WANG

III.H.8.M-1

CUSTOMER ENGINEERING REPRINT FOR FACIT MODEL 4070 TAPE PUNCH WITH ADDENDA

FACIT SERVICE

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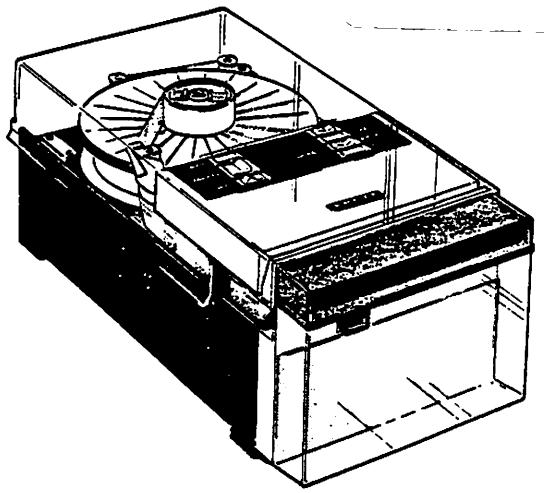

SERVICE INSTRUCTION

Tape punch
4070

Group FD3

Replaces earlier Service Instruction Edition 4

5

Publ.No.
7759-Eng U.S.

MAT. 179-7C

FACIT-ADDO, INC.
66 Field Point Road, Greenwich Connecticut 06830

APRIL 1981

REORDER NUMBER
729-0930

Paper Tape Punch

A change is in process to assign a separate part number to the Facit Paper Tape Punch machine which has been modified by manufacturing. The 725-0099 Facit Paper Tape Punch is modified with a 210-T320 PCA Tested Board, two lock-nuts and spacers. The paint on the case is scraped for grounding purposes and the unit is then assembled with other parts to produce the CEI.

The modified Paper Tape Punch unit can be used as a serial device for teletype communication and phototypesetting equipment. Currently there is no separate part number for modified Paper Tape Punch, and the field is using the 725-0099 number to order replacements. The new part number should be available in Q1.

WANG

III.H.8.M-1

CUSTOMER ENGINEERING REPRINT

PRODUCT MAINTENANCE MANUAL

FACIT MODEL 4070
TAPE PUNCH WITH ADDENDA

APRIL 1981

REORDER NUMBER
729-0930

PREFACE

This document is a combination of the Facit Service Instruction Manual for the 4070 Paper Tape Punch, product information for the 5163 Facit Code Translating Interface card, and operating and tape loading procedures. Information relating to the interface is added as Addendum A, while operating and tape loading procedures are found in Addendum B. These documents relate to the Wang PTP-3 Paper Tape Punch (WLI #177-9460), which itself is a combination of the 4070 Facit Punch and the 5163 Facit Code Translating Interface.

FACIT
SERVICE

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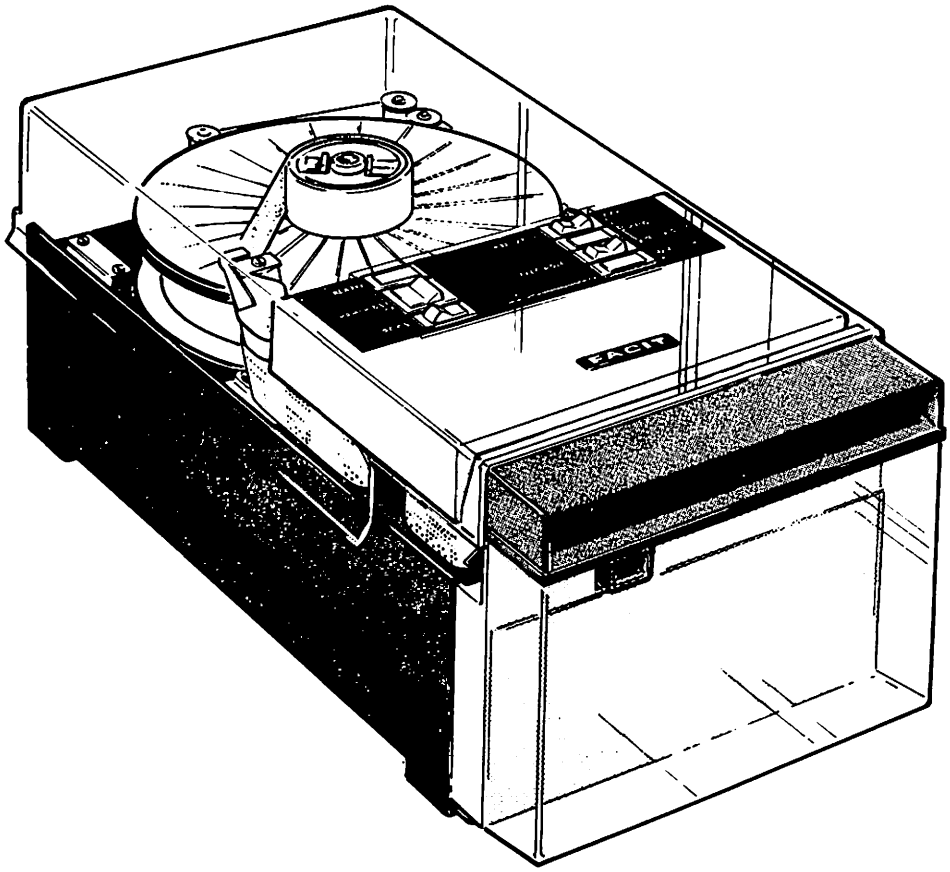

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Tape punch
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FACIT-ADDO, INC.
66 Field Point Road, Greenwich, Connecticut 06830

1 GENERAL

FACIT 4070 tape punch records data on 5-, 6/7- or 8-track tape. Punching speed depends on the flow of data to the punch and can vary from 0 to 75 characters per second.

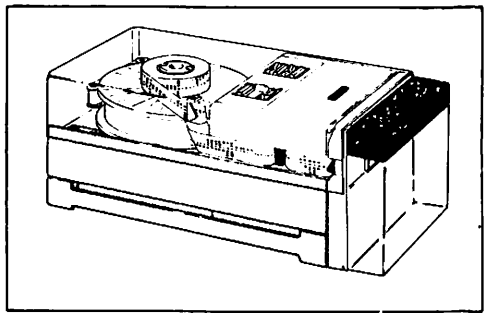
The tape is fed by a stepper motor driver capstan. All nine punch pins are solenoid-operated.

This service instruction (Ed.4) describes the tape punch 4070 built up with TTL-circuits in the 74-series. Old (DTL) and new (TTL) circuit boards are compatible and can thus replace each other. The descriptions are so worked out that they cover both the old and the new version of the Facit 4070. See Table of contents. In appendix 4 the data generator for 4070 is presented. The document (UB691110) for this generator is thereby replaced. In cases when an adapter (SPI-interface) is built in, the reader is advised to look for the service instruction entitled: "Facit 5117 tape punch adapter service manual" (MEB730531).

1.1 TAPE PUNCH VARIANTS

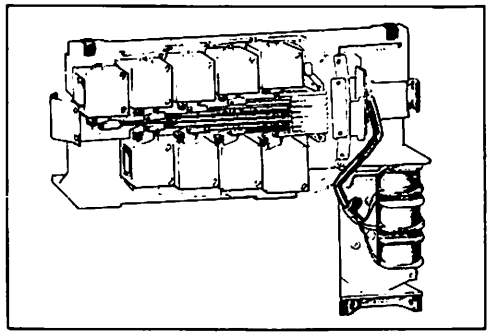
VARIANT		APPLICATION											
No.	Name plate/ Prod. no.	ECMA	TS	Rack	Voltage (V) 100/-240	115	DC 48/60	DC 24	Hz 50-100	60	Safety approval CSA	UL	
1	9280 16 01	X			X				X				
2	02		X		X				X				
3	03	X						X					
4	04*	X				X				X	X	X	
5	05*		X			X				X	X	X	
6	07	X		X	X				X				
7	08		X	X	X				X				
8	09	X		X				X					
9	10*	X		X		X				X	X	X	
10	11*		X	X		X				X	X	X	
11	12	X					X						
12	9280 16 13	X		X			X						

* Label marked 115V/60Hz, but the machine is re-connectable for 100/.....240V, 50-100Hz.



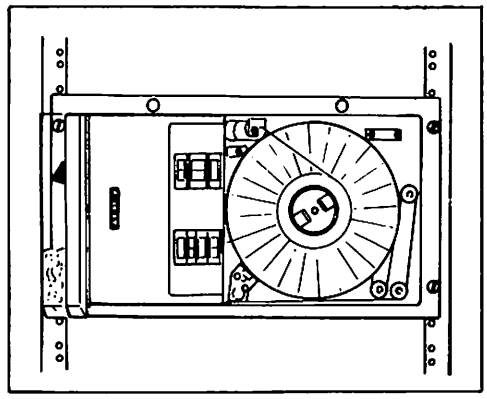
Facit 4070

The Facit 4070 tape punch operates at speeds up to 75 characters per second. It punches 5, 6/7 or 8 tracks tape and is also available for punching 6-track typesetting tape.



Facit 4071

Punch and feed unit.



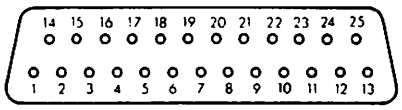
Facit 4070 rack

The Facit 4070 in a 19" rack-mounted version. The text on the control panel is turned for easy readability. The specially designed chad box replaces the front lid to ensure optimum air cooling for the punch unit. The chad box must thus always be in place when the punch is operating.

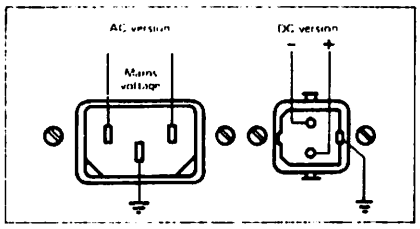
2 SPECIFICATIONS

2.1 EXTERNAL CONNECTORS

P1 (Signal connector)



P3 (Power connector)



2.1.1 Signal connector P1

PIN	SIGNAL	PIN	SIGNAL	PIN	SIGNAL
1	Ch1	10	SD	18	-
2	Ch2	11	PI	19	EXT
3	Ch3	12	PR	20	ERR1
4	Ch4	13	TP	21	TL
5	Ch5	14	-	22	+24V
6	Ch6	15	-	23	-
7	Ch7	16	-	24	+6V
8	Ch8	17	-	25	0V
9	Ch9				

2.2 INTERNAL CONNECTORS

The signals in the following board edge connectors are listed in section 2.7. The connector locations are shown in Fig. 1.

K1: 22-contact connector for control circuit board.

K2: 22-contact connector for bridging board or system adaptation board.

K3: 22-contact connector for PC board containing fuses for punch solenoids and stepper motor.

2.3 VOLTAGES, POWER CONSUMPTION, FUSES

Supply voltage AC-variants: 100/115/220/240V $^{+15\%}_{-10\%}$
Single phase 50-100Hz
Grounded mains inlet

Supply voltage DC-variants: 24V $^{+20\%}_{-15\%}$, max peak current 30A

48/60V $48V^{+8}_{-4}$, $60V^{+10}_{-5}$

Extra power output 500mA from +6V

Power consumption:

	MIN	MAX
AC-variants,	50W	200W
DC: 24V	5W	180W
: 48/60V	40W	220W

Fuses: F1, 0.63A (located on control circuit board)
F3-12, 2A, for each punch solenoid and motor winding (located on punch unit).

The transformer is provided with a thermal protector that is self-resetting.

F2, DC variants are provided with a 5A time-delay fuse (located on the rear panel).

F2, AC variants are provided with a 2A time-delay fuse (located on the rear panel).

2.3.1 External load

Both the AC variants and the 24V DC variant are dimensioned to provide extra DC outputs for additional electronics of 1A at +6V and +24V.

2.4 GENERAL DATA

Operation speed: Up to 75 characters per second

Tape feed: Asynchronous, externally controlled

Feed accuracy: Complies with or exceeds ISO standards:

	Better than
Adjacent rows,	$\pm$3%
10 rows	$\pm$1%
50 rows	$\pm$0.5%

Backspacing: 4-10 steps depending on tape quality

Mark character: Customer-selected. Usually on all-hole delete character. Programmed using straps (TTL) diodes (DTL) on control circuit board.

Buffer register: Built in, stores one character.

2.5 TAPE DATA

Punch hole configuration: 5-8 track ISO standard, 6 track typesetting.

Type widths: 5 track tape, 11/16 inch (17,5mm $\pm$0.08mm) and 8 track tape, 1 inch (25,4mm $\pm$0.08mm). Alternatively 6 and 7 track, 7/8 inch (22.2mm $\pm$0.08mm)

Thickness of tape: 0.08mm - 0.11mm

Type of tape: ISO-standardized dry paper tape. Paper/Mylar/Paper tape.

2.6 DIMENSIONS AND WEIGHT

Designation/Version	Width		Depth		Height		Weight			
							AC		DC	
	mm	in	mm	in	mm	in	kg	lb	kg	lb
4070 table top	220	8.6"	432	17"	198	7.8"	13.5	30	9.5	21
4070 rack mounted	483	19"	198	7.8"	266	10.5"	15.1	33	11.1	24

2.7 SIGNAL SPECIFICATIONS

Appendix 1 supplies information about all internal connectors and which signals that passes through each connector. Following table presents all signals used in each model. The signals are presented in alphabetical sequence.

SIGNAL	CONNECTOR P1/Pin in	P1/Pin out	K1/Pin in	K1/Pin out	K2/Pin in	K2/Pin out	MEANING/DESCRIPTION
Ch1-8	1-8		A1-8		A1-8	B1-8	Channel 1 through 8. Data signals from external unit. A high signal (pulse) for each hole to be punched.
Ch9	9		A9		A9	B9	Channel 9. Feed hole channel. A high signal (pulse) for each hole to be punched.
CODE HOLES			B16				Code holes. A low signal from switch S5 on control panel makes the punch unit to punch feed holes and holes as per straps W1-W8.
ERR1		20				A16	Error signal 1. This signal goes high when an error is detected. (Tape ruptured). Sets PR low.
ERR2				A17		A20	Error signal 2. The same action as ERR1. Turns on the error lamp. (Available only via system adaption board in connector K2/A20).
EXT	19				B14		External signal. 0V when EXT button (S4) is depressed.
FEED HOLES			B15				Feed holes. A low signal from FEED HOLES button (S5) causes the tape punch to feed tape while punching feed holes.
FAN				B13			Fan. A low signal causes the Fan motor (M2) to start. Starts when feeding or punching is called for.
L1-L8				B1-8			Coils 1 through 8. Signals for the coils contained in the punch solenoids (for the character punching). When low a hole is punched.
L9				B9			Coil 9, signal for the coil contained in the punch solenoid for the feed hole punching. When low a hole is punched.
L10,L11,L12				B10-12			Coils 10 through 12. Signals for the coils contained in the stepper motor M3. The signals are low, one at a time, causing the motor shaft to turn at 120° intervals.
PI	11		A11		A11	B11	Punch instruction. When high, acting as a start pulse for the punching cycle. See Fig.4.
PR	12		A12		A12	B12	Punch ready. Low when data is stored in the buffer register. High when punching is completed. Low at error.
SD	10		A10		A10	B10	Stepping direction. SD=0 means forward feed. SD=1 means backward feed.
TAPE ERROR			B17				Tape error. When reed switch S8 opens, an error condition arises and the error lamp (red) is lighted and error is signalled as described above. Fig. 3 shows the error occassions.
TAPE FEED			B14				Tape feed. When depressing the TAPE FEED button, this signal goes low causing tape feed to be executed.
TL, TAPE LOW		21		A18			Tape low. When the tape low sensor arm makes reed switch S9 to close (see Fig. 3), TL goes high signalling tape low. At the same time Lamp X3 (orange) is lighted.
TP		13		A13	B13	A13	Timing pulse. Pulse generated in the TP flip-flop. Becomes 1 during excitation of punch solenoids.
+24V		22	AB19		A19		} See section 2.3.
+6V		24		AB21	A21		
GND	25	25	AB20 AB22	AB20 AB22	A22	A22	DC-return and signal ground

2.8 FLIP-FLOPS (TTL)

DESIGNATION	MEANING / DESCRIPTION
FFB1-9	Buffer register flip-flops 1 through 9. Contain the character for delivery to the punch unit.
FFC1	Stepper motor counter, flip-flop 1. High level at Q energizes L11. A low level at both FFC1 and FFC2 energizes L10.
FFC2	Stepper motor counter flip-flop 2. High level at Q energizes L12. A low level at both FFC1 and FFC2 energizes L10.
FFCC*	Current control flip-flop. Switches the current on and off to the stepper motor (about 5 kHz).
FFMF	Manual feed flip-flop. Blocks the buffer register inputs, sets PR low and causes FFSL to give 50 ch/s when activated.
FFPC*	Punching cycle flip-flop. High during a punching cycle (IC12/6).
FFSL	Speed limit flip-flop. Adds time to FFTF for supervision of PR (TF+SL=13.3 ms).
FFSR*	Switch regulator flip-flop. Switches the current on and off to coil L1 (about 30 kHz).
FFTF	Time for feeding flip-flop. Controls the current time for the stepper motor together with FFTP.
FFTP	Time for punching flip-flop. Controls the current time for the punch solenoids. Is also used together with FFTF as described above.
FFTS	Start pulse flip-flop. Strobes the data, clocks the stepper motor counter (FFC1-FFC2) and triggers FFTF.

*One shot circuits

OS1	1-sets FFCC (IC17/8 high) at a specific time after reset.
OS2	1-sets FFSR (IC17/3 high) at a specific time after reset.
OS3	Re-triggers FFPC during manual feed.

3 DESIGN AND CONSTRUCTION

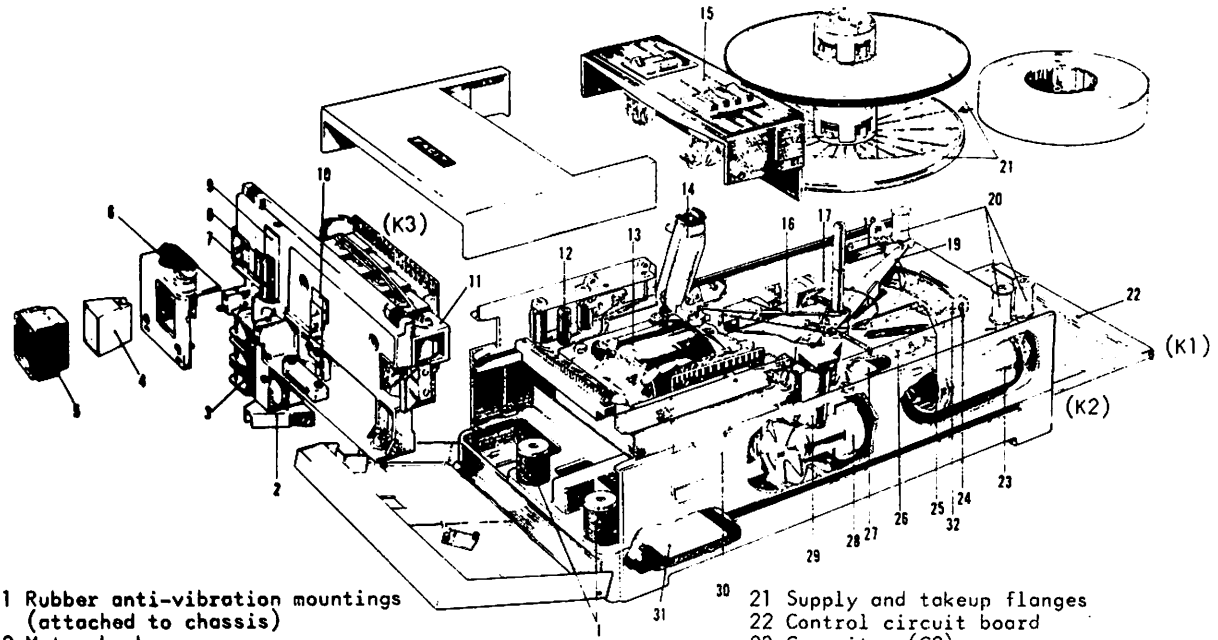
The basic constrution of the Facit 4070 tape punch unit is divided into five modules:

- Punch/feed unit
- Tape supply/takeup unit
- Tape check devices

Mechanical description is briefly given in section 4. See also section 5.

- Power supply
- Circuit boards

Fig. 1 shows an exploded view of the punch



1 Rubber anti-vibration mountings (attached to chassis)
2 Motor brake
3 Stepper motor
4 Chad exhaust
5 Connection for chad tube
6 Pinch roller
7 Die
8 Capstan
9 Punch pin guide
10 Spring-mounted tape guide
11 Punch solenoids
12 Reversing buffer arm
13 Transformer (T1)
14 Tape lifter
15 Control panel
16 Tape low sensor arm
17 Capacitor (C1)
18 Retainer magnet
19 Surge takeup arm
20 Guide rollers
21 Supply and takeup flanges
22 Control circuit board
23 Capacitor (C2)
24 Signal connector (P1)
25 Power inlet (P3)
26 Disturbance suppressor
27 Filter circuit board
28 Fan motor
29 Winding motor
30 Rectifier circuit board
31 Bridging board (can be replaced by a systems adaptation circuit board)

FIG 1

4 FUNCTION

4.1 CONTROLS AND LAMPS

Fig. 2 shows the control panel and the abbreviations mean:

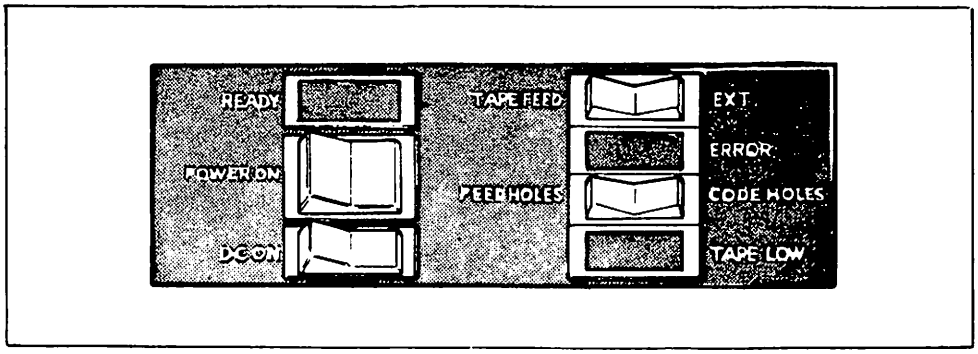


FIG 2

POWER ON:	Switches on mains supply.
DC ON:	Switches on internal DC supply (+6V).
READY:	Pilot lamp (green) - lights up when internal DC is switched on.
TAPE FEED:	Feed virgin tape (without any holes).
EXT:	May be used for signalling to data input source - "transmit data", "clear", etc.
ERROR:	Pilot lamp (red) - lights up when tape breaks or tightens.
FEED HOLES:	Feeds blanc tape (with feed holes).
CODE HOLES:	Feeds tape with customer-selected mark character.
TAPE LOW:	Pilot lamp (orange) - lights up when tape nearing end.

4.2 TAPE FEED AND PUNCHING

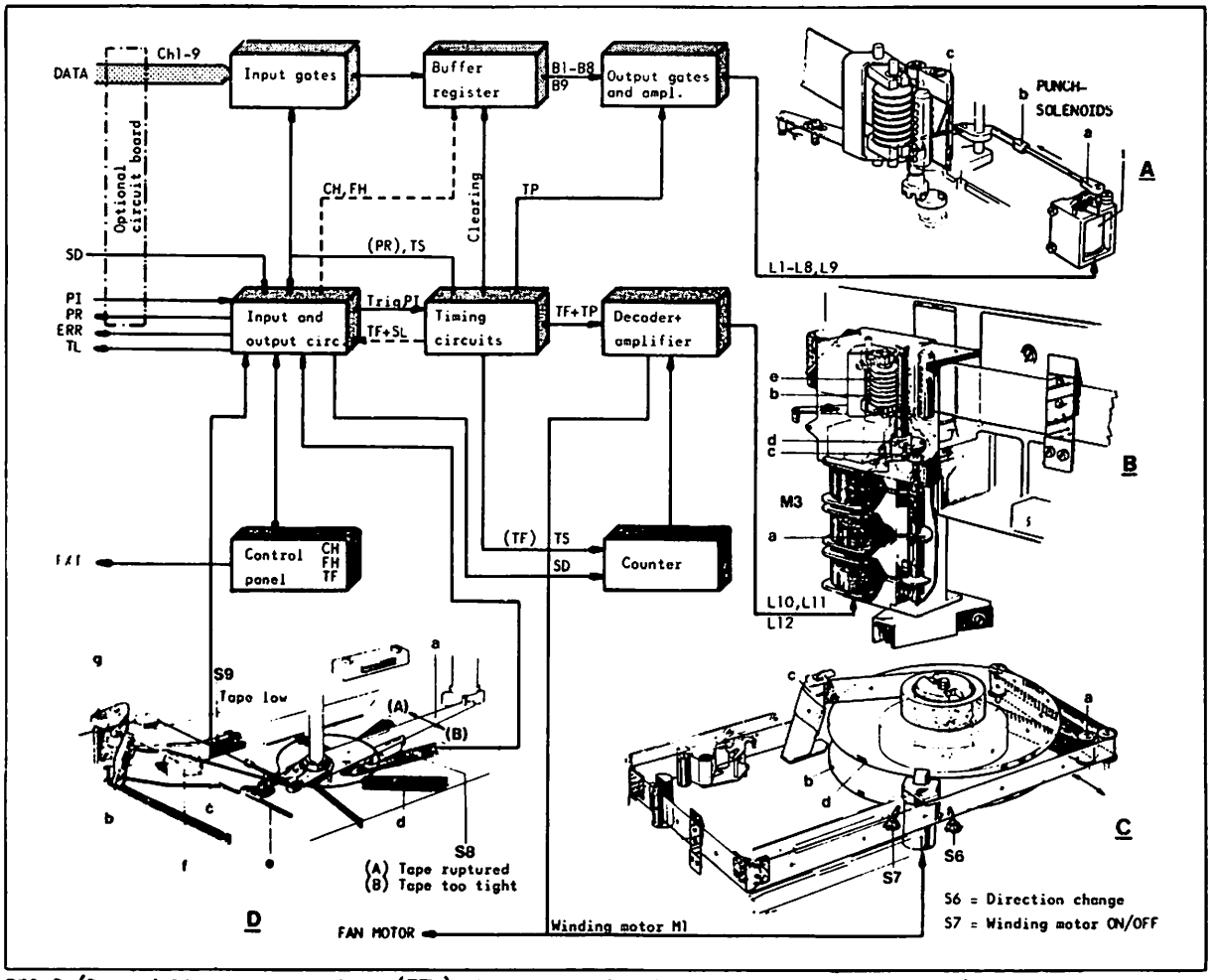


FIG 3 (Dotted lines= new variant (TTL). Letters within brackets= old variant (DTL)

4.2.1 Block diagram - electronic description

Following description refer to Figs 3 and 4. The description is so worked out that it covers both the old and the new version. Comments within brackets concern the old version.
If PR is high a punching cycle is started by setting PI high. After a delay of about 10µs the input circuits accepts PI and generates a start trig pulse to the timing circuits. The cycle is now started and can not be stopped. The timing circuits generates the timing sequence TS-TF-TP(PI-TF-TP)
└SL
During TS (PI to PR), the data input gates are open to the buffer register in which the data is to be stored until punching shall commence. At the trailing edge of TS, when PI goes high, TF is generated and the stepper motor counter is also triggered. (The counter steps forward or backward depending upon SD.) During TF, current is supplied to the stepper motor which turns the motor shaft 120° to its next position. At the same time (TF + TP delayed) PR is set low indicating feeding and punching continuing. When TF has elapsed TP and SL (TP) are generated. TP opens the amplifiers for the punching solenoids, which punch holes according to the buffer register content. During TP the stepper motor still receives current for keeping the tape steady during punching. When TF vanishes, SL takes over and continues to keep PR low. The time during which SL is high thus determines when PR shall go high signalling ready for next cycle.

At manual control using any of the MF pushbuttons TF, FH or CH, the punching-/feeding cycle parallely starts with PI and is completed as described above. When any of the MF push buttons is depressed PR is low and PI and the data inputgates are blocked.

4.2.2 Block diagram - mechanical description

4.2.2.1 Tape feed

See subfig. B in Fig. 3. For each step pulse (L10, L11,L12) from the stepper motor drive circuits, the motor shaft (a) turns 120°. The shaft motion is transferred to the capstan (b) via pinwheel (c) and slotted wheel (d). When the capstan turns (half a revolution for each motorshaft revolution), the tape is fed by capstan (b) and the pinch roller (e).

4.2.2.2 Punching

See subfig. A in Fig.3. The motor first advances the tape one row (one step, L10-L12) then the selected punch solenoid/s receive a punch signal wherewith the actuator/s (a) turns. The motion is transferred via the punch pin driver/s (b) to the punch pin/s (c) which is/are pressed through the tape. When the pulse vanishes the components return to their initial positions.

4.2.2.3 Tape supply and take up

See subfig. C and D in Fig 3. If the tape is unwound too rapidly, the surge takeup arm (a) moves in the direction shown by the big arrow in subfig. C. The brake shoe (b) (subfig. D) then is moved by means of link (c) wherewith it is pressed against the supply flange (b) (subfig. C). The braking continues until the surge takeup arm (a) re- assumes its normal operating position.

The tape spirals once around tape lifter (c) in subfig. C and proceeds to the take up flange (d). The take up flange is driven by winding motor (M1) which presses against a rubber ring at the periphery of the flange.

4.2.2.4 Tape checks

See subfig. D in Fig. 3. Tape unwinding is checked automatically when three situations arise:

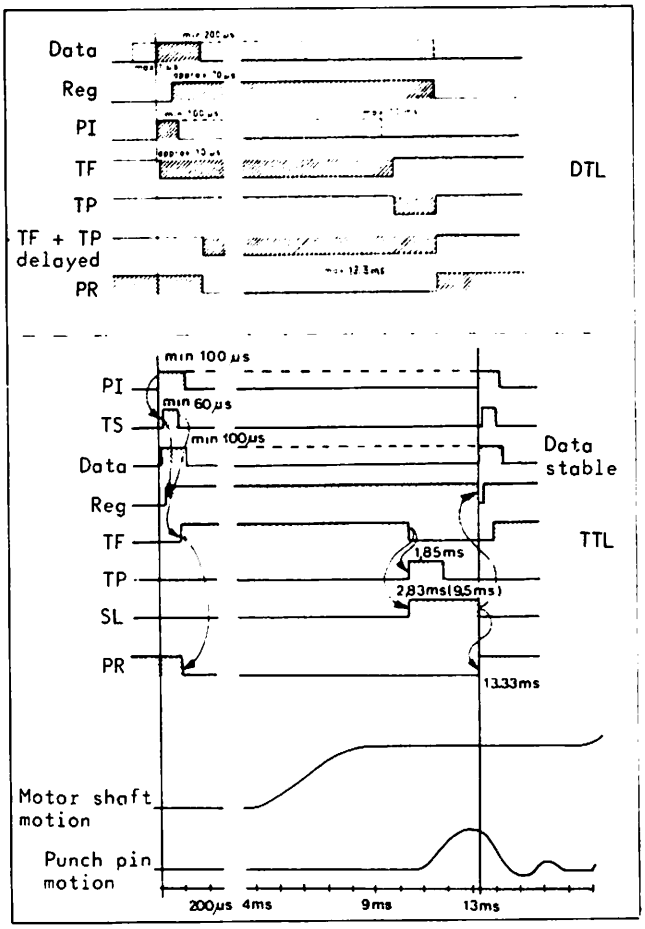


FIG 4

A. Tape ruptured

B. Tape too tight

C. Tape low (supply almost exhausted)

Situations A and B are handled by permanent magnet (d). This magnet actuates reed switch (S8) when the surge takeup arm (a) leaves the working sector. S8 opens and inhibits one of the conditions for punching. PR is set low and the ERROR lamp on the control panel lights.

Tape low is sensed by tape low sensor arm (e) which rests against the tape on the supply reel. As the tape is unwound the permanent magnet (f) moves gradually toward reed switch S9. At a certain point the switch closes wherewith the TAPE LOW lamp lights on the control panel. The tape low indication can be adjusted from 1000 to 10 000 rows before end of tape using screw (g).

4.3 ELECTRONIC DESCRIPTION

4.3.1 Starting the punching cycle (DTL)

The punching cycle comprises two phases: feed and recording. See Fig. 4. Feed takes place during time TF (approx 10.5ms); recording takes place during time TP (approx 1.85ms). Power is supplied to the stepper motor during the entire punching cycle TF + TP. The motor thus keeps the tape stationary while it is punched. 200µs after the data is entered into the buffer register, signal PR goes low and remains low until the character has been punched.

Signal PI triggers FF-TF via gate V42 (see appendix 2). IC201/11 goes high simultaneously, and as a result a trigger pulse can proceed to counter flip-flops FF-C1 and FF-C2. The TF signal is differentiated and triggers the counter flip-flops via IC6. When the PI signal vanishes, the inputs to the counter flip-flops are blocked, thus eliminating the effects of any unwanted pulses.

When FF-TF is triggered, test point S goes high. Transistor V45 therewith becomes conducting and gates out the signal V42 via diode D45. Consequently, PI cannot trigger FF-TF again before the punching cycle is completed, i.e. when test point S goes low. Capacitor C35 located between the base and collector of V42, prevents signals having a duration of less than about 10µs from starting a punching cycle. When the collector of V45 goes low, the register inputs are opened and the character that is to be punched is entered into the register. Register flip-flops that are 1-set receive holding current via feedback resistors R10 - R18. 0-setting takes place when V45 is cut off.

Signal TF also triggers timing flip-flop FF-A1 which, in turn, triggers timing flip-flop FF-A2. The purpose of these flip-flops is to keep signal PR low for 13.3ms, thus limiting the punching speed to 75 characters per second.

The signal from the timing flip-flops proceeds via OR circuit IC201 and a 200µs delay circuit to transistor V43. V43 becomes conducting and gates out data signals via diodes D1 - D9. Simultaneously, the gate used for the PI signal is closed via diode D46, and transistor V38 becomes conducting. The PR signal goes low and remains low during the entire punching cycle.

During time TF (and TP) the stepper motor steps one step. See section 4.3.3.

When flip-flop FF-TF returns to the 0 state, flip-flop FF-TP is triggered. The TP signal (0 V) cuts off transistor V40, wherewith diodes D28 - D36 are blocked and the information in the register is gated to the punch solenoids. When FF-TP returns to the 0 state, V45 is cut off, wherewith the register is 0-set. When FF-A2 returns to the 0 state, V43 is cut off, wherewith signal PR goes high, thus indicating externally that the punch is ready to receive and punch a new character.

4.3.2 Starting the punching cycle - (TTL)

The punching cycle comprises two phases: feed and recording. See Fig. 4 . Feed takes place during time TF (approx 10.5ms); recording takes place during time TP (approx 1.85ms). Power is supplied to the stepper motor during the entire punching cycle TF+ TP. The motor thus keeps the tape stationary while it is punched. 70µs after the data is entered into the buffer register, signal PR goes low and remains low until the character has been punched.

If PR is high the punching cycle is started when PI goes high. See appendix 1. (PI is blocked at V12 when PR is low). The inverted PI pulse at V11 is delayed 10µs at IC15/12 because of R65, C13. The delayed PI pulse triggers FFPC, setting IC12/6 high wherewith the reset condition at the buffer register flip-flops FFB1-9 vanishes. At the same time FFTS is triggered and 1-set. The high condition on the Q-output of FFTS opens the data inputs at V1-V9 via IC11/1 (IC11/2 is high at no manual feed). FFTS is 1-set 60µs (C35). At the trailing edge of the TS pulse, the stepper motor counter flip-flops FFC1 and FFC2 are triggered and count one step (forward or backward depending on SD, see next section). At the same edge, FFTF is triggered and the Q-output goes low. $\bar{Q}$ low sets IC13/6 low and IC16/8 high. This means that the current control pulses from FFCC (see section 4.6) passes IC13/8. The stepper motor counter position now directs the current control pulses to the stepper motor drive circuits via IC7/3, 6 or 11. FFTF$\bar{Q}$ also sets PR low via IC19/9, D10 and V13. At the trailing edge of TF, when FFTF$\bar{Q}$ goes low, FFSL and FFTP are triggered and 1-set. The low condition at FFTP$\bar{Q}$ opens V21 via IC13/3 and the information in the buffer register is gated to the punch solenoid drive transistors V24 through V32. (For the channels that are not to be punched, the current flows through D1 - D9 to gnd because the corresponding flip-flops FFB1 - FFB9 are 0-set). The TP signal is also available at connector P1 (for external strobing). When FFTP$\bar{Q}$ is low the stepper motor drive circuits still receive current, via IC13/4, as described above. This causes the tape to stand still during punching.

FFSL$\bar{Q}$ retains PR low via IC19/10, D10 and V13, causing the cycle time to be 13.33ms. This results in maintained speed at 75ch/s.

When FFTP returns to its 0-state the punch solenoid and the stepper motor drive circuits are switched off. When the SL pulse goes high, the FFPC is reset wherewith the buffer register is cleared. At the same time the PR signal goes high indicating externally that the punch is ready to receive and punch a new character.

4.3.3 Stepper motor control

Following description refers to Figs. 5 and 6 which describe the new and old versions respectively. Comments within brackets concern the old version (DTL).

The stepper motor windings receive signals from 2-bits counter IC8 (IC2) FFC1 and FFC2 (FF-C1 and FF-C2). These signals are decoded in gating system IC7 (IC1/6, IC4/1 and IC4/11). The signals are gated out during times TF + TP.

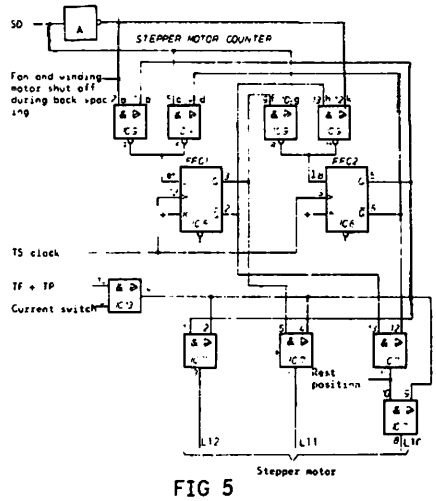


FIG 5

Flip-flops FFC1 (FF-C1) and FFC2 (FF-C2) are JK flip-flops. The counter is triggered by the trailing (leading) edge of signal TS (TF). It can count to 3, either up or down, depending on the polarity of condition SD. For forward feed, the counter assumes states 10, 01, 00, 10 etc. As a result, the winding in the stepper motor are energized in ascending sequence L11, L12, L10 etc. For backspacing, the counter assumes states 01, 10, 00, 01 etc. Consequently, the windings are energized in descending sequence L12, L11, L10 etc. See tables in sections 4.3.3.1 and 4.3.3.2 respectively.

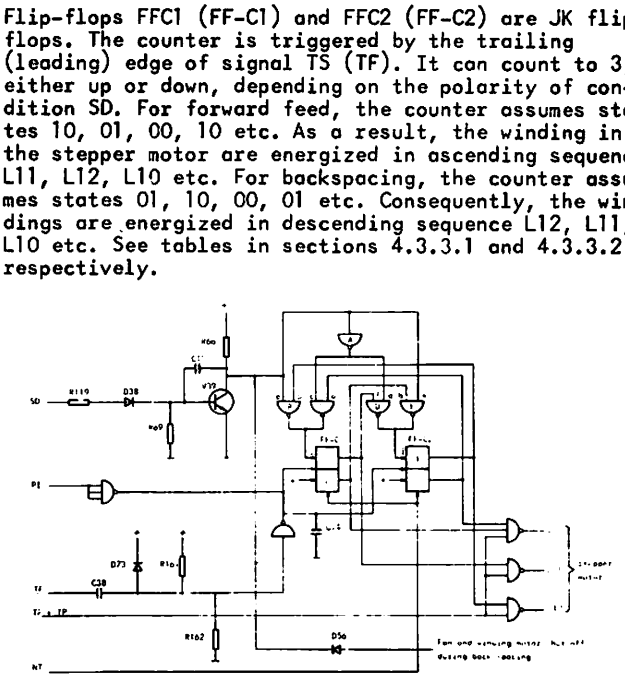


FIG 6

4.3.3.1 Forward feed

Forward feed- (10, 01, 00)

Trigger pulse (TF)	Condition a b e	State of (FF-C1) FFC1	Condition h k l	State of (FF-C2) FFC2	Energized motor winding
1	H L H	0	H H L	0	L10 *) initial pos.
2	H L H	1	L H H	0	L11
3	H H L	0	H H L	1	L12
4	H L H	0	H H L	0	L10 initial pos.
5	H L H	1	L H H	0	L11

H = high level. L = low level.

Gates C and D are blocked during forward stepping, $SD_{c,}$ (inputs c and g obtain the low level via inverter A). This means that the polarity at points e and l is determined by the output signals from gates B and E respectively.

*) When the counter is at its initial state (00) the motor is at its L10- energized position. The motor thus steps to its L11-energized position when the trigger pulse 1 changes the counter state to 10.

4.3.3.2 Backward feed

Backspacing- (01, 10, 00)

Trigger pulse (TF)	Condition c d e	State of (FF-C1) FFC1	Cordition f g l	State of (FF-C2) FFC2	Energized motor winding
1	H H L	0	L H H	0	L10 initial pos.
2	H L H	0	L H H	1	L12
3	H H L	1	H H L	0	L11
4	H H L	0	L H H	0	L10 initial pos.
5	H L H	0	L H H	1	L12

H = high level. L = low level.

Pulses from the counter are sent via decoder IC7 (IC4/11, 1 and IC1/6) to the amplifier for the stepper motor which steps one step for each pulse. For backspacing diode D25 (D56) becomes conducting via transistor V16 (V39), whereupon power to the winding motor and fan motor is shut off.

4.3.3.3 Stepping to the initial position

See appendices 1 and 2.
When the power is turned on, the counter flip-flops are always set to state 00 by "power on" circuit IC21/11 (V65). State 00, the initial state, corresponds to the L10-energized position of the stepper motor.

To prevent a backspace when starting up, it is necessary to step the motor to its initial position when the power is turned off. This is accomplished as follows:

When the +24V supply drops beneath approx +19.0V, (19,5V), the level monitor circuit V18, IC20/6 (flip-flop V56 and V57) is 1-set, whereupon the level at test point V (T) becomes high. Transistor V12 (V43) thereupon becomes conducting and blocks data signals and PI signals via V1 - V9 (D1 - D9 and D46). PR is also set low. In addition, one condition is met at gate IC19/12 (IC7/8). The gate opens if punching is not in progress or if the counter is at state 10 or 01, herewith 1-setting the FFMF flip-flop via IC11/9 (MAN.FEED flip-flop via diode D41) and 1-setting buffer register flip-flop 9 via IC11/8 (via diode D67). This flip-flop is for the feed hole track. Manual feed is now carried out as described in section 4.3.3.4. The stepper motor steps until the counter has reached state 00, after which gate IC19/12 (IC7/8) is blocked when the output of gate IC7/11 (IC4/4) goes high (low). When the last punching cycle is finished, the voltage at test point W (S) goes low, and as a result the switch regulator is turned off and the MAN.FEED flip-flop is 0-set via IC12/6 diode (D51). While the motor is being stepped to its initial position, the stepper motor and DC voltage regulator are supplied from filter capacitors C1 and C2 in the power supply.

4.3.3.4 Manual feed - Mark character

There are three feeding possibilities in the Facit 4070. See section 4.1.

New version (TTL)

When feeding is executed the speed is reduced to 50ch/s due to the fact that resistors R128 and R99 then are connected to the pulse duration input of FFSL, (V17 is cut off). When any of the manual feed-pushbuttons is depressed FFMF is triggered and set (IC12/8 low). The high condition at IC12/11 causes V13 and V12 to conduct via D38, wherewith PR is set low and PI is blocked.

The data inputs are at the same time blocked, V10 is cut off.

The stepper motor is activated during TF as described in section 4.3.2. A mark character (CODE HOLES) can be programmed by moving jumpers W1 - W8 on the main PCB. At delievery from factory, all jumpers are mounted. For a hole not to be punched the corresponding jumper shall be positioned as per the dotted line in appendix 1.

Old version (DTL)

When the MAN.FEED flip-flop is 1-set, diode D55 is cut off. Transistor V47 then obtains base current from the common point in the motor amplifiers via R102, D52, R111 and D54. When the motor pulse has vanished, capacitor C23 discharges via R111 and D54, and as a result V47 is kept conducting for approx an additional 7ms. The signal from the collector of V47 triggers FF-TF and the counter via gate IC7/1, whereupon a new punching cycle commences. The punching speed is approx 50 characters per second. As the MAN.FEED flip-flop is set IC9/13 is high which makes V43 to conduct and cut off the data inputs. PI is blocked at V38 and D46 respectively. The stepper motor is activated during TF as described in section 4.3.1.

A mark character is programmed using diodes D19-D27 on the main PCB (see appendix 2).

At delievery from factory, all diodes are mounted. For a hole not to be punched the corresponding diode shall be removed.

4.4 DC VOLTAGE REGULATOR +6V (DTL)

See appendix 2. In principle the +24V supply is switched on and off at a rate that provides the desired +6V.

The regulator comprises a level monitor made up of differential amplifier V58 and V59 and Schmitt trigger V54 and V60 together with a drive stage V37 and V53. The drive stage is supplied with +24V from the power supply. The level monitor controls the drive stage by sensing +6V via resistor bridge R125, R126, R135 and R136. Capacitor C26 and resistor R143 are connected up in parallel across the +6V load. When the voltage across this circuit drops just below +6V, the drive stage is actuated via the level monitor. (R143 senses rapid variations in the output voltage). Current through the drive stage and coil L1 charges capacitor C26, and when the voltage across C26 rises to approx +6V the drive stage is cut off. The pulse frequency of approx 35kHz varies somewhat with the load.

4.4.1 DC voltage regulator shutoff

The DC voltage regulator is shut off when the +24V supply drops beneath approx +19.0V. Voltage is sensed by transistors V56 and V57. When the voltage at the base of V56 drops beneath approx +5.5V, V56 (and therewith V57) become conducting. The voltage at test point T goes high and cuts off the differential amplifier via diode D63. If the +24V supply drops while a punching cycle is under way or while the stepper motor is not at its initial position, voltage shut-off is inhibited until the punching cycle has been

completed and the counter reaches its initial position. The inhibition circuit comprises transistors V61 and V62. For inhibition, V61 becomes conducting and blocks diode D63. When inhibition ceases, V61 is cut off. V62 then becomes conducting and helps to cut off V61.

4.5 DC VOLTAGE REGULATOR +6V (+5V) (TTL)

See appendix 1. In principles the +24V supply is switched on and off at a rate that provides the desired +6V (+5V). The switch regulator is built up around bistable flip-flop FFSR which at IC17/3 switches the current to coil L1 via V14 and V38. On and off is controlled at IC17/1 and IC17/4 respectively. IC17/5 is kept high via V20 as long as the voltage across C44 is more than 0.6V lower than the reference voltage at the emitter of V20. The negative trigger pulse (about 0.5µs), from the pulse shaping circuit IC21/8 and IC20/11, which is obtained at power on, sets FFSR to ON making V38 to cunduct. When the voltage at the base of V20 goes sufficient high, V20 is cut off and FFSR changes state. After a certain time, depending on charging and recharging of C33 controlled by IC22/8, the FFSR is again set to ON.

4.5.1 DC voltage regulator shutoff, DC-on

The switch regulator is started or stopped via diode D26. The delay circuit R93, C42 controls that any retriggering of the FFSR flip-flop at short power failures, is prevented. The DC-ON circuit which monitors power failures and controls the current grow up, is built up around IC20/6 and V18. The switch regulator turns off/on the PR signalling and the PI control is monitored across R68 by IC20/6. The level across R68 follows the 24V supply. When the level goes high the switch regulator starts and PR goes high.

4.5.1.1 Manual DC-on (TTL)

When the DC-ON push button is depressed 24V is supplied to the base of V18 via R122 and R125 in parallel. The V18 emitter then goes high. After a certain time when the regulator has come into function, +5V is supplied to the collector of V18 wherewith V18 acts as an emitterfollower. When the DC-ON push-button is released, the level at the collector of V18 is controlled by the voltage divider D28 - R125 and R124.

Adjusting R124. R124 shall be adjusted so that IC20/6 goes high when the supply voltage drops to 19.2V.

4.5.1.2 Automatic DC-ON (TTL)

With diode D35 positioned at ®, V18 will act as an emitter follower from the start. This means that IC20/6 goes low as soon as the 24V supply reaches 25V (192V at the primary side of T1). The hysteresis-voltage of 0.8V in IC20/6 causes, together with zener diode D28, the right on- and off levels.
Note: Automatic DC-ON can not be used in DC-variants.

4.6 SWITCHED CURRENT CONTROL FOR THE STEPPER MOTOR (TTL)

The regulator is built up around FFCC (bistable flip-flop) which controls the current to the motor via IC13/8. The current to the motor flows through R112, R113. When the current through these resistors reaches 3.2A (adjusted with R127) the voltage drop is detected by V15 which opens and resets FFCC. The negative trigger pulse (about 5µs) which is then obtained from the pulse shaping circuit IC16/12 and IC19/6, again sets IC17/8 high and so on. During TF and TP IC16/8 is high enabling the pulses from FFCC to pass via IC13/9 and the selected drive input from the stepper motor counter (see also section 4.3.2).

4.7 POWER CONTROL FOR THE STEPPER MOTOR

This circuit prevents the stepper motor from damage if a drive pulse becomes too long or is repeated too rapidly on one winding. This can happen either if TF or TP becomes too long or if the stepper motor counter stops in a certain position.

4.7.1 TTL - Version 1

If, for example, V33 feeds, C27 is charged during the negative pulses via D17 and R103 and is discharged in the pauses via R106. R103 and R106 are so chosen that the point between these resistors is lowered at an appropriate time constant as long as feeding continues. The level at this point is compared with a reference voltage at the emitter of V19 via D21. At the moment when the base of V19 goes enough low, V19 opens V37 which is fed back to V19 via D24. V37 now supplies approx 4A through F1 which blows after about 30ms. R121 and D34 compensate for different variations in the +24V supply.

Adjusting R102 Connect a digital voltage meter or an oscilloscope between the emitter and the collector of transistor V23. Adjust the 25V supply to 25±0V by means of a variable transformer. The voltage across V23 shall then be 3.95 ± 0.05V

4.7.2 TTL - Version 2

If, for example, V33 feeds, C27 is charged during the negative pulses via R103 and is discharged in the pauses. The level is lowered at an appropriate time constant as long as feeding continues. The level at C27 is compared with a reference voltage at the emitter of V19 via D21. At the moment when the base of V19 goes enough low, V19 opens V37 which is fed back to V19 via D24. V37 now supplies approx 4A through F1 which blows after about 30ms. If the switching system fails, C50 is charged so high that V41 starts to conduct and opens V19.

4.8 FAN AND WINDING MOTORS

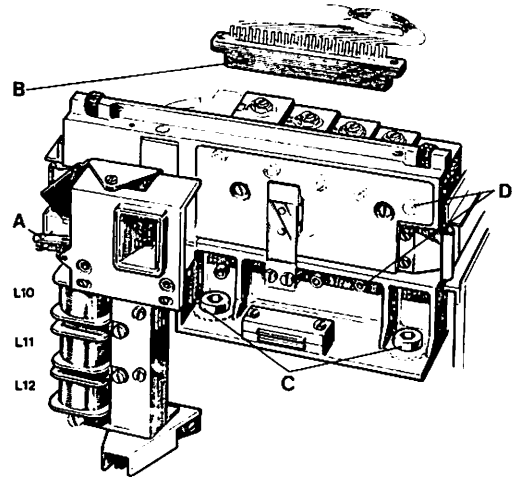
The fan and winding motors are driven via V36 (V48, V52) and IC20/3. The motors start at PR, IC21/4 and DC-ON (DC-ON) and are stopped at backward feed via diode D25 and transistor V16 (D56, V39). There is a 40ms delay at power off, R59, C41 (R113, C24).

Switch S6 controls the winding motor direction. Using switch S7 the motor can be switched on/off. At off the motor load is substituted by a resistor load.

5 SERVICE

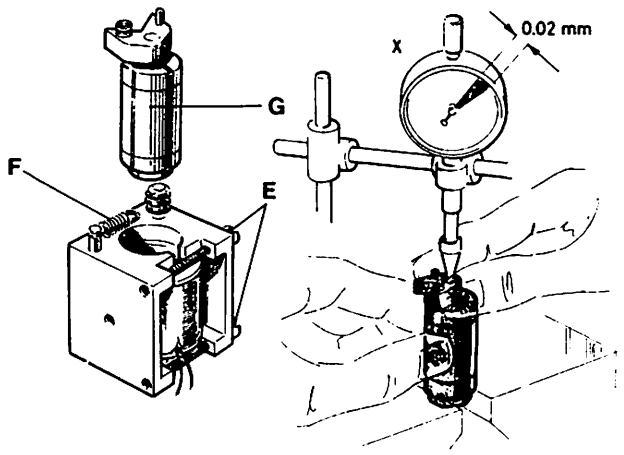
5.1 MECHANICAL CHECKS AND ADJUSTMENTS

A Removing punch/feed unit



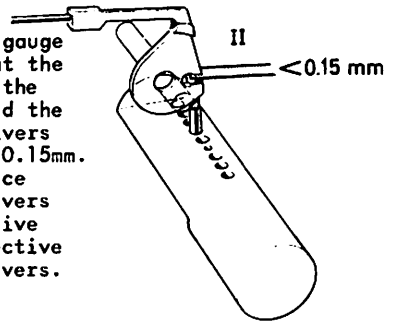
1 Unhook the wire from arm A.
2 Remove connector B from the punch/feed unit.
3 Remove screws C and carefully lift out the punch/feed unit.

B Disassembling and checking punch solenoid



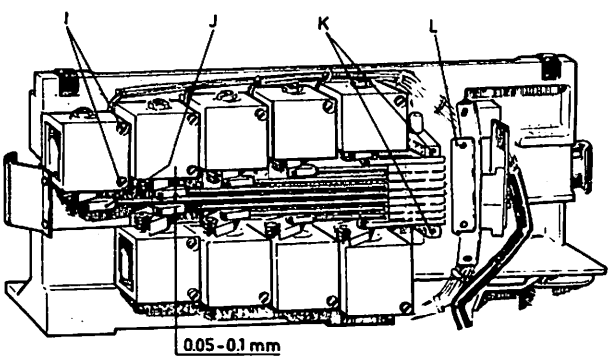
1 Remove retaining screw D for the solenoid(s) that are to be checked. See Fig. in section A.
2 Loosen screws E.
3 Unhook spring F and press out solenoid armature G.
4 Check that the spring attachments are not defective.
Remedy: Replace the spring attachment.
5 Check that the axial play does not exceed 0.02mm.
Remedy: Replace solenoid armature.
6 Check that the actuator rotates easily and that it does not bind when depressed.
Remedy: Replace solenoid armature.
7 Check that the spring eyes F are not defective.
Remedy: Replace the spring F.

C Checking punch pin drivers



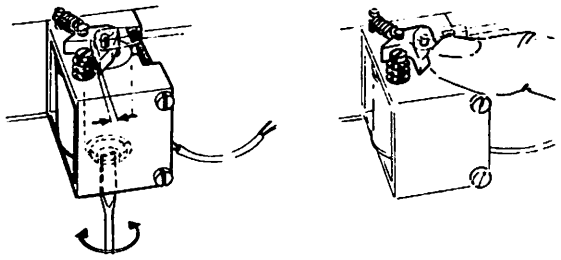
1 Using feeler gauge II, check that the play between the punch pins and the punch pin drivers is less than 0.15mm.
Remedy: Replace punch pin drivers having excessive play and defective punch pin drivers.

D Replacing punch pin drivers

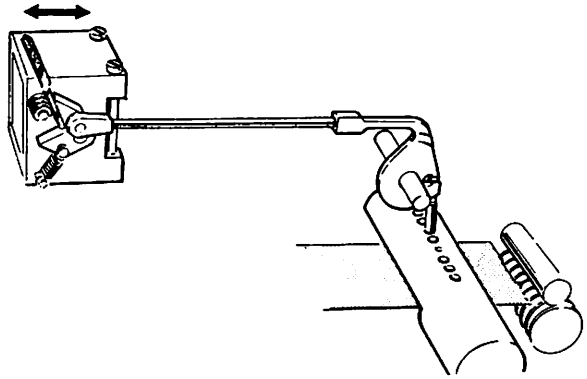


1 Loosen stop screws K for the punch pin driver shaft and press out the shaft. These stop screws are accessible after bracket L has been removed.
2 Replace the punch pin driver.
3 Press in the punch pin driver shaft, tighten stop screws K and replace bracket L.

E Fitting and adjusting punch solenoid



1 Screw the punch solenoid onto the punch/feed unit. Make sure that the pin on the actuator fits into punch pin driver J. (See Fig. in section D).
2 Adjust the solenoid armature axially in the solenoid until there is a clearance of 0.05-0.1mm between the punch pin driver and the adjacent actuator.
3 Connect a DC voltage to the solenoid coil and adjust so that a current of 1.0A ± 5% runs through the coil.
4 Turn the solenoid core using a screwdriver until the actuator just leaves its resting position on the O-rings.
5 Tighten screws I.
6 Adjust the DC voltage connected to the solenoid coil so that a current of 2A ± 5% runs through the coil.
7 Check that the actuator turns through its full stroke and contacts the O-rings. (A very small clearance between actuator and O-rings is permissible).
8 Use your finger to press the actuator back from the O-rings. If properly adjusted you should feed an abrupt reduction in force as the actuator is pressed back to its initial position.
Remedy: Loosen screws I and repeat from step E3 with the adjustment position slightly changed.
Note: When testing with current flowing as in steps E3 and E6, the current shall only be allowed to flow for short intervals so that the coil will not overheat.
A stabilized DC power supply that provides 0 - +6V and 2A is recommended.
9 Check the axial play as instructed in E2. If adjustment is necessary, E3 to E8 must be rechecked.
10 Tighten screws I.



11 Insert a piece of 0.1mm paper tape between the punch pin guide and the die.
12 Insert feeler gauge III between the actuator and the O-rings. Use the 1.85mm end of the gauge for data tracks and the 2.0mm end for the feed hole track.
13 Adjust the longitudinal position of the solenoid until punch pin presses the tape lightly against the die without cutting into the tape. Move feeler gauge III lightly back and forth as adjustment proceeds, to achieve a stabel position against the O-rings. Lift the pinch roller and check by moving the tape back and forth.
14 Tighten the punch solenoid retaining screw.
15 Re- check the adjustment as instructed in step E7.

F Replacing the punch head

1 Unscrew and remove the stepper motor and cover A as shown in Fig. Z. See that the chad exhaust is not pulled along when cover A is removed. removed.
2 Loosen lock screw F. See Fig. Y.
3 Position special tool XV on the punch pin guide and loosen screw B about 1mm to provide guidance for the tool.
4 Turn the punch head with tool XV until the punch pins disengage the punch pin drivers.
5 Remove the punch pins. NOTE: Be sure to remember their track sequence if they are to be used again in the old punch head.
6 Press out the old punch head and insert a new one.
7 Turn the punch head and insert the pins accompaning it (note that the pins are matched with the holes in the punch head).
8 Turn the punch head until the punch pins engage their punch pin drivers.
9 Align the reference surfaces of the punch pin guide and the punch/feed unit using tool XVII, as shown in Fig. Y.
10 Lock the punch head using lock screw F.
11 Unscrew and remove screws B and C on the punch head and check that there is grease. Rocol MTS 2000, in the punch pin guide (Fig.Z). Lubrication: Position grease nipple XXI as in Fig Z. Insert grease tube in nipple and pinch tube to press in grease. Continue pressing until all old grease is forced out on the opposite side. Remove excess greace and replace screws B and C.
12 Repeat steps E11 through E16.
13 Punch a bit of tape by turning the solenoid armatures manually. Check that the feed hole is 9.96 ± 0.1mm from the reference edge.

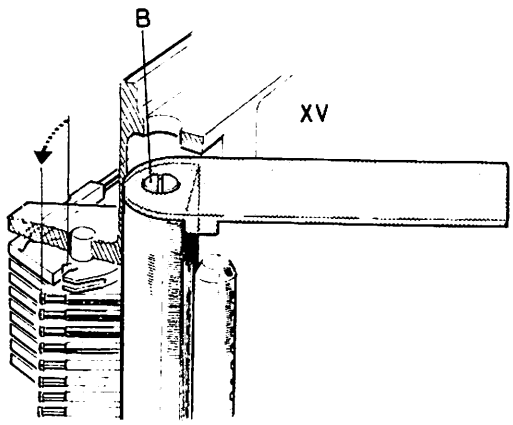


FIG X

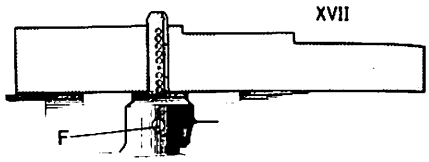


FIG Y

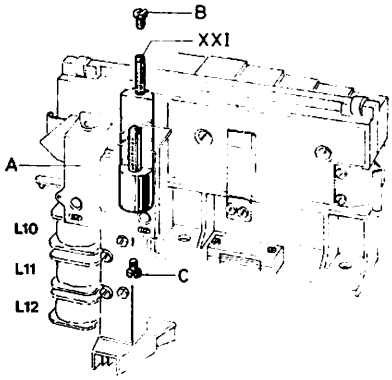
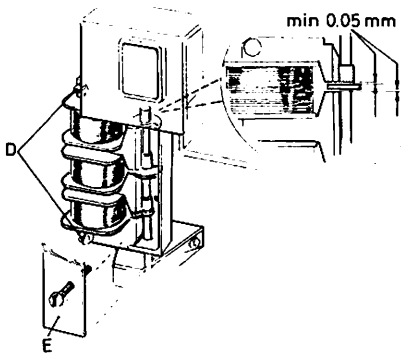


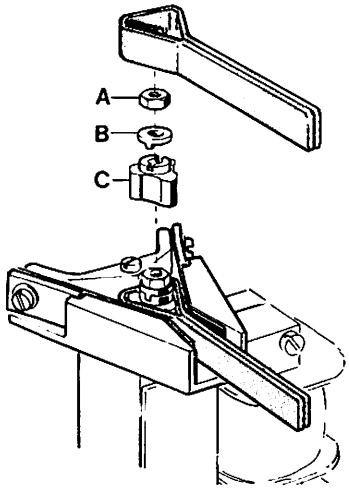
FIG Z

G Checking stepper motor



1 Remove protective plate E.
2 Supply approx 1A to each individual motor winding in sequence.
3 While the current is flowing, check that the clearence between the individual vanes and the stator is not less than 0.05mm.
Adjustment: Loosen screws D. Then make a rough adjustment by inserting two feeler gauges having sequential thicknesses (0.07 and 0.08mm for example) on each side of the vane closest to the punch/feed unit so that play between stator and vane is entirely taken up. Press the stator and motor mount together and tighten screws D. Repeat steps G3 and G4. Try to have the two air gaps between stator and vane as equal as possible.
4 Check that the pin-wheel, brake shoe and vanes have not turned relative to each other.
Remedy: Replace motor mount.
5 Check that feeding accuracy between adjacent rows is better than 3%.
Remedy: Replace brake shoe C as instructed in section H.

H Replacing the brake shoe

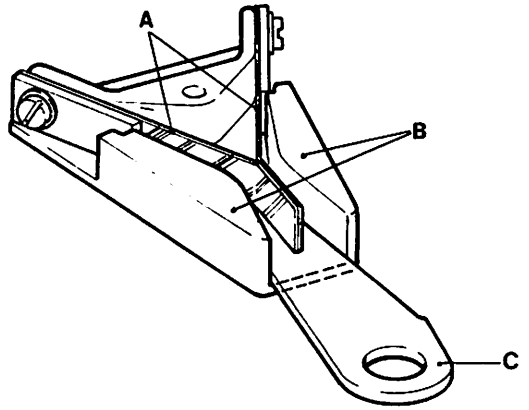


1 Fit the holding tool on the brake shoe as indicated in the figure.
2 Unscrew nut A carefully. Remove locating washer B and brake shoe C.
3 Mount the new brake shoe. Observe that it fits only in one position due to the fact that the locating slot is placed unsymmetrically.
4 Fit the locating washer observing the same as in point 3.
5 Fit the nut and tighten it carefully.
6 Remove the holding tool and check and adjust as described in "Checking motor brake".

I Checking motor brake

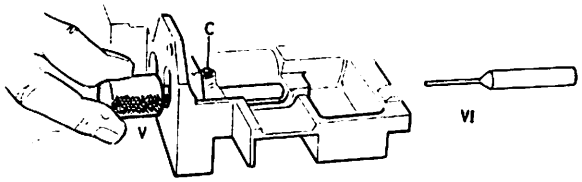
1 Turn the brake shoe and check that springs A do not touch the brake housing at point B.
2 Check that springs A do not contact the dust washer inside the brake shoe.
Adjustment: Insert feeler gauge C as to Fig. Loosen the retaining screws holding the brake springs and adjust the springs. Tighten the retaining screws, remove the feeler gauge and repeat checks 1 and 2.

If the brake housing has been removed from the motor mount or the brake shoe has been replaced, the brake housing must be positioned correctly relative to the electrical zero position of the motor shaft. Supply approx 1A to the motor winding L-10 and tighten the brake at the position assumed by the brake shoe.



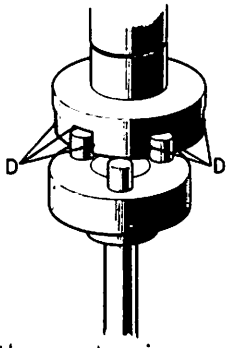
J Checking and replacing capstan

1 Remove the stepper motor and cover A (Fig. Z in section F) and check that the capstan rotates easily. See that the chad exhaust is not pulled out when cover A is removed.
Remedy: Replace capstan as instructed below.
2 Loosen lock screw C.
3 Press capstan out carefully using mandrel VI.
4 Press in the new capstan manually.
5 Press in the capstan to its correct position using mandrel V.
6 Tighten lock screw C.
7 Check that the capstan rotates freely.

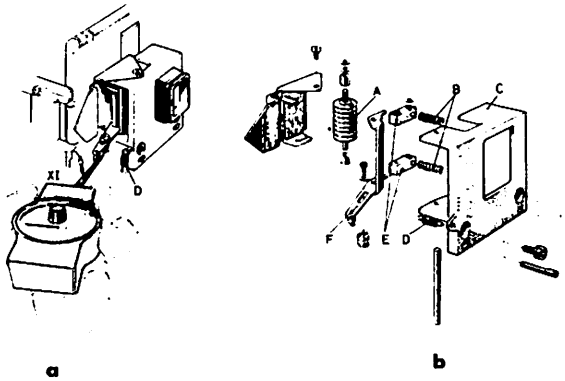


K Checking transmission between stepper motor and capstan

1 Unscrew and remove the motor brake.
2 Lift the pinch roller away from the capstan.
3 Turn the motor shaft and check that the transmission does not bind
Adjustment: Unscrew the motor and turn the motor shaft 120° or 240°. If it still binds, replace the capstan.
Check that there are no binds or mold marks at D (6 grooves).
If binding persists after the capstan is replaced, the motor mount must be replaced.



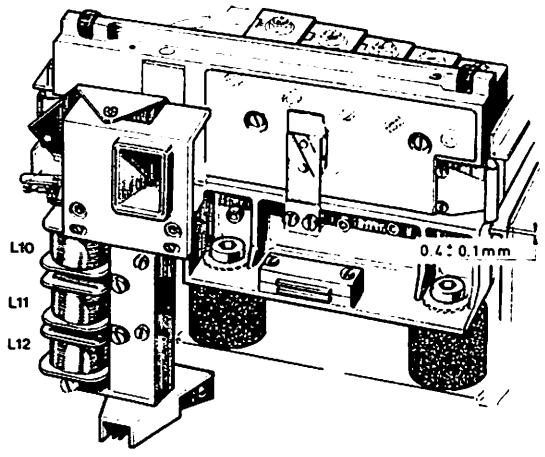
L Checking pinch roller



a b

1 Unhook spring D.
2 Check as shown in Fig. a that the pinch roller exerts a force of 5.88 ± 0.49N (600 ± 50gf) against the capstan.
Remedy: Replace springs B.
3 Remove cover C.
4 Check that pinch roller A rotates easily.
Remedy: Replace pinch roller.
5 Check that there are no defects on the periphery of the pinch roller.
Remedy: Replace pinch roller.
6 Check that the pinch roller flanges do not run in any of the tracks on the tape.
Adjustment: Insert washers between arms E and yoke F.

M Fitting punch/feed unit



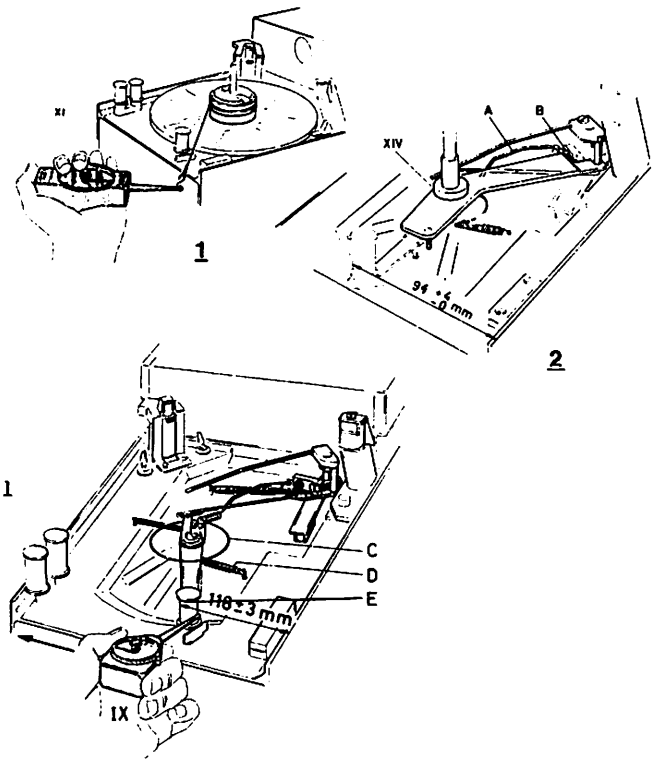
1 When fitting the punch/feed unit, check that its reference edge is 0.4 ± 0.1mm above the reference edges of the tape slots in the right-hand and left-hand sidewalls.
Adjustment: Adjust by inserting washers between the rubber antivibration mountings and the punch/feed unit.

N Checking braking force on supply flange.

1 Loosen the surge takeup arm and check the braking force on the supply flange as shown in Fig. 1. The braking force shall be 3.92 ± 1.47N (400 ± 150gf).
Explanation: If the braking force is too high or too low the reason can be
1. too little torque exerted by the surge takeup arm
2. worn or improperly mounted brake shoe.
Adjustment: 1. see step N2 below or 2. replace brake shoe B. See Fig. 2. Then secure the surge takeup arm using holder XIV. Adjust the length of link A so that the brake shoe just touches the edge of the tool. When the brake shoe is adjusted correctly, the surge takeup arm is 94 $+4_{-0}$ mm from the edge of the punch.

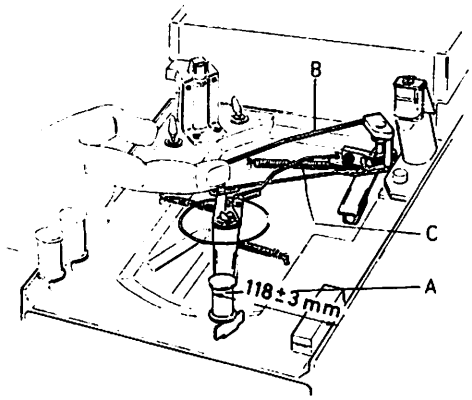
2 Measure the torque exert by the surge takeup arm dynamically at a point 118 ± 3mm to the left of the sidewall. Readings shall be taken as the arm is moved to the left. The torque shall be 0.78 - 0.98N (80 -100gf). Note arrow and dimension in illustration.

Adjustment: Clean the surge takeup arm shaft hole and/or replace spring D.



O Checking sensor arm

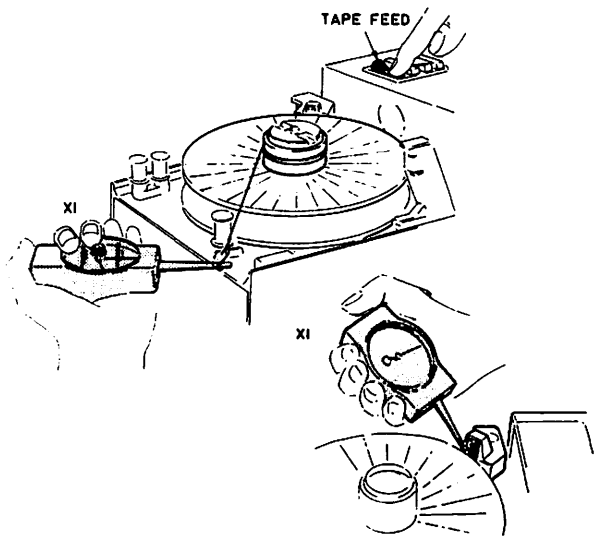
1 Loosen the surge takeup arm A from the retainer magnet.
2 Check that sensor arm B does not bind. You should be able to move it out easily to both end positions. After moving the surge take-up arm to its rear end position, allow it to return carefully, while checking to see that the sensor arm is moved down toward the centre of the punch.
Adjustment: Clean the sensor arm shaft hole and/or replace spring C.



P Checking pulling force of winding motor

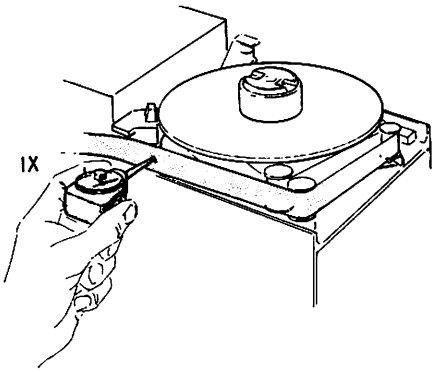
1 Check as shown in Fig. that the pulling force which the winding motor exerts on the takeup flange is not less than 9.31N (950gf).
Explanation: If the pulling force is too low the reason can be
a. that the winding motor is not pressing against the takeup flange properly
b. that the winding motor drive wheel is worn
c. that the transmission between drive wheel and capstan is binding or
d. the winding motor is faulty.
Adjustment: a. see step P2, b. replace the drive wheel, c. replace the motor mount or d. replace the winding motor.

2 Check that the winding motor drive wheel presses against the takeup flange with a force of 5.88 - 8.33N (600-850gf).
Adjustment: Adjust the position of the motor by bending the motor retaining spring.



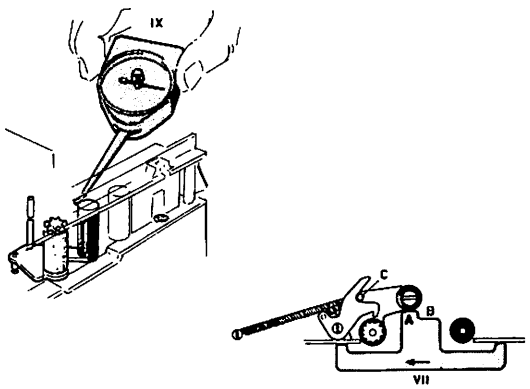
Q Checking unwinding force

1 Fit the supply flange and takeup flange and load the punch with a full coil of tape.
2 Loosen the surge takeup arm from the retainer magnet and check as shown in Fig. that the force exerted for unwinding the tape does not exceed 0.49N (50gf).
Explanation: This check is important to assure correct inter-row spacing. If the pulling force is too high the reason can be
a. binding at the supply flange hub
b. warped supply flange or
c. binding guide rollers.
Adjustment: a. remove the supply flange and clean both the shaft and its hole, b. straighten the supply flange or replace it or c. clean the guide roller shafts and their holes.



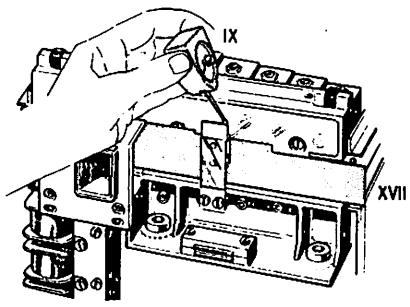
R Checking reversing buffer arm

1 Check that the torque exerted by the reversing buffer arm is 1.76 ± 0.20N (180 ± 20gf) when the guide rollers are all aligned.
Adjustment: Clean and lubricate the reversing buffer arm shaft hole, the rubber-coated roller shaft hole and the shaft.
2 Hold special tool VII as shown in Fig.
3 Check that the rubber-coated roller is not caught by the catch when the reversing buffer arm is moved out against stop A on the special tool.
4 Now move the tool in the direction shown by the arrow, move the reversing buffer arm against stop B and check that the roller is picked up and that there is ample engagement between the ratchet wheel and catch.
Adjustment: Engagement can be increased or decreased by carefully bending pin C.



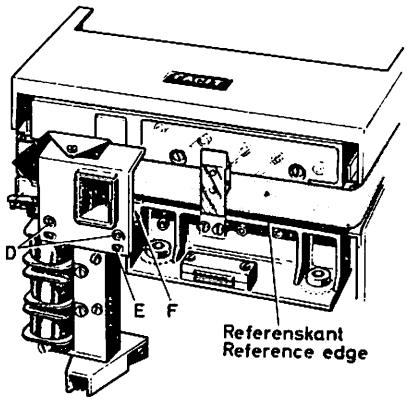
S Checking adjustment of spring mounted tape guide

1 Check that the spring-mounted tape guide exerts a max force of 0.25N (25gf) on the tape.
Adjustment: Unscrew and remove the spring-mounted tape guide and straighten it. When replacing with tool XVII, adjust vertical position of spring-mounted tape guide.

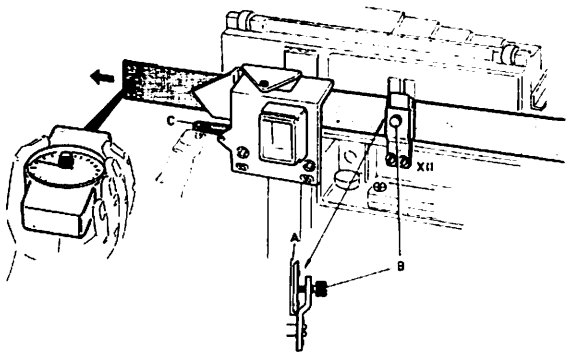


T Checking tape feed

1 Load the punch with tape.
2 Run the pucnh by depressing the TAPE FEED button and check that tape is fed down along the reference edge of the punch/feed unit.
Note that the cover above the punch solenoids shall be in place and that the spring-mounted tape guide shall not press against the tape.
Adjustment: Loosen lock screw F. Loosen retaining screw D slightly. Run the tape punch using the TAPE FEED button or a data generator (50 characters per second). Turn eccentric screw E slowly until the tape eases away from the reference edge. Then turn the eccentic screw back until the tape is fed down along the reference edge. Lock the eccentric screw using lock screw F and tighten retaining screw D.
3 Run the punch and check that the tape does not strike the edge of the takeup flange.
Adjustment: Straighten the takeup flange or replace it.



U Checking stepper motor pulling force

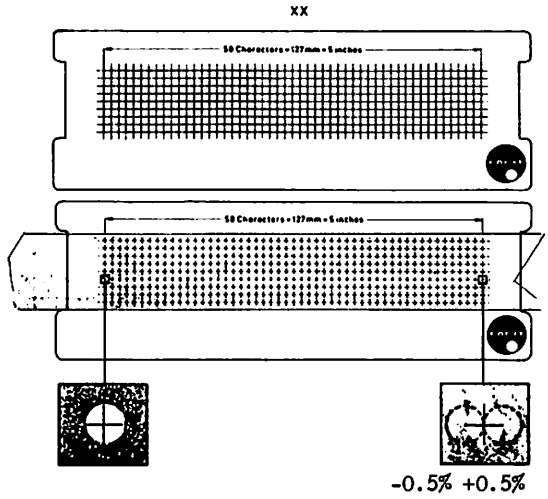


1 Remove spring-mounted tape guide and screw special tool XII in place as shown in Fig.
2 Load the punch with a piece of paper tape and run the tape through gap A on the special tool.
3 Depress the TAPE FEED button.
4 Increase the friction on the tape by screwing in screw B.
5 Release the TAPE FEED button when the friction becomes so high that the stepper motor is unable to feed the tape without missing a step occasionally.
6 Cut off the tape at the tape lifter. Bend over the end of the tape and make a hole for the dial-type spring tension gauge.
7 Lift aside the pinch roller by pressing arm C and insert the tip of the spring tension gauge into the hole in the folded-over tape end.
8 Move the spring tension gauge perpendicularly to the tape in the direction shown by the arrow.
9 Read the spring tension gauge when the pulling force it exerts is sufficient to just about cancel out the friction at special tool XII. The reading shall be at least 1.96N (200gf).
10 Screw the spring-mounted tape guide in place and adjust as instructed in step S1.

W Checking punching action

1 Load the punch with a coil of tape and connect it to mains via a variable auto-transformer set to the rated voltage.
2 Run the punch via a data generator (75 characters per second) so that holes are punched in all tracks.
3 Slowly lower the output voltage from the variable auto-transformer until the DC voltage is shout off.
4 Check that holes are punched fully in all tracks on the tape.
Note: The CODE HOLE button does not provide DC voltage shutoff.

V Checking inter-row spacing



1 Position a punched tape on the template so that the centre of a feed hole coincides with the leftmost virtical line on the template and one of the horizontal track lines.
2 Check that the centres of the feed track holes - from the leftmost to the rightmost vertical line - are directly above the track line. Check that one vertical line is visible in every feed hole.
3 The inter-row spacing is indicated by the rightmost vertical line. The max permissible deviation is ± 0.5%.

X Checking tape check functions

Tape low

1 Move the sensor arm (e in subfig D in Fig. 3) toward the centre of the supply flange.
2 Check that the TAPE LOW lamp lights just before the sensor arm reaches the hub of the supply flange.
Adjustment: The actuation point can be adjusted between 1,000 and 10,000 rows before end of tape using screw (g) as shown in subfig. D in Fig.3.

Tape reptured/tape too tight

3 Load the punch with a coil of tape.
4 Run the punch with a data genereator and move the surge takeup arm to its two end positions.
5 Check that the punch stops and that the ERROR lamp lights. See section 4.2.2.4.

Mark character

6 Depress the CODE HOLES button and check that the programmed mark character is punched into the tape. See section 4.3.3.4.

Blank tape

7 Depress the FEED HOLES button and check that blank tape (only the feed hole punched) is obtained.

Virgin tape

8 Depress the TAPE FEED button and check that virgin tape is obtained.

5.2 PERIODIC SERVICE

INTERVAL	MEASURE	SECTION
50-reel service (carried out by customer)	• Dust removal, punching control	-
500-reel service*	• Lubricate the punch head	F11
	• Check wear on winding up motor drive	P
	• " " " supply flange brake	N
	• " " " rubber ring on core catch	
	• " " " spring attachment on punch solenoids	
	• " " " brake triangle of stepper motor (feeding accuracy adjacent rows, 3%)	H6
	• " " " punch pin driver	C
	• Check bearings on supply and takeup flanges	
	• " " " surge takeup arm	N
	• " " " tape low sensor arm	O
	• " " " guide rollers	
	• " " " reversing buffer arm	R
	• " " " pinch roller	L
	• " " " motor shaft	G
	• " " " capstan	J
	• " " " punch solenoids	B
	• Run through checklist in section 5.4	
1.000-reel service	• 500-reel service, when applicable	
	• Replace punch head and punch pins	F
	• " punch solenoids	B
	• " stepper motor mount	G
2.000-reel service	• 1.000-reel service	
	• Remove, clean and check movable parts	
	• " " " " " shafts	
	• " " " " " bearing sleeves	
	• Check and if necessary replace winding motor	
	• " " " " " fan motor	
	• " " " " " capstan	J
	• " " " " " pinch roller	L
	• " " " " " supply and takeup flanges	
	• " " " " " supply flange brake	N
	• " " " " " springs	

* With respect to certain operating conditions such as -
- irregular duty cycles with very long stop periods
- characteristics of the tape being used

a lubrication of the tape punch head as per section F/11 might be required between each 500-reel service.

5.3 LUBRICATION INSTRUCTIONS

LUBRICATE	INSTRUCTIONS	USE
Plastic parts	Clean shafts and shaft holes for all plastic rollers carefully with methylated spirits or equivalent. NOTE: Never permit oil or grease to contact plastic parts.	Methylated spirits
Punch/feed unit	Lubricate the punch head as instructed in section 5.1.F11	Rocol MTS 2000
Surge takeup arm	Clean the surge takeup arm shaft and its hole and the bearing sleeves of the two arms located above the surge takeup arm. Lubricate all these parts with a thin coat of oil.	
Reversing buffer arm	Lubricate the reversing buffer arm with grease Esso P 290 or equivalent.	Esso P 290

5.4 CHECK LIST

CHECK	LIMITS gf-mm	LIMITS N	SECTION
• Unactuated position of surge takeup arm	96 $^{+4}_{-0}$ mm edge of punch		N1
• Torque exerted by surge takeup arm	80 - 100	0.78 - 0.98	N2
	40 - 60	0.39 - 0.59	N3
• Braking force on supply flange	400 ± 150	3.92 ± 1.47	N1
• Unwinding force	max 50	max 0.49	Q
• Force exerted against takeup flange by winding motor	600 - 850	5.88 - 8.33	P
• That sensor arm moves easily			O
• Torque exerted by reversing buffer arm	180 ± 20	1.76 ± 0.20	R1
• Fan motor blows air out through side crevices			
• Force exerted against tape by spring-mounted tape guide	max 25	max 0.25	S
• Force exerted by pinch roller against capstan	600 ± 50	5.88 ± 0.49	L1
• Pulling force of winding motor	min 950	min 9.31	P
• Pulling force of stepper motor	min 200	min 1.96	U
• Inter-row spacing			V
• Punching action			W
• Tape check functions			X

5.5 TEST POINTS

TEST POINT TTL	TEST POINT DTL	DESCRIPTION	REMARKS TTL	REMARKS DTL
a1 - a8		Low at holes when reading into the buffer register.		
b1 - b8	A-I	High at read and stored bit/s (hole/s).		
c		Low at a manual feed, for blocking the buffer reg. inputs.		
d	P	High, clock pulse for the stepper motor counter. Read-in pulse to the buffer register in TTL version.	TS	
e		Low 0-setting FFMF and buffer register.		
f	X	High (TTL) Low (DTL) during TF (10.5 ms).	TF	TF
g-j	J, L	Stepper motor counter position.		
k		Low at stepper motor drive.	TF+TP	
l		Low pulses for current control.		
m		High during speed limit.	SL	
n	Y	High (TTL) Low (DTL) during TP.	TP	TP
o-q	K, M, N	High (TTL) Low (DTL) at feed to corresponding motor winding.		
r		Low trig pulse for current control.		
s		Low during drifting in the switch regulator.		
t		Level at current control.		
u	U	Low during motion (High at home position).		
v	T	Low at accepted 24V level.		
w	Z	High at switch regulator on (DTL, Off).		
x	R	High (TTL) Low (DTL) during punching.		
	S	High during punching. When low the MF flip-flop and the buffer register are 0-set.		
	V	High at manual feed.		

5.6 FAULT TRACING DIAGRAM

FAULT	PROBABLE CAUSE	REMEDY
Faulty inter-row spacing	Incorrect pulling force	Section V
	Transmission between motor shaft and capstan binding	Section K
	Motor or brake binding	Section G and I
	Unwinding mechanism	Section Q
	Pinch roller binding	Section L
	Flanges on pinch roller run in code-hole tracks on tape	Section L
	Brake shoe worn	Section H
Skipped track (no mark on tape)	Faulty printed circuit board	Section 4.3
	Broken punch pin driver	Section D
	Faulty punch solenoid	Section B and E
	Punch solenoid loose on punch/feed unit chassis	Section B and E
	Punch solenoid coil loose in solenoid frame	Section B and E
Unsatisfactory readability	Worn or damaged punch pins	Section F
Sporadically skipped track (mark on tape)	Incorrect punch pin vertical adjustment	Steps E11 through E16
	Improperly adjusted punch solenoid	Section B and steps E11 through E16
	Play in punch pin driver	Section C and D
	Punch pins binding	Step F11
	Chads jammed in die	Clean carefully
	Faulty printed circuit board	Section 4.3
Faulty tape feed indication (rupture tape)	Supply reel core not secured or faulty core latch	Secure core or repair latch
	Supply flange brake improperly adjusted or worn	Section N
Faulty tape feed indication (tape too tight)	Supply flange binding	Clean
	Surge takeup arm binding	Step N2
	Supply flange warped	Replace or straighten supply flange
	Sticky tape	Replace tape
Unsatisfactory winding	Winding motor pulling force too low	Section P
	Takeup flange warped	Replace or straighten
	Reversing buffer rollers binding	Clean
	Reversing buffer arm twisted	Replace or straighten

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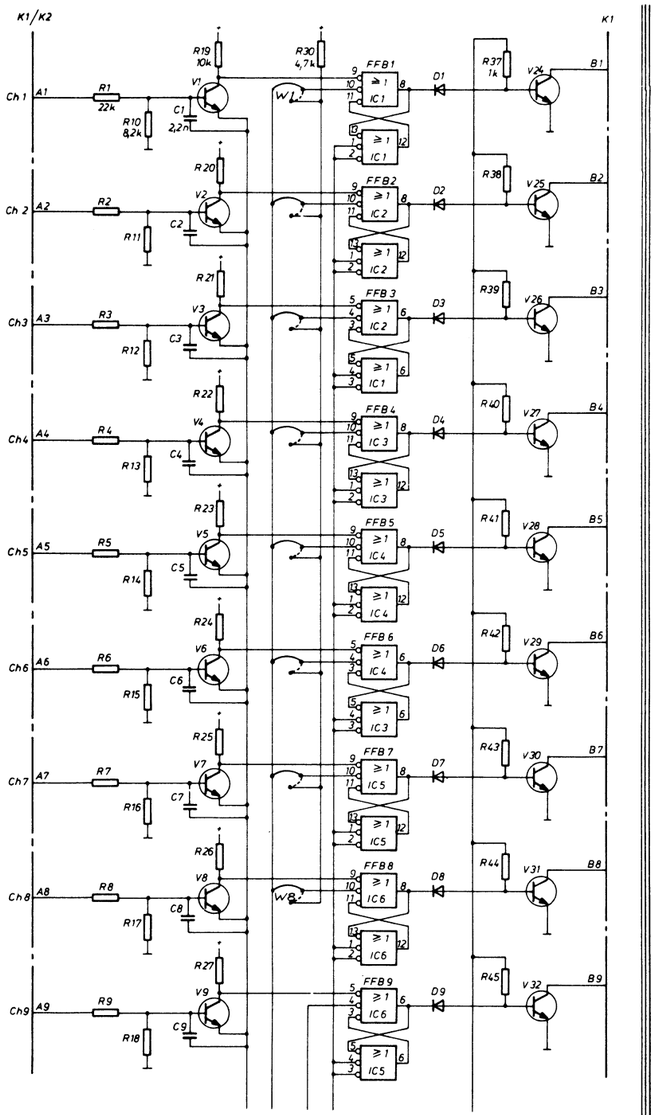
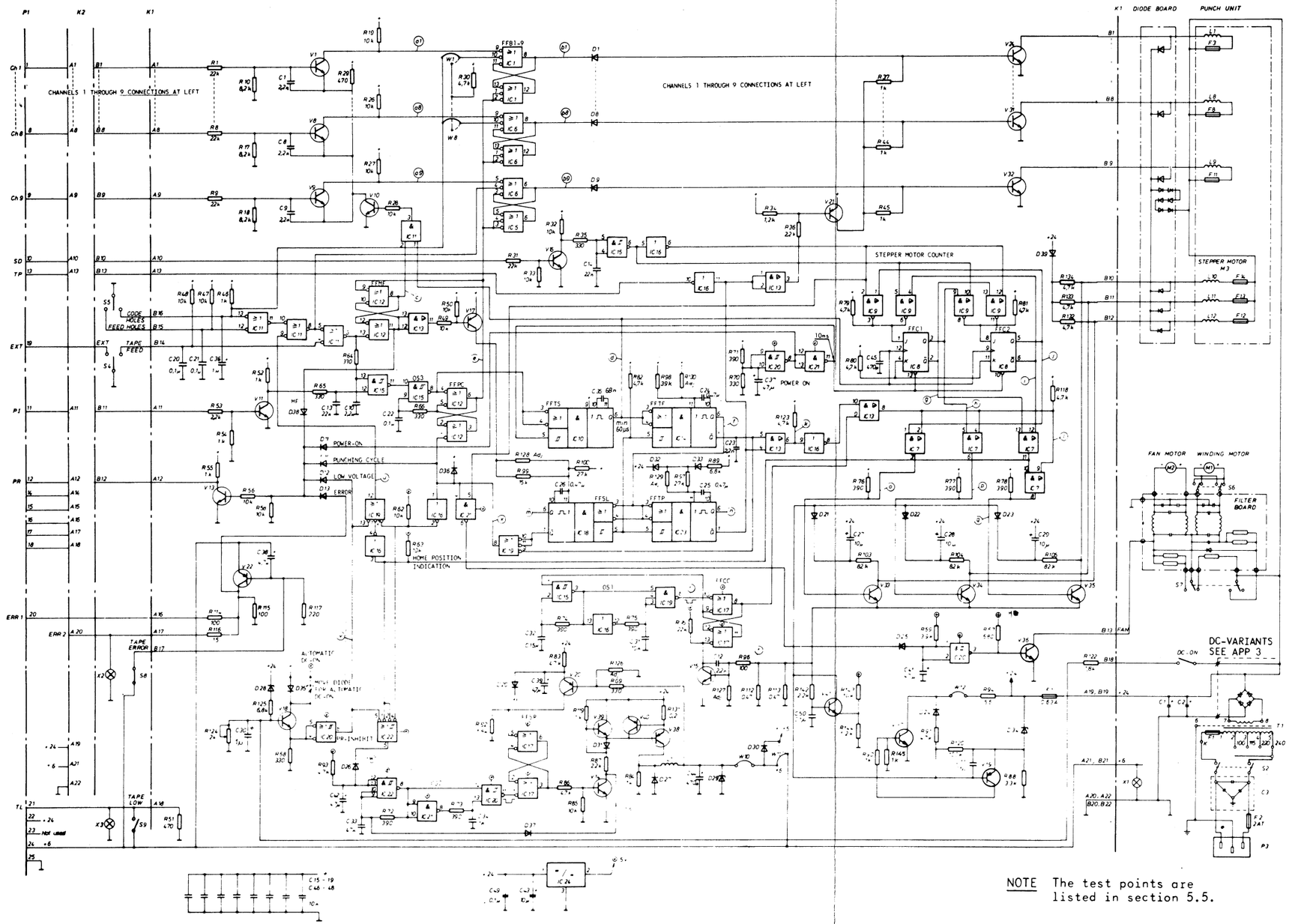
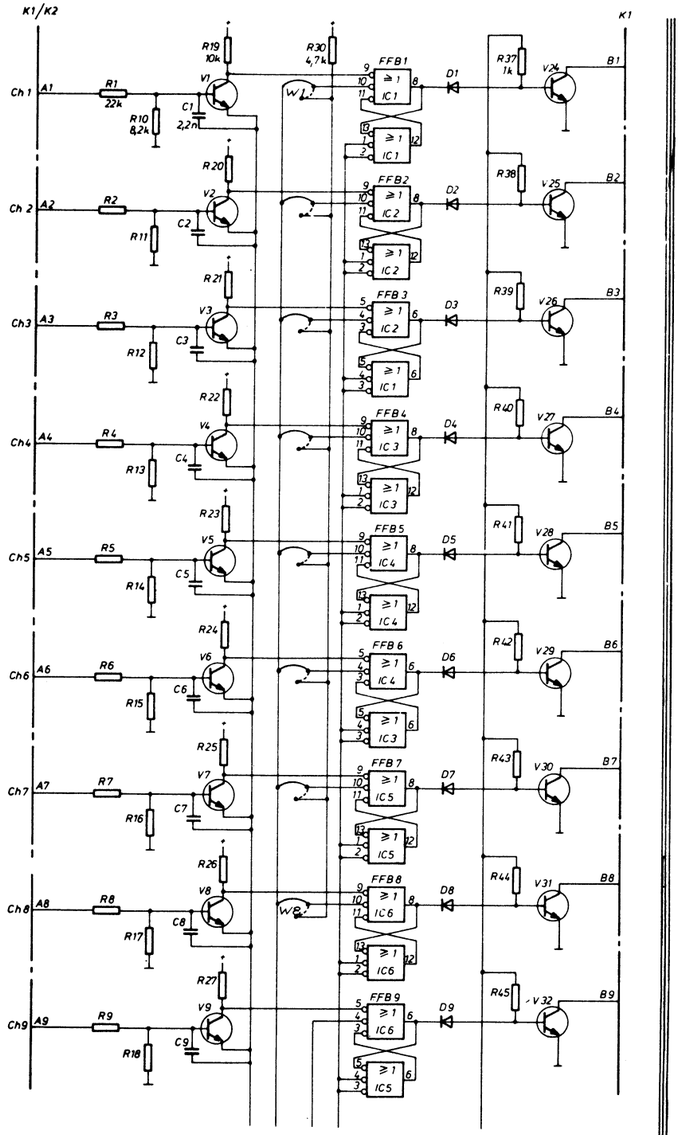


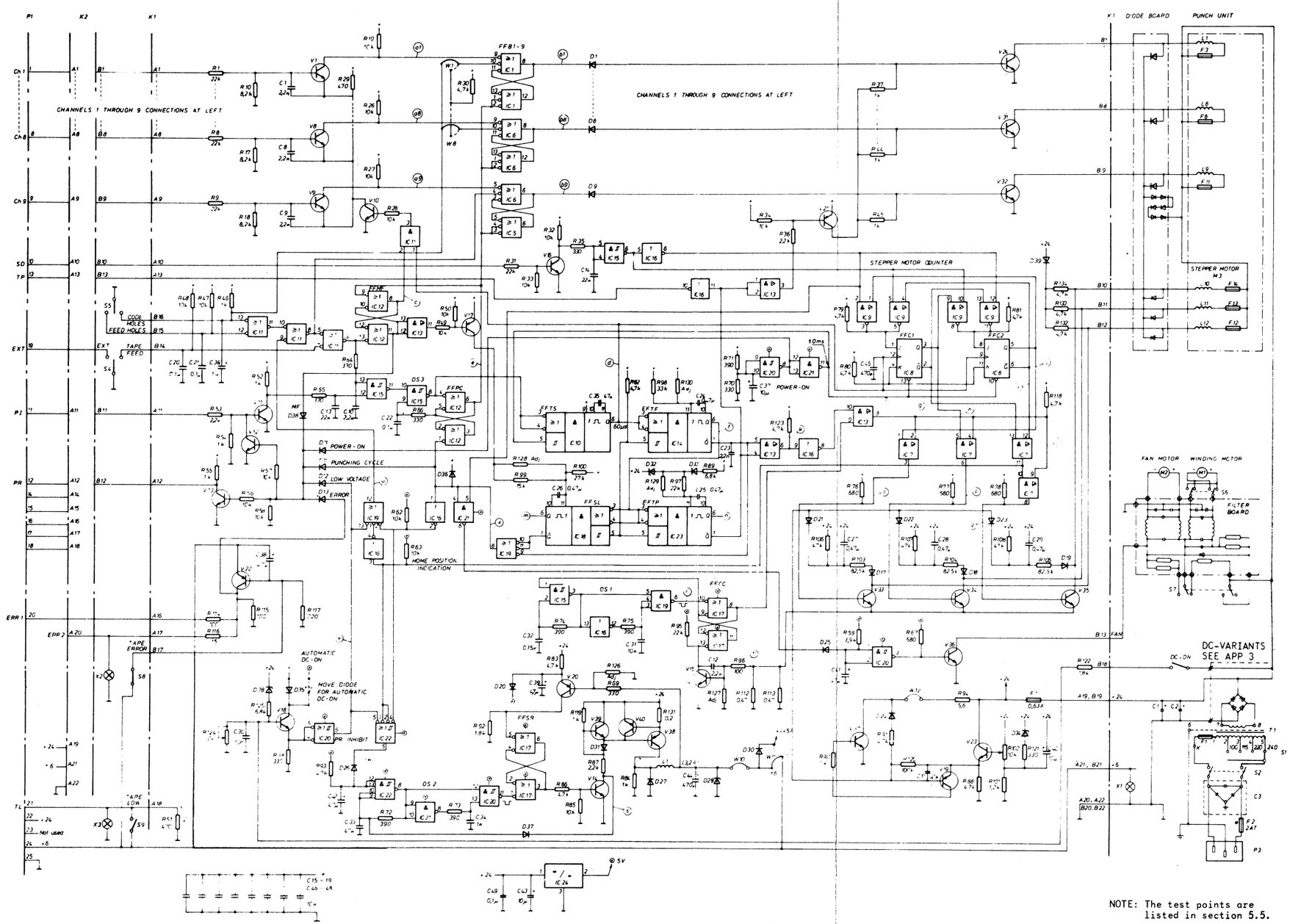
DATA CHANNELS 1 THROUGH 9



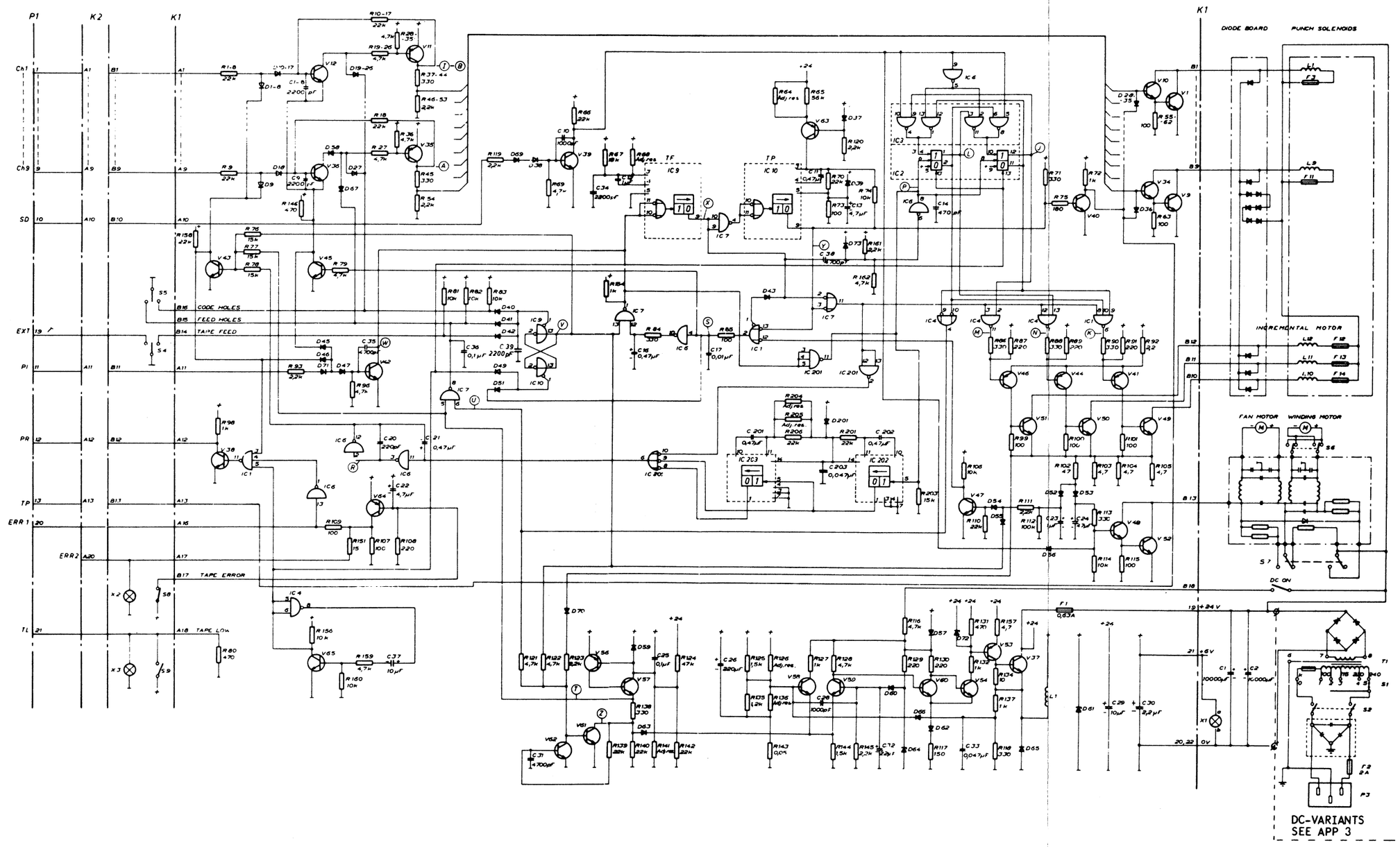
NOTE The test points are listed in section 5.5.



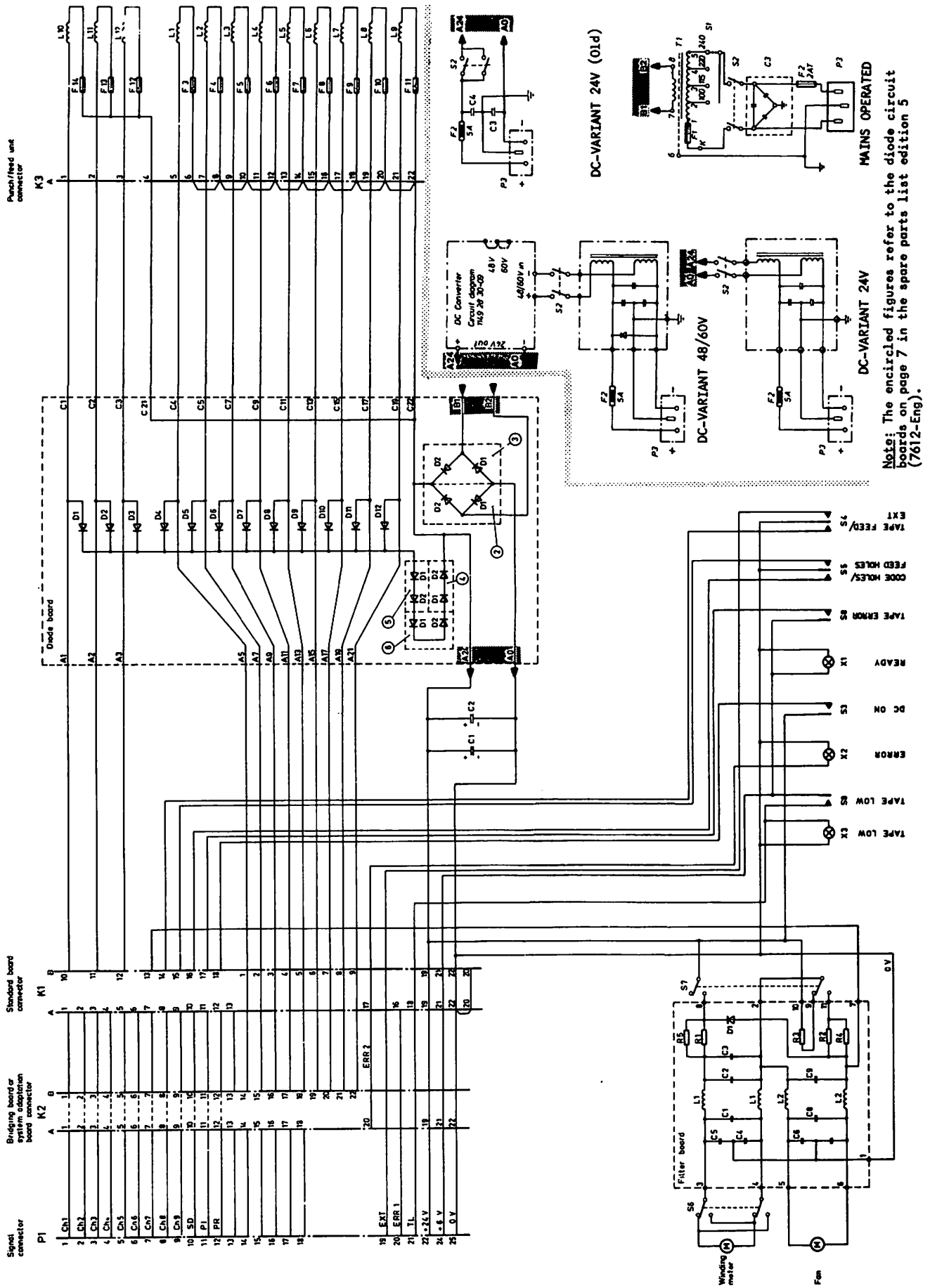
DATA CHANNELS 1 THROUGH 9



NOTE: The test points are listed in section 5.5.



NOTE: The test points are listed in section 5.5.


DC-VARIANT 24V (Old)
MAINS OPERATED
DC-VARIANT 48/60V
DC-VARIANT 24V
Note: The encircled figures refer to the diode circuit boards on page 7 in the spare parts list edition 5 (7612-Eng).
Punch/feed unit connector
Diode board
Standard board connector
Bridging board or system adaptation board connector
Signal connector
Filter board
Winding motor
Fan
TAPE FEED/ EXT
CODE HOLES/ FEED HOLES
TAPE ERROR
READY
DC ON
ERROR
TAPE LOW
0 V


FACIT

ADDENDUM A

Product information for the Facit 5163
Code Translating Interface Card.

FACIT
DATA PRODUCTS

5163 INTERFACE

CODE TRANSLATING INTERFACE FOR FACIT 4070 PUNCH

The 5163 (P/N 9289 99 01-01) allows code conversion within a 4070 punch. It consists of a microprocessor based converter interface. Data input can either be serial RS 232-C or current loop. Standard code convertions are:

* ASCII to BAUDOT
* BAUDOT to ASCII
* ASCII to ASCII (transparent)
* BAUDOT to BAUDOT (transparent)

The interface is installed in the lower slot of a standard 4070, position K2. The P2 data connector (DB25S) on the interface board must be used for connection purposes. NOTE: The connector on the punches rear panel must not be used. The interface in general conforms to RS 232-C and can be inter-connected to either terminal or modem: Accomplished by DIP A4. Serial input data is converted to parallel and punched at 75 c.p.s. The input buffer indicates full (X Off) when it contains 512ch. and empty (X On) when the buffer is empty. (DC1: start, DC3: stop). Input rates from 50 to 9600 baud, word lengths 5-8 data bits, 1 or 2 stop bits and odd or even parity can be selected. All selections are made via DIP switches.

* STANDARD 1K BUFFER (expandable to 2K)
* X ON/X OFF BUFFER STATUS
* TERMINAL OR MODEM
* CUSTOM CODE CONVERSION - OPTIONAL

When the conversion Ascii to Baudot is required the Ascii input does not have to be specially formatted. The 5163 translates and expands the Ascii to Baudot character as required. For example: $ is expanded to DLR (see conversion table for complete conversion). Other features include automatic carriage return (CR + LF), i.e. line feed insertion at 69ch. to prevent overprint on BAUDOT terminals: TWX (ASCII) has 72ch. carriage and TELEX (BAUDOT) has 69ch. carriage.

P2 INTERFACE CONNECTOR

Pin No.	Name	Modem or Terminal	
		IN	OUT
2	Transmitted data	IN	OUT
3	Received data	OUT	IN
4	Request to send	} inter-connected	
5	Clear to send	} inter-connected	
6	Data set ready	Connected to +12V	
7	Signal ground	---	---
8	Data carrier	OUT	OPEN
20	Data terminal	OPEN	OUT
12	Current transmit	(-)	low
13	Current receive	(-)	low
14	Current transmit	(+)	high
16	Current receive	(+)	high 60MA
18	Current receive	(+)	high 20MA

Current loop section can be either half or full duplex. For half duplex, select either pin 16 or 18 and use pin 12 as return. Pin 13 and 14 must be externally connected together.

Standard interface switch setting

- Ascii to Baudot
- Modem
- RS 232-C
- 600 baud
- Word length 7
- Even parity, enable
- 1 stop bit

5163 as TERMINAL. When connected to a modem the interface must look like a terminal in regard to signal direction. See fig. 1.

Pin	2	Transmitted data	(output, X ON/OFF-buffer status)
	3	Received data	(input)
	8	Data carrier	(not used)
	20	Data terminal ready	(output, error condition)

5163 as MODEM. When connected to a terminal e.g. word processor, the interface must look like a modem in regard to signal direction. See fig. 1.

Pin	2	Transmitted data	(input)
	3	Received data	(output, X ON/OFF-buffer status)
	8	Data carrier	(output, error condition)
	20	Data terminal ready	(not used)

PROGRAMMING Selection of Terminal, Modem code conversion mode is made via DIP A4. See fig. 1.

FUNCTION of 5163	S1	S2	S3	S4	S5	S6	S7	S8	S9
Terminal (DIE)		X			X	X			
Modem (DCE)	X		X	X					
Current loop							X		
ASCII to BAUDOT								X	
BAUDOT to ASCII									X
ASCII to ASCII									
BAUDOT to BAUDOT								X	X

DIP A4

FIG. 1

X = Closed

■ = Standard Setting

S1 - 6 determines TD, RD, DCD and DTR directions
S7 is only used for Current loop
S8 - 9 code selection mode

DIP
A27

BAUD SELECTION (A27)

BAUD	S1	S2	S3	S4
50	X	X	X	X
75		X	X	X
110	X		X	X
134.5			X	X
150	X	X		X
300		X		X
◤ 600	◤ X	◤	◤	◤ X
1200				X
1800	X	X	X	
2000		X	X	
2400	X		X	
3600			X	
4800	X	X		
7200		X		
9600	X			
19200				

FIG. 2

X = Closed
◤ = Standard setting

WORD LENGTH, PARITY AND STOP BIT SELECTION (A27)

FUNCTION	S5	S6	S7	S8	S9
WORD LENGTH - 5			X	X	
" " - 6			X		
◤ " " - 7			◤	◤ X	
" " - 8					
◤ PARITY - YES	◤ X				
" - NO					
◤ " - EVEN					◤
" - ODD					X
◤ STOP BIT - 1		◤ X			
" " - 2					

FIG. 3

X = Closed
◤ = Standard setting

S5 is Parity selection
S6 is stop bit selection
S7 - 8 is W. length selection
S9 is Odd or even parity

NOTE: Parity only used for parity configuration at X ON/OFF transmission. Although incoming data would also, if parity is used, be checked the punch does not respond if an error is detected.

JUMPER REQUIRED

Ensure that a JUMPER WIRE is installed at: DIP A57

Pin 6 to Pin 15

CONVERSION TABLE 1 (Standard-green)

ASCII ◄——►	CCITT #2	ASCII ◄- - -►	CCITT #2
NUL	BLANK	6	6 (Y)
BEL	BELL (Figs J)	7	7 (U)
LF	LF	8	8 (I)
CR	CR	9	9 (O)
SP	SPACE	(	((K)
DEL	LTRS	)	) (L)
A	A	+	+ (Z)
thru	thru	,	, (N)
Z	Z	-	- (A)
0	0 (Figs P)	.	. (M)
1	1 (Q)	:	: (C)
2	2 (W)	=	= (V)
3	3 (E)	?	? (B)
4	4 (R)	'	' (S)
5	5 (T)	/	/ (X)

MODIFIED CONVERSION

ASCII ——►	CCITT #2
ENQ	WRU (Figs D)
SOH	ZCZC
STX	Figs G
EXT	Figs H Ltrs
EOT	NNNN

CCITT #2 ——►	ASCII
WRU	ENQ
ZCZC	ZCZCSOH
Figs G	G
Figs H Ltrs	H Delete ETX
NNNN	NNNNEOT

EXPANDED CONVERSION

ASCII ——►	CCITT #2
$	SP DLR SP
"	Figs SS
%	SP PCT SP
&	SP AND SP

CCITT #2 ——►	ASCII
SP DLR SP	SP DLR SP
Figs SS	" "
SP PCT SP	SP PCT SP
SP AND SP	SP AND SP

NOTE:

1. Lower case alpha Ascii input characters are converted to upper case.

2. Conversion from Ascii to Baudot and Baudot to Ascii in modified and expansion are different (see table).

BAUDOT as per CONVERSION 1 (green)

CHARACTER		MARK/BITS					CHARACTER		MARK/BITS				
LET	FIG	1	2	3	4	5	LET	FIG	1	2	3	4	5
A	-	x	x				Q	1	x	x	x		x
B	?	x			x	x	R	4		x		x	
C	:		x	x	x		S	'	x		x		
D	WRU	x			x		T	5					x
E	3	x					U	7	x	x	x		
F		x		x	x		V	=		x	x	x	x
G	STX		x		x	x	W	2	x	x			x
H	ETX			x		x	X	/	x		x	x	x
I	8		x	x			Y	6	x		x		x
J	BELL	x	x		x		Z	+	x				x
K	(	x	x	x	x		BLANK						
L	)		x			x	LETTERS		x	x	x	x	x
M	.			x	x	x	FIGURES		x	x		x	x
N	,			x	x		SPACE				x		
O	9				x	x	CARR RTN					x	
P	0		x	x		x	LINE FD			x			

b_7 b_6 b_5 / Bits b_4 b_3 b_2 b_1 / ROW / COLUMN					$0\ 0\ 0$	$0\ 0\ 1$	$0\ 1\ 0$	$0\ 1\ 1$	$1\ 0\ 0$	$1\ 0\ 1$	$1\ 1\ 0$	$1\ 1\ 1$
					0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	LF	SUB	*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	12	FF	FS	,	<	L	\	l	|
1	1	0	1	13	CR	GS	-	=	M	]	m	}
1	1	1	0	14	SO	RS	.	>	N	^	n	~
1	1	1	1	15	SI	US	/	?	O	_	o	DEL

Indicates codes not recognized.

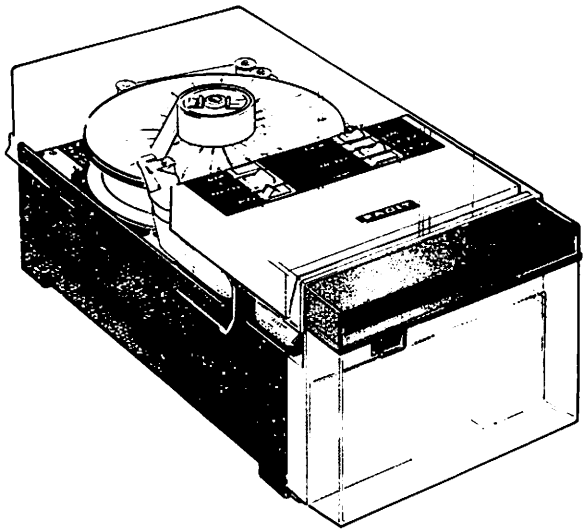
USASCII

ADDENDUM B

Operating and tape loading instructions for the Facit 4070 Paper Tape Punch (PTP-3).

FACIT 4070

Tape punch – Instruction book



Do's and don'ts

- Never lift the tape punch by the tape flanges.
- In the event of a mains power failure the READY lamp will go out. Restart the punch by pressing the DC ON switch.
- A fault in the tape will cause the ERROR lamp to light up.
- Do not cover the ventilation holes in the side of the punch.
- Dust the machine under the front panel when necessary.
- Do not use the TAPE FEED key during operation.
- Check the inter-character spacing every 50th coil.

Description (Fig. A)

1. Take-up flange motor
2. Take-up flange
3. Tape guide arm
4. Supply flange
5 and 6. Fixed tape guides
7. Loop controller
8. Take-up flange motor switch
9. Tape lifter
10. Take-up direction switch
11. Low-tape sensor arm

Controls (Fig. B)

READY: Pilot lamp–lights up when DC ON switch is operated.
POWER ON: Switches on mains supply.
DC ON: Switches on internal supply.
TAPE FEED: Feeds virgin tape (without feed holes).
FEED HOLES: Feeds blank tape (with feed holes).
EXT.: may be used for signalling to data input source: "transmit data", "clear", etc.
ERROR: Pilot lamp–lights up when tape breaks or is too taut.
CODE HOLES: Feeds tape with internally programmed code.
TAPE LOW: Pilot lamp–lights up when tape nearing end.

Connections (Fig. C)

1. Mains voltage selector: 100, 115, 220 or 240 V. Connector for signal cable. 3. Mains voltage socket.
4. Matching board.

Winding tape in punch (Fig. D)

Tape is wound up in the punch on a plastic bobbin placed on the take-up flange (2).

Tape in basket (Fig. E)

To collect tape in a basket, allow it to run freely from the punching mechanism out at the side of the punch.

Practical accessories (Fig. F)

1. Transparent plastic cover. 2. Chad box of transparent plastic.

Tape width adjustment (Fig. G)

The tape punch is supplied for 5 and 8 track tape or 6–7 track tape.
Adjustment from 8-track to 5-track tape and vice versa is carried out on the tape lifter by moving the tape guide as shown in the figure to the left.
A minor modification is required to convert a tape punch intended for 5 and 8 track tape to 6–7 track tape and this should be performed by a qualified serviceman.

Inserting tape (Fig. A, H-K)

Parts incorporated in the tape path will be evident from the illustration on the inside front cover.
1. Move the motor (1) aside and remove the take-up flange (2).
2. Move the tape guide arm (3) to the left until it locks.
3. Release the bobbin lock on the supply flange (4) as shown in Fig.I.
4. Pull out about 2 metres (6 feet) of tape from the tape coil and place the coil on the supply flange. Check that the coil of tape lies close against the supply flange.
5. Lock the coil of tape in place by pushing the sleeve on the bobbin lock downwards as shown in Fig. K. Note that the lock has two positions–one for large-diameter bobbins (lower position) and one for small-diameter bobbins (upper position).
6. Lead the tape round the tape guides (6), (3) and (5) as shown in Fig. A.
7. Drop the tape into the punch to the bottom of the threading slot as shown in Fig. H and inside the loop controller (7).
8. Move the motor (1) aside and fit the take-up flange back in place. Release the bobbin lock, place a bobbin on it and lock the bobbin in place, see Figs. I and K.
9. If the tape is to be collected in a basket, switch off the motor (1) by means of switch (8), see Fig. A.
10. Wind the tape one turn round the tape lifter as shown in Figs. G and J.
11. Wind the tape in a clockwise direction a few turns round the take-up flange bobbin.
12. Rotate the take-up flange clockwise. Check that the tape tautens. Make sure that the take-up flange motor is switched on. Take-up direction can be selected by means of switch (10), see Fig. A. Position FOR for clockwise take-up and position REW for anti-clockwise take-up. We recommend clockwise take-up when tape has to be re-wound prior to computer read-in.
Anti-clockwise take-up is suitable when using a computer capable of reading tape backwards. In this case the tape does not require rewinding.
13. Press the POWER ON switch.
14. Press the DC ON switch and check that the pilot lamps READY and ERROR light up.
15. Move the tape guide arm (3) to the right until the ERROR lamp goes out. Hold the arm in this position and press the TAPE FEED switch. Release the arm when the tape becomes taut. Check that the ERROR lamp remains extinguished.
Punch is now ready to receive data.

Accessories

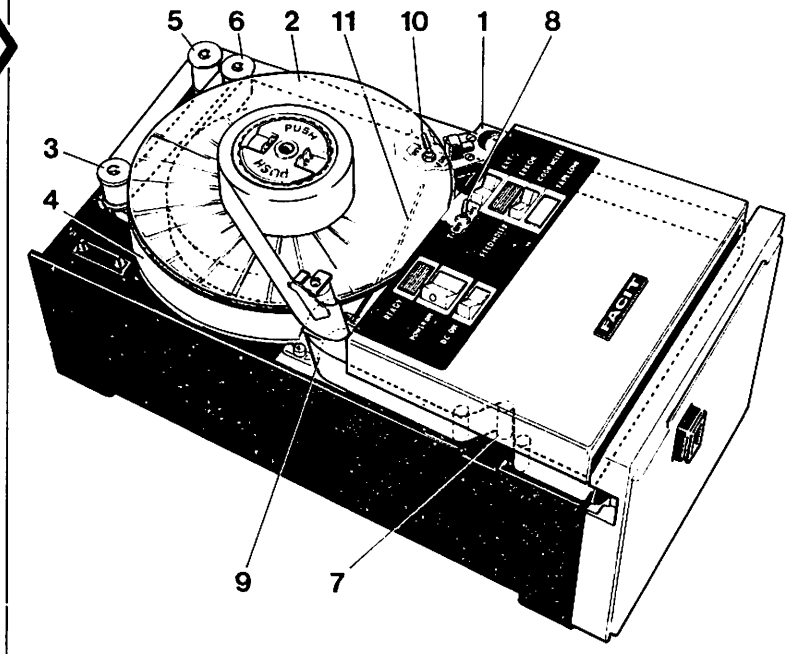
An electric tape winder for winding up tapes on cores.
A tape that has been properly wound will not have to be rewound at the computer centre.

The Facit 4012
The diameter of the tape roll is
200 mm (7.87 in).
Tapes for 5, 6/7 and 8 tracks.

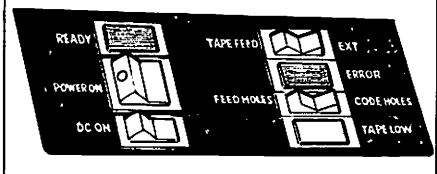
Cardboard cores for winding up tapes.
• It is easier to store, transport and protect the tape when it is wound up on a core. Furthermore, it facilitates handling in the tape reader.
The inner diameter of the core is
51–52 mm (2 in), and it is available
for both 5 and 8-track tapes.

Plastic boxes for storing and transporting tapes.
• A tape that has been properly packed will arrive at the computer centre undamaged thus avoiding costly and time-consuming delays during processing.
An air-tight lid =a well-protected tape.

Fig. A-K



A



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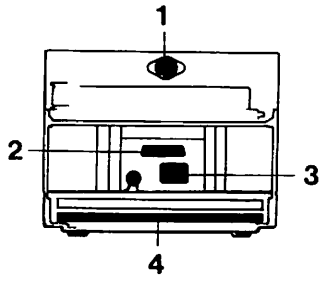

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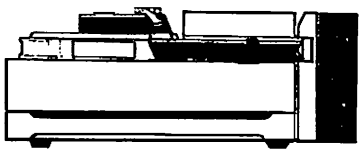
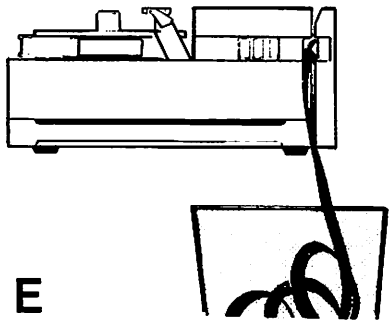
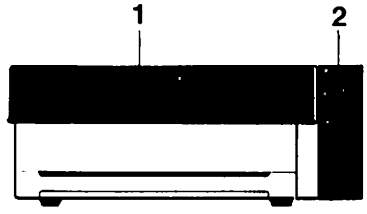


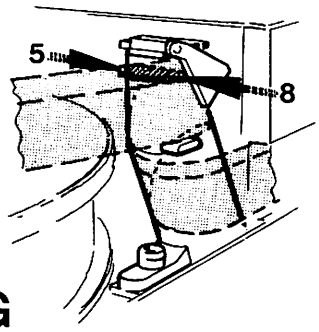
D



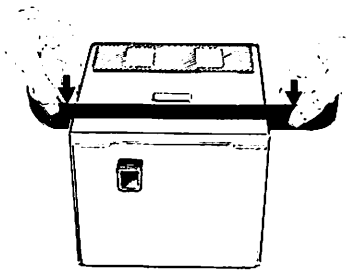
E



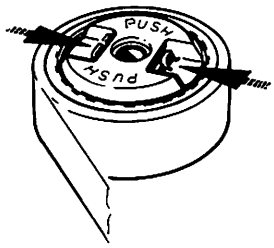
F



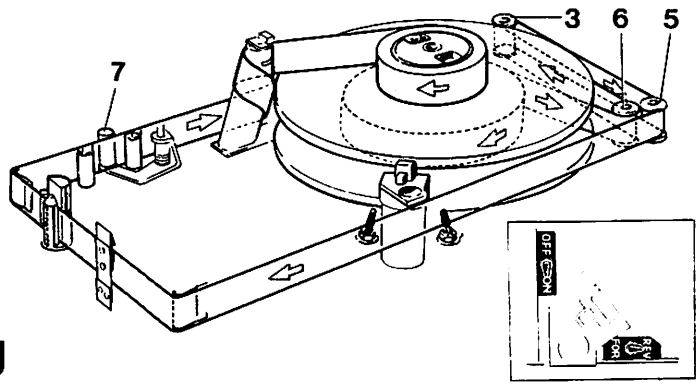
G



H



I



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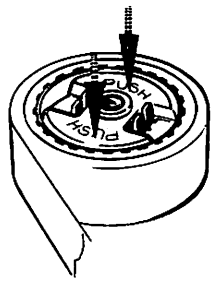
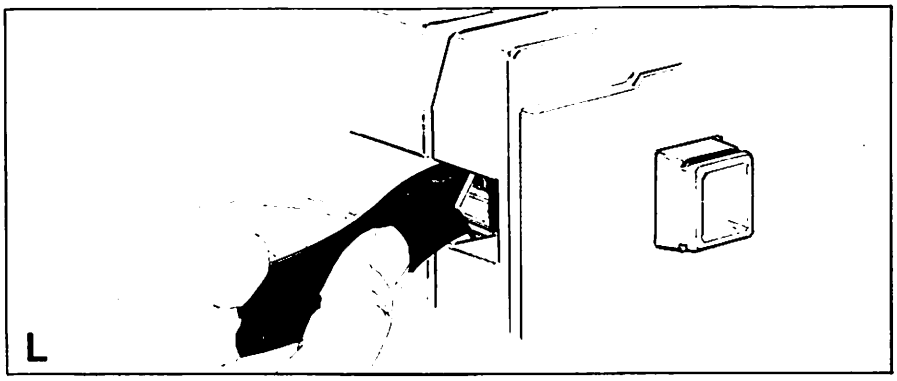
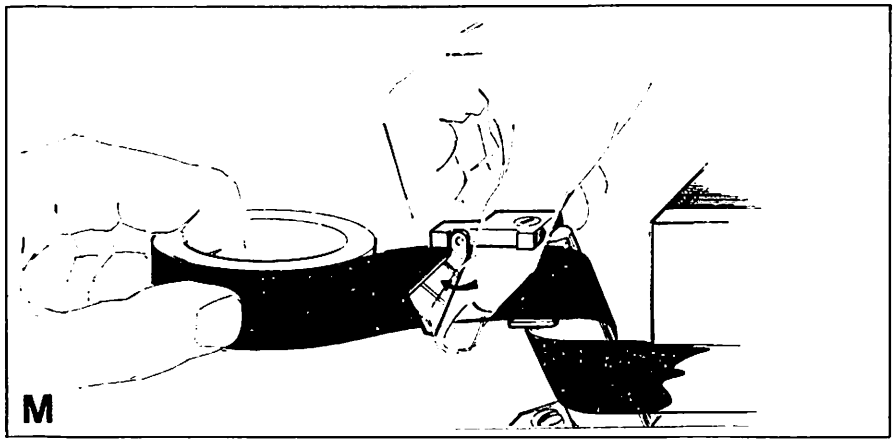
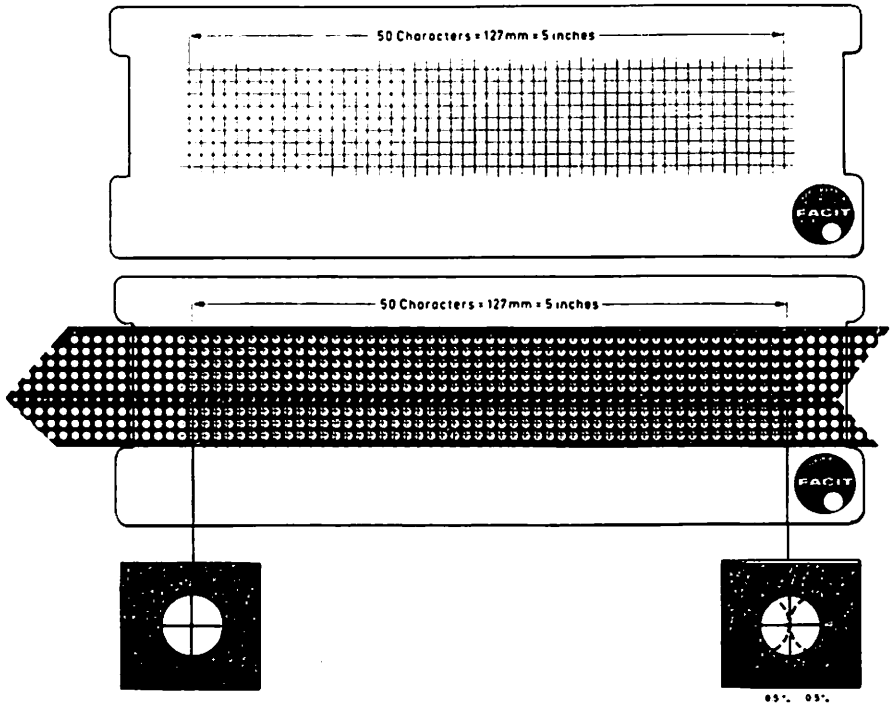


K


L


M



Tearing off and changing tape

(Fig. L, M)

When the TAPE LOW lamp lights up, this indicates that the tape is nearing the end. A sufficent amount of tape to permit punching an additional 1,000–10,000 characters then remains on the supply flange. Sensing takes place by means of the low-tape sensor arm (11).

1. Depress TAPE FEED and feed the tape forward until the last row of data is approximately 0.6 metres (2 feet) past the tape tearer to be used. Two tape tearers are provided on the punch (see Figs L and M).
2. If the tape is collected in a basket, use the front tape tearer as shown in Fig. L. Note: If mylar tape is used, it should be cut off with scissors instead.
3. If the tape is wound onto the take-up flange, release the bobbin lock, remove the coil of tape and tear it off with the tape tearer on the tape lifter as shown in Fig. M.

If it is desired to continue punching without changing the tape, feed the tape forward and then follow points 10–12 under INSERTING TAPE.

4. Tear off the tape between the tape guide arm (3) and the fixed tape guide (5).
5. Move the tape guide arm to its locked position and remove the tape from the tape path.
6. Remove the take-up flange.
7. Release the bobbin lock on the supply flange and remove the rest of the tape.
8. Fit a new coil of tape.

Checking inter-character spacing

1. Lay a length of punched tape on top of the template so that the centre of one of the feed holes coincides with the 0 graduation on the template and with a line representing a track.
2. Check that the centres of the feed holes–from the first to the last graduation – are directly above the track selected, and that a vertical graduation can be seen in **all** the feed holes.
3. Read the spacing at the last graduation on the template. The maximum permissible deviation is ± 0.5%. If more get in touch with the Facit service organization.

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