FACIT 4552

Strip printer   Technical description
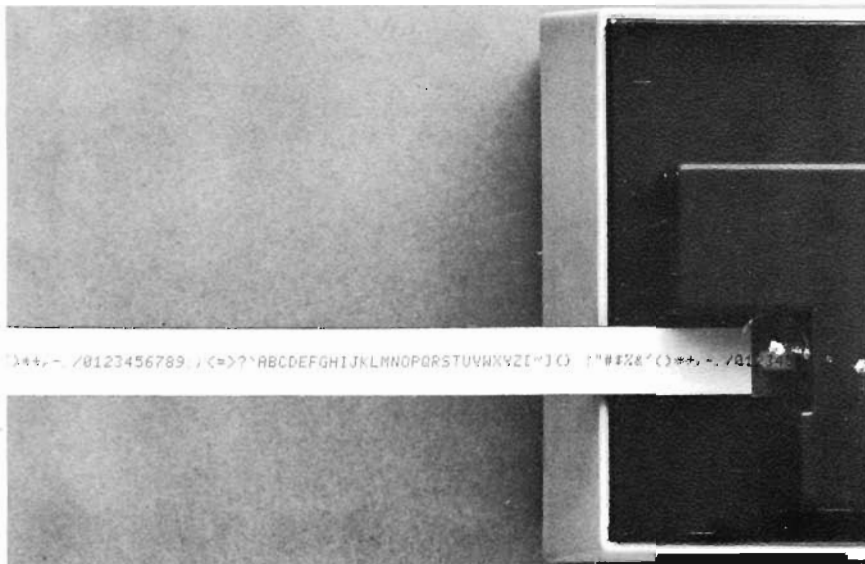
Fig. 1   Facit 4552 strip printer with one example of character set

CONTENTS

The Facit 4552 strip printer is an output peripheral that prints alphanumeric information on pressure-sensitive paper tape. Its flexibility and low cost make it ideal for a wide variety of applications in the fields of data recording and message transmission.

The Facit 4552 features compact design and silent operation and is thus particularly well suited to office environments. Fig. 1 shows the strip printer along with one example of its character set.

The Facit 4552 consists of four main subunits:

- Print mechanism
- Drive circuits
- Control circuits
- Chassis with interconnection board

The print mechanism comprises components used for printing and feeding. Few moving parts assure excellent functional reliability. The drive and control circuits are mounted on easily exchangeable PC-boards.

The strip printer operates at a maximum synchronous printing speed of 15 characters per second. It is externally controlled and consequently the operating speed can be varied within the asynchronous speed range. A five by seven dot matrix is used to print the characters. Printed messages are fully legible without having to feed out any additional tape. A sensor device stops the printing operation automatically when the end of the tape is reached — or if the tape breaks.

Fitting a new tape coil to the raiseable hub is very easy (Fig. 2). When the pushbutton marked with an arrow is depressed the tape can be moved to its feed position, and the strip printer will be ready to receive new information.
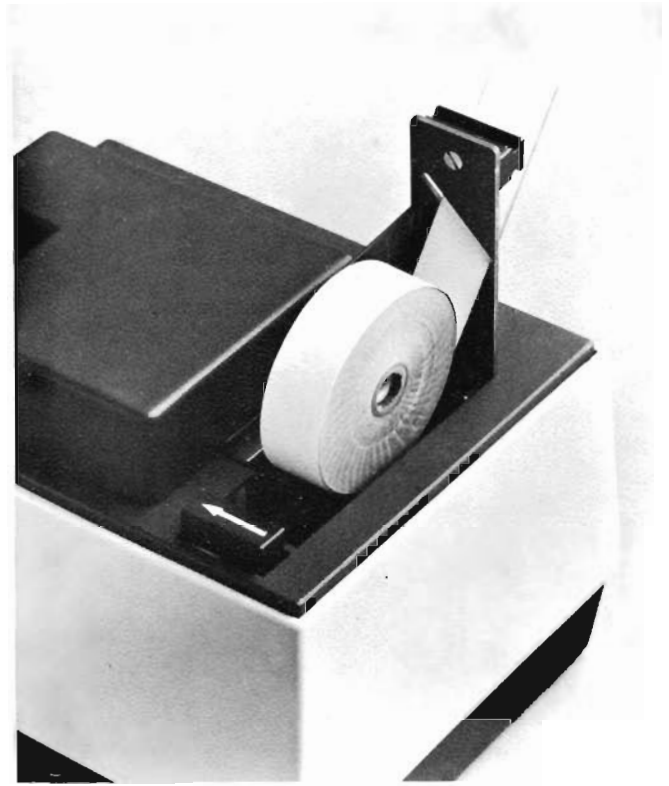

Fig. 2 Hub raised to accept new paper tape coil

Variants

Three variants of the strip printer are available (see Fig. 3):

- Facit 4552/03
  Control circuits with character generator for 64 different characters. US ASCII-coded information is supplied one character at a time on six channels. Other codes will be available.

- Facit 4552/02
  Control circuits but no character generator. Information is supplied one matrix column at a time on seven channels. An eighth channel is used for a synchronization signal.

- Facit 4552/01
  Without PC-board for control circuits. This variant is supplied with a small jumper board in place of the control circuit board. It is easy to replace this jumper board with a customer-designed control circuit board if so desired.

Drive circuits, print mechanism and interconnection board are included in all variants.

The Facit 4552/02 and 03 are fully compatible with the Facit SP1 standard interface for parallel data transfer. Further information about the SP1 is presented in the specifications.
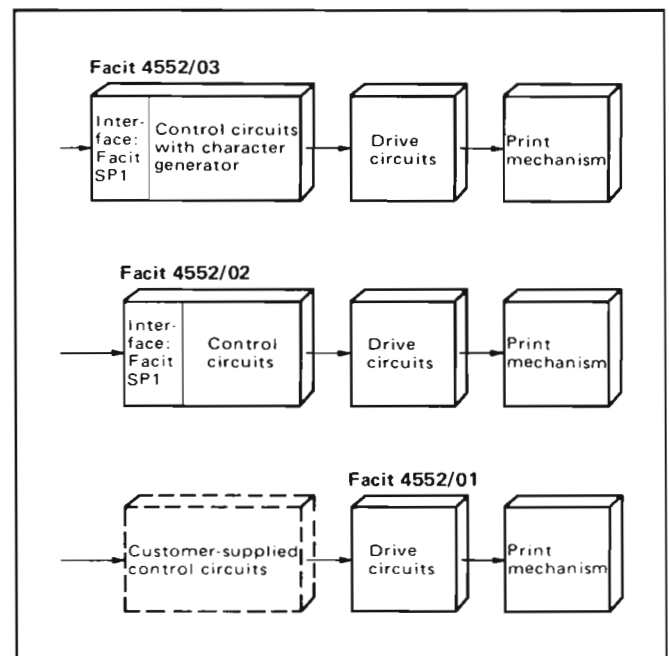

Fig. 3 Variants
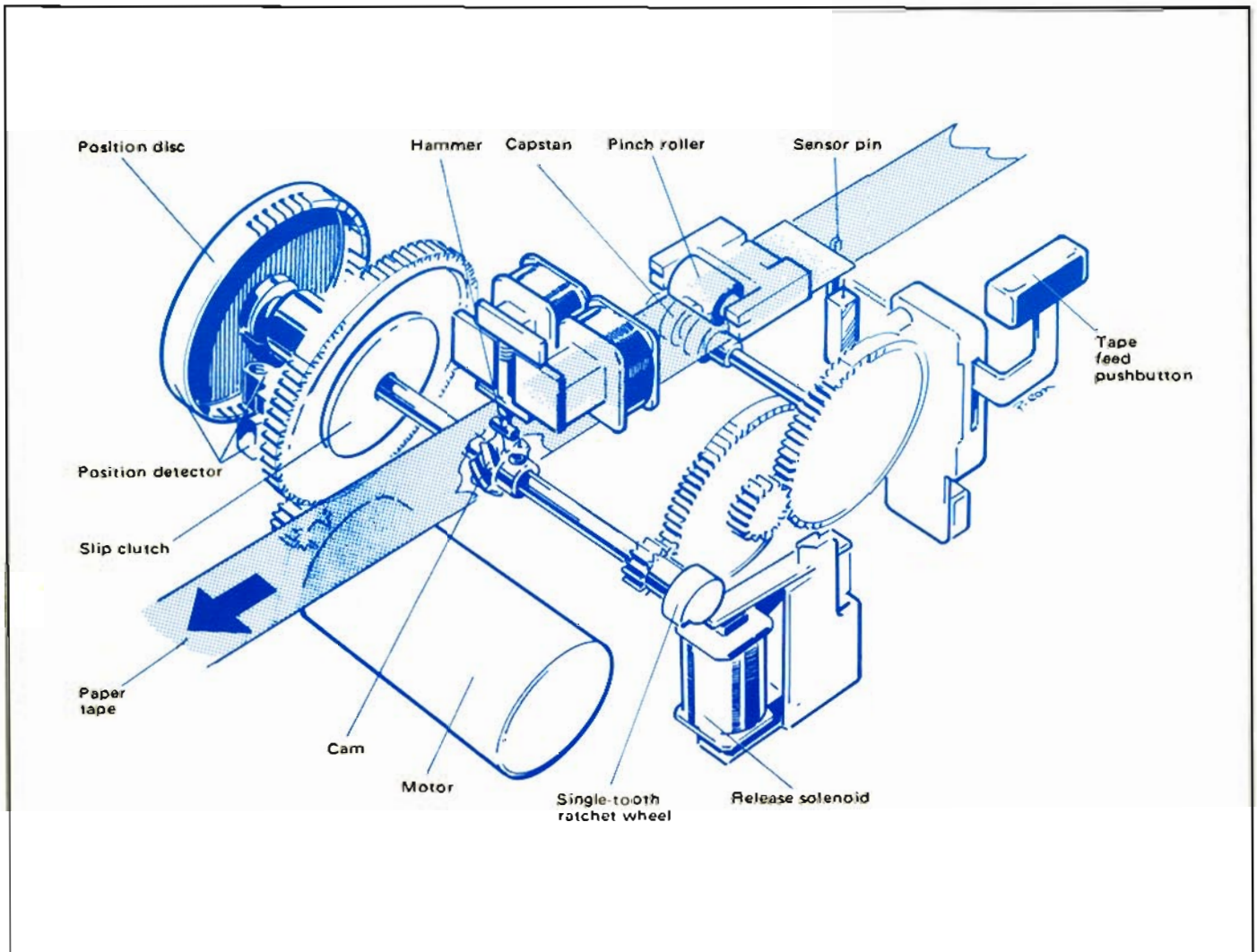
MECHANICAL OPERATION

Fig. 4 Mechanical operation

Printing is carried out by a hammer that strikes the paper against a cylindrical cam having helical projections (Fig. 4). Paper tape is fed between hammer and cam by a capstan and pinch roller.

- A five by seven dot matrix (five columns, seven lines) is used, see Fig. 5a. The hammer runs through the matrix one dot at a time, column by column, from bottom to top and left to right, striking only the desired positions as shown in Fig. 5b. The print hammer operates at a maximum speed of about 1000 strokes per second.

- A position detector is used to synchronize printing. This detector comprises a position disc (Fig. 4) having 35 slots arranged in five groups of seven. Slots correspond to positions in the dot matrix. The position detector sends signals to the control circuits when a slot passes. One revolution of the position disc — and therewith the cam — corresponds to the printing of one character.

- The capstan and the shaft with position disc, cam and single-tooth ratchet wheel are driven by a motor via a slip clutch. The motor operates at constant speed even if the load and/or mains voltage varies.
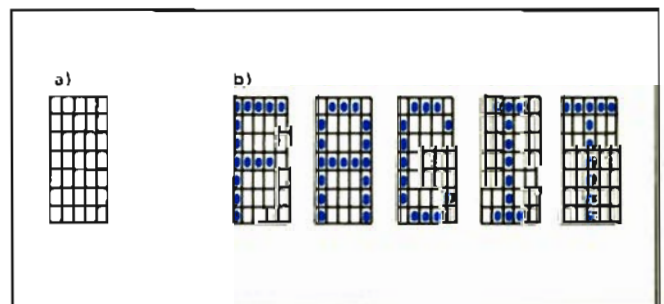

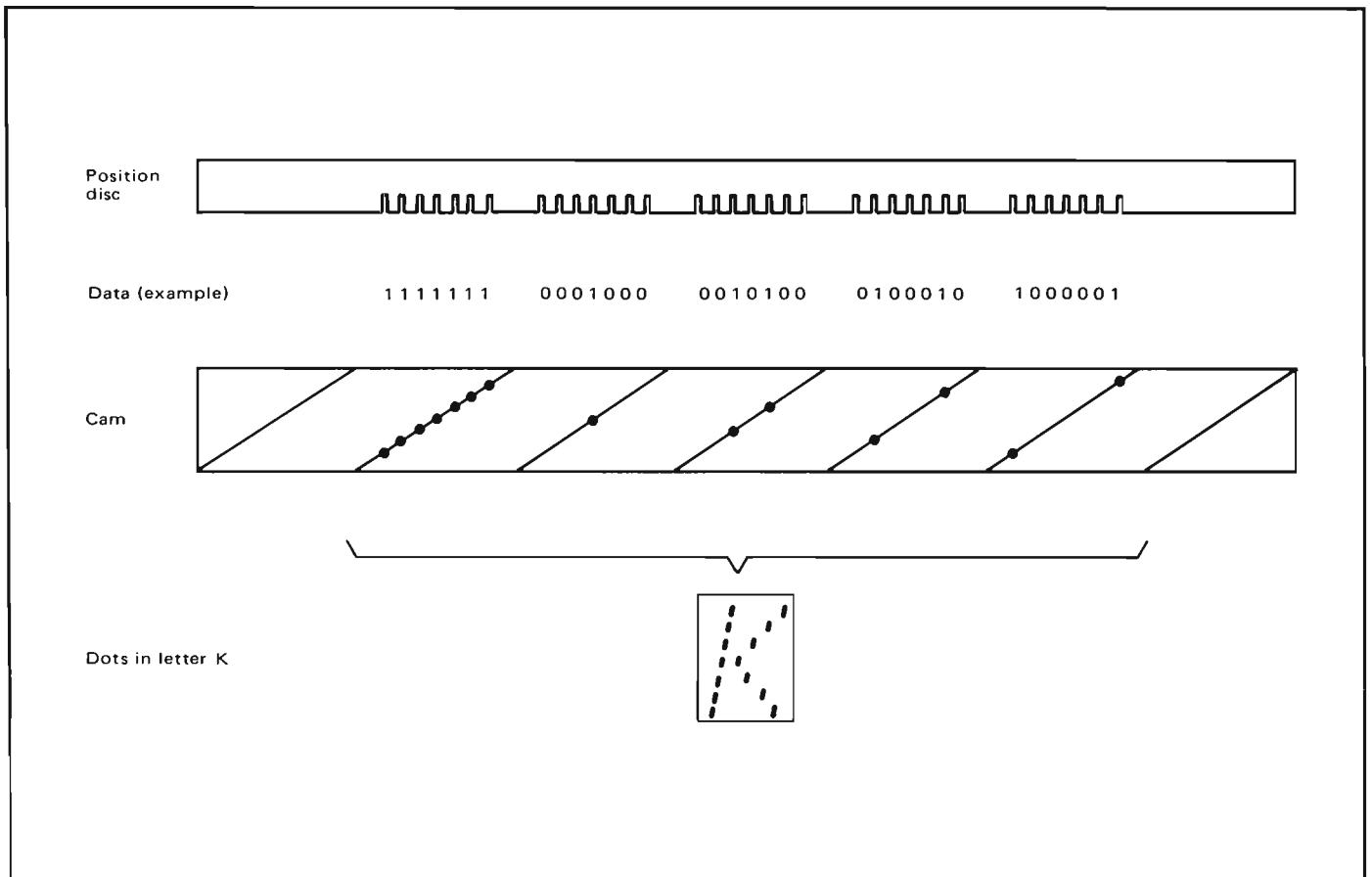Fig. 5 Matrix with dots forming letters

Position disc

Data (example)   1 1 1 1 1 1 1   0 0 0 1 0 0 0   0 0 1 0 1 0 0   0 1 0 0 0 1 0   1 0 0 0 0 0 1

Cam

Dots in letter K

Fig. 6   The cam and position disc peripheries laid out in a single plane

- Printer operation can best be explained by means of a specific example — say the letter K. Fig. 6 shows the cam and position disc peripheries laid out in a single plane with dots representing the letter K.

  The hammer makes a stroke at positions where high (logical one) signals arrive.

- The position disc and cam stop when the ratchet is blocked (i.e. when the release solenoid is de-energized). On the other hand, as long as data is present — and as long as there is paper tape at the printing position — the position disc and cam rotate at uniform speed.

- As long as there is paper tape at the printing position, a sensor pin in the sensor device is kept depressed by the tape. When the tape runs out or breaks, a spring presses up the pin which activates the sensor device and as a result both printing and tape feed are stopped.

- When the tape feed pushbutton, indicated by arrow in Fig. 2, is depressed, the end-of-tape sensor pin is moved down out of the tape pathway, the feed mechanism starts and a new tape can be fed in between the guides. Then the printer is ready to receive new information.

ELECTRICAL OPERATION

The following description of electrical operation presents first the most advanced of the three variants — the Facit 4552/03. The Facit 4552/02 is described only insofar as it differs from the 03. The 02 and 03 variants are both fully compatible with the Facit SP1 standard interface.

A printed description of the Facit SP1 interface can be obtained from Facit distributors. Excerpts from the SP1 manual including principal data are presented in the section headed "Specifications".

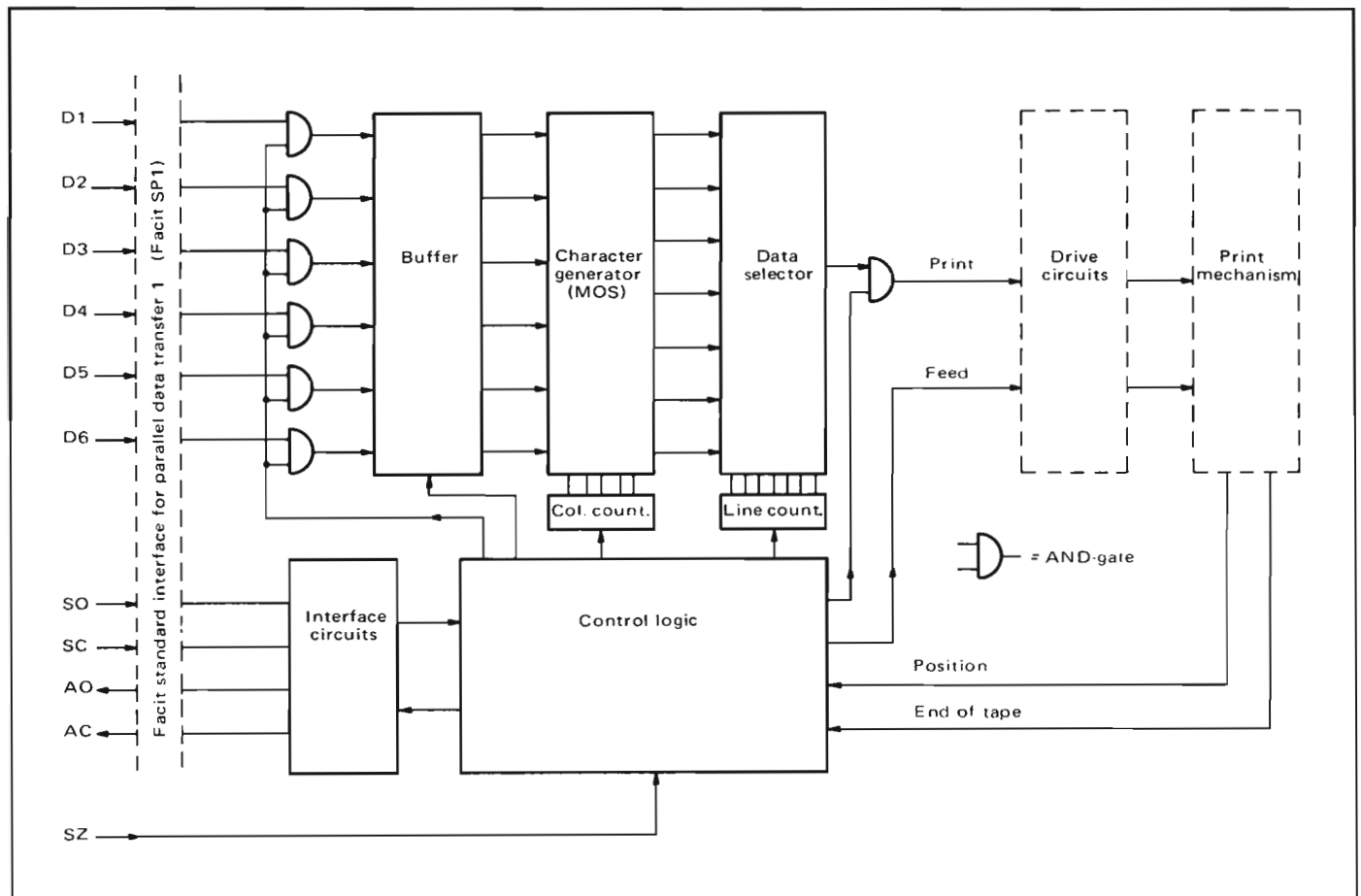## Facit 4552/03 — Variant with character generator

Fig. 7   Control circuits with character generator (Facit 4552/03)

The control circuits (Fig. 7) comprise integrated circuits — both bipolar and MOS. Very briefly, the circuitry functions as follows (see Fig. 8):

- After voltage is turned on, signal "Set to Zero" (SZ) (a special signal obtained from the power supply) shall remain low for approx. 75 ms. During this interval the circuitry components are set to zero.

- When SZ becomes high, outgoing control signal "Acceptor Operable" (AO) also goes high.

- Incoming control signal "Source Operable" (SO) is assumed to be high.

- When outgoing control signal "Acceptor Control" (AC) goes high, data is requested. AC is valid only when AO is high.

- When incoming control signal "Source Control" (SC) goes high, the data is defined. (AO, SO, AC, SC are high). Data is now stored in the buffer.

Data for the first (leftmost) matrix column (see Fig. 5) is now present at the outputs of the character generator and data for the lowest dot in the first column is located at the data selector output.

The signal "Feed" sent to the drive circuits simultaneously releases the cam, which starts to rotate together with the position disc.

- When rotary motion reaches a position corresponding to the first position in the matrix (lowest dot in first column), a signal "Position" is sent to the control logic. If the output signal from the data selector is simultaneously high (logical 1) a signal "Print" is sent to the drive circuits and the hammer makes a stroke.

- The first column is run through in this manner from bottom to top. The line counter selects lines in response to orders received from the control logic.

- When the first column is finished, the column counter is stepped to column two. Data for the second column is now present at the character generator outputs and the data for the bottom dot in the second column is present at the data selector output.

- The entire matrix is run through in this manner, position by position. Hammer strokes are made only at the positions indicated by the data.

- When data is no longer present, the tape feed mechanism stops the tape. The motor continues to run for about one second.

- If the supply voltage is cut off, or if the paper tape runs out (the signal "End of tape" goes low) AO goes low — thus indicating that the printer is not able to accept any character.

Source interface requirements:

- Before SC goes high, SO, AO and AC must be high (specified for Facit SP1)
- First character: no time limitation
- Subsequent characters: new SC signal within 100 μs after AC goes high (maximum printing speed)

Acceptor interface response:

The timing diagram in the upper right-hand corner of Fig. 8 shows that data is acknowledged (AC goes low) within 5 μs after data is sent out (SC goes high). Data is stored in the buffer after a delay of approximately 1 μs.
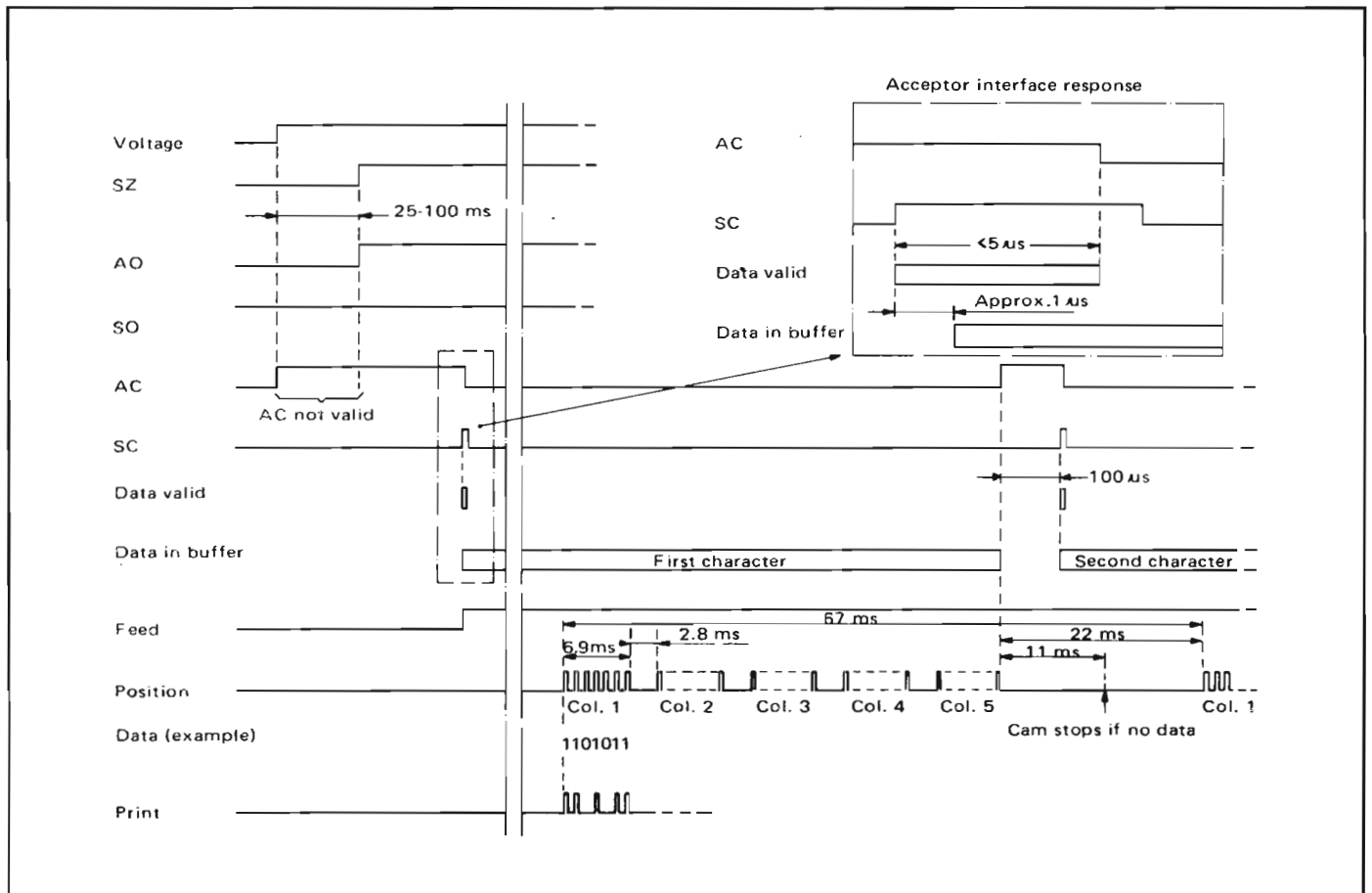

Fig. 8   Electrical operation (Facit 4552/03)
Continuous printing (15 char/sec)

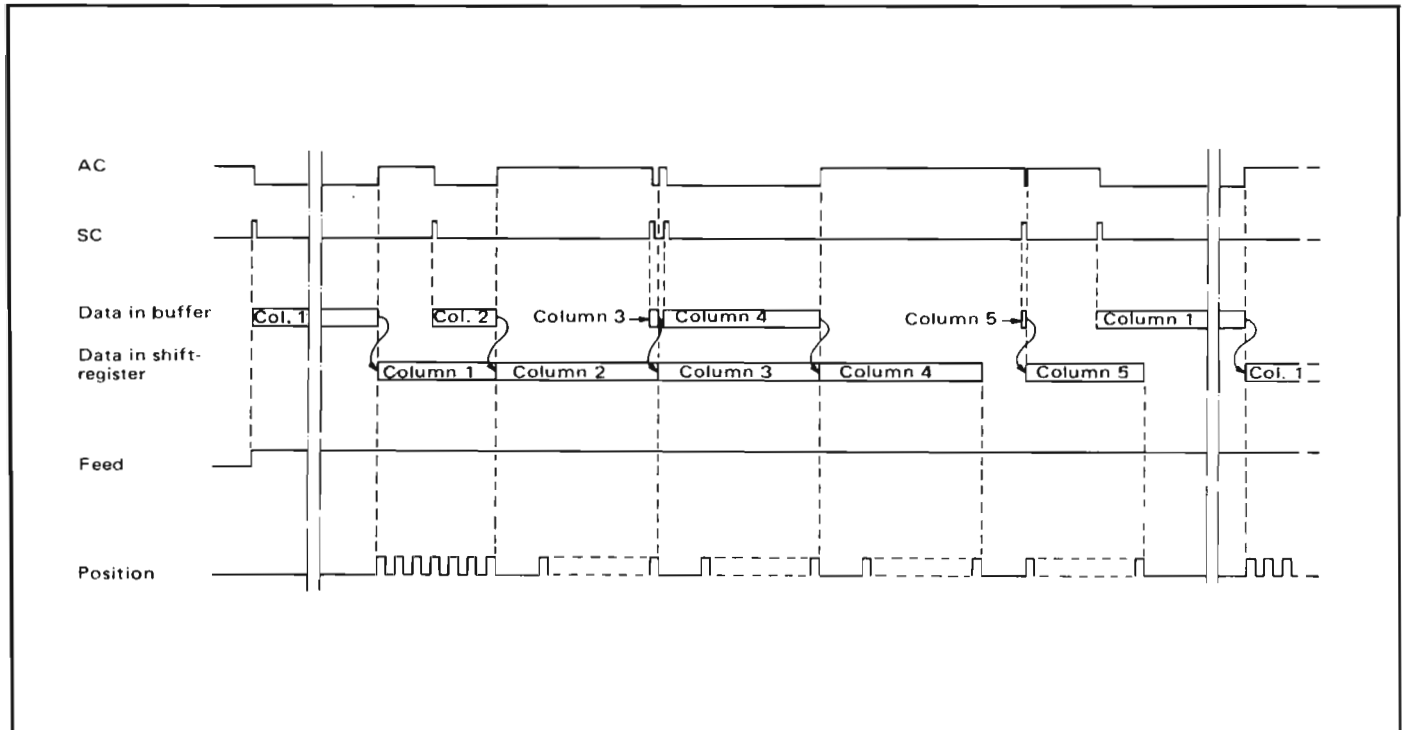## Facit 4552/02 — Variant without character generator

Fig. 9   Electrical operation (Facit 4552/02)

Only bipolar integrated circuits are used in this variant.

Operation differs from that previously described in the following respects (Fig. 9 and Fig. 10):

Fig. 10   Control circuits without character generator

- Characters are received for one column at a time. Seven channels designated D1 through D7 are used. Two columns can simultaneously be stored in the control circuits, see Fig. 9.

- The eighth channel, designated D8, carries a synchronizing signal along with the first column of each character. Repetitive printing errors caused by delays of incoming data are prevented by synchronization.

- A signal that shifts the content of the shift register one position is generated in the control logic for each dot in the column.

Source interface requirements:

- Before SC goes high, SO, AO and AC must be high (specified for Facit SP1)

- First column: no time limitations

- Subsequent columns: new SC signal within 9 ms after AC goes high. Otherwise letters will be distorted

  Note that the time delay between two subsequent SC signals can vary up to 18 ms depending upon previous transmission interval.

Acceptor interface response: same as Facit 4552/03.

Facit 4552/01 — Variant without control circuits

This variant includes (Fig. 11):

- Print mechanism
- PC-board with drive circuits
- Interconnection board
- Jumper board

The jumper board can be replaced with a customer designed control circuit board if desired. Further information about the connections is presented in Fig. 11.

Main signals:

- Feed — Signal to drive circuits (motor and release solenoid)
- Print — Signal to drive circuits (twin-coil solenoid for print hammer)
- Position — Signal from position detector
- End of tape — Signal from end-of-tape sensor assembly

Interface circuits and timing diagram see Figs. 12 and 13.

1) Screen conductor connections easily altered as desired
2) 17 (12 + 5) connections for customer-supplied control circuits (if used):

P4	A1	A2	A3	A4	A5	A6	A9	B1	B2	B3	B4	B5
P1	T	M	N	P	K	H	D	U	V	R	S	L

P4	A16	A17	A18	A20	A21
P2	D	J	K	E	C

22 — — — — — — — -3 2 1 A
22 — — — — — — — -3 2 1 B

Internal connector P4 viewed from insertion side
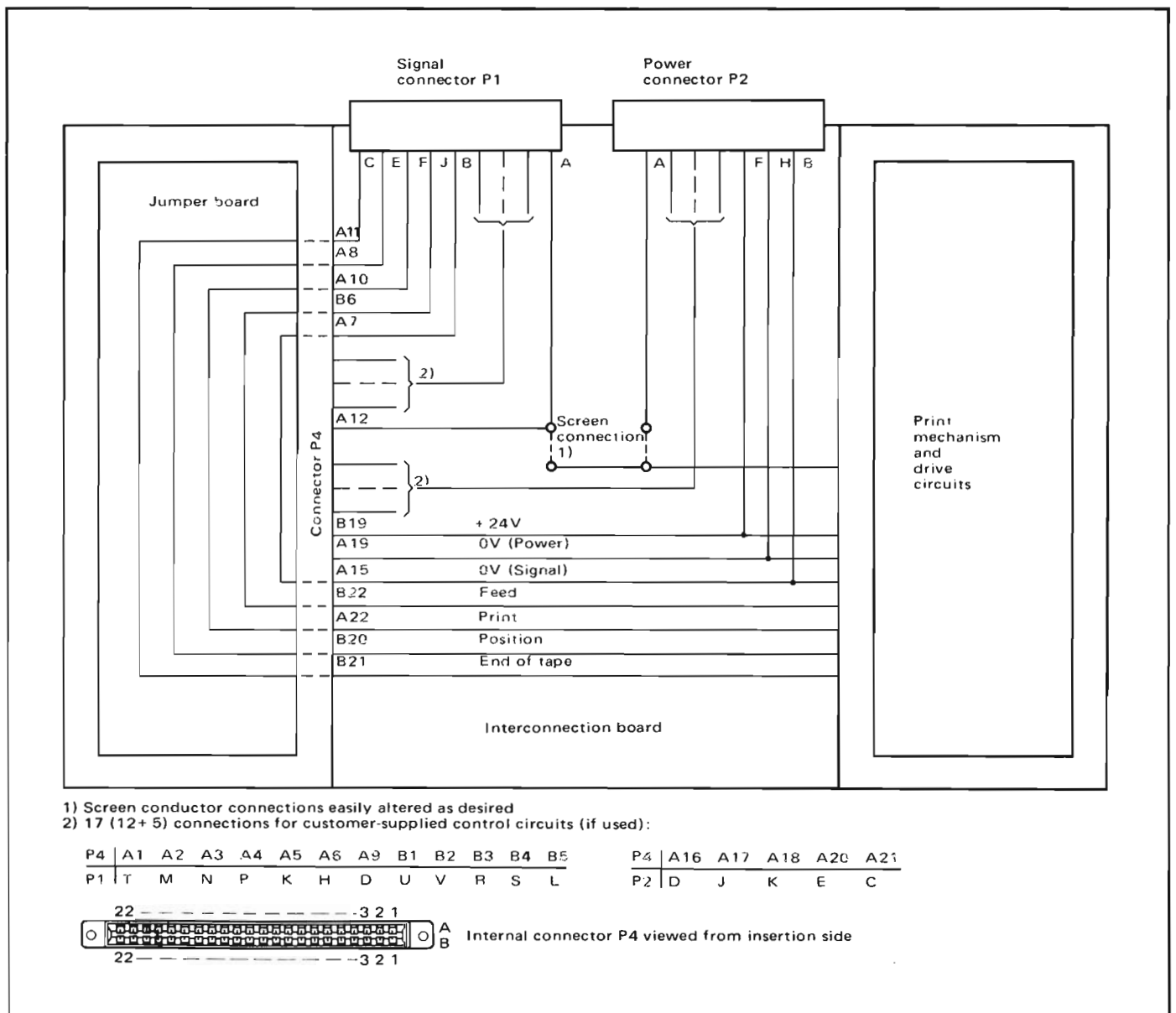
Fig. 11 Interconnections (Facit 4552/01)
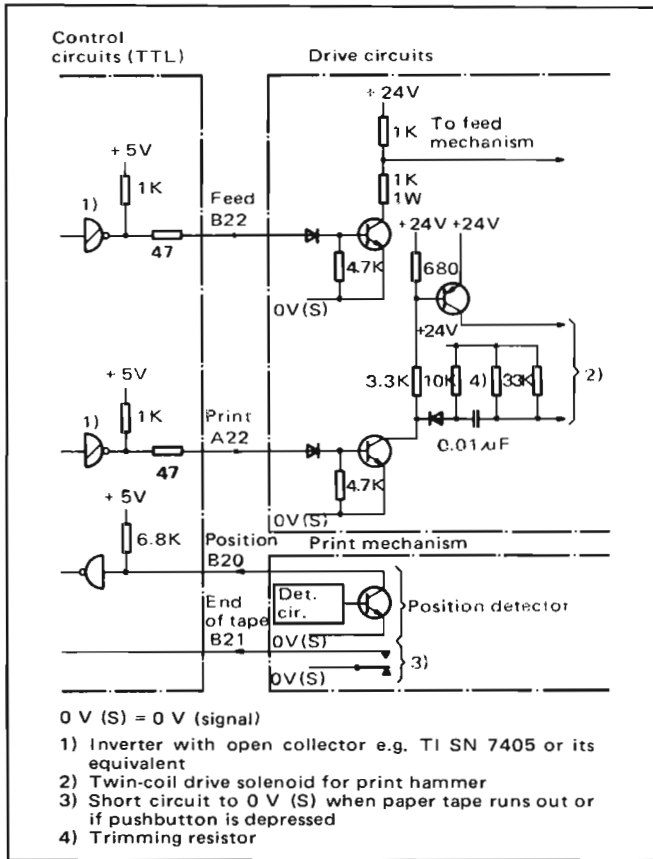
Fig. 12   Interface circuits (Facit 4552/01)

0 V (S) = 0 V (signal)

1) Inverter with open collector e.g. TI SN 7405 or its equivalent
2) Twin-coil drive solenoid for print hammer
3) Short circuit to 0 V (S) when paper tape runs out or if pushbutton is depressed
4) Trimming resistor

P1 — Signal connector (18 pins)

Viewed from
outside of printer
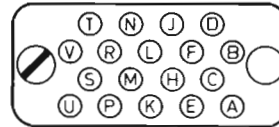
Pin	4552/03 and 02	4552/01
A	Screen (S)	Screen (S)
B	Zero voltage reference (signals)	Zero voltage reference (signals)
C	Acceptor Operable (AO)	End of tape
D	Source Operable (SO)	—
E	Acceptor Control (AC)	Position
F	Source Control (SC)	Print
H	—	—
J	—	Feed
K	—	—
L	—	—
M	Data bit 1 (D1)	—
N	Data bit 2 (D2)	—
P	Data bit 3 (D3)	—
R	Data bit 4 (D4)	—
S	Data bit 5 (D5)	—
T	Data bit 6 (D6)	—
U	Data bit 7 (D7)[1]	—
V	Data bit 8 (D8)[1]	—

1) 4552/02 only

Fig. 13   Timing diagram

Feed

Position

Rise time <25us

Feed

Rise time <25us

Position   1)   600± 100us   460± 100us   T

Rise time <4us

Print   <40us   675±75us

T = Starting time:
   approx. 50 ms with stationary motor
   approx. 30 ms with rotating motor

1) When starting with stationary motor the first pulse endures longer than 700 µs
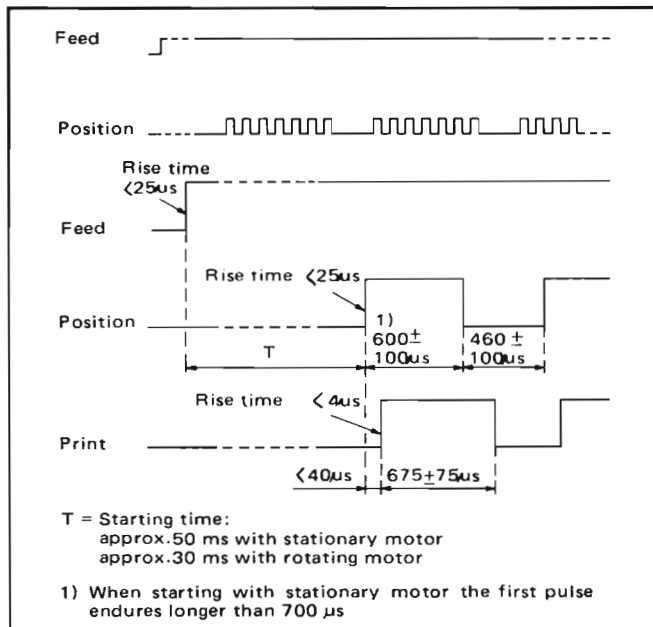
P2 — Power connector (9 pins)

Viewed from
outside of printer
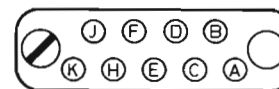
Pin	4552/03 and 02	4552/01
A	Screen	Screen
B	0 V (signal)	0 V (signal)
C	−12 V 2)	—
D	+5 V	—
E	+12 V 2)	—
F	+24 V	+24 V
H	0 V (power)	0 V (power)
J	Set to zero	—
K	—	—

2) 4552/03 only

SPECIFICATIONS

General data

Width	189 mm
Depth	158 mm
Height	149 mm
Weight	Approx. 2.5 kg
Ambient temperature	+15°C to +40°C
Printing speed, cont.	Max. 15.5 char./sec.
Character height	3.2 mm
Inter-character spacing	2.54 mm (10 char./inch)

Paper tape:

Width	17.5 ± 0.2 mm (± 0.3 mm incl. moisture tolerance)
Thickness	Max. 0.1 mm
Outside diameter of coil	Max. 75 mm
Inside diameter of coil	Cardboard core with bore of min. 10.5 mm

The paper tape shall be

- Pressure–sensitive (self-printing under pressure)
- White to assure maximum contrast
- Coloured 1 metre from trailing end (colour shall not obscure printing)
- Coiled with the pressure-sensitive side facing in
- Unattached to core at trailing end

Designations

Facit 4552/01	Strip printer with drive circuits
Facit 4552/02	Strip printer with drive circuits and control circuits (including Facit SP1 interface)
Facit 4552/03	Strip printer with drive circuits and control circuits (including Facit SP1 interface and character generator for US ASCII-code)

Supply voltages

Variant	Voltage	Power consumption [1]	Remarks
4552/01-03	+24 V ±7%	2.5 W 7 W 18 W	While idling Average power consumption during print-out of character 0.1 ms for printing out a single dot
4552/02-03	+5 V ±3%	1.3 W	Continuous
4552/03	+12 V ±5%	0.4 W 0.6 W	Average Maximum
	−12 V ±5%	0.1 W	

[1] At nominal voltages

Input/Output signals
Facit 4552/02 and 03

Facit 4552/02 and 03 are fully compatible with the Facit standard interface for parallel data transfer 1 (Facit SP1). For details see Facit SP1 folder. Principal data are presented below. Note that AM, P and CA are not utilized in strip printer.

Levels	Transmitting circuits AO, AC	Receiving circuits	
		SO, SC	Data
Logic 1	$\geqslant +2.4$ V [1] $\leqslant +5.5$ V	$\geqslant +2.2$ V [3] $\leqslant +5.5$ V	$\geqslant +2.0$ V [3] $\leqslant +5.5$ V
Logic 0	$\geqslant 0$ V $\leqslant +0.4$ V [2]	$\geqslant 0$ V $\leqslant +0.6$ V [4]	$\geqslant 0$ V $\leqslant +0.8$ V [5]

SO = Source Operable (logic 1)
AO = Acceptor Operable (logic 1)
AC = Acceptor Control:
    Logic 1 — data requested
    Logic 0 — data acknowledged
SC = Source Control:
    Logic 1 — data sent out
    Logic 0 — acknowledgement understood

Data D1 – D6 (Facit 4552/03): US ASCII-code
Data D1 – D7 (Facit 4552/02): logic 1 – hammer stroke
    D8 (Facit 4552/02): logic 1 – synchronizing pulse in first column in every character

[1] At +2.4 V the output current shall be able to reach 0.4 mA
[2] At +0.4 V the input current shall be able to reach 0.2 mA
[3] At +2.4 V the input current shall be $\leqslant$ 0.4 mA
[4] At +0.4 V the output current shall be $\leqslant$ 0 mA
[5] At + 0.4 V the output current shall be $\leqslant$ 2.0 mA

Signal "Set to zero" (SZ) (not included in SP1).
Logic 1: 25–100 ms after +5 V voltage exceeds +4.85 V and −12 V voltage drops below −11.3 V
Logic 0: immediately when +5 V voltage drops below +4.55 V or −12 V voltage exceeds −10.7 V. (−12 V voltage: Facit 4552/03 only)

Input/Output signals
Facit 4552/01

This variant is not compatible with Facit SP1.

Output signals (Figs. 11–13):
- "Position" = Signal from position detector
- "End of tape" = Signal from end-of-tape sensor assembly

Input signals (Figs. 11–13):
- "Feed" = Signal to drive circuits (motor and release solenoid)
- "Print" = Signal to drive circuits (solenoid for print hammer)

FACIT