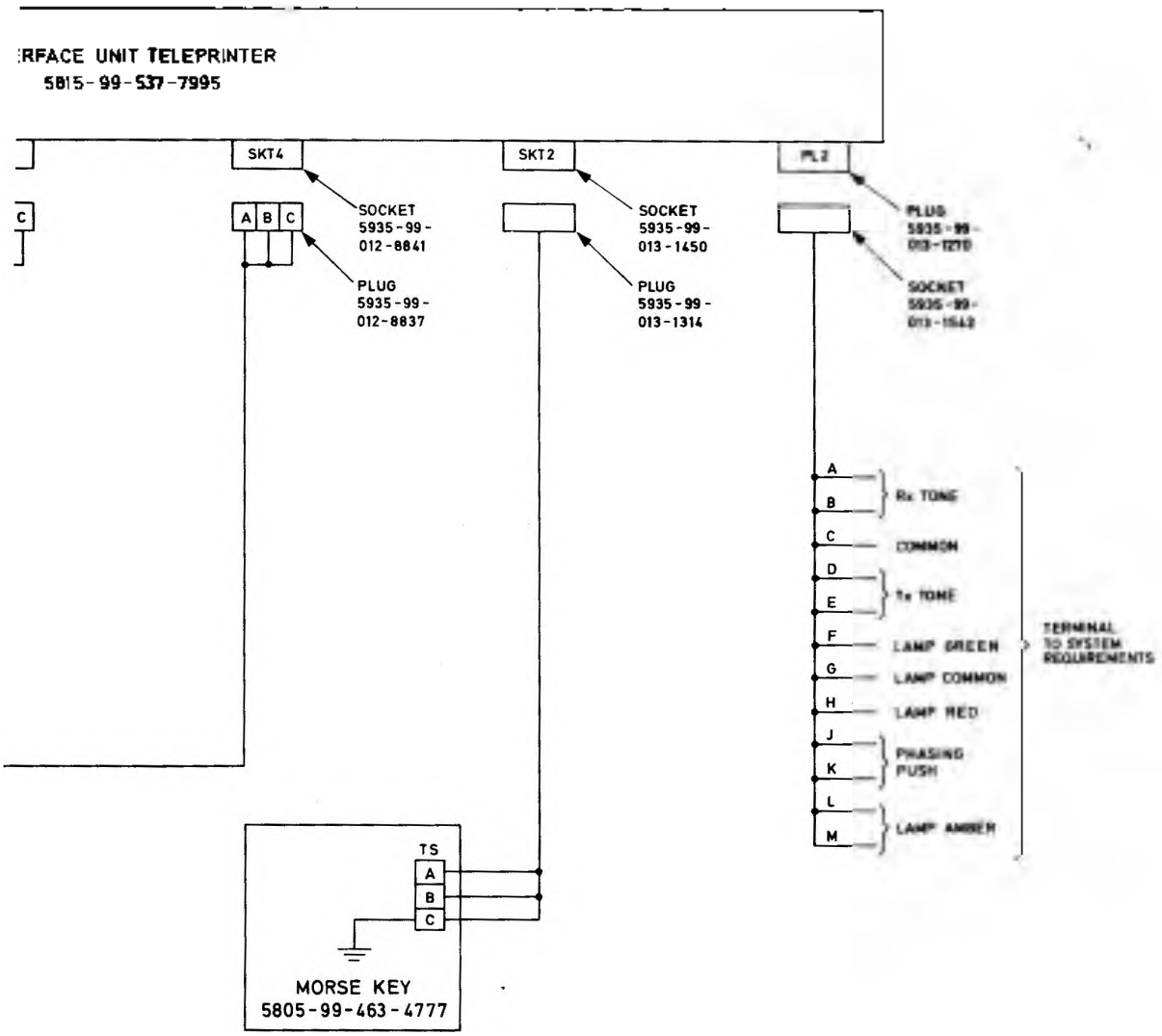


FIG. 3.17.2 INTERFACE UNIT, TELEPRINTER PRINTED CIRCUIT BOARDS



INTERFACE UNIT TELEPRINTER REAR PANEL FIG.3.17.3


INTERFACE UNIT TE
5815-99-537-
SKT1
SKT3
PL1
SOCKET
5935-99-
012-9340
PLUG
5935-99-
012-9331
SOCKET
5935-99-
013-1456
PLUG
5935-99-
013-1320
PLUG
5935-99-
013-1244
A B C
SOCKET
5935-99-
013-1516
AC MAINS
A
B
TONE CHARACTER
RELEASE
C
COMMON
D
DC CHARACTER
RELEASE
E
KEYED -12V FROM
LITERALISER
F
6-0-6V FROM
LITERALISER
SIGNAL
MAINS
INPUT
FLYING LEADS
TGN



ACE UNIT TELEPRINTER-INTERCONNECTIONS.

FIG

TELEPRINTER TGN4

AND

INTERFACE UNIT, TELEPRINTER

CATEGORY 5 - MAINTENANCE INSTRUCTIONS

CONTENTS

TELEPRINTER TGN4

AND

CATEGORY 5A - DIAGNOSTIC MAINTENANCE

CONTENTS

CHAPTER 1

DIAGNOSTIC MAINTENANCE - TGN4

CONTENTS

ILLUSTRATIONS

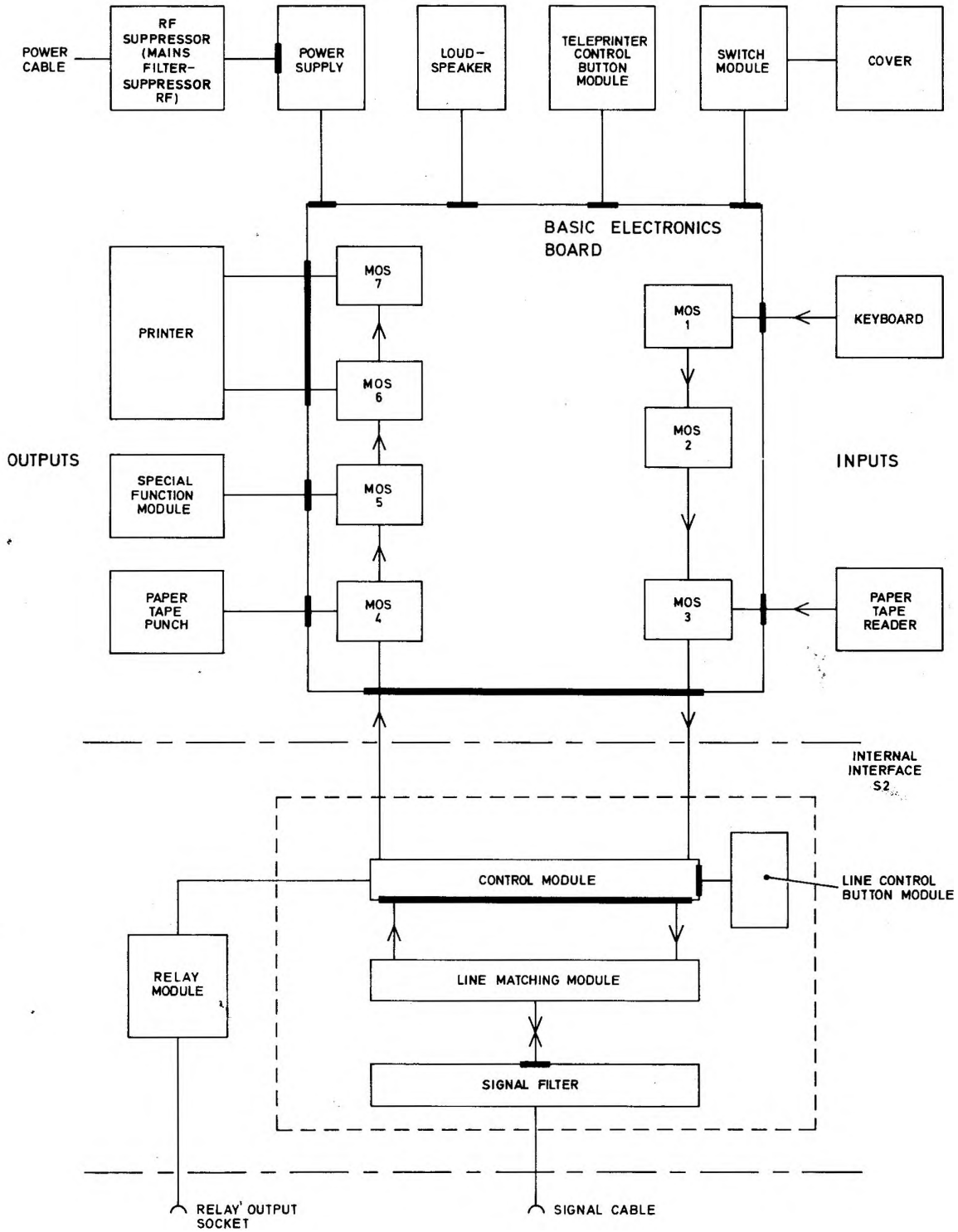


FIG. 5A. 1.1

TGN4

BLOCK DIAGRAM

CHAPTER 1

DIAGNOSTIC MAINTENANCE - TGN4

GENERAL

1 The Repair Policy for the TGN Series is to replace defective modules only. The replacement modules require no alignment or setting up; they only have to be connected into the teleprinter to be immediately operational.

2 Diagnostic maintenance is carried out with the aid of an algorithm, (Figure 5A.1.2), to locate the faulty module. Easily recognisable faults requiring no exchange of modules, such as worn ink ribbon, damaged or worn print wheel and blown fuses, are not included on the algorithm. The modules specified on the algorithm are in the order of their fault probability and time required for their replacement. Before any attempt is made to replace a module, reference must be made to Category 5B of this handbook on Corrective Maintenance.

PRECAUTIONS

3 The Basic Electronics, Line Matching and Control module boards carry MOS devices which are liable to damage by electrostatic potential differences at their pins. Although these pins are protected, maintainers must ensure that they are electrostatically discharged by touching a metal part of the teleprinter, before handling these modules. For transportation, these modules must be wrapped in conductive foil, conductive foam or the original packing.

4 Always remove the signal and power plugs from their sockets before starting to dismantle any part of the teleprinter, otherwise modules may be damaged.

Requirements

5 Before any fault finding is carried out, the teleprinter should be in the following state:

(1) Teleprinter paper and Punch paper tape inserted.

(2) Teleprinter cover closed.

(3) Signal and power cables connected.

FAULT FINDING USING ALGORITHM

Figure 5A.1.2

6 It should be noted that the following bracketed numbered paragraphs correspond to the numbered steps in the algorithm. The meaning of the letters Y and N vary, but this is explained in each step.

(1) Ensure teleprinter state is as in Paragraph 5. Depress the Line button, if illuminated.

(2) Lift cover and move the carriage to centre of line position and turn the print wheel out of the visibility position, in order that the carriage return and print wheel synchronisation may be observed. Close cover and press the Local button.

Y = Some response when Local button is pressed. (For normal responses, see Step 4.)

N = No response when Local button is pressed.

(3) Operate the Keyboard first and then the Paper Tape Reader, checking at the same time whether the Printer and Paper Tape Punch operate as well. This should cause the fault to be reproduced in the Local mode. The data flow can be seen in Figure 5A.1.1. If the teleprinter has no Paper Tape Punch or Reader, proceed to next applicable step.

Y = Fault occurs in Local mode; it is not necessary to find out if fault also occurs in On-Line mode.

N = Fault occurs in On-Line mode.

(4) Normal visible responses when switching to Local mode, during switching on phase.

a. One carriage return is carried out.

b. One line feed is carried out.

c. Print wheel turns back into visibility position.

d. Ink ribbon vertical shift gear switches to visibility position.

e. Cover lighting is switched on.

f. Cooling fan is switched on.

g. Lamp in Local button is illuminated.

Throughout the Operating mode, (e), (f) and (g) are in the operating condition.

Normal visible responses when switching off the Local mode, by pressing the Line button.

h. Ink ribbon vertical shift gear moves to non-visibility position; bottom half of ink ribbon.

j. Cover lighting is switched off.

k. Cooling fan is switched off.

m. Lamp in Local button is switched off.

n. Carriage, platen and print wheel can be moved by hand.

Y = Fault only occurs during switching on phase.

N = Fault also occurs during the operating condition or in the operating condition only.

The fault can be found by operating specific controls on the teleprinter, eg, if no carriage return or line feed is carried out when the Local button is pressed. The presence of these faults in the operating condition can be determined by pressing the Carriage Return/Line Feed button. If after operating the Carriage Return/Line Feed button the faults still exist, the question asked by the Algorithm's Step 4 must be answered by a negative.

(5) Peripheral modules which can cause faults are:

a. Keyboard.

b. Paper Tape Reader.

c. Teleprinter Control button module.

d. Line Control button module.

e. Switch module.

f. Printer.

g. Paper Tape Punch.

h. Cooling Fan.

j. Loudspeaker.

If after replacing a suspected defective peripheral module, the fault is still present, then obviously the fault lies in one of the electronic modules, such as the Basic Electronics, Power Supply, Protector or Special Function.

Y = Fault can be isolated to one peripheral module, ie, the fault only occurs when this particular module operates.

N = Fault cannot be isolated to one peripheral module, therefore the fault is in an electronic module.

(6) To check the teleprinter in the On-line mode, it either has to be connected back to back with another teleprinter, or if it is connected to a Interface Unit, Teleprinter, the Looped switch on the Interface Unit, Teleprinter must be made.

Y = Fault occurs in the On-line mode, eg, Printer does not produce copy when receiving.

N = Fault only occurs in the Standby condition when:

a. Peripheral modules are fully operational.

b. Standby state functions are faulty - see (9).

c. Upon application of power, independent module responses occur which are of short duration only or can be stopped by switching to an operating mode.

(7) Normal visible responses when switching to an On-line mode, - during switching on.

a. One carriage return and line feed is carried out.

b. Print wheel turns into visibility position.

c. Ink ribbon vertical shift gear switches to the visibility position.

d. Cover lighting is switched on.

e. Fan is switched on.

f. Call/Alarm button or Line button illuminates.

Throughout the Operating mode d, e and f are in the operating condition.

Y = Any response when Call/Alarm button is pressed.

N = No response when Call/Alarm button is pressed.

(8) Slow flashing of the Call/Alarm button indicates that the teleprinter is not ready to operate, for the following reasons:

a. Printer paper not inserted.

b. Paper tape not inserted. This only occurs if the Punch has been selected by the Tape Punch On button on the teleprinter.

c. Cover lid is not closed.

d. Signal cable is not plugged in.

These prevent both Operating modes from being switched on.

Y = Call/Alarm button flashes slowly although the teleprinter is ready to operate. Check microswitch contacts of (8), a, b and c.

N = No response from teleprinter.

(9) Standby state functions are checked as follows:

a. Press Call/Alarm button, lamp should illuminate.

b. Open teleprinter cover. Call/Alarm button flashes slowly.

If fitted with Paper Tape Punch:

c. Close tape cover, - tape lead in (see Category 2B Chapter 2, Paragraph 11).

d. Press Tape Feed button on Punch, - tape feeds in.

By means of this test, the operating voltages are shown to be present.

Y = Standby state functions correctly.

N = Standby state functions incorrectly, - check operating voltages with the Diagnostic Unit (see Paragraph 7).

(10) After checking the power line and fuse, as well as the operating voltages with the aid of the Diagnostic Unit, (see Paragraphs 8 and 9). the following should be found.

Y = All operating voltages are missing.

In the event of a short circuit, disconnect the modules in the following order: (See Special Cases 12/6.)

a. Printer.

b. Paper Tape Punch.

c. Paper Tape Reader.

d. Line Matching module.

e. Line Control Button module.

f. Control module.

g. Teleprinter Control Button module.

h. Special Function module.

j. Switch module.

k. Basic Electronics module.

If the fuse blows again, only the RF Suppressor and Power Supply are short circuited.

N = Some voltages are missing or too low.

(11) Exchange modules, one by one in the order given (with power switched off. Refer to Corrective Maintenance Section of this handbook for details of changing modules) until the fault is removed. The fault must be in the last module removed. With the replacement fitted instead of the faulty module, replace all original modules. Sometimes faults may occur in other modules, not so far mentioned, in which case see Paragraph 12, Special Cases.

NOTE Before fitting the Printer or Paper Tape Punch replacement modules, plug in the Diagnostic Unit and check that the required voltages are present (see Paragraphs 8 and 9).

Final Test

7 This is to verify that the fault has been removed and the teleprinter is in an operational state. Carrying out the following:

(1) Select Local mode.

(2) Check the functioning of the contacts and the flashing of the lamp in the Call/Alarm button by activating the end-of-tape, end-of-paper and cover contacts, one at a time.

(3) Press the buttons on the Teleprinter Control button module and ensure the correct corresponding function is carried out.

(4) Switch on the Paper Tape Punch.

(5) Type test text - "the quick brown fox ... etc".

(6) Enter characters until the lamp in the Unlock Keyboard button illuminates to show that the end-of-line has been reached and the Keyboard is blocked.

(7) Press Carriage Return button to unlock Keyboard.

(8) To fill Keyboard buffer, depress ten Keyboard keys simultaneously and check functioning of Unlock Keyboard button.

(9) Insert punched tape generated in Sub-paragraph (5) above, into the Tape Reader.

(10) With Paper Tape Punch switched on, start Tape Reader.

(11) Compare printed copy page with that generated in Sub-paragraph (5).

(12) Compare visually the test and generated punched tape.

(13) Check print pattern of the printed text of test tape, correct start of line position, correct column spacing and line alignment (straight and parallel), completeness and correctness of columns.

Diagnostic Unit — Figure 5A.1.3

8 This is used to check the control signals for the print hammer and the Paper Tape Punch magnets, as well as all the operating voltages. The signals of the Paper Tape Punch magnets are combined in one light emitting diode. It is essential to use this unit before fitting replacement modules to the Printer or Paper Tape Punch, since faulty control signals from the Basic Electronics board may cause damage to the new module.

9 The Diagnostic Unit is used by plugging it into the Diagnostic Socket on the Basic Electronics board, Figure 5A.1.4 and this may be done with power on. If during the Idle state and Standby condition all six light emitting diodes emit light of equal intensity, there is no fault condition present. The Diagnostic Unit will also give the following indications:

(1) When the voltage tolerance exceeds ± 10%, the 5 V diode goes out.

(2) When the teleprinter is operating in On-line mode, the diode for the Paper Tape Punch flickers, while the other five diodes emit light of equal intensity.

If the diodes for the Printer and Paper Tape Punch are not illuminated, FIRST change the Basic Electronics board before fitting the Printer or Paper Tape Punch replacement modules.

NOTE The Diagnostic Unit has the German abbreviations for the Printer and Paper Tape Punch on its top surface. They are as follows:

(1) Printer - DR.

(2) Paper Tape Punch - LO.

Special Cases — Figure 5A.1.2

(12) The following numbers refer to the Special Cases section shown at the bottom of Figure 5A.1.2 and contain the following:

a. Supplementary information on the fault branch concerned on the algorithm.

b. Examples of faults to be classified as special cases, where the fault may be in modules not already specified.

(12.1) Fault Occurs in Standby State only.

Fault pattern: Lighting and fan are switched on.
Check Power Supply and Basic Electronic modules.

(12.2) Fault Occurs in On-line Mode

a. Fault pattern: Printer does not print on bottom half of ribbon when receiving.
Check Printer, Control, Basic Electronics and Special Function modules.

b. Fault Pattern: Character errors occur regularly.
Check Switch and Basic Electronic modules.

(12.3) Fault cannot be isolated to one peripheral module or it occurs in more than one module.

a. Fault pattern: Information flow between Send and Receive modules is blocked, (Reader runs).
Check Control, Teleprinter Control Button and Basic Electronics modules.

b. Fault pattern: Lighting and fan are not switched on.
Check Power Supply and Basic Electronics modules.

(12.4) Fault can be isolated to one module.

a. Fault pattern: Paper Tape Reader transmits discrete characters only, ie, continuous transmission is not possible.
Check Control and Basic Electronics modules.

b. Fault pattern: Printer does not print a certain character.
Check the print wheel.

c. Fault pattern: Copy print is too weak.
Check the ink ribbon, Printer, Switch and Basic Electronics modules.

d. Fault pattern: Printer prints on top half of ribbon instead of lower half, while working in Local mode.
Check the Printer, Basic Electronics, Special Functions and Control modules.

e. Fault pattern: Loudspeaker produces a continuous tone which cannot be stopped.
Check Basic Electronics and Control module.

f. Fault pattern: Not all three positions of the Line Spacing switch module module are effective.
Check the Switch, Printer and Basic Electronics module.

g. Fault pattern: Cover lighting will not switch on or flashes.
Check the Switch, Power Supply, Basic Electronics modules and Cover.

(12.5) Faulty On/Off switching of Local and On-line modes

a. Fault pattern: Local button ineffective.
Check the Line Control button, Control and Basic Electronics modules.

b. Fault pattern: Local mode switches on automatically.
Check the Line Control Button, Control and Basic Electronics modules.

(12.6) Localising a short circuit on a module.

The Power Supply unit is protected against sustained short circuits. When a short circuit occurs, the Power Supply unit switches off all the operating voltages for approximately four seconds and then attempts to switch them on again (audible). If the short circuit is still present, the Power Supply unit switches the operating voltages off again. This sequence is repeated until the short circuit has been removed. To localise a short circuit with the power supply connected, plug in the Diagnostic Unit and disconnect the modules connected to the Basic Electronics board, one by one, until the voltage is indicated again.

(12.7) Call/Alarm button flashes slowly, although the teleprinter is in the Standby state, i.e:

a. Printer paper and paper tape loaded.

b. Cover closed.

This fault is caused by the signalling loop for the Standby state being faulty. This loop consists of the following modules:

a. Paper Tape Punch.

b. Printer.

c. Control module. 537 - 5910

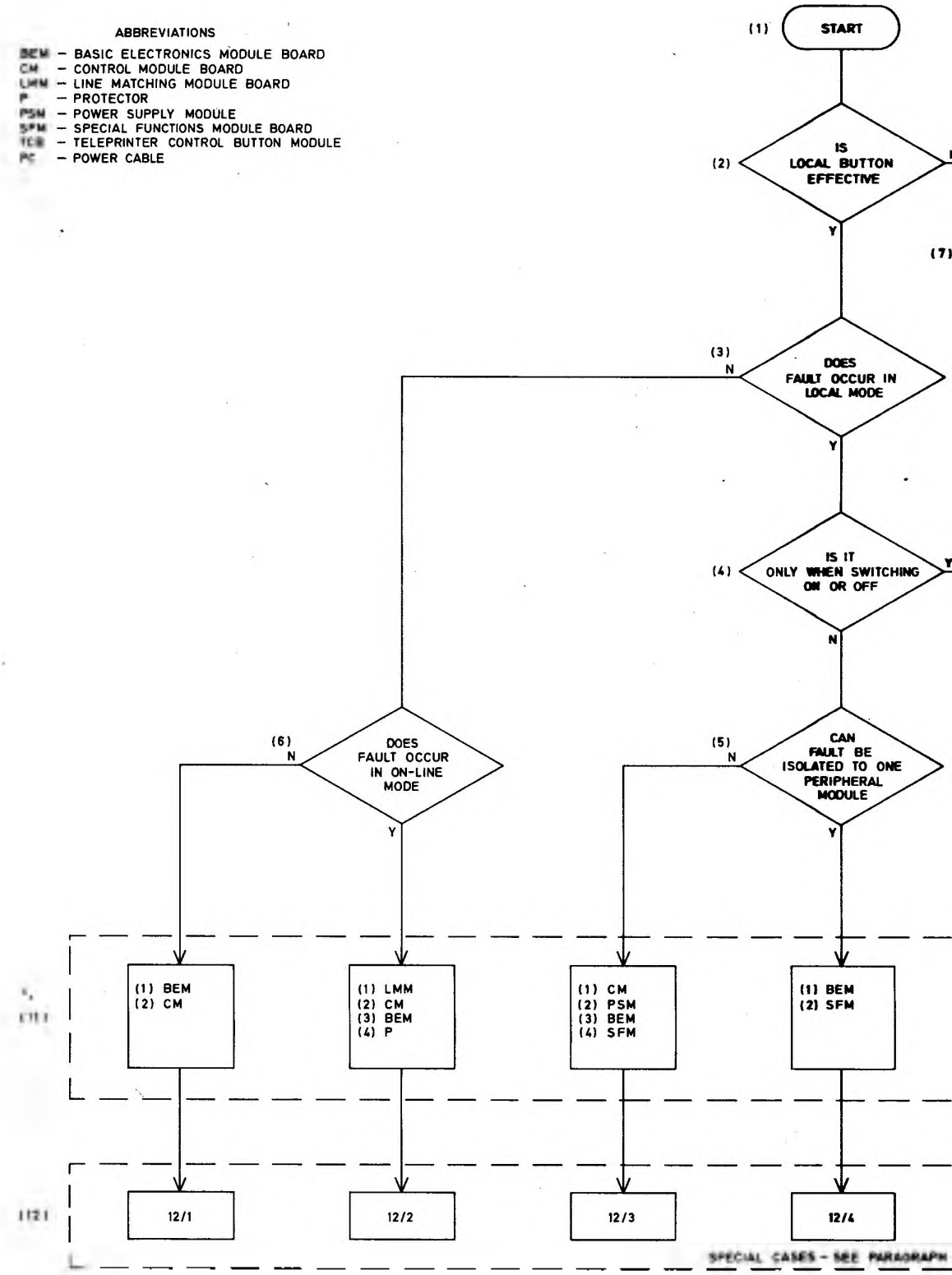
d. Switch module. 537 - 5920

e. Basic Electronics module.

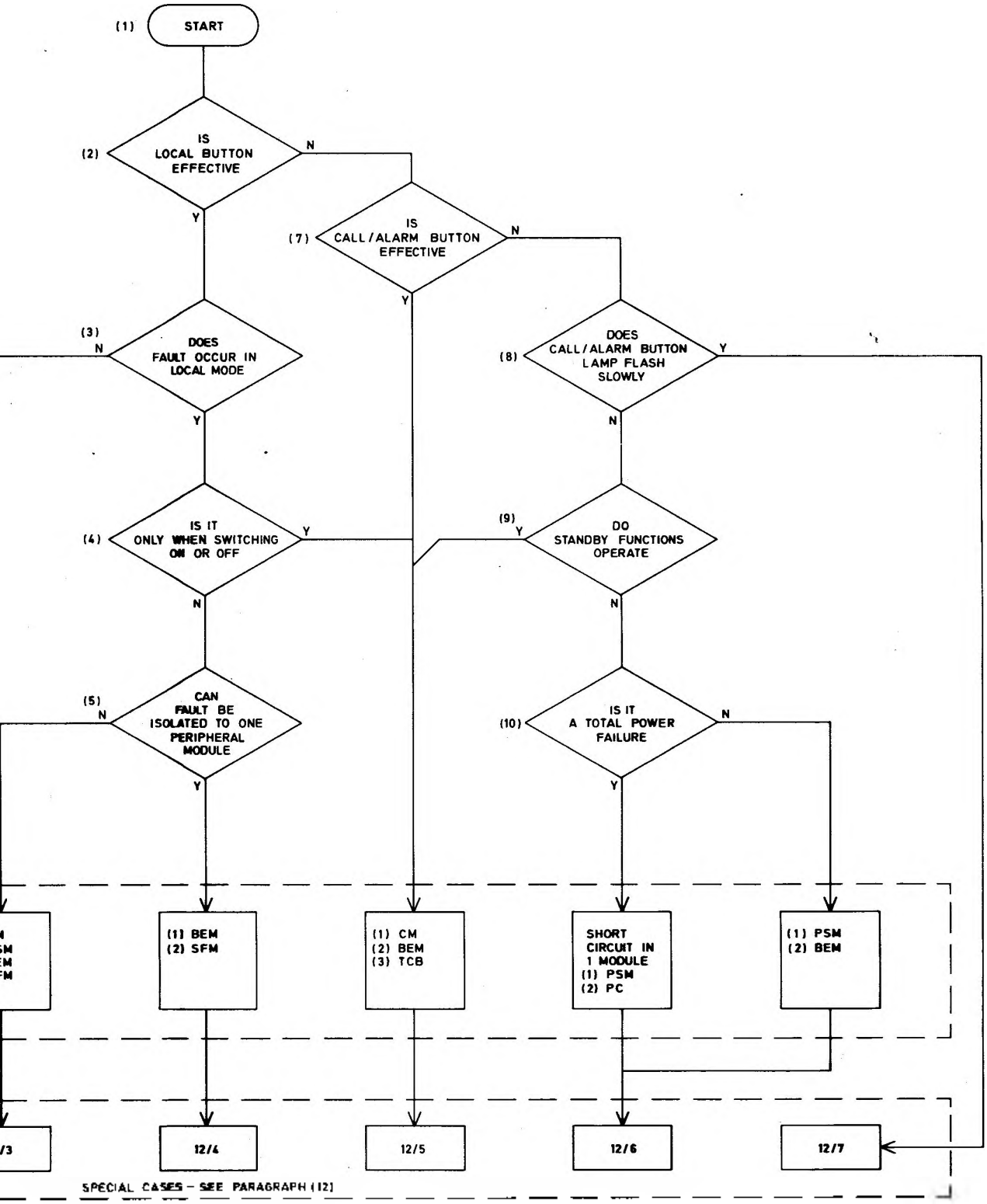
f. Signal cable. 537 - 5912

g. Protector. 537 - 5911

Replace the above modules in the order given, one by one, until the Call/Alarm button no longer flashes.



FAULT FINDING ALGOR



FAULT FINDING ALGORITHM

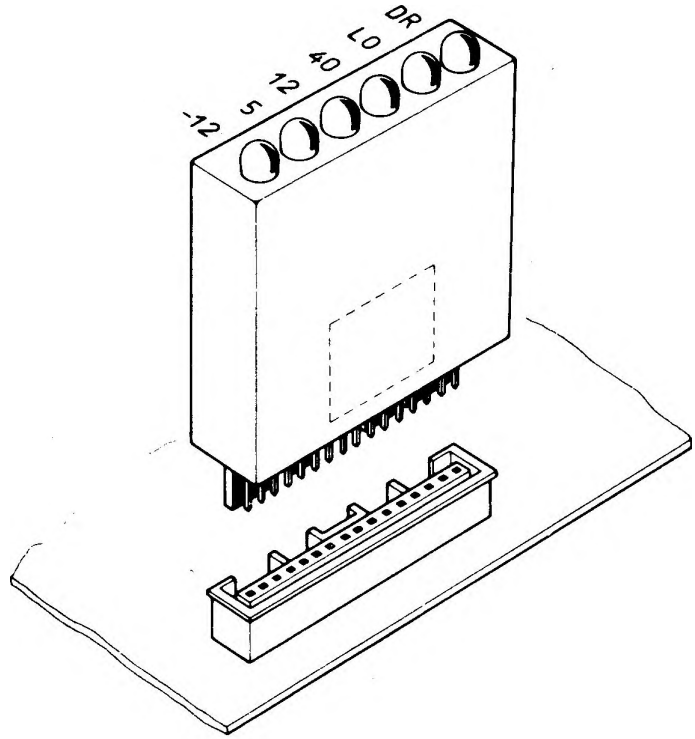


FIG. 5A.1.3 DIAGNOSTIC UNIT

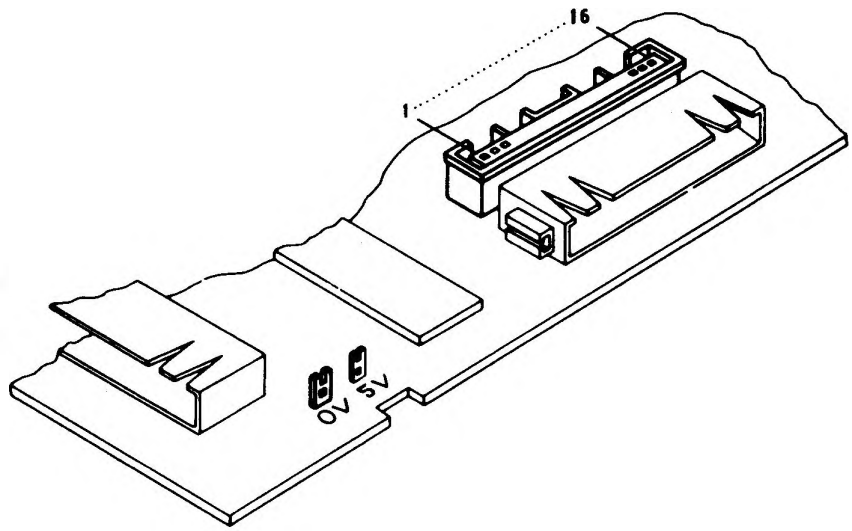


FIG. 5A.1.4 DIAGNOSTIC SOCKET

CHAPTER 2

DIAGNOSTIC MAINTENANCE -

INTERFACE UNIT, TELEPRINTER

CONTENTS

Paragraph

ILLUSTRATION

Figure

CHAPTER 2

DIAGNOSTIC MAINTENANCE -

INTERFACE UNIT TELEPRINTER

GENERAL

1 The Repair Policy for the Interface Unit, Teleprinter is to printed circuit board only. Excluding lamps, fuses and switches, the most probable failure in the Interface Unit, will be one of the printed circuit boards.

TEST EQUIPMENT

2 The following test equipment is required:

(1) Telegraph and Data Generator NSN 6625-99-531-8643.

(2) Trend Telegraph and Data Analyser NSN 6625-99-531-8644.

(3) Multimeter Model 8SX or NSN 6625-99-943-1524
Multimeter Set CT498A NSN 6625-99-105-7049

(4) Wattmeter Absorption CT44 NSN 6625-99-949-0510

(5) Headphones.

(6) Oscilloscope CT436 or NSN 6625-99-914-2605
CT570 NSN 6625-99-522-4161.

(7) Frequency Counter

(8) Battery, Dry or 6 V dc power supply.

PRELIMINARY CHECKS

3. (1) On the Interface Unit, switch off the mains supply and remove all connected cables from the rear of the unit.

(2) Unscrew the two captive screws which secure the Interface Unit to the base plate and remove the unit.

(3) Remove the bottom cover of the unit. Check that the correct fuses are fitted and that the mains switch on the Power PCB is set for the supply required. The voltage indicator label fitted on the bottom cover should agree with the setting of the Mains switch.

NOTE In the following checks, the Interface Unit should be transferred to a suitable working area, such as the maintenance TQA bay and a teleprinter placed alongside it, with its connections made as required. To ensure satisfactory operation of both the Teleprinter and Interface Unit, check that their supply voltage comes from the same source.

MAIN CHECKS

+5 Volts Supply

4 (1) Connect the positive terminal of the Multimeter 8SX (set to 10 V dc range) to the pin marked +5 Volts on the Power PCB.

(2) Connect the negative terminal to the pin marked Common.

(3) Switch on the Mains supply.

(4) The multimeter should show a reading of +5 V, ± 0.1 V.

(5) Switch off the mains supply and disconnect the multimeter.

+12 Volts Supply

5 (1) Connect the positive terminal of the multimeter to the pin marked +12 Volts on the Power PCB. Set the multimeter to the appropriate range.

(2) Connect the negative terminal to the pin marked Common.

(3) Switch on the mains supply.

(4) The multimeter should show a reading of +12 V ± 0.1 V.

(5) Switch off the mains supply and disconnect the multimeter.

-12 Volts Supply

6. (1) Connect the multimeter's negative terminal to the pin on the Power PCB marked -12 Volts. Set the multimeter to the appropriate range.

(2) Connect the positive terminal to the pin marked Common.

(3) Switch on the mains supply.

(4) The multimeter should show a reading of -12 V, ± 0.1 V.

(5) Switch off the mains supply and disconnect the multimeter.

NOTE If the above voltage checks do not give the correct readings, replace the Power PCB with a spare.

(6) Replace the bottom cover.

Line Output Level

7 See note at the end of this chapter.

(1) Set the three position Selector switch to MORSE.

(2) Set the Wattmeter Absorption CT44 to read 0 dBm (1 mW) at 600 ohms impedance and plug it into the Transmit monitor socket.

(3) Connect a morse key to Socket SK2 (rear panel).

(4) Switch on the Mains supply and operate the morse key, keeping it continuously made.

(5) The meter (CT44) should show a reading of 0 dBm (1.00 mW) on the red scale.

(6) Switch off the mains supply and disconnect the CT44 from the Transmit monitor socket.

Frequency Output

8 (1) Set the three position Selector switch to MORSE.

(2) Connect a morse key to socket SK2 (rear panel).

(3) Connect a frequency counter to the Transmit monitor socket.

(4) Switch on the mains supply and operate the morse key, keeping it continuously made.

(5) A frequency of 1 kHz ± 3 Hz should show on the counter.

(6) Switch off the mains supply and remove the plug from the Transmit monitor socket.

Safe Lamp

9 (1) Using a flying lead connect the front panel common socket to PL2-M.

(2) Connect a 6 V battery (NSN 0562-6135-99-106-9853) across PL2-L (+6 V) and PL2-M.

(3) Switch on the mains supply and check that the Safe lamp lights. (If not, check for defective lamp and read note at end of this chapter.

(4) Switch off the mains supply and remove the above connections.

Transmit/Receive Lamps, Override and Phasing Switches

10 (1) On a spare 12-pin socket, free connector, wire the following connector pins in parallel:

Pin F to Pin H
Pin H to Pin J
Pin G to Pin K

(2) Connect a 10 ohm resistor in series with a flying lead to Pin G. Connect another flying lead to Pin F. Connect the wired up 12-pin socket into PL2 on the rear of the Interface Unit. Connect the flying leads to a 6 V battery, (NSN 0562-6135-99-106-9853). Observe that the Transmit (green) and Receive (red) lamps light. (If not, check for defective lamps.)

(3) Operate the Override Transmit and Phasing push switches individually and check that the red and green lamps go out, whilst the push switches are made.

NOTE The 10 ohm resistor in series with the power supply is to limit the current to protect the switch contacts from overloading.

Morse Operation

11 (1) Connect a morse key to SK2 (rear panel) and plug a headphone set into the Transmit monitor socket.

(2) On the front panel, set the three position Selector switch to MORSE.

(3) Switch on the mains supply, operate the morse key and listen on the headphone set for the appropriate keyed morse signal.

Traffic Lamp

12 (1) Set up as in Paragraph 11 (1) and (2).

(2) Operate the morse key and then release; the period of time taken for the Traffic lamp to go out after the morse key has been released should be 3 seconds, ± 1.5 second.

Mains Isolation

13 With a multimeter check for a short circuit between PL1-C and the rear earth stud, and an open circuit between the front panel common monitor socket and the rear panel earth stud.

Transmit/Receive Distortion

14 It is necessary to use a Trend Telegraph and Data Analyser with a Telegraph and Data Message Generator for this check.

(1) On the Telegraph Data Message Generator, set the following:

a. Test Message - 5 units.

b. Speed - 75 bauds.

c. Stop Pulse Length - '1'.

d. Switch to FREE RUN.

e. Signal Polarity switch to Mark -ve and Start +ve.

(2) On the Telegraph and Data Analyser, set the following:

a. Switch to HOLD PEAK DISTORTION.

b. Speed - 75 bauds.

c. Switch to START/STOP.

d. Elements per Character - 5.

e. Input switch to V28.

(3) Connect from Generator output V28 into SK1 Pins D-E (E is common) on the rear panel of the Interface Unit.

(4) On the front panel of the Interface Unit, connect the REC output and Common monitor sockets to the V28 and Common on the Analyser's front panel.

(5) Link the Transmit and Receive monitoring sockets with a jack plug lead.

(6) Switch the three position Selector switch to RATT.

(7) Switch on the mains supply to all three units.

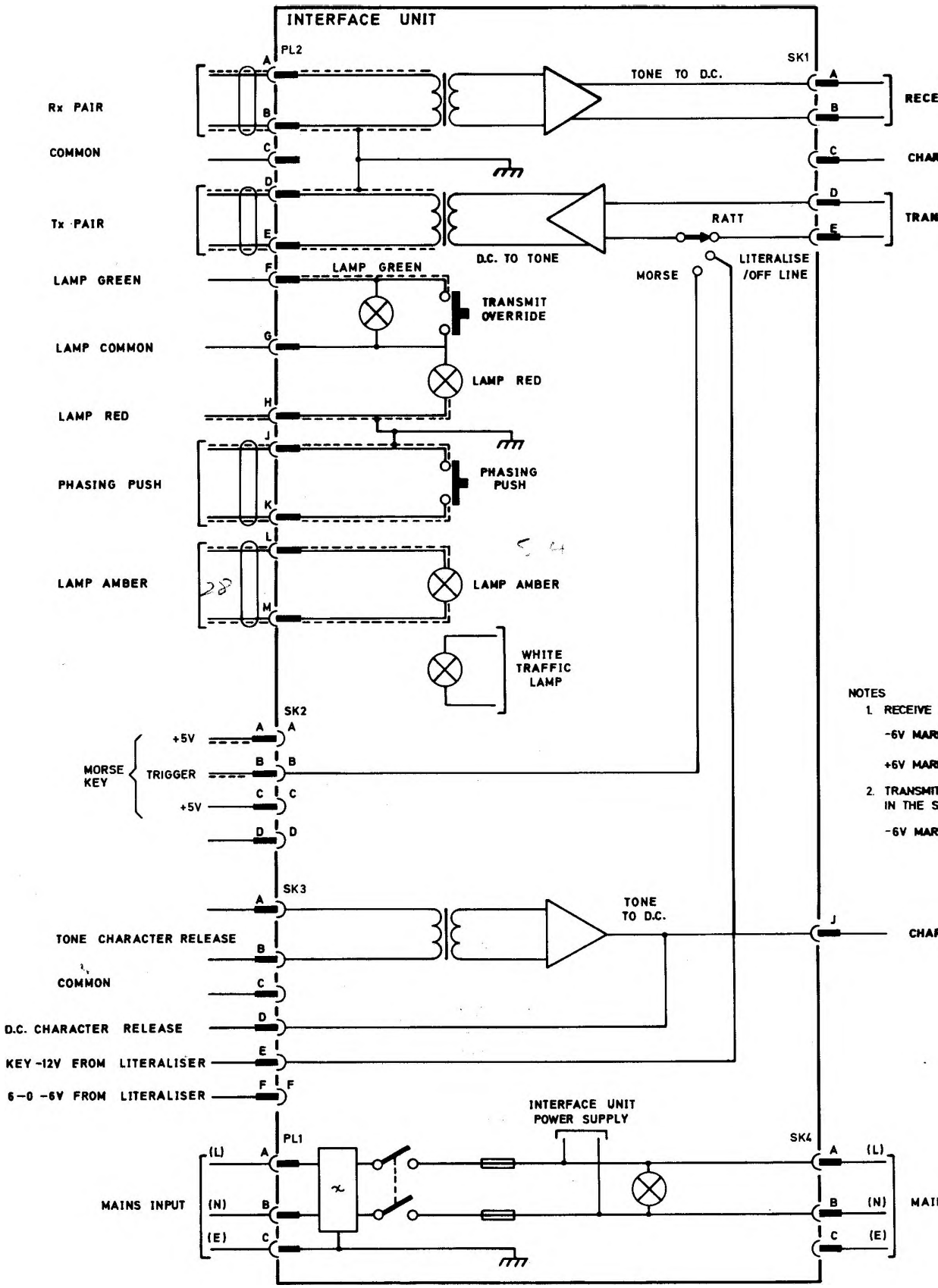
(8) When the signal appears on the display, press the Analyser Reset Hold Peak button.

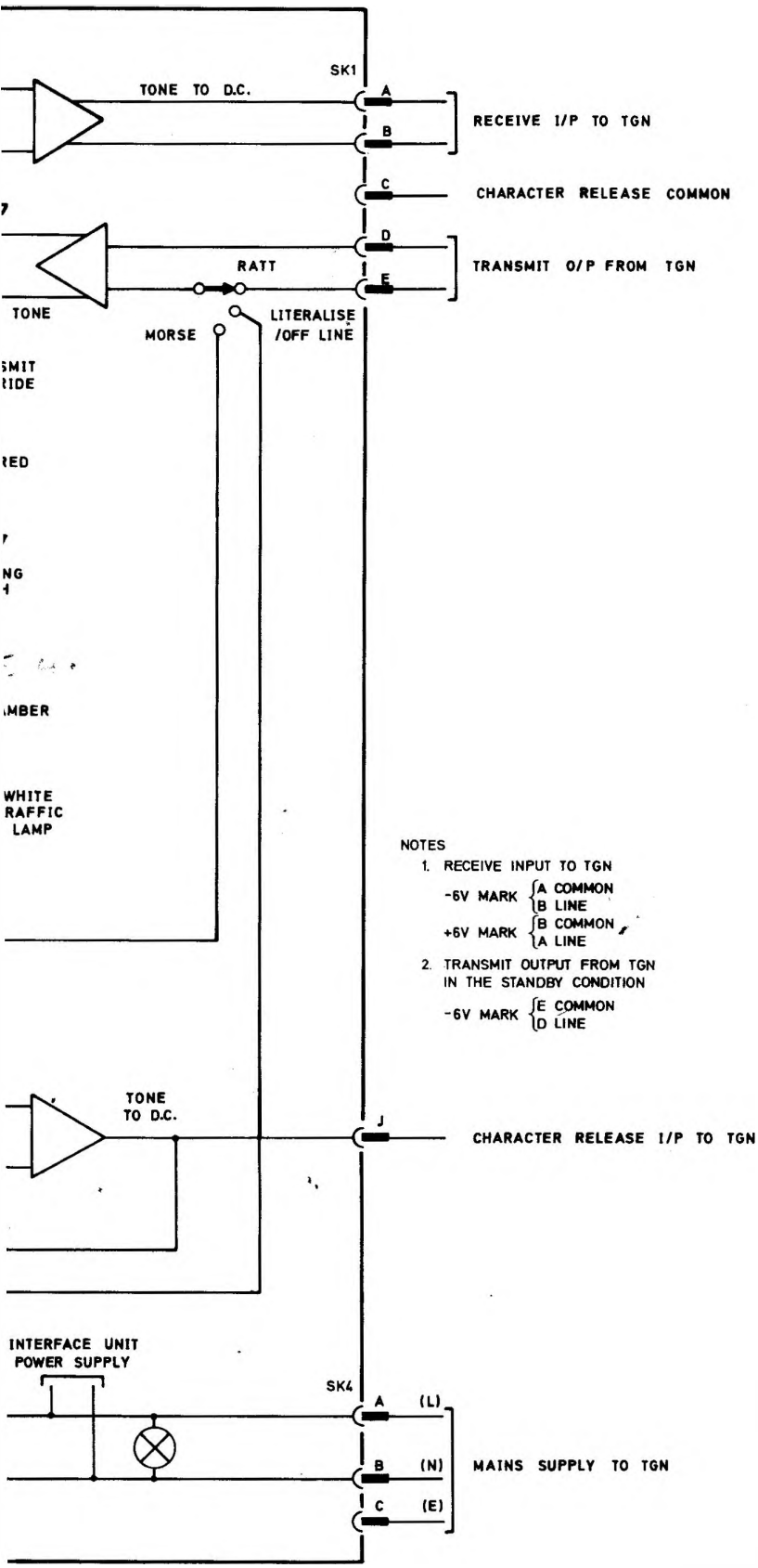
(9) The peak distortion reading on the Analyser should not be greater than ± 3%.

(10) Confirm peak distortion after five minutes operation.

(11) Switch off mains supply and dismantle the test equipment.

NOTE If the checks carried out in Paragraphs 7, 8, 10, 11, 12 and 14, do not give the correct readings, change the Interface PCB.


INTERFACE UNIT
PL2
SK1
TONE TO D.C.
Rx PAIR
COMMON
Tx PAIR
RATT
D.C. TO TONE
LAMP GREEN
MORSE
LITERALISE /OFF LINE
LAMP GREEN
TRANSMIT OVERRIDE
LAMP COMMON
LAMP RED
LAMP RED
PHASING PUSH
PHASING PUSH
LAMP AMBER
LAMP AMBER
WHITE TRAFFIC LAMP
SK2
+5V
MORSE KEY
TRIGGER
+5V
SK3
TONE TO D.C.
TONE CHARACTER RELEASE
COMMON
D.C. CHARACTER RELEASE
KEY -12V FROM LITERALISER
6-0 -6V FROM LITERALISER
INTERFACE UNIT POWER SUPPLY
PL1
SK4
MAINS INPUT
(L)
(N)
(E)
NOTES
1. RECEIVE
-6V MAR
+6V MAR
2. TRANSMIT
IN THE S
-6V MAR



INTERFACE UNIT – TELEPRINTER
WIRING DIAGRAM

FIG. 5A.2.1

CHAPTER 3

INSTALLING A REPLACEMENT TELEPRINTER

CONTENTS

Paragraph

CHAPTER 3

INSTALLING A REPLACEMENT TELEPRINTER

GENERAL

1 The following instructions are for use when installing replacement equipment after servicing. Full installation specifications are to be found in BI425 - Installation Specification for Teleprinter TGN(1), (2), (3) and (4).

Preparation

2 Before unpacking the replacement teleprinter, carry out the following:

(1) Switch off mains supply to Interface Unit, Teleprinter.

(2) Disconnect all leads to the Interface Unit, Teleprinter and to the defective teleprinter.

(3) Unscrew the two thumb screws on either side of Interface Unit, Teleprinter and withdraw the unit from the housing under the teleprinter.

(4) Remove the four screws securing the teleprinter to the mounting plate.

(5) Remove the defective teleprinter from the mounting plate to a place of safety, until it can be fitted into the packing case.

Unpacking the Replacement Teleprinter

3 (1) Remove the two metal or plastic bands from around the outside of the packing case.

(2) Open the packing case and remove packing pieces and Silica Gel bags.

(3) Lift out the replacement teleprinter, mounted on its wooden base board.

(4) Remove the four screws securing the teleprinter to the wooden base board and place the teleprinter on its mounting plate.

(5) Remove the main cover (Category 5B, Chapter 1, Paragraph 6) and check that the mains voltage indicator label shows the required voltage. If it is necessary to change the supply, remove the Power Supply module (Category 5B, Chapter 1, Paragraph 17) and set the correct supply voltage (Category 3, Chapter 9, Paragraph 10).

(6) Replace main cover.

(7) Secure the teleprinter to its mounting plate. Do not use the screws taken from the wooden base board, but those removed in Paragraph 2(4).

(8) Remove elastic bands or sticking tape securing loose objects on the teleprinter.

General Checks

4 (1) Lift the lid and visually examine the teleprinter, checking for damage or loose components.

(2) Check that the teleprinter is the correct type required. The pattern number is recorded on a label at the rear of the teleprinter cover.

(3) The Print Head, which is locked to the left-hand side of the carriage unit during transportation, has to be freed. The lever locking the Print Head is located on a bracket, on the left-hand side of the teleprinter, in front of the Print Head guide shaft. Slide the lever to the front and push the Print Head assembly to the right.

Loading the Teleprinter

5 (1) If an ink ribbon is not fitted, see Category 2B, Chapter 2, Paragraph 12.

(2) Load a paper roll, as in Category 2B, Chapter 2, Paragraph 10.

(3) If the teleprinter is fitted with a Paper Tape Punch, load a paper tape as in Category 2B, Chapter 2, Paragraph 11.

Installation

6 NOTE If any of the following checks should fail, refer to Category 5A, Chapter 1 - Diagnostic Maintenance.

(1) Insert and secure the Interface Unit, Teleprinter into its housing beneath the teleprinter. Both units' mains supply indicator label should read the same.

(2) Connect mains supply lead to Interface Unit, Teleprinter.

(3) Connect teleprinter's main lead into SK4 on the rear panel of the Interface Unit, Teleprinter.

(4) Operate the Mains On switch on the front panel of the Interface Unit, Teleprinter. Indicator lamps on both units should light.

Control Buttons

7 NOTE The control buttons are described in Category 2B, Chapter 1.

(1) Press the Local (Off-line) button and operate the teleprinter's keyboard, checking that all the Keyboard keys function correctly.

(2) Switch on the Paper Tape Punch and punch out a test tape (Category 2B, Chapter 2, Paragraph 2). Check that the Tape Feed (Letter Shift) and Back Spacing keys operate.

(3) Using the test tape, check the operation of the Tape Reader (Category 2B, Chapter 2, Paragraph 4). Check continuous run and single shot, one character pitch operation.

(4) Check that the printed copy is correct.

(5) Check that the character line length is 69 characters per line.

(6) Approximately 70 seconds after receipt of the last character, the teleprinter should switch itself off, but will revert to an operational mode on receipt of the first character of an incoming message or operation of the keyboard.

(7) Switch off the Local (Off-line) button by depressing it again and depress the Call/Alarm button, which causes the Line (Half Duplex) button to light.

(8) Operate the Keyboard and then the Paper Tape Reader, checking each time that a correct printed page copy is produced.

(9) Before the operation of the Duplex Working button can be checked, it is necessary to link pins on the teleprinter's signal plug, flying lead. This can be done on the plug itself or on a mating socket connector, with links across the soldered terminals. The following pins have to be connected:

Pin A to Pin E
Pin B to Pin D.

(10) Depress the Call/Alarm button and the Duplex Working button.

(11) Operate the Keyboard and the Paper Tape Reader in turn and check that the printed page copy is correct.

(12) Check that the Call/Alarm button flashes during the following states:

a. Teleprinter cover open in the non-operational mode.

b. Teleprinter paper run out.

c. Punch paper tape run out; but only if the Paper Tape Punch has been selected.

Relay Output (Shore Stations Only)

8 Check the Relay Output socket for operation of relay contacts, using a Multimeter 8SX, switched to Ohms Range, as follows:

(1) Connect the multimeter across the Relay Output socket Pins 3 and 4. Allow teleprinter paper to run out or remove roll from teleprinter. The multimeter should show a full swing. Replace the paper roll.

(2) Connect multimeter across Pins 5 and 6, tear tape off at the roll and allow the tape to run out, using Run Out button. The multimeter should show a full swing. Replace the paper tape into the tape guide.

(3) Connect the multimeter across Pins 1 and 2 and operate the Bell Key. The multimeter should show a full swing.

(4) Remove mating socket connector or links across the pins of the signal plug. Remove the multimeter.

Operation of the Switch Module

9 (1) Operate the Call/Alarm button. This will illuminate the Line (Half Duplex) button.

(2) Press in the Lid Locking buttons and lift the Lid to the open position.

(3) With the test tape in the Paper Tape Reader, start the Reader and from the printed page copy, check the following operations of the Switch module, which is located on the right-hand side, to the rear.

a. Line Spacing (top switch), marked 1 - 1.5 - 2.
Move the switch to each position and check the line spacing on the printed page copy.

b. Print Force (middle switch). Left position of the switch for single ply paper; right position for printing up to four copies (heavier blow by print hammer on print wheel).

c. Signalling speeds (bottom switch), marked 50 - 75 - 100 Bauds. Move switch to each position and observe change in speed on teleprinter.

Teleprinter Receiving Margin

10 A Trend Telegraph and Data Message Generator is the correct test equipment for this check, but if it is not available, a Telegraph Distortion Measuring Set, Type TDMS 5A can be used.

Trend Telegraph and Data Message Generator

11 (1) Set the teleprinter speed to 75 Bauds.

(2) Set the Trend Generator Speed switch to 75 Bauds.

(3) Set the Trend Generator to 1 Unit STOP PULSE LENGTH.

(4) Test Message switch to 5 Units, QUICK BROWN FOX.

(5) Switch to FREE RUN.

(6) Signal Polarity switch to MARK -ve and SPACE +ve.

(7) Connect the V28 and Common terminals on the Trend Generator to the teleprinters flying lead, signal plug as follows:

V28 to Pin B
Common to Pin A.

(8) Switch on the mains supply and the teleprinters should print a page copy of QUICK BROWN FOX.

(9) On the Trend Generator, switch the Distortion % switch to MARK BIAS and the Distortion switch to 40%.

(10) Allow the teleprinter to print 10 to 12 lines. Check page copy for errors.

(11) Switch in turn to SPACE BIAS, SHORT START and LONG START. Check printed page copy at each position for errors. Disconnect test connections.

Telegraph Distortion Measuring Set, Type TDMS 5A

12 When the TDMS 5A is being used, it is necessary to carry out the following, using two 6 V batteries (NSN 0562-6135-99-106-9853).

(1) Link the +ve terminal of one battery to the -ve terminal of the other and then connect it to the Earth terminal of the TDMS.

(2) Connect the free -ve terminal of the battery to Mark or -80 terminal of the TDMS.

(3) Connect the free +ve terminal of the battery to the space or +80 terminal of the TDMS.

(4) On the TDMS, connect the Line and Earth terminals to the teleprinter's flying lead, signal plug as follows:

Line to Pin B
Earth to Pin A.

(5) Set the Distortion switch to DIST. OUTPUT.

(6) Set the Selector switch to CODER.

(7) Set the Selector switch to its mid-position.

(8) Switch on the mains supply.

(9) Turn the Selector switch clockwise until the TDMS display shows 40% distortion.

(10) Print two lines of page copy and check for errors.

(11) Turn the Selector switch counter-clockwise until the TDMS display shows 40% distortion.

(12) Print two lines of page copy and check for errors.

(13) Disconnect all test leads.

Teleprinter Transmitter Margin

13 This test can be carried out using a Telegraph Distortion Measuring Set, Type TDMS 6 or a Trend Telegraph and Data Analyser. Both methods are given here.

Telegraph Distortion Measuring Set Type TDMS 6

14 (1) Set the Unit Code switch to 7.

(2) Set the Display switch to MS and SM.

(3) Set the Speed switch to 75 Bauds.

(4) Set the Range switch to DOUBLE CURRENT - M.

(5) Set the Input 1/Input 2 switch to INPUT 1.

(6) Connect the teleprinter's flying lead, signal plug to the Input 1, Low Sens and Earth terminals as follows:

Pin D - Input 1 Low Sens
Pin E - Earth

(7) Set the Cont/Start Stop switch to CONT.

(8) Switch on power supplies and transmit from Tape Reader.

(9) Switch the CONT/START STOP switch to START STOP.

(10) Check display, distortion should not be greater than ± 3.

(11) Transmit from keyboard, using Character Y and Repeat keys.

(12) Check display, distortion should not be greater than ± 3.

Trend Telegraph and Data Analyser

15 (1) Connect Input Terminals V28 and Common to the teleprinter's flying lead, signal plug as follows:

V28 to Pin D
Common to Pin E.

(2) Set the Analyser's Display Control switch to HOLD PEAK DISTORTION.

(3) Measurement Mode switch to START/STOP.

(4) Speed switch to 75.

(5) Elements per Character switch to 5.

(6) Switch on the mains supply and transmit from the Keyboard.

(7) The Analyser's display will show and hold the highest value of distortion received, until it is manually reset by operation of the push button switch below the Display Control switch.

(8) The distortion displayed should not be more than + 3%.

(9) Carry out the same test transmitting from the Paper Tape Reader.

(10) Disconnect all test leads and return the teleprinter to its operational state.

TELEPRINTER TGN4

AND

INTERFACE UNIT, TELEPRINTER

CATEGORY 5B - CORRECTIVE MAINTENANCE

CONTENTS

CHAPTER 1

CORRECTIVE MAINTENANCE - TGN4

CONTENTS

ILLUSTRATIONS

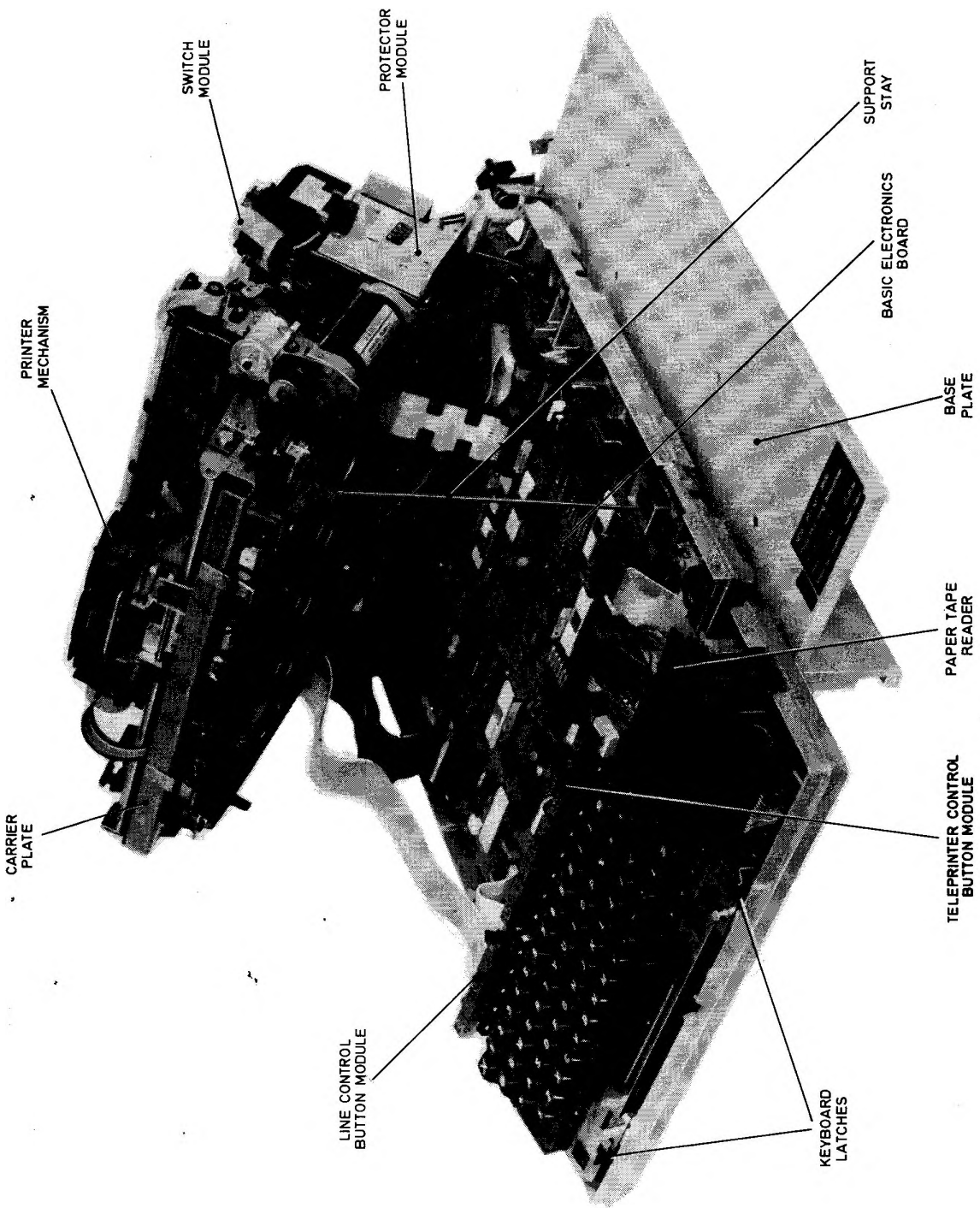


FIG.5B.1.1 TGN 4 COVER REMOVED CARRIER PLATE LIFTED

CHAPTER 1

CORRECTIVE MAINTENANCE - TGN4

GENERAL

1 The Repair Policy for the TGN Series is to replace defective modules only. The replacement modules require no alignment or setting-up; they only have to be connected into the teleprinter to be immediately operational.

PRECAUTIONS

2 The Basic Electronics, Line Matching and Control Module boards carry MOS devices which are liable to be damaged by electrostatic potential differences at their pins. Maintainers must ensure that they are electrostatically discharged by touching a metal part of the teleprinter, before handling these modules. For transportation, these modules must be wrapped in conductive foil, conductive foam plastic or the original packing.

3 Always remove the signal and power plugs from their sockets before starting to dismantle any part of the teleprinter, otherwise the modules may be damaged.

Preparations

4 Before starting to dismantle the teleprinter, it is advisable to remove it from its place of operation to the appropriate workshop, where there is space to lay the modules on a flat surface. Since it is necessary to remove the teleprinter's cover before any of the modules can be taken out, first remove the paper roll, paper tape and chad waste box, which should be emptied.

5 The following procedure is for removing all the modules from the teleprinter frame. When it is necessary to replace just one defective module, it will be stated if any other modules have to be removed to enable the defective one to be taken out. The modules are replaced by reversing the removal procedure.

REMOVAL OF MODULES

Main Cover

6 (1) Release paper support frame from its securing clip, swing towards front and unclip from cover.

(2) Undo quick release screw located at centre, rear of cover.

(3) Swing open cover lid by depressing black buttons on either side of front part of cover.

(4) Undo quick release screws situated in recesses, just inside front part of cover.

(5) Close lid and remove cover by lifting it straight up.

Lifting Carrier Plate

7 (1) Move Printer mechanism to extreme left. Undo quick release screw situated in recess through Printer mechanism cable cover.

(2) Move Printer mechanism to extreme right. Undo quick release screw situated in recess through Printer mechanism cable guide.

(3) Holding onto Printer mechanism carrier bar, swing carrier plate upwards to limit of travel, approximately 45°, push left-hand end of stay to release it from housed position and place leg of stay into support tray, as shown in Figure 5B.1.1.

NOTE When the printer carriage plate is lowered into its operational position, ensure the fold of the cables, Figure 5B.1.1, is correct between the PEC line matching module and the rear of the printer assembly.

Unplugging and Plugging in of Connectors

8 Care must be taken when unplugging or plugging in connectors, to avoid damaging them. The connector should be held between the thumb and forefinger and gently eased out, avoiding jerky movements. Colour coding on clip connector and blade connector indicate which way the connector should be replaced. When removing a module, a note should be made of the cable run to ensure that they are returned to the same position on reassembly.

Paper Tape Punch

9 (1) Lift carrier plate, as in Paragraph 7.

(2) Unplug connector from Basic Electronics board, as identified in Figure 5B.1.2.

(3) Remove chad box.

(4) Remove two securing screws, one located in space vacated by chad box, the other in recessed hole beneath paper tape on baseline of Punch.

(5) Remove the bolt which screws into the base of the Tape Punch Unit, securing the teleprinter to the baseplate.

(6) Pull Paper Tape Punch unit sideways off the teleprinter frame slides.

Paper Tape Reader

10 (1) Lift carrier plate, as in Paragraph 7.

(2) Unplug connector from Basic Electronics board, as identified in Figure 5B.1.2.

(3) Unclip earth connector.

(4) Push retaining clip (similar shape to paper clip) situated near the back of the Reader, right-hand side, to the front and remove the Reader by moving it back and up.

NOTE When replacing, ensure that the lugs on the front of the Reader, locate in slots in the teleprinter frame.

Printer Mechanism

11 (1) Move the Printer mechanism to the left of the carrier bar.

(2) Remove Printing mechanism cable cover by pushing lug to the rear and lifting.

(3) Remove Printer mechanism cable connector, as identified in Figure 5B.1.3.

(4) Pushing Printer mechanism release lever to the rear and holding mechanism with both hands as shown in Figure 5B.1.3, tilt mechanism up and ease clear of the two support springs.

(5) Lay Printer mechanism on a flat surface with the Print wheel uppermost.

Printer

12 (1) Lift carrier plate as in Paragraph 7.

(2) Unplug Printer connector from Basic Electronics board, as identified on Figure 5B.1.2.

(3) Unclip earth connection attached to Power Supply frame, to left of Switch module.

(4) Put Printer mechanism carrier frame to centre of carrier bar. Undo in a counter-clockwise direction, the two quick release screws located in recessed holes on either side of the carrier plate, beneath the stepper belt.

(5) Lift Printer vertically, feeding the Printer cable through carrier plate.

(6) Rest Printer on its four base studs.

NOTE When reassembling, ensure that the spring locking device engages in the slots of the four base studs.

Printer Electronics Board

13 (1) Remove Printer from teleprinter as in Paragraph 12.

(2) Remove Printer electronics board's earth connection, Figure 5B.1.3.

(3) Unplug the three connectors from board at rear of Printer, beneath platen.

(4) Unplug Print mechanism connector, Figure 5B.1.3.

(5) Release the two spring clips at rear of Printer beneath platen, securing board to Printer.

(6) Release the two clips at front of Printer, Figure 5B.1.3.

(7) Lift Printer off Printer electronics board.

NOTE When reassembling, it is advisable to carry out the operation with the Printer resting on its front side, placing the board into the two front clips first and then securing it into position with the back clips.

Teleprinter Control Button Module

14 (1) Lift carrier plate, as in Paragraph 7.

(2) Unplug connector from Basic Electronics board, as identified on Figure 5B.1.2.

(3) Unlock the Teleprinter Control Button module (right hand set of buttons above Keyboard) by pulling wire fastener clear of locking lug.

(4) Remove module by tilting and lifting.

Keyboard

15 (1) Lift carrier plate, as in Paragraph 7.

(2) Unplug connector from Basic Electronics board, as identified on Figure 5B.1.2.

(3) Unclip earth connection.

(4) Unlock the Line Control Button module, (left-hand set of buttons above Keyboard) by pulling wire fastener clear of locking lug.

(5) Remove module by tilting and lifting, lay to side of teleprinter still connected.

(6) Pull back the two latches securing the Keyboard to the teleprinter frame, Figure 5B 1.1. Swing the Keyboard upwards and forwards to remove.

Special Function Module Board

16 (1) Remove Keyboard, as in Paragraph 15.

(2) Unplug connector from Basic Electronics board, as identified on Figure 5B.1.2.

(3) Unclip Special Function Module board by easing it back against the retaining spring and lifting out.

Power Supply Module

17 (1) Lift carrier plate, as in Paragraph 7.

(2) Unplug Power Supply module connector from Basic Electronics board, as identified in Figure 5B.1.2.

(3) Unplug Connector A, identified in Figure 5B.1.4.

(4) Unscrew securing Screw 1, Figure 5B.1.4, by about 4 mm.

(5) Unscrew securing Screws 2 and 3, Figure 5B.1.5 by about 4 mm.

(6) Push Power Supply module about 4 mm to the right, (viewed from rear), causing the latching hook (Figure 5B.1.4) to disengage.

(7) Lift right-hand end of Power Supply module (viewed from rear), and slide the unit to the right clear of securing Screws 2 and 3, Figure 5B.1.5.

(8) Lift Power Supply module clear of carrier plate, feeding cable and connector through the slot in the carrier plate.

NOTE On reassembling, ensure that the star washer for securing Screw 2, lies between the Power Supply module and the metal support.

Switch Module

18 (1) Lift carrier plate, as in Paragraph 7.

(2) Unplug connector from Basic Electronics board, as identified on Figure 5B.1.2.

(3) Unclip Switch module earth connection.

(4) Pull connector cable sideways out of stowage clip.

(5) Unfasten Clip B and Hook A, Figure 5B.1.5, by lifting slightly and pull Switch module sideways off its lugs.

Line Matching Module Board

19 This module board carries MOS devices, so it is important that the correct protective measures are taken. See Paragraph 2 of this section.

(1) Lift carrier plate, as in Paragraph 7.

(2) Remove Printer, as in Paragraph 12.

(3) Remove Switch module, as in Paragraph 18.

(4) Unplug Line Matching module board connector, as identified in Figure 5B.1.5, left-hand side.

(5) Remove cable Clip B, Figure 5B.1.6, securing the Line Matching module board cable to the Control module board interconnecting cable.

(6) Ensure that the connector to the Power Supply module, Figures 5B.1.5/6 is removed.

(7) Unplug Connector A as identified on Figure 5B.1.6.

(8) Lift spring clip upwards, Figure 5B.1.6 and holding the Line Matching module board by its handle, pull it out sideways.

NOTE When reassembling, ensure handle base fits into slot on carrier plate.

Control Module Board

20 The Control module board carries MOS devices, so it is important that the correct protective measures are observed. See Paragraph 2 of this section.

(1) Lift carrier plate, as in Paragraph 7.

(2) Unplug Connectors A, B and C, as identified on Figure 5B.1.6.

(3) Release cable Clip A, Figure 5B.1.1.

(4) Unplug Control module board connector from the Basic Electronics board, as identified on Figure 5B.1.2.

(5) Unplug earth connector attached to Basic Electronics board.

(6) Lifting Control module board securing clip, ease module upwards, feeding cable through frame.

Line Control Button Module

21 Before the Line Control Button module is removed, it is first necessary to remove the Control module board. This is because the connector for the Line Control Button module, if otherwise removed, would have to be fed down between the Line Matching module board and the Control module board, with the possibility of damaging either.

(1) Remove Control module board, as in Paragraph 20.

(2) Unlock the Line Control Button module, (left-hand set of buttons above Keyboard), by pulling wire fastener clear of locking lug.

(3) Remove module by tilting and lifting.

Basic Electronics Board

22 The Basic Electronics board carried MOS devices, so it is important that the correct protective measures are observed. See Paragraph 2 of this section.

(1) Lift carrier plate, as in Paragraph 7.

(2) Ensure all connectors are unplugged from the Basic Electronics board.

(3) Remove earth tag from rear of board.

(4) Push Basic Electronics board horizontally to the rear against its flat springs until it unclips from the front, then lift out frontways.

Signal Filter

23 (1) Remove Switch module, as in Paragraph 18.

(2) Remove Paper Tape Punch, as in Paragraph 9.

(3) Remove Line Matching module board connector from top of Signal Filter Figure 5B.1.5.

(4) Remove the two securing screws at rear of Signal Filter, Figure 5B.1.5.

(5) Prise signal cable guide from slot in frame, Figure 5B.1.5 and lift Signal Filter clear.

(6) When replacing the Filter, ensure the locating lugs engage in the slots.

Mains Filter (Suppressor RF)

24 (1) Remove Power Supply module, as in Paragraph 17.

(2) Remove Switch module, as in Paragraph 18.

(3) Remove Signal Filter as in Paragraph 23.

(4) Remove Printer earth connector from top of Mains Filter (Suppressor RF).

(5) Unclip the earth connector from teleprinter frame, noting run of earth strap.

(6) Remove two securing screws situated on right-hand side of unit, on carrier plate (viewed from back).

(7) Slide unit horizontally to the rear until it stops, then tilting unit inwards, slide clear sideways.

(8) When replacing the Mains Filter, ensure the locating lugs engage in the slots.

NOTE Mains Fuse, 2.5 A, requires only ½ turn, counter-clockwise, to remove. Do not overturn.

Relay Module Assembly

25 (1) Lift Carrier plate, as in Paragraph 7.

(2) Unplug connector B (Figure 5B.1.6).

(3) Release cable of connector A (Figure 5B.1.4) from plastic retainer plate.

(4) Remove securing screw situated close to carrier plate hinge and lift assembly clear. This comprises of the Relay Module board and Relay Output socket, both being secured to the Relay Module assembly bracket.

(5) Remove two screws securing relay socket to the bracket and starting from the bottom, remove socket, taking care the wiring is clear.

Replacement of Copy Lighting Lamps

26 To replace a defective lamp, it is recommended that the main cover of the teleprinter be removed.

Proceed as follows:

(1) Remove main cover as laid down in Paragraph 6.

(2) Place cover upside down on a flat surface.

(3) Press defective lamp into its holder and turn it through 60^{o} in a counter-clockwise direction.

(4) Pull lamp out of socket.

(5) Replace lamp and main cover by reversing removal instructions.

Replacement of Lamps in Control Buttons

27 If a lamp is defective in a control button of the Teleprinter Control Button module or Line Control Button module, proceed as follows:

(1) Grip button cap firmly with fingers and pull it off vertically.

(2) Push an insulating tube, (inside diameter 4.5 mm) over the defective plug-in lamp and lift out, vertically.

(3) Insert new lamp into holder and apply slight pressure with finger tip, until properly seated.

(4) Replace button cap.

Replacement of the Punch Needle Assembly

28 (1) Place the teleprinter on a work surface and remove the Tape Punch Unit as described in Paragraph 9.

Open the Tape Punch housing as follows, Figure 3.10.2.

(2) With a screwdriver turn the locking screw (35) counter-clockwise through 90^0.

(3) Swing the hinged cover (34) upwards.

(4) Press in latch (36) and remove cover (17), simultaneously ensuring the wire guide (1) does not foul the cover.

(5) Remove hinged cover (34).

Remove the Tape Punch Module as follows, Figure 5B.1.7.

(6) Disconnect the upper plug (5) on the punch electronics.

(7) Remove micro-switches (6 and 7) by bending the plastic lugs to clear the switch body.

(8) Undo three screws, (8) four turns only to retain the Keep washers.

(9) Withdraw the Punch Module, taking care no damage is caused to the micro-switches and associated wiring.

Remove the Punch Needle Assembly as follows, Figure 5B.1.7.

(10) Disconnect spade connectors (10), on the rear of the Feed Unit (11), noting the colour coding.

(11) Remove screw (12) and lift off the Chad Chute (13).

(12) Remove the Tape Guide (14) by bending two plastic clips (23) on either side of the guide.

(13) Undo screws (15) and remove the Tape Feed Unit by pulling it to the front.

(14) Undo screws (18) and remove the Punch Needle Assembly by pulling it to the front.

(15) Remove all paper-fluff and chads.

Insert the Punch Needle Assembly as follows, Figure 5B.1.8.

(16) Push the replacement assembly (19) complete with transit support (20) against the contract surfaces (1) of the mounting bracket (21) as arrowed, ensuring the bell cranks (22), engage in the cut-outs of the punch pins and the transit support is pressed out.

(17) Replace and tighten screws (18).

Reassemble the Tape Punch Module as follows, Figures 5B.1.7 and 5B.1.9.

(18) Before proceeding ensure all surfaces are free of fluff and chads.

(19) Replace Tape Feed Unit (11) using screws (15) together with the washers and lightly secure adjusting plate (16) in place. It is important that screws (15) are left loose enough for plate (16) to be moved during later adjustments (Tape hole pitch).

(20) Replace the complete Tape Guide (14) by fitting the lip on the guide into the Punch Needle Assembly and lowering to engage firmly on to clips (23).

(21) Place Chad Chute (13) on plate (17). Insert screw (12), push the Chad Chute in direction D so that it is tightly drawn over the slanted surface on to plate (17).

(22) Tighten screw (12).

(23) Connect spade connectors (10) into the Tape Feed Unit (11), as noted in item (10) above.

Replace the Tape Punch Module as follows:

(24) Ensure the ribbon cable to the micro switch is clear of the Chad Chute box base, then reverse procedures (6) to (9) above.

(25) Replace the Tape Punch Unit as described in BR 8604(5B) Chapter 1 Paragraph 9.

(26) Connect the Teleprinter to the mains supply and switch On.

Adjust the tape hole pitch as follows, Figure 5B.1.10.

(27) Replace the paper tape roll as described in BR 8604(2B) Chapter 2 Paragraph 11.

(28) Clip the Tape Pitch gauge (5815-99-539-6705), into the tape channel (22) with the 11/16 in. tape guide uppermost.

(29) Insert a screwdriver into slot (S) and gently move plate (16) to ensure it is loose enough for adjustment.

(30) Insert tape and tear it off along the arrow shaped tear off point.

(31) Press the Tape Feed button and hold down to produce a run of tape through the gauge.

(32) Examine the tape hole pattern under the gauge as the tape is being advanced. (The impression of a stationary picture will be created.)

(33) Adjust plate (16) if required, in the + or - direction, until the stationary picture corresponds to 3, 4 or 5 after ensuring the incorrect tape pitch has run completely through the gauge.

(34) Tighten screws (15) and recheck to ensure the pitch is still correct.

NOTES (1) Corrective adjustment is only necessary if the aggregate error over 50 tape hole pitches exceeds ± 0.63 mm or approximately half the diameter of a tape feed hole.

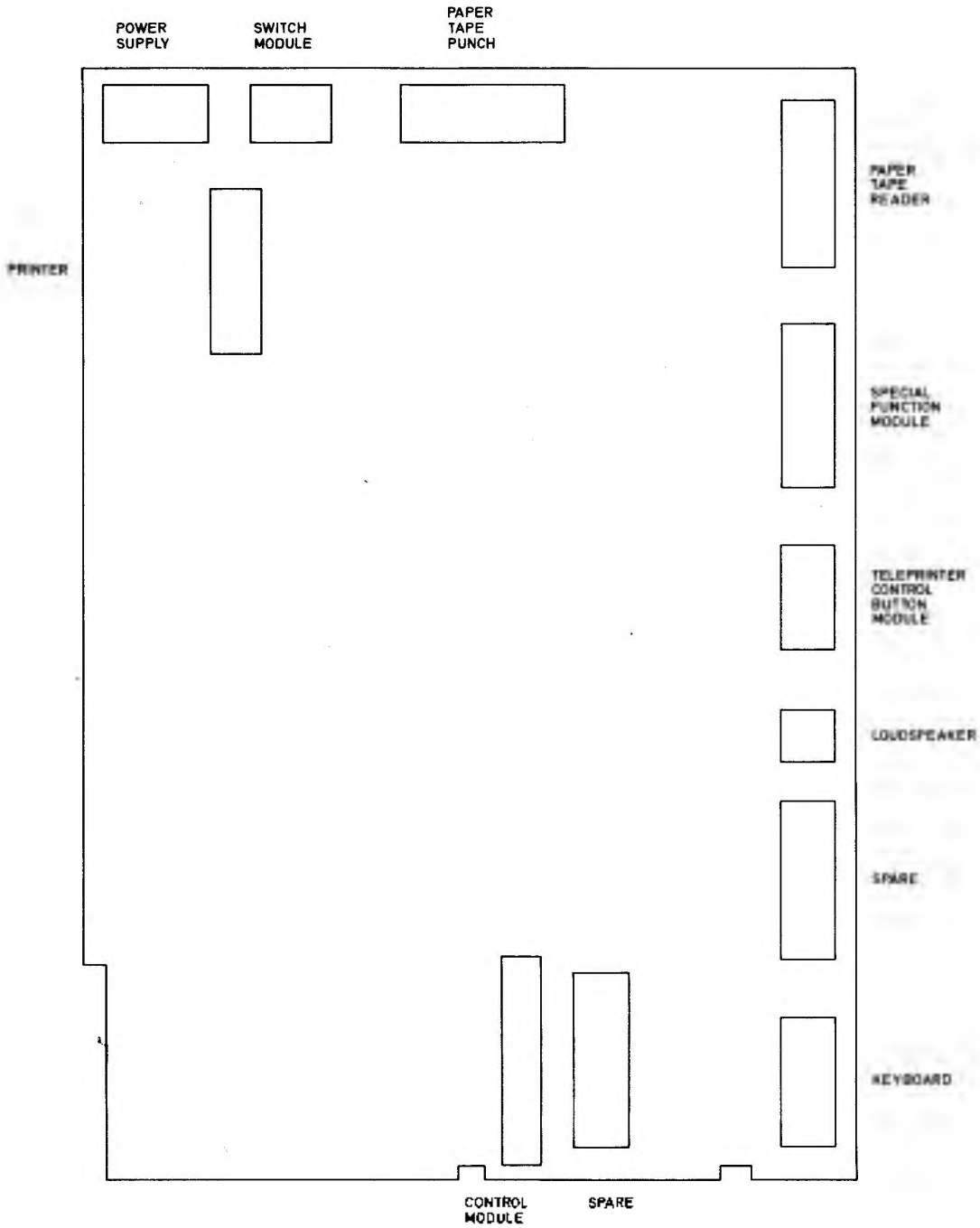
(2) Roughness of the paper tape, possibly caused during punching or by the quality of the paper, will not cause errors and is no reason for replacing the Punch Needle Assembly.

(3) If a cyclic effect is noticed when the tape is run out, check for paper deposit around the sprocket feed wheel by operating the feed wheel drive (23)(Figure 5B.1.7), by hand through one cycle of operation.

(35) Switch OFF the main supply and disconnect the teleprinter.

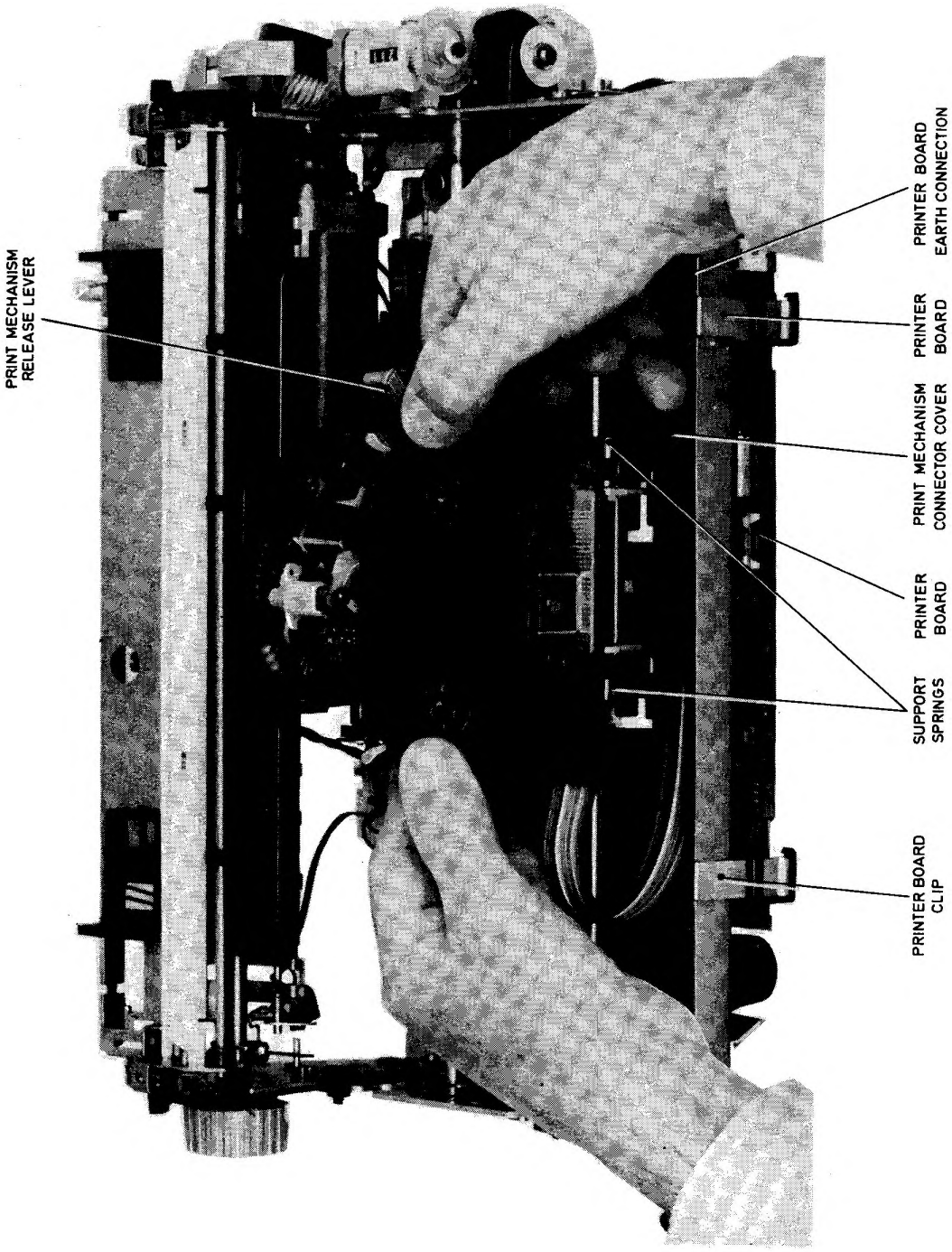
Close the Tape Punch housing as follows:

(36) Reverse procedures (2) to (5) above.



BASIC ELECTRONICS BOARD
CONNECTOR DIAGRAM

FIG. 5B.1.2



PRINTER

FIG.5B.1.3

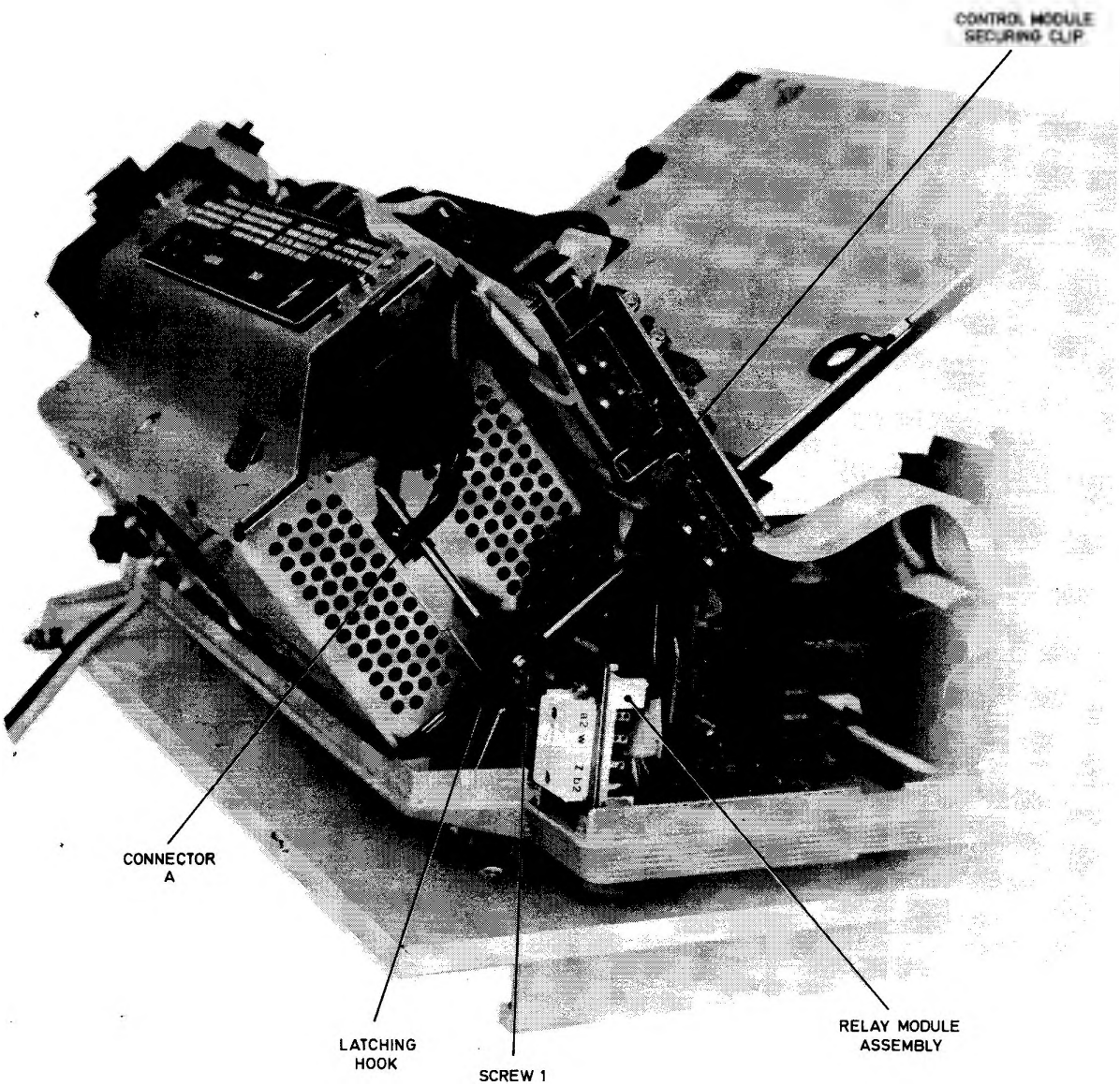
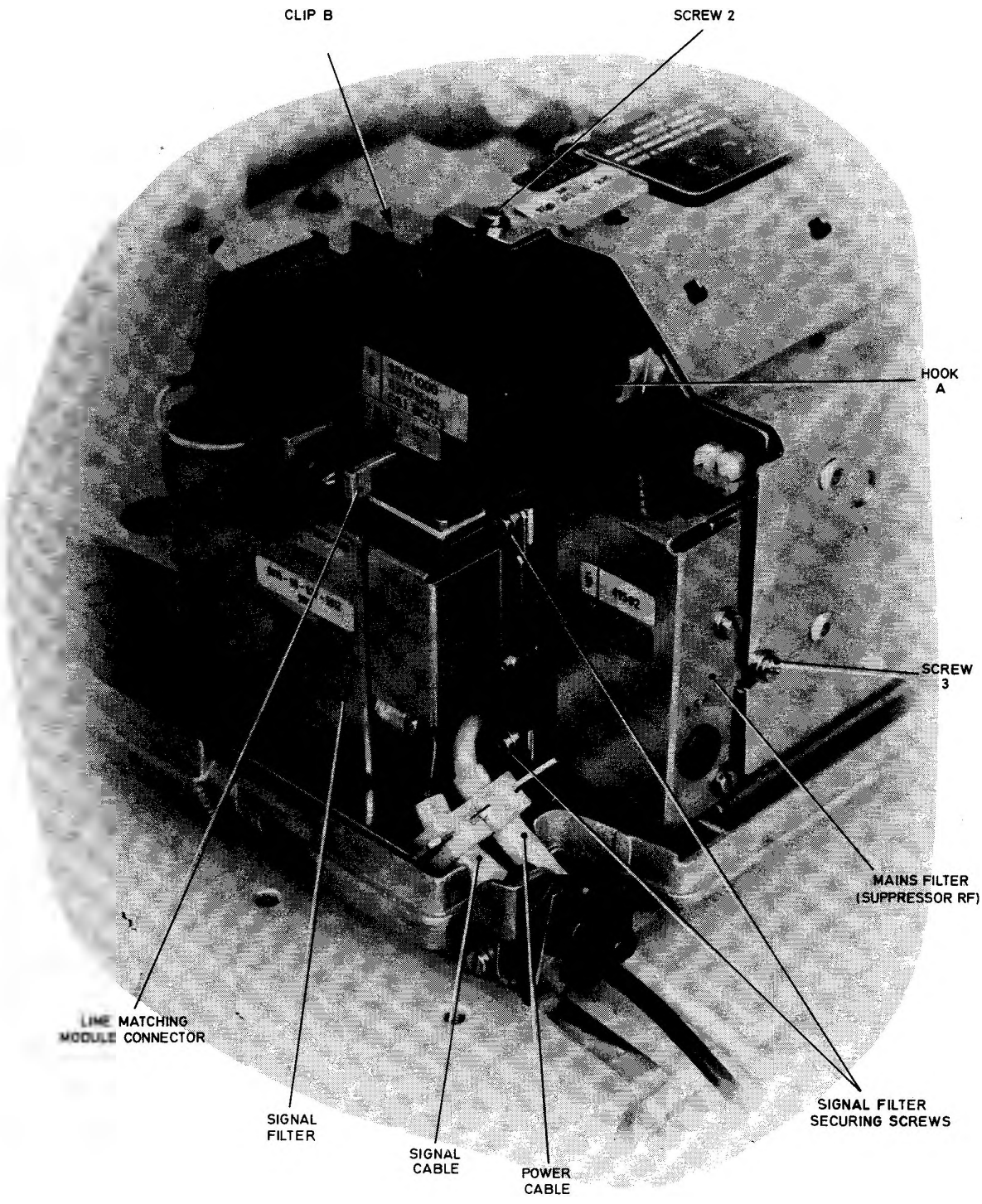


FIG.5B.1.4 TGN 4 REAR ASSEMBLY LEFT HAND SIDE



TGN 4 REAR ASSEMBLY RIGHT HAND SIDE FIG.5B.1.5

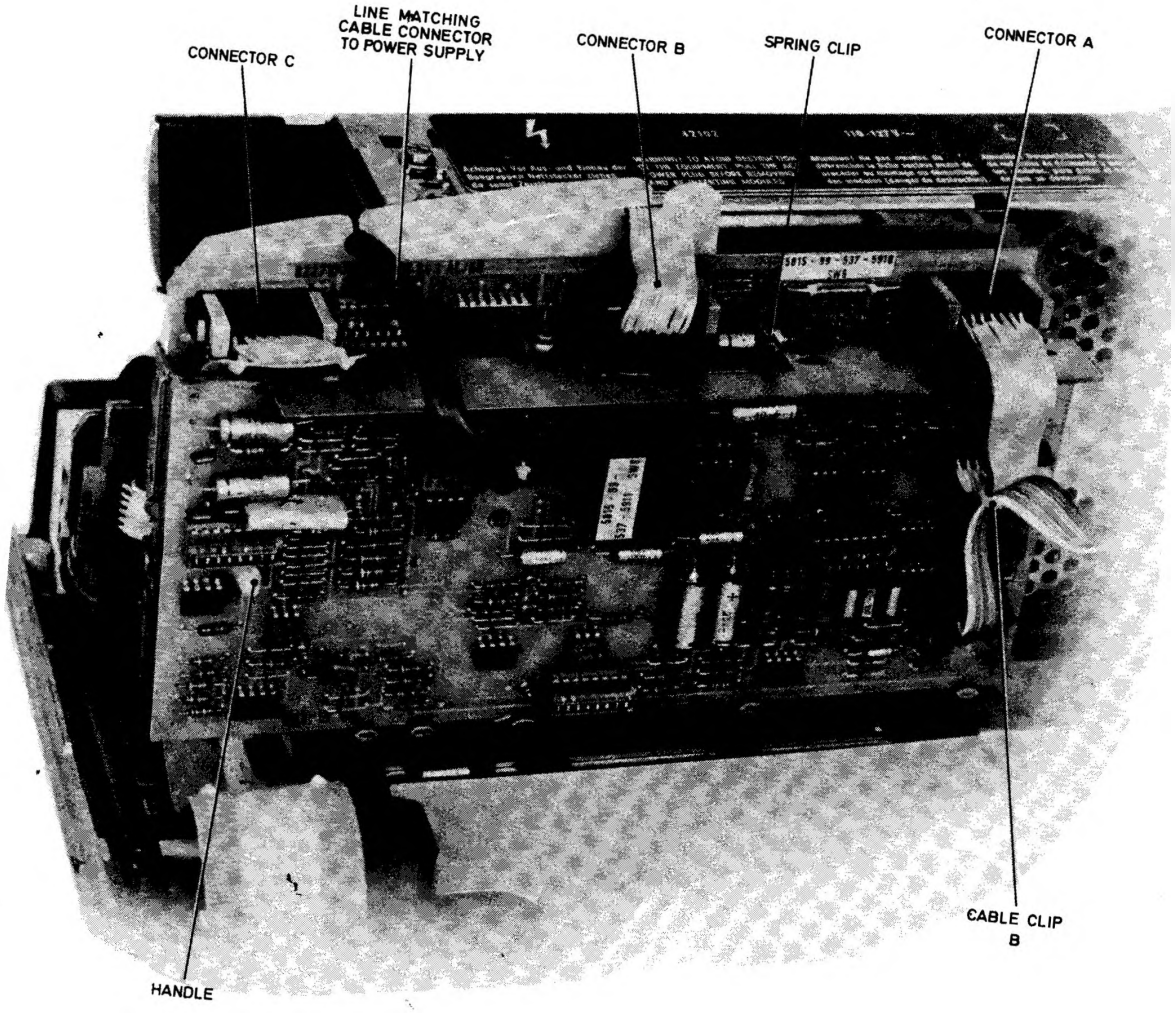
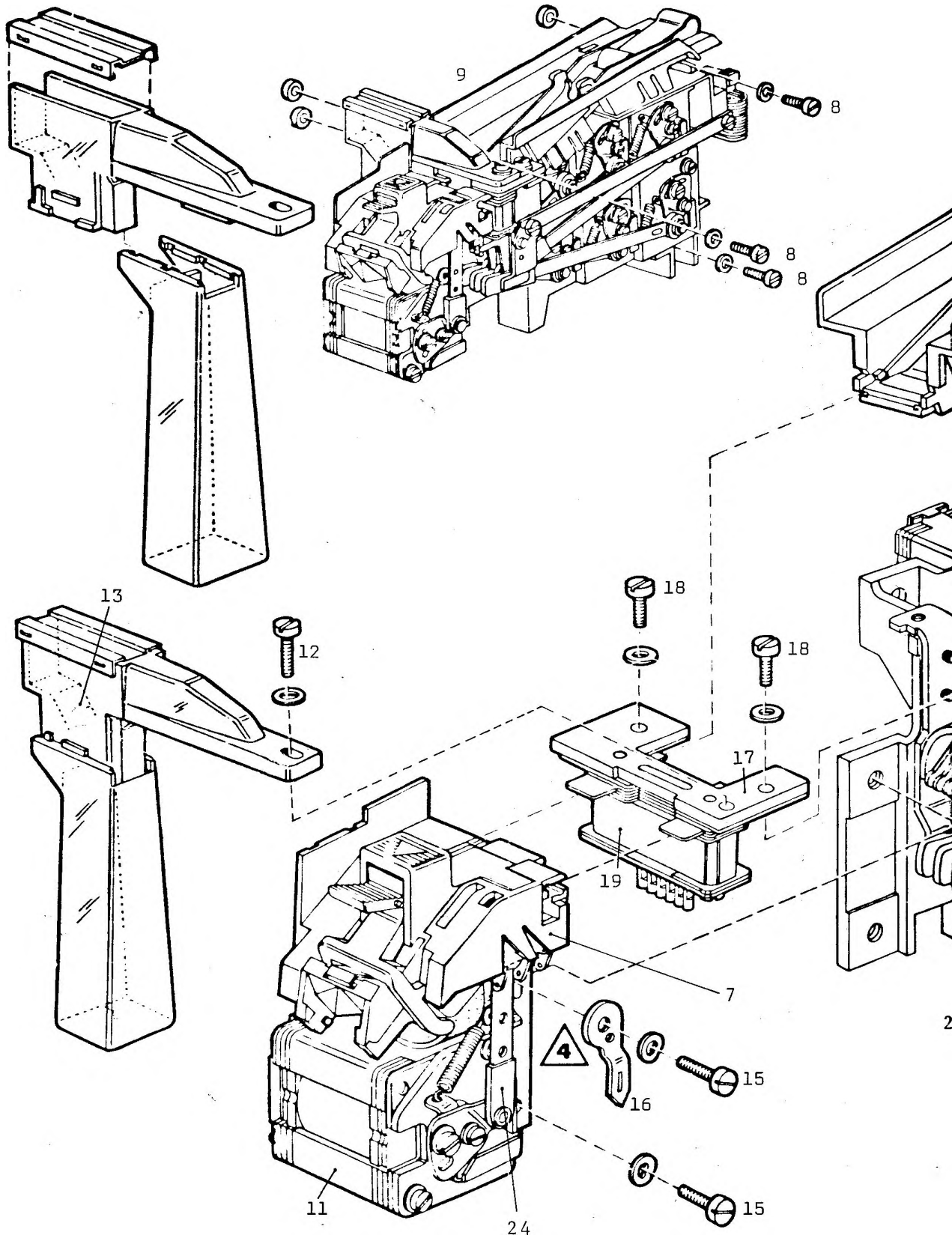


FIG.5B.1.6 LINE MATCHING MODULE BOARD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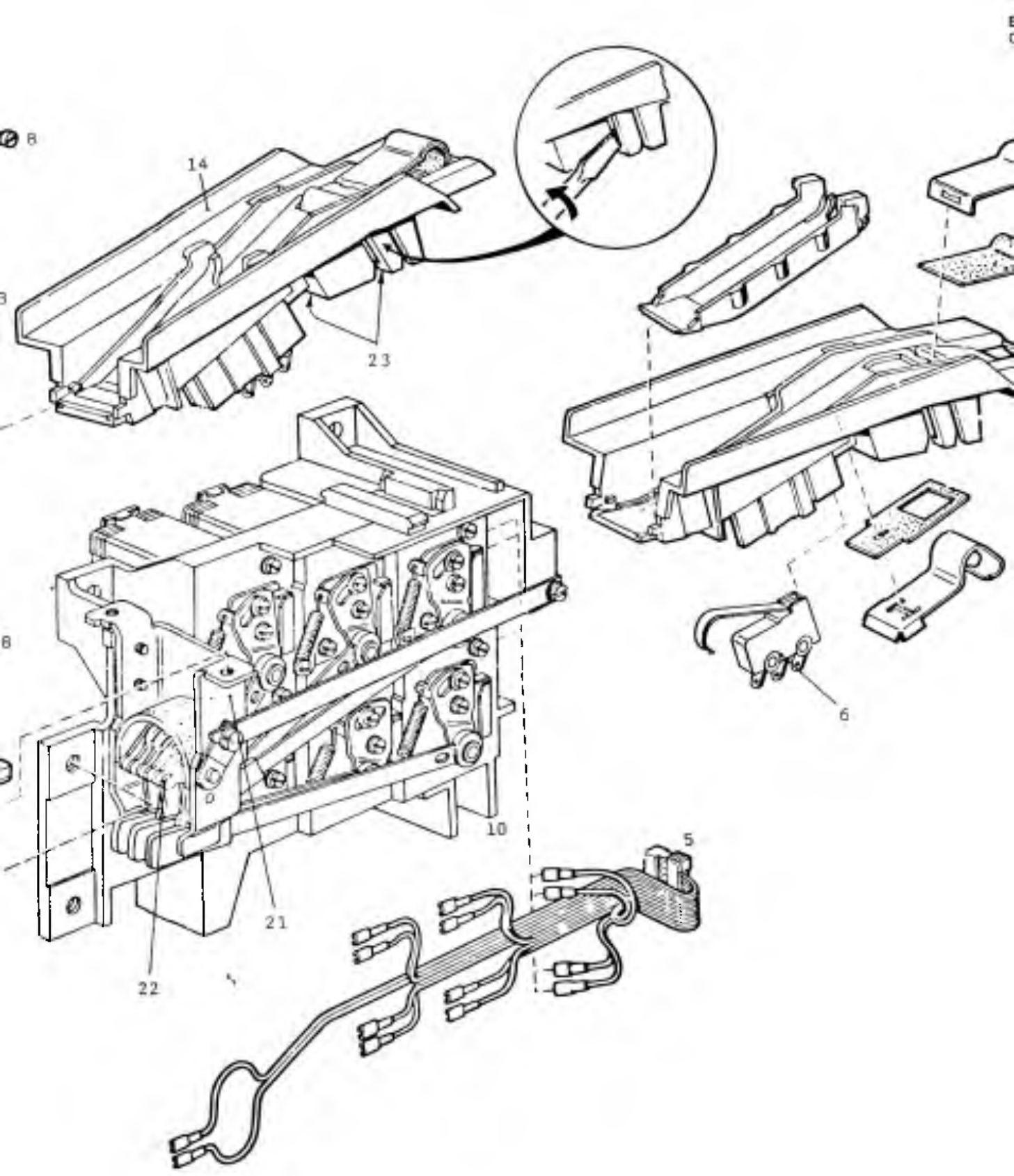
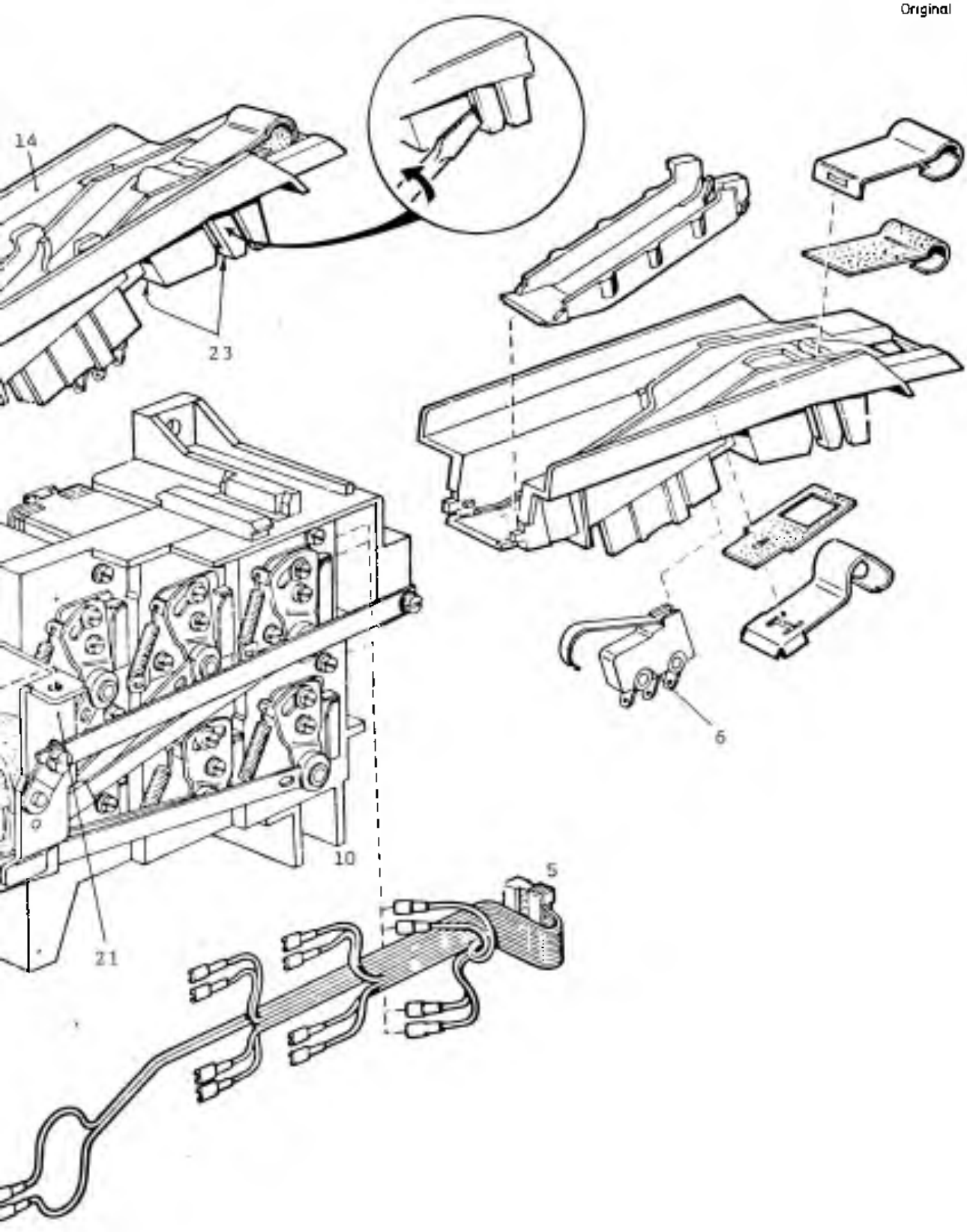
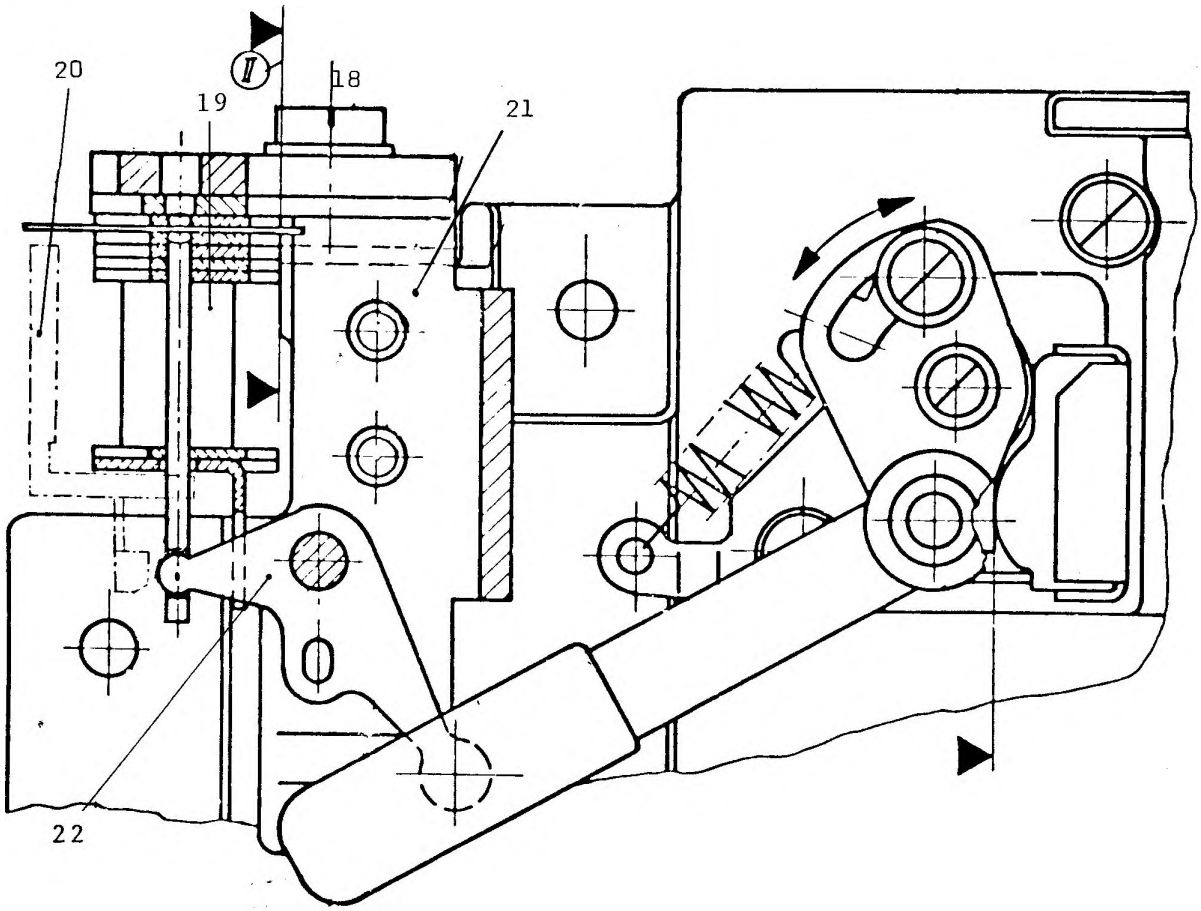


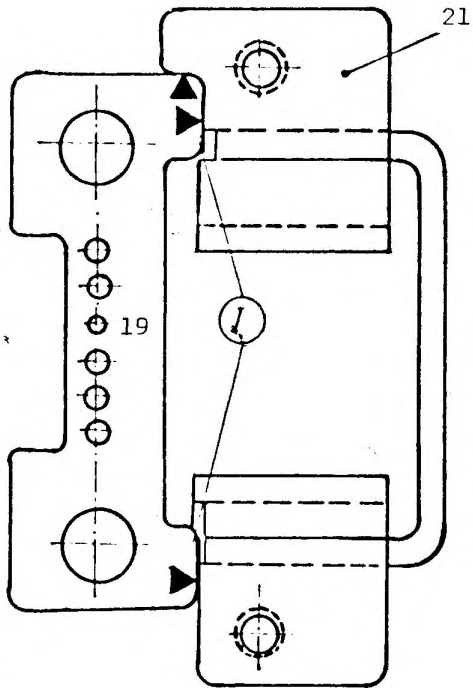
TAPE PUNCH ASSEMBLY

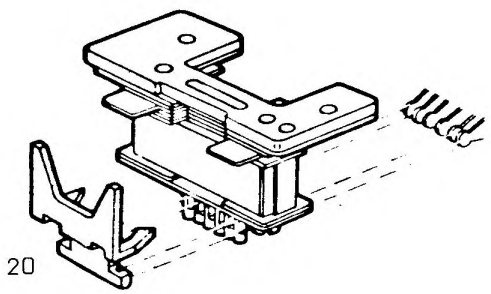


CH ASSEMBLY

FIG. 5B.1.7

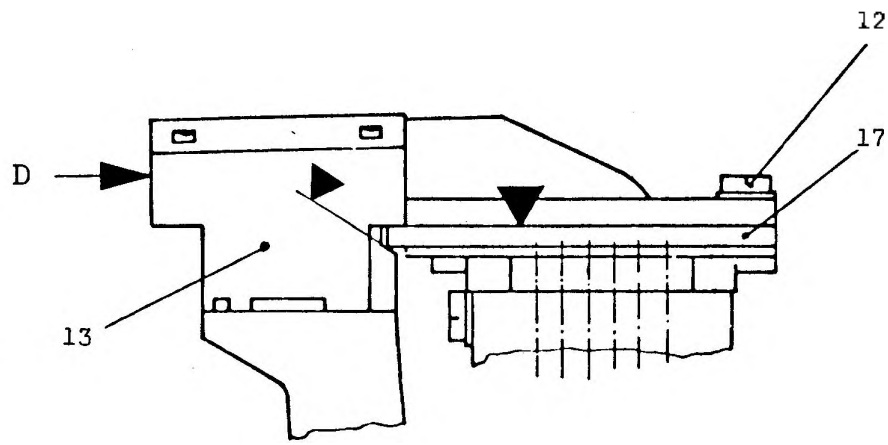






▶ POINT OF CONTACT

FIG.5B.1.8 PUNCH NEEDLE ASSEMBLY LOCATION



CHAD CHUTE LOCATION

FIG.5B.1.9

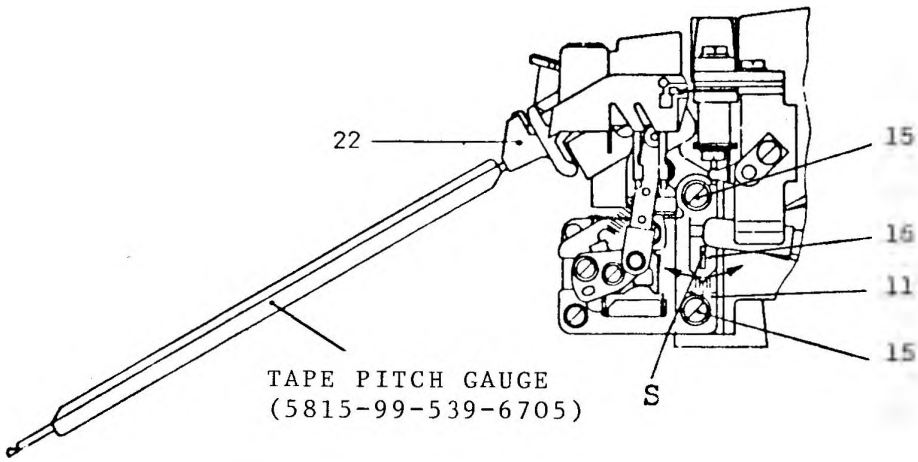
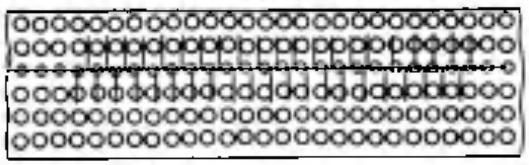
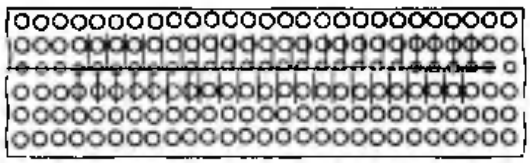


Fig 1



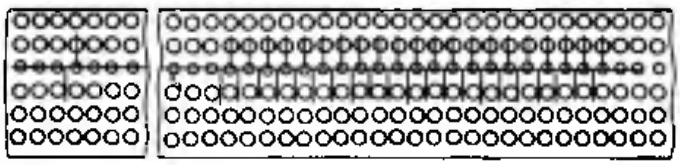
Pitch too narrow: move adjusting plate 16 in "+" direction of the scale on mounting bracket- 11

Fig. 2



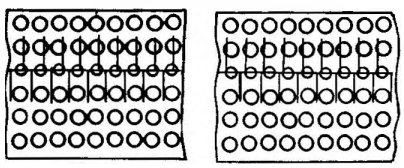
Pitch too wide: move adjusting plate 16 in the "-" direction of the scale on mounting bracket- 11

Fig 3



Pitch is correctly adjusted since the picture of information hole and pitch mark is identical for scale marks 1 to 20 and the last scale mark.

Fig 4 *Fig 5*



Pitch is adjusted correctly if the picture of information hole and pitch mark is indentical for scale marks 1 to 20 and the last scale mark.

TAPE HOLE PITCH ADJUSTMENT FIG. 5B.1.10

CHAPTER 2

CORRECTIVE MAINTENANCE -

INTERFACE UNIT, TELEPRINTER

CONTENTS

Paragraph

CHAPTER 2

CORRECTIVE MAINTENANCE -

INTERFACE UNIT, TELEPRINTER

GENERAL

1 The Repair Policy for the Interface Unit, Teleprinter is to replace defective lamps, switches and PCBs only. The replacement PCBs require no setting up, except for checking that the Mains Selector switch is in the correct position.

Preparations

2 Before starting to dismantle the Interface Unit, Teleprinter, it is advisable to remove it from the teleprinter to the appropriate workshop, where there is space to lay the PCBs on a flat surface. The following procedure should be carried out:

(1) Switch off the mains supply.

(2) Remove all plugs and sockets from the rear panel.

(3) Release the two captive thumb screws on the front of the Interface Unit and withdraw it from under the teleprinter.

REMOVAL OF PCBs

Power Supply PCB

3 (1) Remove the Interface Unit's bottom plate, securing screws and lift the plate clear.

(2) Press in the studs on the sides of the connector socket and withdraw it from the plug.

(3) Using a 7 mm spanner or socket, remove the eight PCB securing nuts, with star and flat washers.

(4) Lift the PCB vertically off its securing studs.

(5) Reverse the above procedure to replace a PCB.

(6) Check that the Mains Selector switch is correctly set.

Interface PCB

4 (1) Remove the Interface Unit's bottom plate, securing screws and lift the plate clear.

(2) Press in the studs on the sides of the connector socket and withdraw it from the plug.

(3) Using a 7 mm spanner or socket, remove the seven PCB securing nuts, with star and flat washers.

(4) Lift the PCB vertically off its securing studs.

(5) Reverse the above procedure to replace a PCB.

TELEPRINTER TGN SERIES AND

INTERFACE UNIT, TELEPRINTER

PARTS LIST

Teleprinter TGN1	5815-99-537-4981
Teleprinter TGN2	5815-99-537-4982
Teleprinter TGN3	5815-99-537-4983
Teleprinter TGN4	5815-99-537-4984
Panel Electronic Circuit (Basic Electronics Board)	5815-99-537-5909
Panel Electronic Circuit (Control Module Board)	5815-99-537-5910
Panel Electronic Circuit (Line Matching Module Board)	5815-99-537-5911
Panel Electronic Circuit (Signal Filter)	5815-99-537-5912
Panel Electronic Circuit (Special Function Module Board)	5815-99-537-5913
Cover, Teleprinter	5815-99-537-5914
Cover, Teleprinter	5815-99-537-5915
Cable Assy Power	5815-99-537-5917
Loudspeaker Assy	5965-99-537-5918
*Manual Control (TGN3 and 4 only)	5815-99-537-5919
*Control Switching (Excl Switch Cover)	5815-99-537-5920
Switch Cover	5815-99-539-8851
Suppressor RF (Mains Filter)	5815-99-537-5921
Keyboard Transmitter Teleprinter	5815-99-537-5922
Reader, Tape	5815-99-537-5923
Punch, Tape	5815-99-537-5924
Printer	5815-99-537-5925
Power Supply	5815-99-537-5926
Print Wheel	5815-99-537-5927
Diagnostic Unit	5815-99-537-5928
Ribbon, Teleprinter	7510-99-537-5929
Spindle, Paper Roll	5815-12-134-0136
*Module Manual Controls	5815-99-537-5931
*Manual Control (TGN1 and 2 only)	5815-99-537-8554
Panel Electronic Circuit (Relay Unit)	5815-99-537-9015
Connector, Relay	5815-99-537-9016
Lamp, Filament	6240-99-537-7318
Lamp, Filament	6240-12-121-2587
Fuse Link Electrical	5920-99-537-7317 (INTERFACE UNIT)
Plate, Mounting Teleprinter	5815-99-537-9605
Chad Waste Box	5815-99-539-0627
Cover, Waste Box	5815-99-539-0628
Interface Unit, Teleprinter	5815-99-537-7995
Panel Electronic Circuit (Interface Unit - Power Supply Board)	5815-99-537-7996
Panel Electronic Circuit (Interface Unit - Interface Board)	5815-99-537-7997
FUSE LINK ELECTRICAL (TGN)	5920-99-539-2461
FUSE HOLDER (INTERFACE UNIT)	5920-99-643-1920

PARTS LIST (Contd)

Punch Needle Assy	5815-99-539-5393
Gauge, Tape Pitch	5815-99-539-6705
Plate, Mounting Teleprinter	5815-99-539-4325
Paper Roll (Two ply) - Teleprinter	AP No 24922
Paper Tape (11/16 in.) - Punch	7530-99-901-1482

* For supply purposes the following spares have a different Parts List nomenclature from that in the Handbook Text:

HANDBOOK NOM	PARTS LIST NOM
Teleprinter Control Button Module	Manual Control
Line Control Button Module	Module Manual Controls
Switch Module	Control Switching.

Demands for Spares must be in the Parts List Nomenclature.