FBS Slip & Passbook Printer LB12/LB15

digital

Field Support Manual

Part Number: EK-A0685-SV002

FBS Slip & Passbook Printer
LB12/LB15
Field Support Manual

Acknowledgments

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Related manuals

LB12/LB15 Field Support Manual (including MSF)	EK-LB125-SM
LB12/LB15 User’s Guide	EK-LB125-UG
APP 6390 HSI (Hardware Software Interface) Manual	AA-PYSXB-TE
APP 6390 Application Programmer's Guide	AA-PTGWB-TE
APP 6390 Available Emulations Reference Manual	AA-PYSWB-TE

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WARNINGS, CAUTIONS AND NOTES

WARNING!

This type of safety instruction is used where there is potential danger of injury to personnel and/or damage to the equipment or the environment. The symbol inside the triangle indicates the type of danger.

CAUTION!

This type of safety instruction is used where injury to personnel and/or damage to the equipment or the environment can occur, if related instructions are not followed.

NOTE!

Notes are used to provide important or explanatory information.

CHAPTER 1 GENERAL DESCRIPTION

Pages 1-1 through 1-20

1.1 INTRODUCTION

The LB12 and LB15 Slip & Passbook Printers provide multi-functional document processing in all-purpose workstations.

Figure 1-1 below shows the LB12/LB15. The printer is equipped with a ***document station*** that can print on different types of documents such as single sheets, form sets, passbooks, and passports, inserted horizontally through a slot at the front.

The document station can handle both vertically and horizontally folded passbooks or passports. Printing is uni-directional or bi-directional and characters can be printed rotated 90### or upside down.

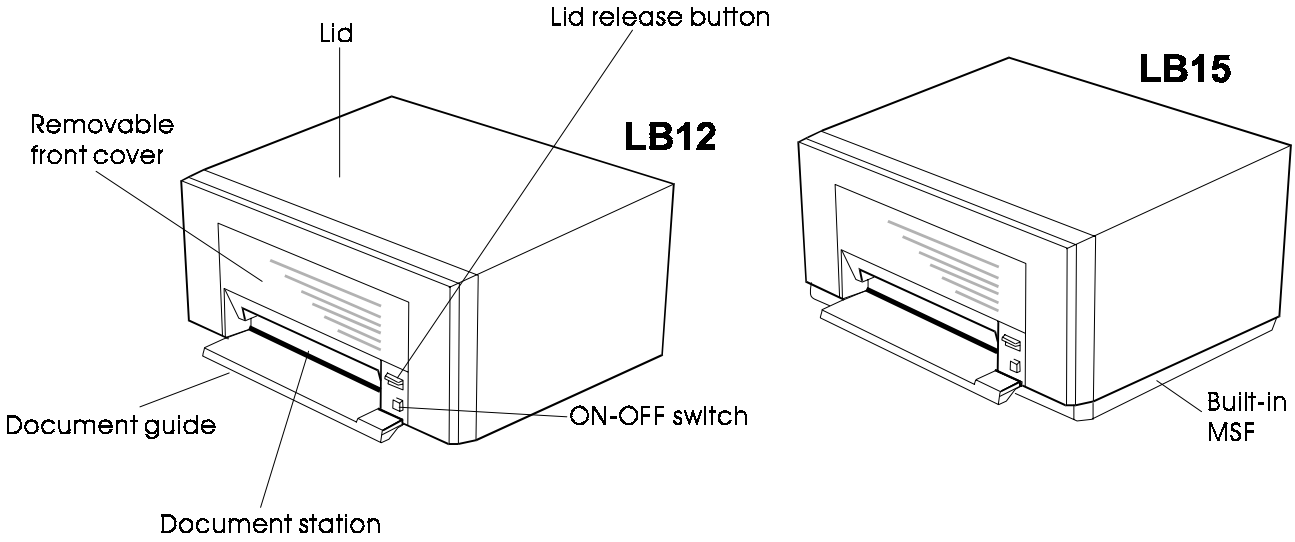


Figure 1-1 The LB12/LB15 printers, exterior

1.1.1 Printing characteristics

On the LB12/LB15 printers, printing can take place at a speed of up to 300 characters per second in both directions. The printer maintains the highest possible print speed by automatically calculating the shortest possible route to the next print position. The position of the 18-needle printhead can be controlled by the application program. The printer can operate in its own Native mode or emulate an IBM ProPrinter III or IBM 4722.

When running in Native mode, the LB12/LB15 can use two character fonts and several national character sets, including OCR-A and OCR-B fonts in PROMs. Other PROMs providing logotypes and special character sets are optional. Additional character sets can also be downloaded to the printer by the application program. When ProPrinter mode is selected, the printer can use all the standard IBM ProPrinter III character generators.

A Position Detection Facility (PDF) can be used to find the left document edge.

1.1.2 Information feedback

The LB12/LB15 printers return a large amount of essential information to the application program, including:

- printer configuration
- number of characters printed
- true status of execution
- error codes.

1.1.3 Maintenance aspects

The mechanical design is such that field replaceable modules can be replaced within five minutes with no need for mechanical adjustments. The printers also have extensive built-in test programs, significantly reducing the time spent on repairs.

1.1.4 Power ON/OFF

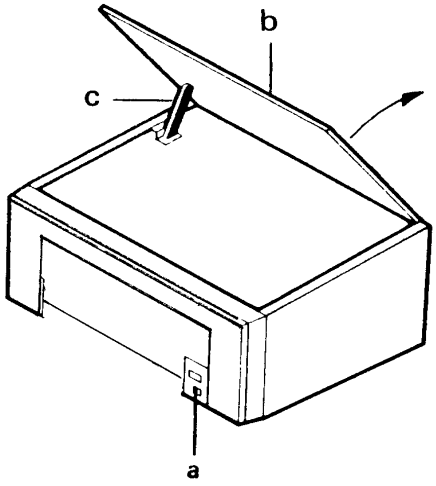
To reduce the amount of heat generated by the printer, the operator can switch the printer from ON to STANDBY mode (and vice versa) by using the ON switch at the front of the printer. The LB12/LB15 can also be switched OFF from the application program. The ON switch, however, overrides software-controlled switching. The ON LED illuminates when the printer is switched ON.

WARNING!

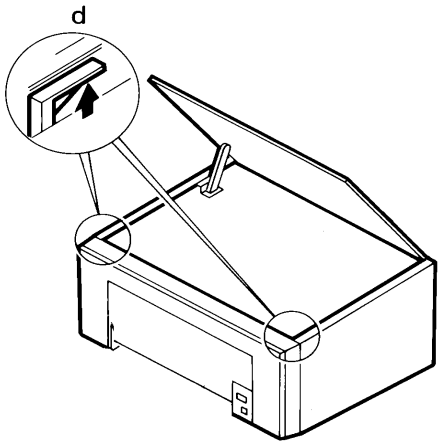
There is high voltage inside the PSU even when the printer is switched off. REMOVE the power cable before you dismantle the PSU.

1.2 REMOVING THE COVER

1. Remove the front cover and the document guide (see the *LB12/LB15 User's Guide*).
2. Press the lid release button (a).
3. Raise the lid (b) until the lid support (c) snaps into the locked position.



4. Press the left side of the cover backward whilst, at the same time, lifting the cover latch (d) slightly, using a screwdriver or similar tool. With the latch lifted, pull the left side of the cover forward a few millimeters. Repeat on the right hand side.



5. Pull the cover straight towards you as far as possible (e).
6. Raise the cover as shown (f) and remove it (g).

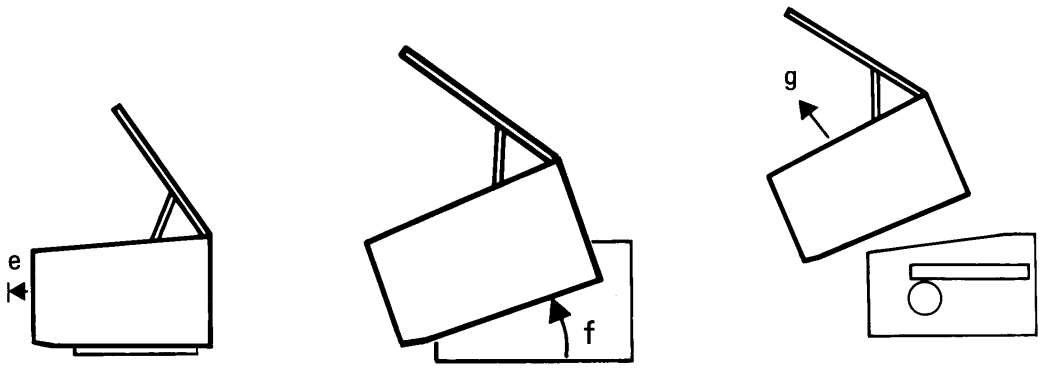


Figure 1-2 Removing the cover

1.3 THE DESIGN CONCEPT

Each printer unit is built up between two side plates, joined by a base plate and various bars and rods. The unit rests on a bottom plate (r) joined to the printer unit by means of two screws. Rubber bushings and dampers reduce the transmission of vibrations to the bottom plate and hence the printer cover.

The printhead (ac) is mounted on a carriage. The above parts and ink ribbon cassette (ae) are all part of the rotary print unit (ad), which can rotate such that the printhead can be in either a horizontal or a vertical position.

When a document is fed horizontally into the document station, the document stops against a row of raised stop pins (y). Two optical sensors in the document station (t) detect that a document is inserted and that it is in the correct position. The sensors are connected to the document sensing board (t). A motor (not shown) lowers four pressure rolls (z) and removes the stop pins. Four feed rolls, one under each pressure roll, feed the document into the print position above a lower print bar (not shown).

Three optical sensors (s) are mounted on the outside of the right side plate. The upper sensor senses when the rotary print unit is in the horizontal position. The middle sensor detects when the printhead is in its extreme right position. The print unit cannot rotate unless the printhead is in this position. The bottom sensor senses the position of the pressure rolls and the stop pins. All sensors are connected to the document sensing board (t) via optical fiber cables.

The ON lamp (v) and the ON-OFF switch (u) are mounted on the document sensing board (t).

As a safety measure, printing cannot take place while the lid is open. An exception to this is when the built-in tests are run.

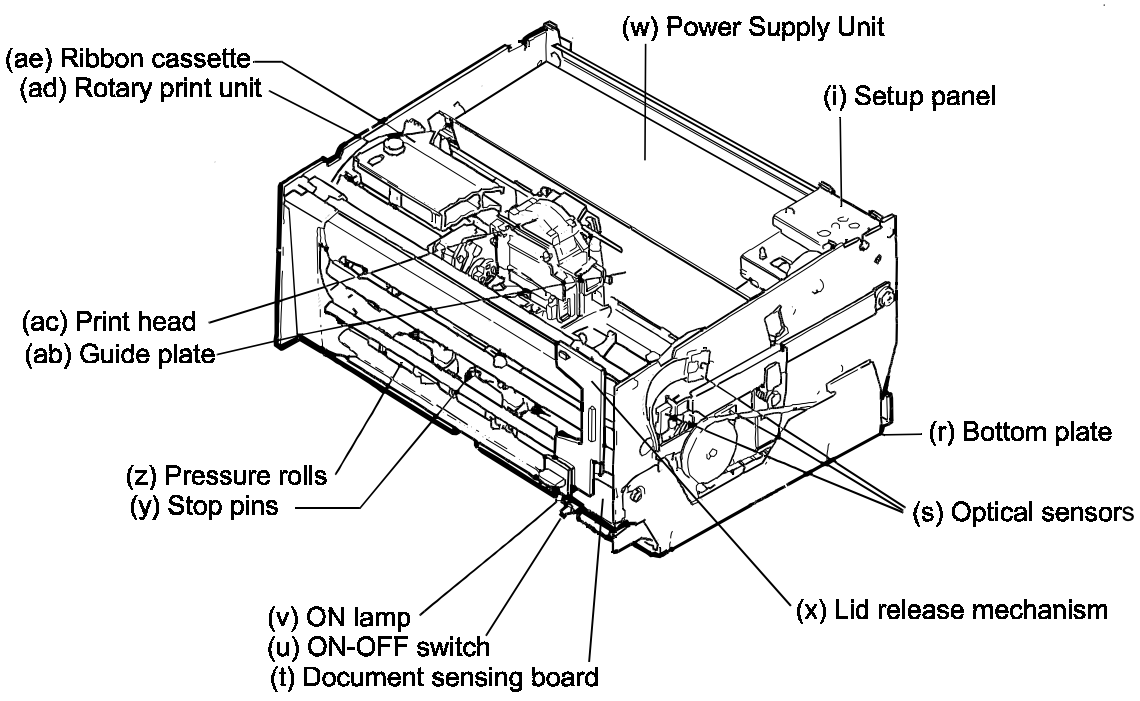


Figure 1-3 Printer modules

The lid release mechanism (x) is mounted on the two shafts at the front. In addition to raising the lid, this mechanism also handles the locking and release of the rotary print unit in the LB12.

The main board (l) is mounted between the printer mechanism and the bottom plate (r). The setup panel (i) can be replaced by an optional diagnostic panel.

1.4 TECHNICAL DATA

1.4.1 General print characteristics

Print method — Impact dot matrix, 18-needle printhead.

Emulation — IBM ProPrinter III
IBM 4722.

Print modes — Alphanumeric, semi-graphics, graphics.

Matrix — 9x12, 18x36 (NLQ single pass), 18x72 (NLQ single pass, OCR)
Right character inclination (italic style) is available under software control.

Resolution (single-pass printing)

Vertical	144 dots/inch.
Horizontal	720 dots/inch.

Print speed

Matrix	**Maximum print speed**
Flash	514cps
Draft	300cps (Draft)
NLQ	Up to 130cps
OCR-A, OCR-B	80cps
Fastfont	360cps

Character pitches

Native mode

Matrix	**Pitches**
9x12	10, 12, 15, 16.5cpi
18x36	10, 12, 15, 16.5cpi, and proportional
18x72	10, 12, 15, 16.5cpi, and proportional
OCR-A	10cpi
OCR-B	10cpi
Flash	17.1cpi

ProPrinter and 4722 modes

Matrix	**Pitches**
9x12	10, 12, 17.1, 20cpi, and proportional
18x36	10, 12cpi, and proportional
Fastfont	12

Number of characters per line (line length = 203mm)

Pitch (cpi)	**Characters**
10	80
12	96
15	120
16.5	132

Input buffer — 5.5KB = approximately 5500 characters.

Standard character sets in PROM

Native mode — Courier and Gothid type faces (NLQ 18x36 and DATA 9x12 qualities), always included in the printer.

ASCII	Italian
German	Swedish
British	Norwegian/Danish
French	Portuguese
Spanish	Swiss

ProPrinter and 4722 modes — Code pages 437 and 850.

Other character sets — Other typefaces, fonts, logos etc. can be added as PROMs or downloaded from the system.

1.4.2 Document station

Voucher dimensions	Width	90—235mm.
	Height	67mm minumum (single sheet). The maximum print height is 286mm, starting 4mm from the upper edge.
	Thickness	2mm maximum (original + 4 copies).
Passbook dimensions	Width	100—235mm.
	Height	75mm minimum. Maximum print height is 185mm from upper edge.
	Quality	50—70 g/m², 0.08—0.16mm. Other paper qualities must be tested. OCR printing requires OCR specified paper quality.
Thickness	See description on Page 1-15.	
Paper weight	Single voucher	45—110 g/m², 0.08—0.30mm
	Voucher set	1 original: 45—90 g/m², 0.08—0.12mm. 4 copies: 40—60 g/m² each, 0.06—0.10mm. 4 carbons: 20-28 g/m² each.
		Note *If four copies are used, the lower values must be followed. The binder for the set can be placed on any side or at the top.*
Document feed	Single line (1/6")	50ms.
	Max. speed	0.4m/s = 95 lines/second.

Print area on vouchers

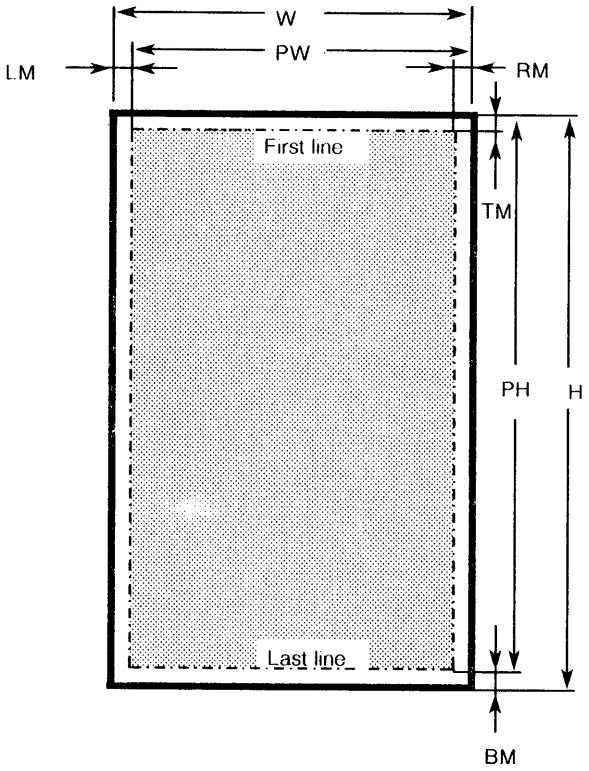


Figure 1-4 Print area on vouchers

Measurement		A4 (mm)	Letter (mm)	Min. (mm)	Max. (mm)
H	Document height	297	279	67	(See Note)
W	Document width	210	216	90	235
PW	Print width (= leftmost print position)	206	206	97	206
RM	Right margin	3	3	3	NA
LM	Left margin	3	10	3	NA
PH	Print height	287	269	61	291
TM	Top margin (from top edge to top of characters)	4	4	4	NA
BM	Bottom margin (bottom edge to base of characters)	6	6	6	NA

NA = Not Applicable

Table 1-1 Print measurements on vouchers

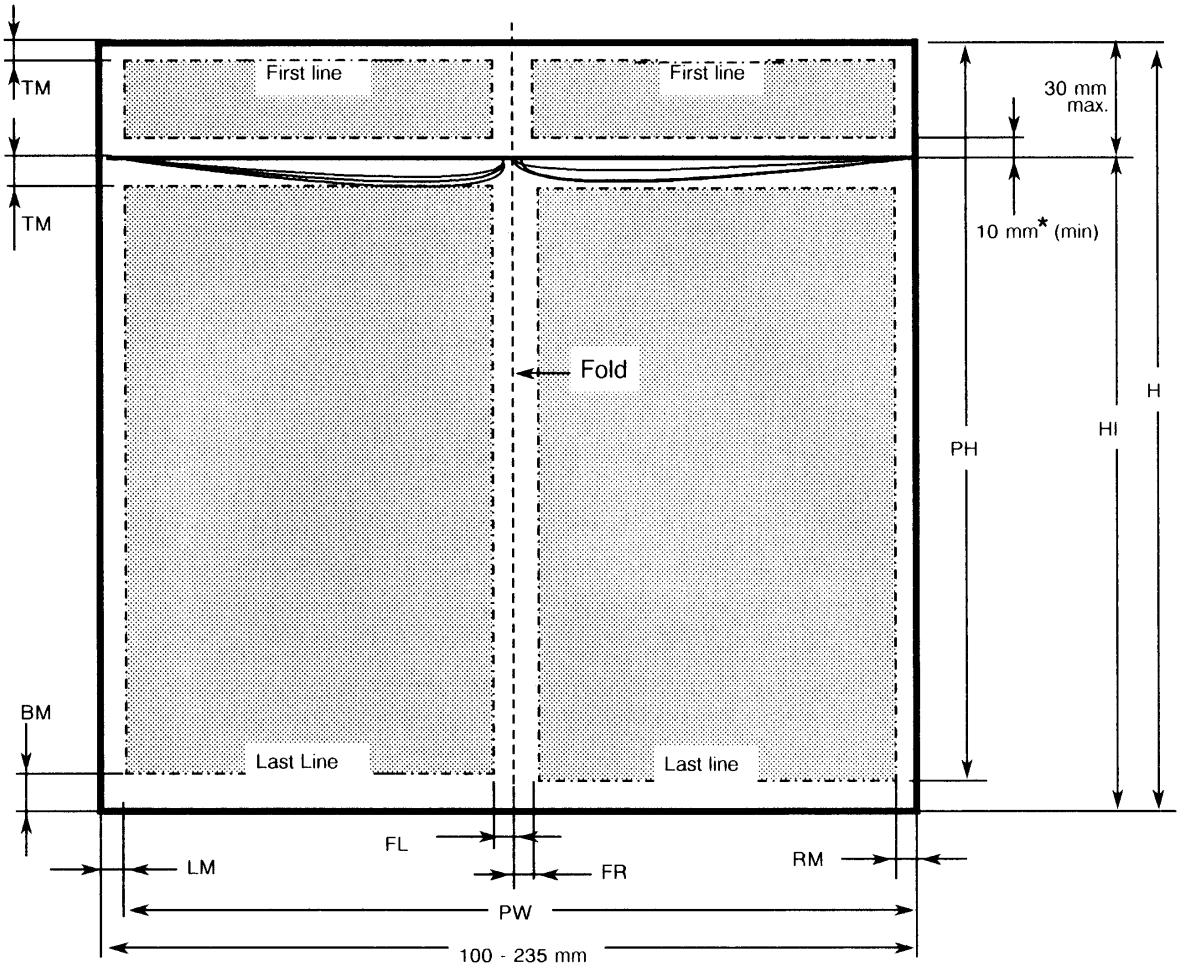
The maximum document height is 318mm when using bottom synchronization, starting 4mm from the upper edge. The document height is infinite when using top synchronization but PH is also maximized for top synchronization.

The above measurements include the binder (20mm wide) on either the short or long edge in a form set. If the binder is placed on the right side, this reduces the line length. The maximum number or lines is reduced if the binder is placed at the top.

Print area on passbooks

Both vertically and horizontally folded books can be used. Two types of vertically folded passbooks can be specified:

- Type A Height is 122mm or more. Upper edge to be inserted first.
- Type B Height is less than 122mm and the book has cut inner pages. Lower edge to be inserted first.



* No restrictions if pages are flipped over.

Figure 1-5 Print area on vertically folded **type A** passbooks

See the measurement table on the next page.

Measurement		Printing (mm)	
		Min.	**Max.**
H	Height (no cut inner pages)	75	NA
HI	Height, inner pages	75	NA
PH	Print height	4	185
PW	Print width	NA	206
RM	Right margin	3	NA
LM	Left margin	3	NA
TM	Top margin	4	NA
BM	Bottom margin	8	NA
FL + FR	Fold margins	6 + 6	NA
Book thickness		NA	3.2

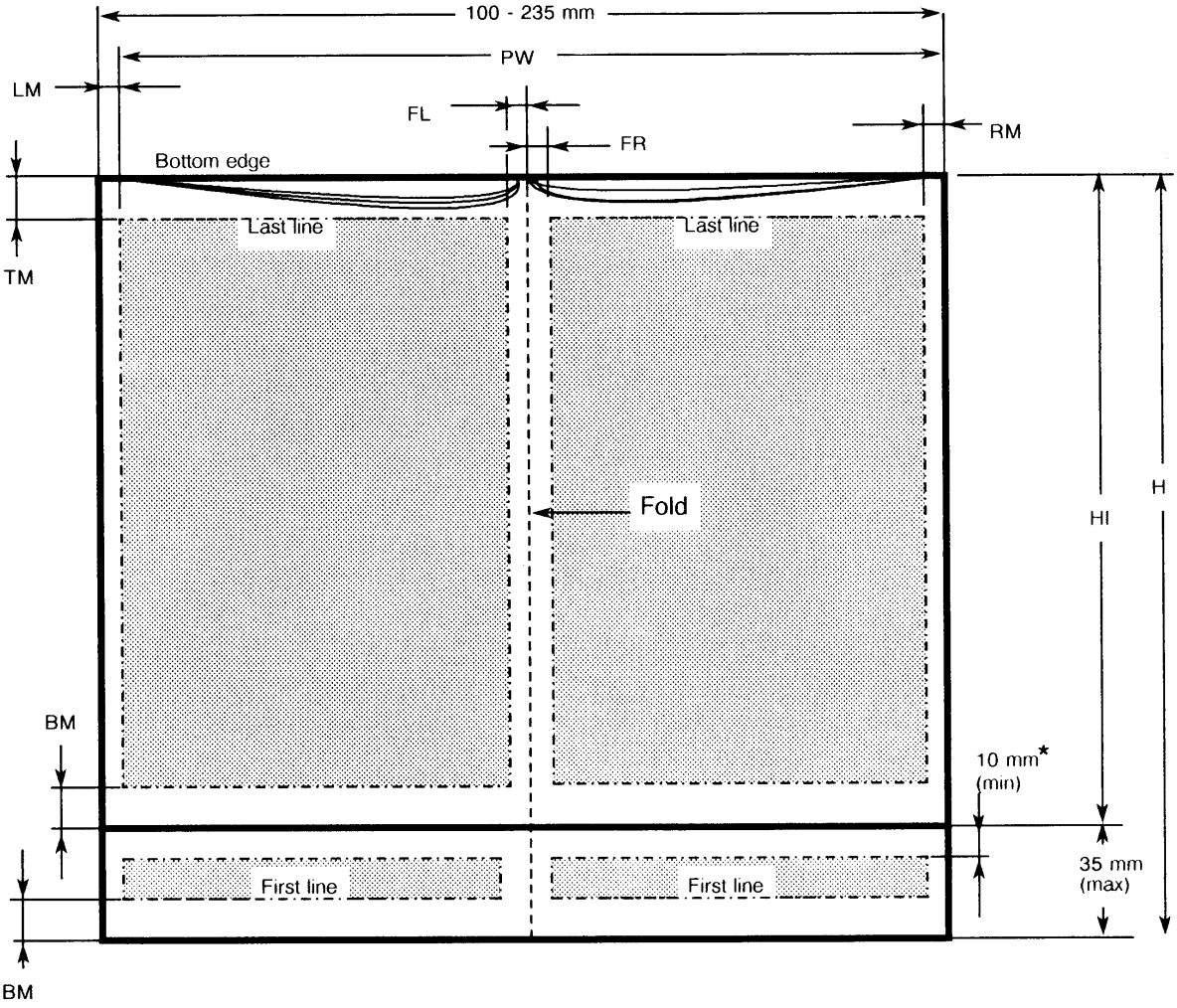
NA Not applicable

Table 1-2 Print measurements on vertically folded type A passbooks

IMPORTANT !
The function of the document feed mechanism must be verified before books of different widths are used in the same printer.

See Chapter 3, Maintenance, for information about adjusting the pressure rolls.

The book is turned upside down to ease paper feeding. The text is rotated 180°.



* No restrictions if pages are flipped over.

Figure 1-6 Print area on vertically folded **type B** passbooks

See the measurement table on the next page.

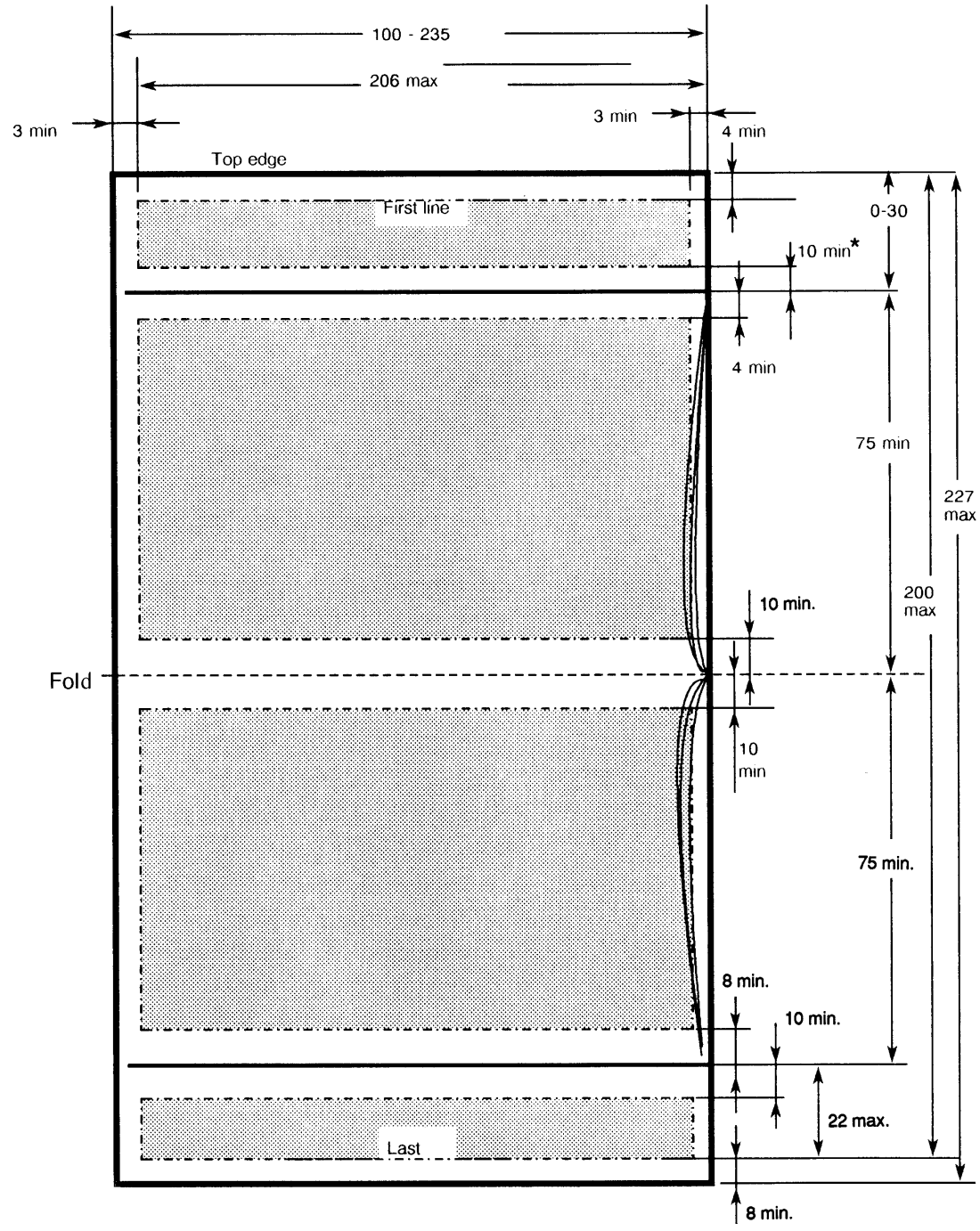
Measurement		Min (mm)	Max. (mm)
H	Height	75	NA
HI	Height, inner pages	75	NA
PH	Print height	NA	NA
PW	Print width	NA	206
RM	Right margin	3	NA
LM	Left margin	3	NA
TM	Top margin	4	NA
BM	Bottom margin	8	NA
FL + FR	Fold margins	6 + 6	NA
Book thickness		NA	2.5

NA Not applicable

Table 1-3 Print measurements on vertically folded type B passbooks

IMPORTANT *!*
The function of the document feed mechanism must be verified before books of different widths are used in the same printer.

See Chapter 3, Maintenance, for information about adjusting the pressure rolls.



* No restriction if pages are flipped over.

Figure 1-7 Print area on horizontally folded passbooks

IMPORTANT *!*
The function of the document feed mechanism must be verified before passbooks of differing widths are used in the same printer.

See Chapter 3, Maintenance, for information about adjusting the pressure rolls.

Book thickness

The thickness should be measured with a force of 200 N/m2 distributed over the passbook surface.

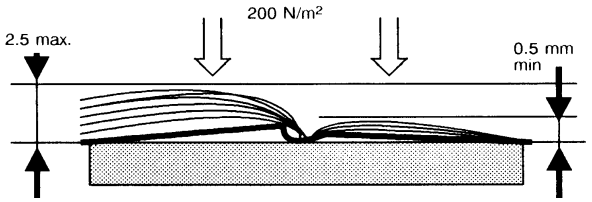


Figure 1-8 Measuring passbook thickness

1.4.3 Power supply

Input voltage	87—132 V or 180—264 V, 50 or 60Hz auto ranging.
Power dissipation	ON mode, not printing: 20 W
	ON mode, printing: 150 W (peak load)
Power consumption	115 V 1.5 A 220 V 0.7 A
ON/OFF mode control	Manually, using switch on front panel.
Input circuit fuse	One fast-acting, glass tube fuse, 6.3x32mm, 4 A.
Output voltage	+5.2 V, +36.5 V, and –12.5 V.

1.4.4 Diagnostic tests

Automatic test	A power-ON test is performed at transition from standby to ON mode. This test includes RAM and PROM tests, movement of mechanical modules, checking of sensors, etc.
Other tests	See Chapter 3, *Maintenance*.

1.4.5 Environmental conditions

Temperature

Operating	+10— +35°C.
Storage	–40— +70°C.

Humidity

Operating	20—80% RH, non-condensing.
Storage	20—90% RH, non-condensing.

1.4.6 Miscellaneous

Dimensions

Width	398mm.
Height, front	LB12: 172mm; LB15: 192mm.
Height, back	LB12: 195mm; LB15: 215mm.
Depth	300mm.
	(See also Chapter 4, *Site Preparation*.)
Weight	LB12: 14kg. LB15: 15kg.

Acoustic noise

Operating	Less than 60 dBA under any sound power level printing condition.
Standby	Less than 40 dBA sound power level.

Ribbon

Type	Cassette with endless loop. The ribbon is twisted 180° inside the cassette on each turn.
Length	2 x 28m (effective length).
Width	12.7mm.
Expected life	More than 4x106 characters. With OCR printing, more than 2.8 x 106 characters. The lower value is due to a higher degree of inking.

1.4.7 Position Detection Facility

Detects the left document edge.

1.4.8 Communications interface

See the *LB12/LB15 User's Guide*.

1.5 MAGNETIC STRIPE FACILITY

The MSF (Magnetic Stripe Facility) is a device in the LB15 printer. This device enables the printer to read and write a track of magnetically encoded characters positioned on the back cover of a passbook.

1.5.1 Design

The main part of the MSF device is a read/write (R/W) head that can be moved sideways in a wide slot at the bottom of the document path. A black plastic panel covers the slot when the head is in its home position on the right side. The panel moves away, exposing the head during the read/write operation.

Passbooks must be inserted manually into the document station, aligned with the right side of the insertion slot. The book must be open with the printable pages facing upward and the outside of the cover downward. The magnetic stripe is then positioned as far as possible to the right.

The MSF mechanics are built into the bottom plate assembly (see Figure 1-9).

The main MSF parts are:

- MSF logic board "piggy-back" mounted on the main board.
- Document guide with increased height (standard MSF version or MSF version with operator panel).
- Printer bottom plate assembly with increased height compared to the bottom plate used in the LB12
- Interconnecting cables between the MSF mechanics and the MSF logic board.

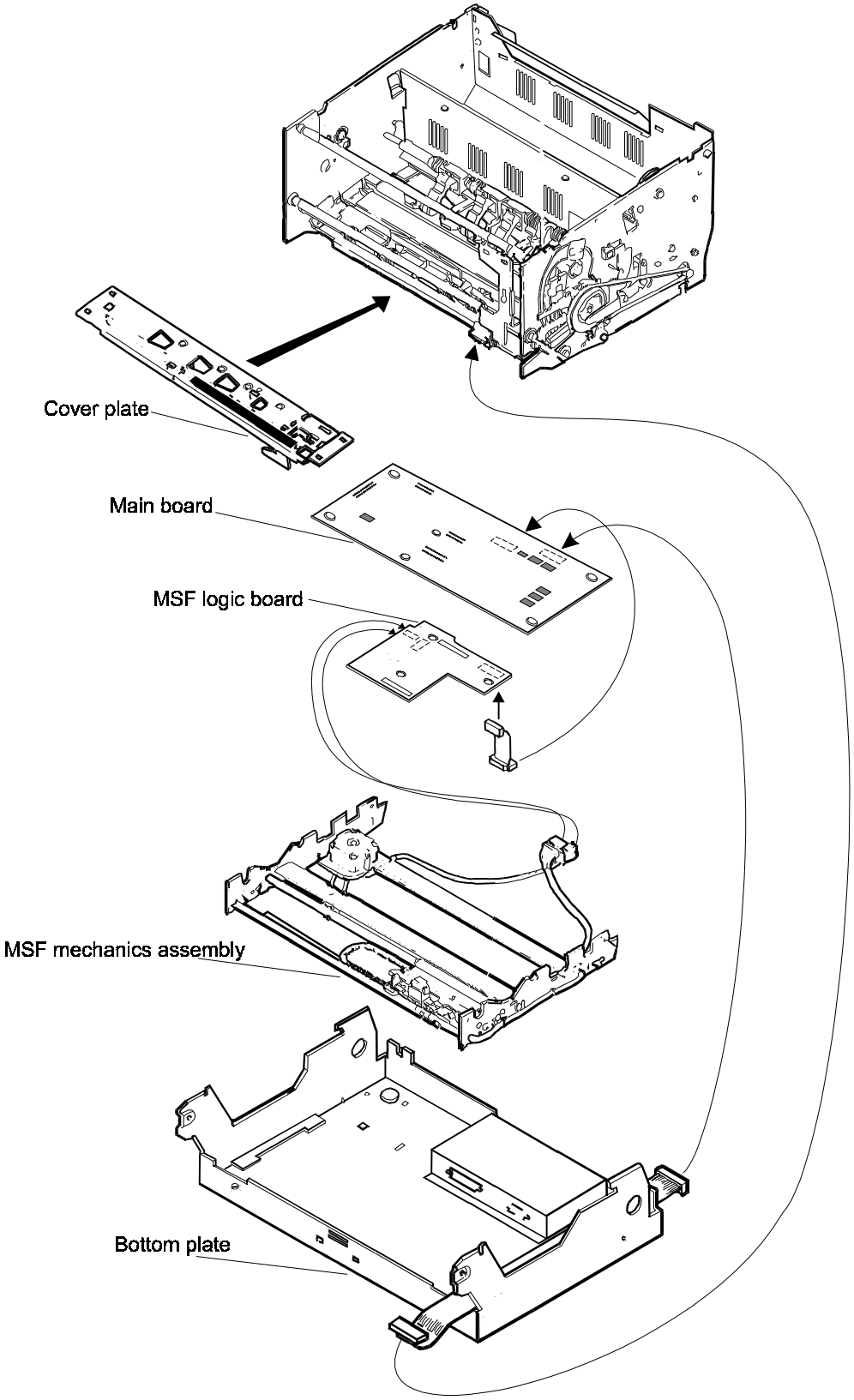


Figure 1-9 The main parts of the MSF device

1.5.2 Performance

Data recording is performed in accordance with the DIN 32744/ISO 8484 standards.

Usually, data recording is carried out in accordance with the DIN 32744 standard, which means that a string of maximum 48 characters is written twice (i.e. the basic string followed by a duplicate) in a single track on the magnetic stripe.

Recording in accordance with the ISO 8484 standard means either that a string of up to 108 characters is written or that a string of up to 48 characters is written twice (i.e. as defined by the DIN 32744 standard).

Non-standard start and stop sentinels can be selected from the application.

Read after write is always performed to check that the string has been recorded correctly. After a duplicate recording, both strings (or records) are read and compared to ensure that they are equal.

Reading and writing is performed while the R/W head moves at constant speed. Writing is performed when the R/W head moves from right to left whereas reading can be performed in any direction.

1.5.3 Encoding technique

The encoding technique used is the F/2F encoding system, which allows serial recording of self-clocking data. This means that the data string comprises both data bits and clock signals. A flux transition occurring between clocks signifies a ONE, whereas the absence of such a flux transition signifies a ZERO.

The data is recorded as a continuous sequence of characters with no inter-character gap. The data string is both preceded and followed by at least 20 synchronizing ZERO bits. In the event of of duplicate recording, the inter-record gap consists of at least 60 ZERO bits.

1.5.4 Specifications

MSF read/write

Packing density	210 bits per inch ±5%.
Read/write speed	8 inches per second.
Return speed	8 inches per second.
Number of tracks	1.
Number of characters	108 maximum (excluding pre- and post-amble).
Character I/O format	5 bits (4 data + 1 parity bit), LSB first.
Parity	Odd.
Transaction time	2.5 s approx. (2 forward + 2 backward movements).

Printer dimensions with MSF device installed

Height, front	197mm.
Height, back	215mm.
Document guide depth	96 mm.

Vertically folded passbooks

Inner pages can be shorter than the passbook cover.

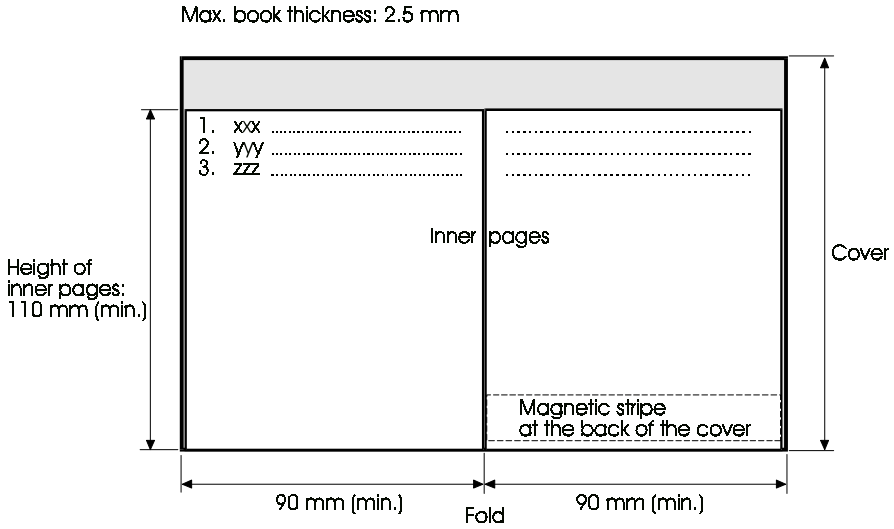


Figure 1-10 Dimensions of vertically folded passbooks

Horizontally folded passbooks

Inner pages must not be smaller than the passbook cover.

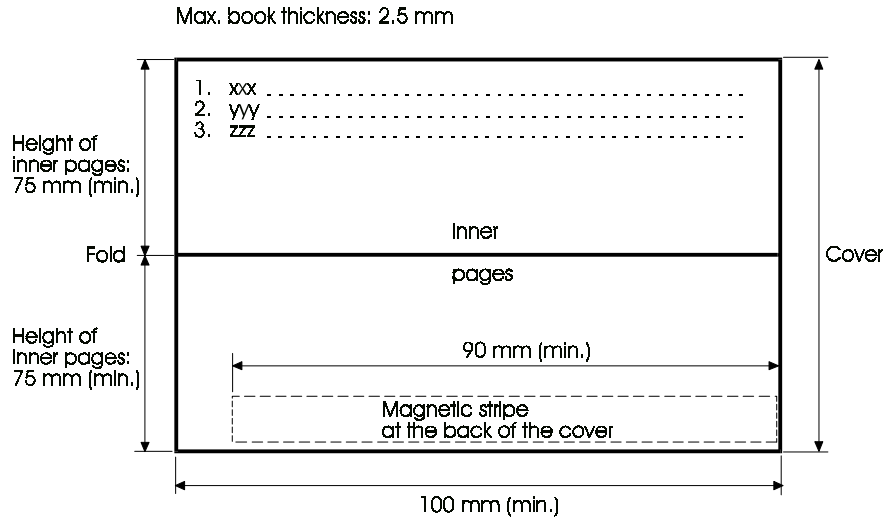


Figure 1-11 Dimensions of horizontally folded passbooks

CHAPTER 2 FUNCTIONAL DESCRIPTION

Pages 1-1 through 1-40

Figure

Table

2.1 MAIN FUNCTIONAL PARTS

This chapter starts with a description of the main mechanical and electromechanical functions. This will give you a good understanding of the interface between the electro-mechanics on the one hand, and the electronics and the hardware-software interactions on the other hand. This is followed by an overall description of the circuit board assemblies and the connected devices. The chapter concludes with descriptions of the mechanical and electronic functions of the Magnetic Stripe Facility.

2.1.1 Document grasp and feed mechanisms

These mechanisms control the insertion, grasping, bi-directional transport, and release of documents inserted into the document station.

The document feed motor drives the front and rear feed rolls. The front and rear pressure rolls can be lowered to press the document against the feed rolls when the document is to be grasped and fed in either direction. A line of stop pins helps the operator to align the document. Both the pressure rolls and the stop pins are controlled by the grasp motor (not shown). A sensor outside the printer's right side plate (not shown) senses the current position of the stop pins.

The document station has the following document sensors (not shown) ensuring that the document is in the correct position before document feeding starts:

- outer edge sensor positioned just outside the outer stop pins
- right-edge sensor
- Automatic Insertion Function (AIF) sensor.

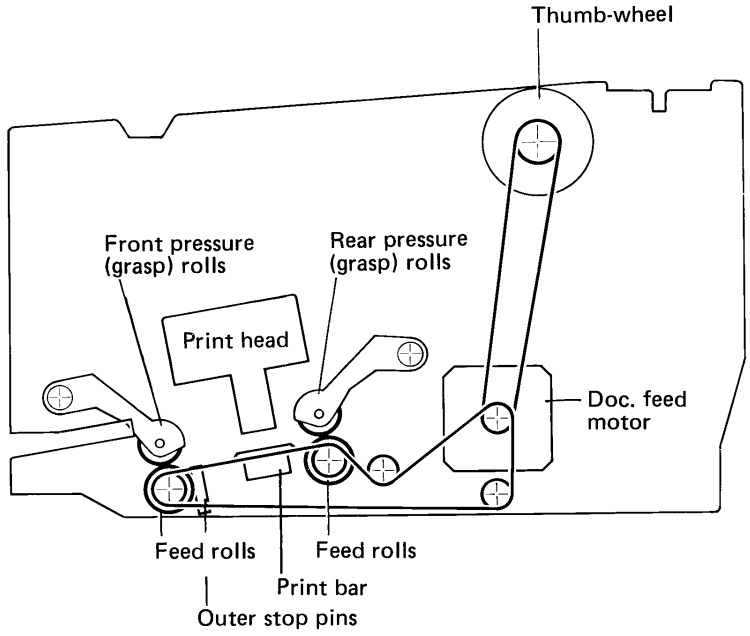


Figure 2-1 Document feed mechanism

The thumbwheel near the setup/diagnostic panel can be used to retrieve a document that has become trapped inside the printer.

Pressure rolls mechanism

The mechanisms for the pressure rolls and the stop pins are shown in more detail in the following two figures.

A cam wheel with two grooves controls both mechanisms. The grasp motor turns the cam wheel, via a toothed belt, to six clearly-defined positions. One of the grooves moves the outer pressure rolls (grasp rolls) up and down via an arm (A). The other groove controls the inner pressure rolls via another arm (B). If you need to remove a jammed document, you can lift the outer pressure rolls further by pressing the release lever down.

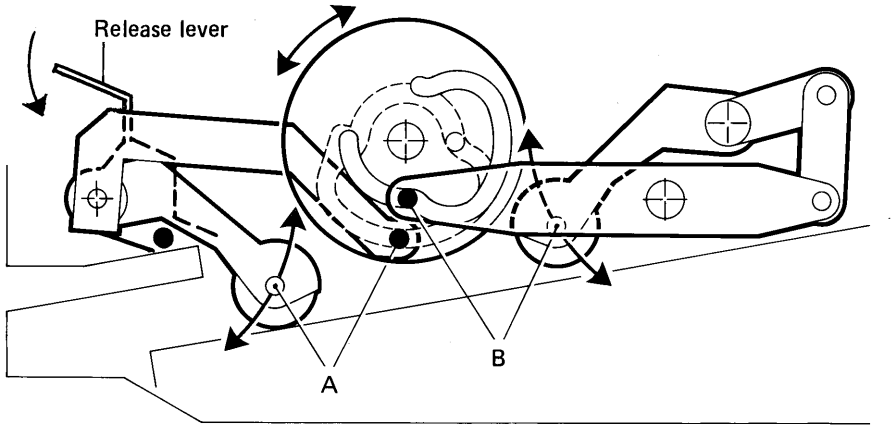


Figure 2-2 Pressure rolls mechanism

Stop pin mechanism

A third arm (C), which follows the same groove as arm (A), directly controls the movement of the stop pins. This arm also controls the stop pins via a tension spring. When the stop pins are lowered, the upper part of arm (C) interrupts the light in the opto-sensor (D) which signals to the CPU that the document path is free.

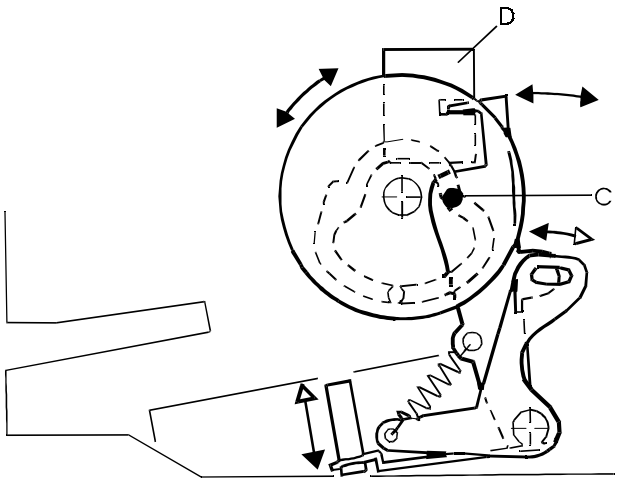


Figure 2-3 Stop pin mechanism

Home position

The figure below shows the basic position of the relevant mechanisms. The pressure rolls (A) and (B) are lifted, and both the outer and inner stop pins (C) are raised.

The application knows which type of document is to be inserted and may have informed the operator by means of an on-screen message. Alternatively, the operator may have informed the application, via the keyboard, regarding the type of document he or she is going to insert.

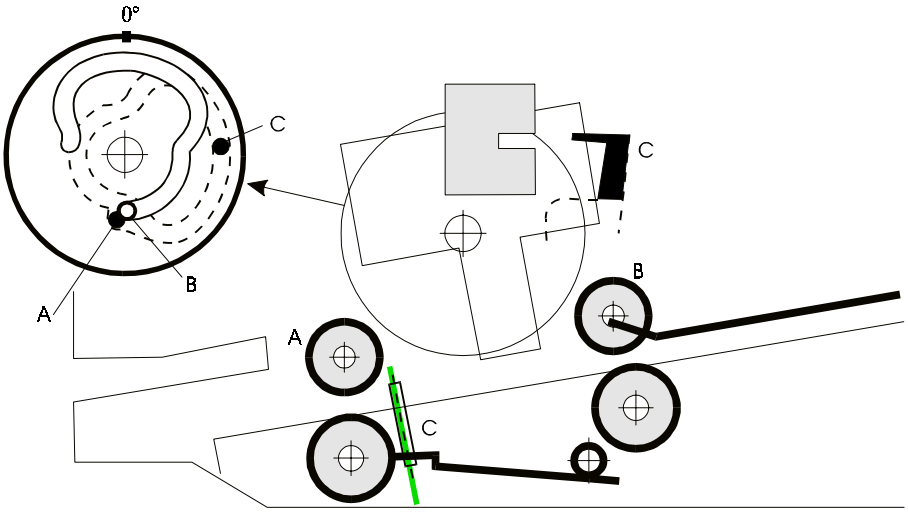


Figure 2-4 Feed rolls and stop pins in home position

Inserting a document against the outer stop pins

Thin documents, such as forms and vertically folded passbooks, should be inserted against the outer stop pins, as shown below.

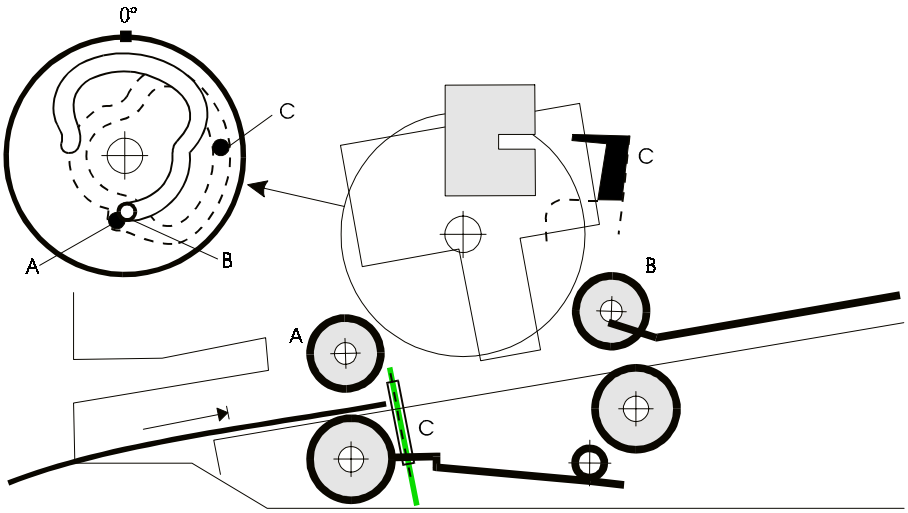


Figure 2-5 The document being fed in

The document sensors are activated when the document is in the correct position. The cam wheel turns 90 degrees, lowering the front feed rolls (A) grasping the document. The turning of the cam wheel also lowers all the stop pins (C). The opto-sensor (C) is activated.

The feed motor starts and feeds the document into the printer.

The application program decides when the printhead is to be lowered to start printing.

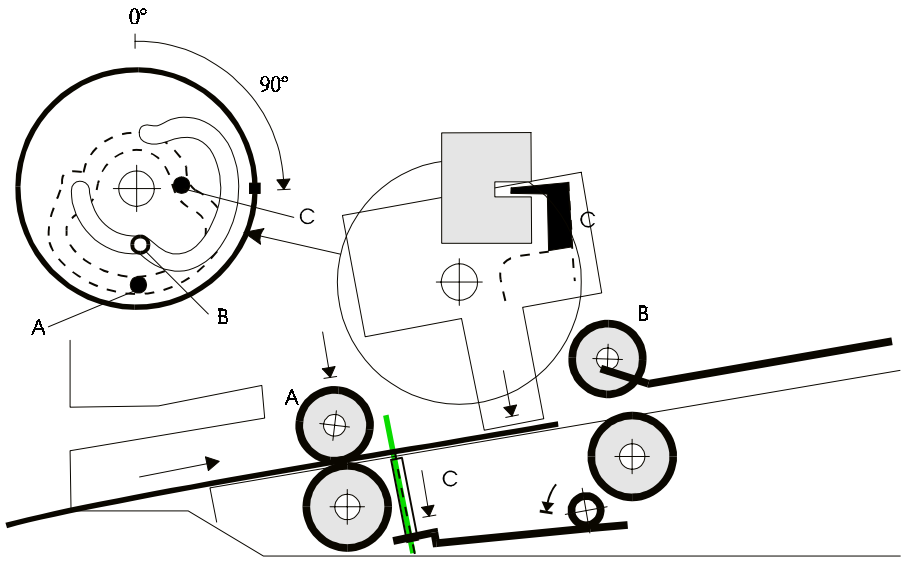


Figure 2-6 The feed motor starting to feed in the document

The cam wheel turns a further 30 degrees, lowering the rear pressure rolls. The rear feed rolls now take part in feeding the document.

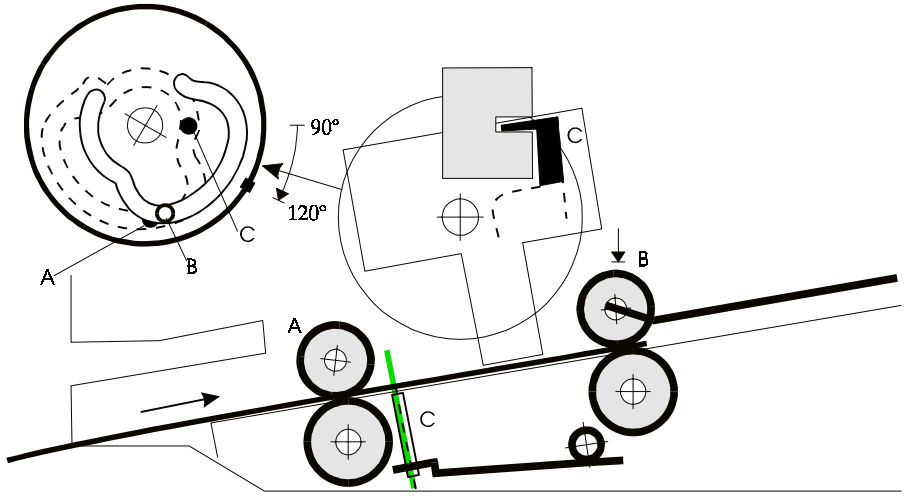


Figure 2-7 Lowering the rear pressure rolls

When printing is complete, the cam wheel turns a further 80 degrees, lifting the front pressure rolls to allow the bottom edge of the document to pass on its way out.

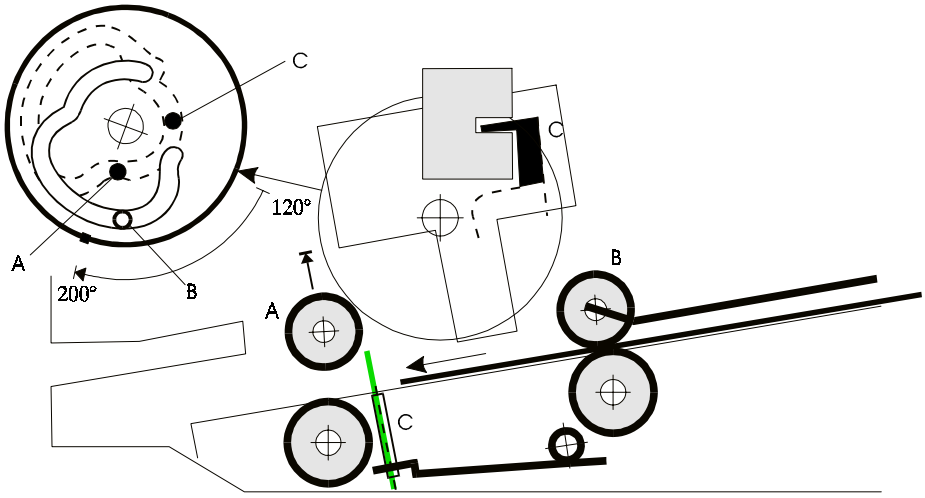


Figure 2-8 The front pressure rolls raised to let the document pass on its way out

When the bottom edge passes the outer edge sensor, the cam wheel returns to the 120 degrees position, thus lowering the front pressure rolls to achieve the complete release of the document.

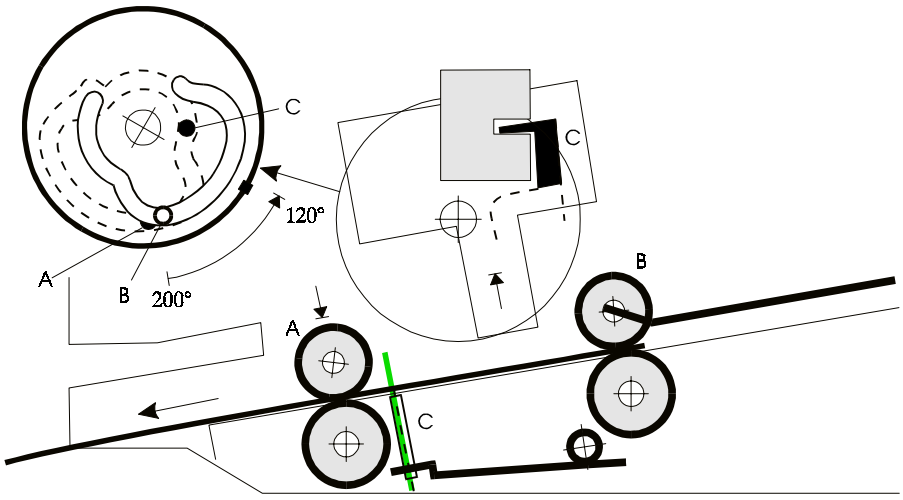


Figure 2-9 Front pressure rolls lowered to complete the document release

The cam wheel then returns to its home position, raising all feed rolls and stop pins. The document station is now ready to receive another document.

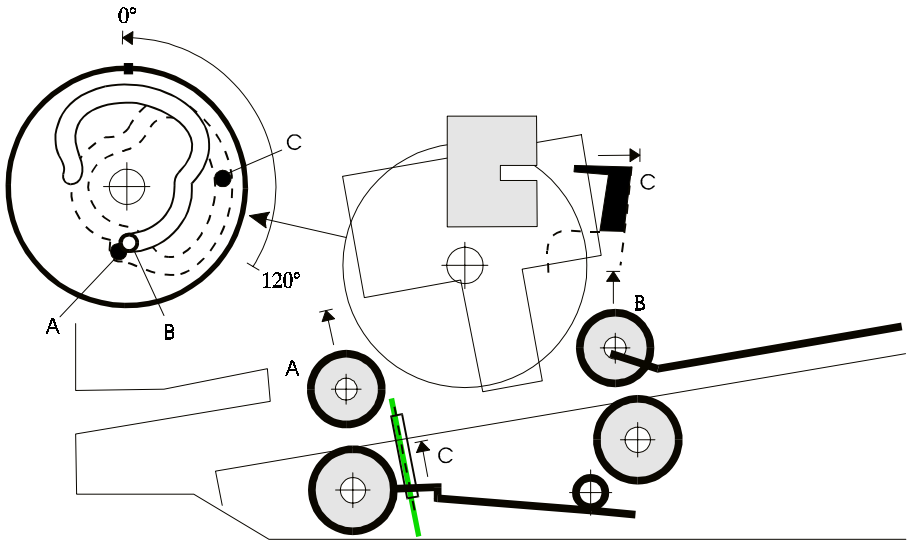


Figure 2-10 The document station ready for another document

2.1.2 Rotary print unit

The rotary print unit is built up between two side plates interconnected by means of a front and a rear guide shaft, along which the carriage moves.

The printhead is mounted on the carriage by means of metal leaf springs. A wire spring pushes the printhead towards the print bar. A PDC mechanism, comprising a stepper motor and a cam wheel can, via a tie-rod, pull the printhead away from the printbar to a number of different positions.

The print unit can be turned to two fixed positions as follows:

Vertical position, used for:

- sensing the left paper edge, using the Position Detection Facility (PDF) in the document station
- printing in the document station.

Horizontal position, used for:

- ink ribbon cassette replacement.

See Page 2-11 for information about the print unit release and locking mechanism.

An opto-sensor detects when the print unit is in its horizontal position.

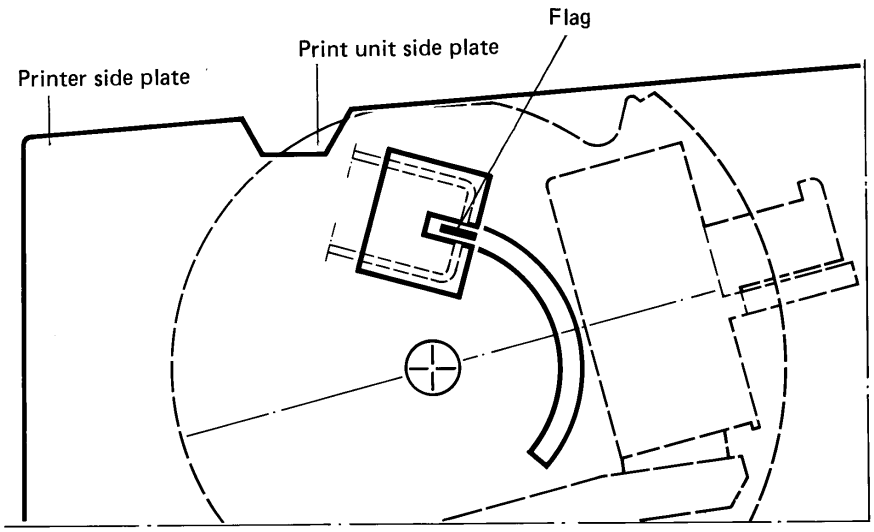


Figure 2-11 Print unit position sensor (V-H sensor)

2.1.3 Lateral carriage movement

The carriage is driven laterally by a stepper motor via a toothed belt clamped to the carriage with a belt clamp.

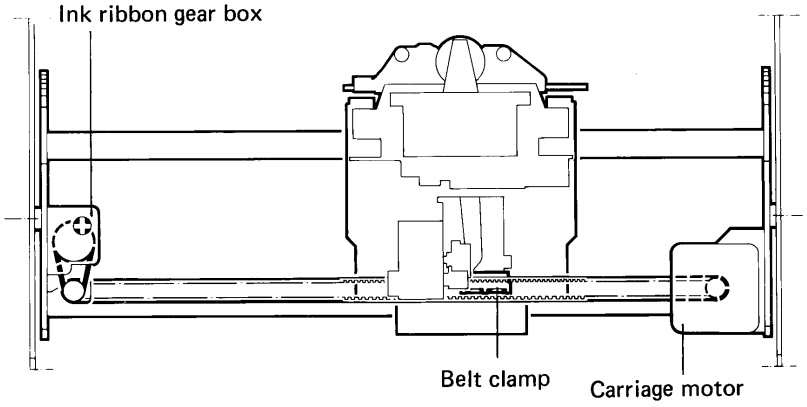


Figure 2-12 Carriage drive mechanism

The printer uses the carriage movement:

- to detect the left paper edge
- to print while the carriage moves
- to tabulate by moving the carriage to defined positions
- to move the carriage to a specific position during calibration of the automatic printhead-to-paper distance control function
- to change between book and document mode by moving the carriage to its extreme right or left hand position
- to feed the ink ribbon.

The CPU generates two 90 degree phase-shifted pulse trains, which move the carriage motor. The frequency of the pulse trains increase or decrease according to tables stored in memory during acceleration or decceleration or at constant speed.

2.1.4 Ribbon feed

The ribbon drive mechanism consists of a gear transmission, with a drive pin entering the ink ribbon cassette. The gear is driven indirectly, via an O-ring, by the carriage motor, using the same toothed belt used to drive the carriage. The drive pin rotates in the same direction regardless of the direction of the carriage movement.

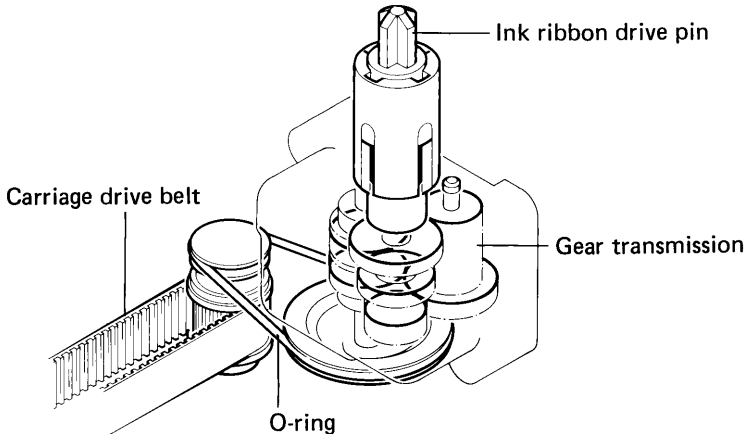


Figure 2-13 Ribbon drive mechanism

2.1.5 Rotary print unit release and locking

A pin (a), mounted on a spring-loaded locking arm (b), is pressed into a hole in the right side plate of the print unit, to hold the print unit accurately in position during printing. The conical-shaped end of the pin enters the hole only partly, thus eliminating any free play. There is one hole each for the horizontal and the vertical position.

When the print unit is to rotate, the carriage moves as far as possible to the right side, where it pushes a small rod (c) against the locking arm, thus disengaging the locking pin. The front end of the locking arm then leaves the gap of an opto-sensor (d), signaling to the CPU that the print unit can be rotated.

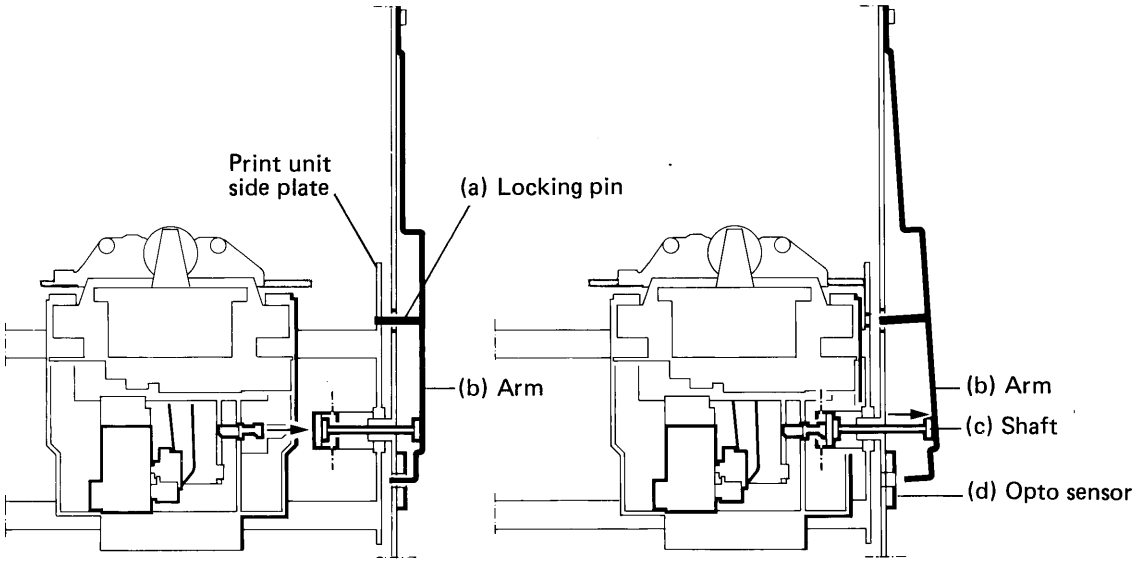


Figure 2-14 Carriage in its extreme right position releases the print unit

At the end of the rotation, the carriage moves slightly to the left to enable the locking pin to lock the unit in its new position. Due to mechanical tolerances, the stepper motor may add some extra motor steps until the latch pin enters the locking position. The opto-sensor senses that the locking pin is engaged.

The locking pin locks the print unit in the vertical or horizontal position only.

When changing from the vertical to the horizontal position, pressing the *step switch* moves the carriage, releasing the locking pin for 10 seconds. A separate latch, controlled by the lid release mechanism, locks the print unit in its vertical position. When the lid release button is pressed within the 10 seconds, this latch unlocks and a tension spring pulls the print unit to the horizontal position.

To return the print unit to the vertical position, press the *step switch* and, when the carriage has released the locking pin, rotate the print unit manually until the latch snaps into the locked position.

2.1.6 Printhead-to-paper distance control (PDC) mechanism

Mechanism design

A wire spring, fitted under the carriage, pushes the printhead towards the print bar. The PDC stepper motor, with its cam wheel, can pull the printhead away from the print bar to a number of defined positions by means of the tie rod connected to the cam wheel.

A sensor arm with a nose wheel is fitted to the front of the printhead. The slide shown in the figure decides how far the nose wheel can be pushed in. When the slide is in its left position, called the *document position*, the nose wheel can extend 0.3—1.2mm in front of the nose. With the slide in the correct position, called the *book position*, the nose wheel can extend 0.5—1.2mm. A sensor indicates the position of the nose wheel in relation to the printhead nose. The sensor comprises a permanent magnet, fitted to the end of the sensor arm, and a Hall element. The output voltage from this Hall element indirectly controls the turning of the PDC motor and hence the position of the cam wheel and the printhead. The sensor is called the *distance sensor.*

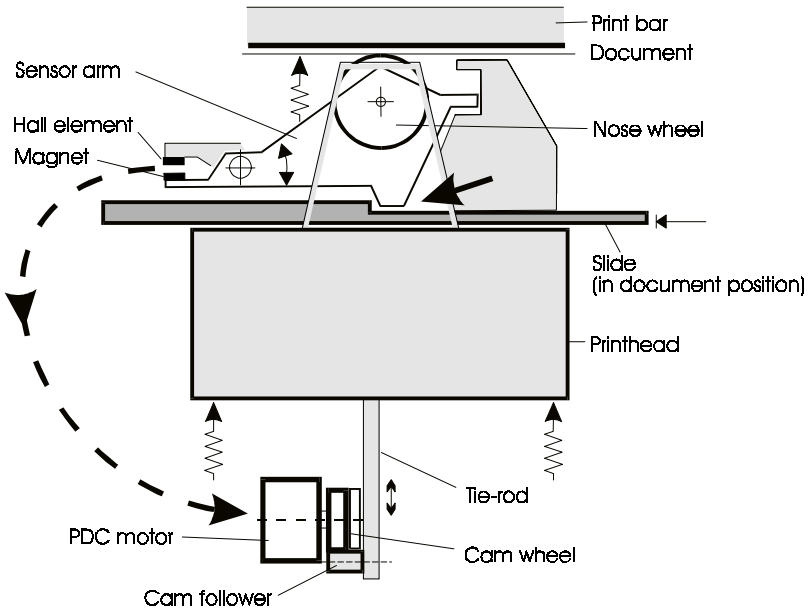


Figure 2-15 Printhead-to-paper distance mechanism in document position

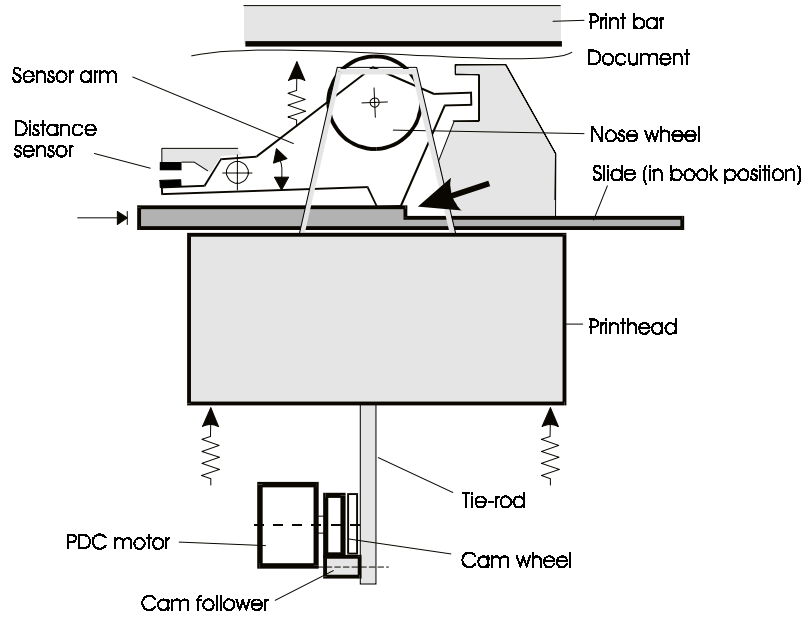


Figure 2-16 Printhead-to-paper mechanism in book position

To change the position of the slide, the application sends a command moving the carriage either against the left print unit side plate, which moves the slide to its right position, or against the right side plate to set the slide in its left position.

Head attach and release

A single step of the PDC motor moves the printhead approximately 50µm.

The printhead can be moved to the following positions on commands from the CPU:

Command	Name	Function
HAT	Head attach	0.3mm from the printbar. Only used during calibration.
HAD	Head attach document	0.40mm from the paper surface. Used when printing on all types of documents except pass-books.
HAB	Head attach book	0.5mm from the page. The nose wheel rolls against the book page. The PDC cam is turned such that it cannot inhibit the printhead movement.
HRS	Head release short	2.0mm from the paper. Used while feeding thick documents in and out.
HRB	Head release book	5.0mm from the printbar. Used while feeding passbooks in and out.
HRL	Home or head release long	5.25mm from the print bar. This is the home position and also the position used when rotating the print unit, when shifting between book and document printing. The printhead is mechanically locked.
TRP	Head transport	Range between Head Attach and Head Release Long positions.

Table 2-1 Printhead positions and related CPU commands

The following figures show some of the printhead positions.

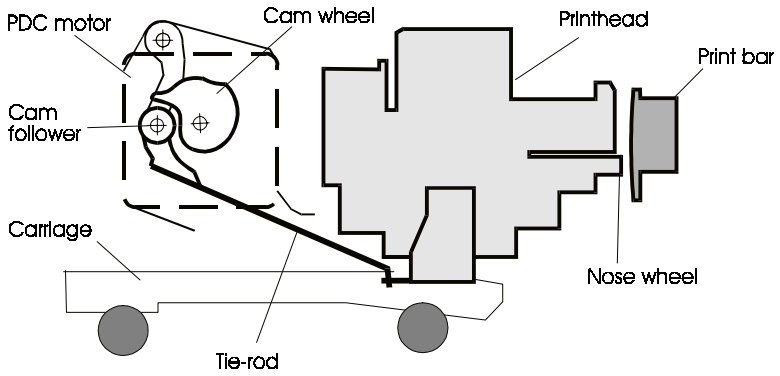


Fig 2-17 Head attach position for passbook printing

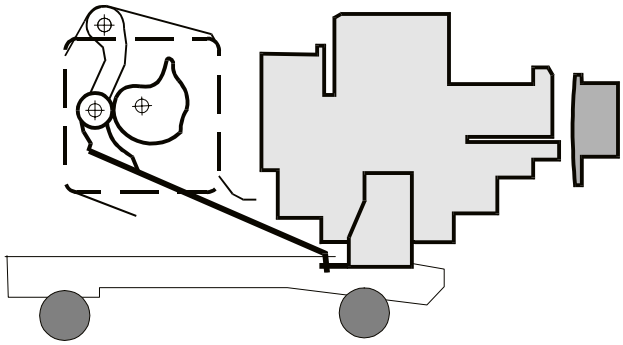


Figure 2-18 Head release short position

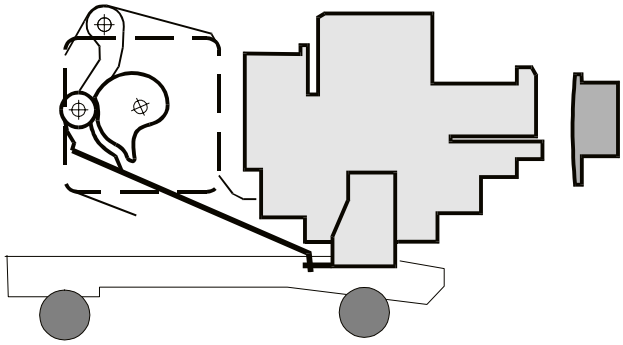


Figure 2-19 Home position (= head release long)

Auto calibration

At printer reset, such as after Power ON, the printhead is first moved forwards and then backwards while the processor measures and stores the corresponding distance sensor output levels. If the values do not fall within the predetermined limits, an error code is generated.

The carriage moves to the extreme right hand side. The slide is set in the document position and the carriage moves back to its home position.

The printer executes autocalibration in the document station.

With the carriage in its home position (close to the right side plate), the printhead is moved forwards. When the nose approaches the printbar, the nose wheel is pressed in, which affects the distance sensor output level. During this movement, the sensor output signal is measured and stored as a function of the number of steps by which the PDC motor has rotated. The active part of the PDC cam wheel is thus tested and an error code is generated if the position or movement cam is found to be incorrect.

The printhead is now moved to a calibration position. While moving the carriage slowly to the left, the PDC function keeps the sensor output signal constant by stepping the PDC motor back and forth. The number of steps used are stored in a deviation table. This ensures that any slope of the printbar and any irregularity has been measured and recorded. Both the printbar irregularity and the maximum/minimum distance between the printbar and the HRL position are checked. If the measurements do not conform to preset values, an error code is generated.

When the carriage reaches the left side plate, the slide is pushed into the book position. The printhead is pulled back to HRL position, then advanced to HAB position, where the distance sensor signal is again measured and recorded. The distance between the printhead and the printbar is 0.5mm, which is the reference position for the calibration of the PDC function.

Since it is known that a single motor step corresponds to 50µm, the processor can calculate how many motor steps are required to move the printhead 0.4mm from the document, and can maintain that distance during printing.

Finally the printhead is pulled back to the HRL position and the carriage is moved to the right, to the center, and then to the home position close to the right side plate. The auto-calibration process is now complete.

Document printing

The printhead is in its home (HRL) position and the nose wheel extends 1.2mm in front of the printhead nose. A command is given to advance the printhead towards the document. A change in the distance sensor output is detected when the nose wheel touches the surface of the document. The printhead is advanced further until it is 0.4mm from the document. **The distance sensor output is then ignored**, and the distance of the printhead from the document is maintained.

The printhead nose wheel presses very lightly against the document during printing. The printhead moves forward or backward to compensate for any slope or irregularity of the print bar, according to the values stored in the calibration table.

If the printhead passes a sudden thickness change (e.g. a staple), the sensing arm hits the slide and the printhead may be pushed backward. For this reason, the distance between the paper and the printhead will never be less than 0.3mm, which prevents the paper from being unintentionally colored by the ink ribbon.

Passbook printing

Passbooks can have several pages and the thickness can vary slightly along the printed line. The pages also need to be pressed together during printing. Before printing starts, the application sets the mechanism in the book position by moving the slide to the right position. The PDC motor turns, moving the printhead towards the book until the sensor arm meets the slide. The nose wheel now presses hard against the page, forced by the wire spring fitted between the printhead and the carriage. The cam wheel turns to a position where the cam follower on the tie-rod separates from the cam wheel. During printing, the nose wheel and the printhead now follow the book surface at the fixed printhead-to-paper distance of 0.5mm.

The passbook method cannot be used when printing on form sets since the nose wheel would cause stripes on the copies.

PDC cam wheel

The printhead moves forward and backward either controlled by the PDC cam wheel or when printing in passbooks, with the cam wheel in the Head Attach Book position, guided by the nose wheel. The figure below shows the number of motor steps required to move the cam wheel to reach the various printhead positions. Each motor step moves the printhead approximately 50µm:

- Head attach book (HAB) — 6 mm (140 steps) forward from home position
- Head release, short (HRS) — 2.0 mm (32 steps) from the paper
- Head release long (HRL), home pos. — Reference position, 5.25 mm from the printbar

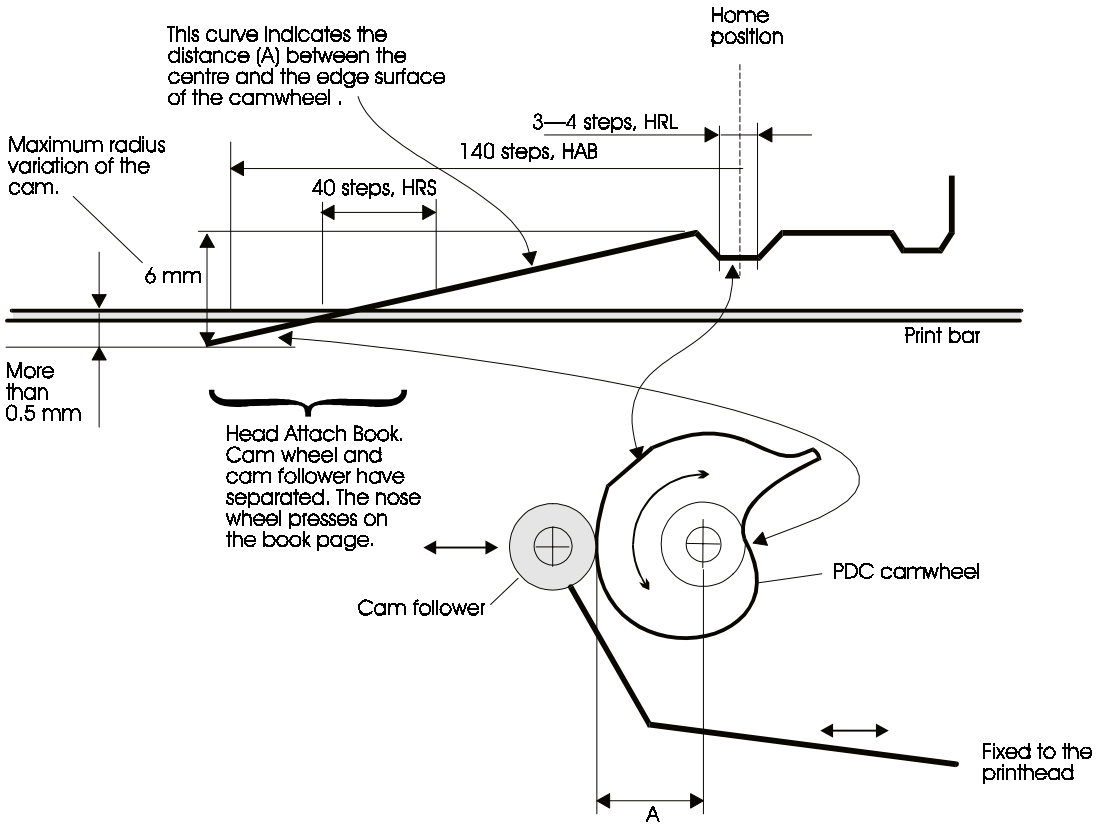


Figure 2-20 The PDC cam wheel

The distance sensor is disabled while the CPU counts the pulses to move the head into position. The sensor is enabled again when the head approaches the Head Attach Book position and the PDCPOS is sent to the CPU.

The figure below shows how the PDC sensor voltage changes as the printhead moves.

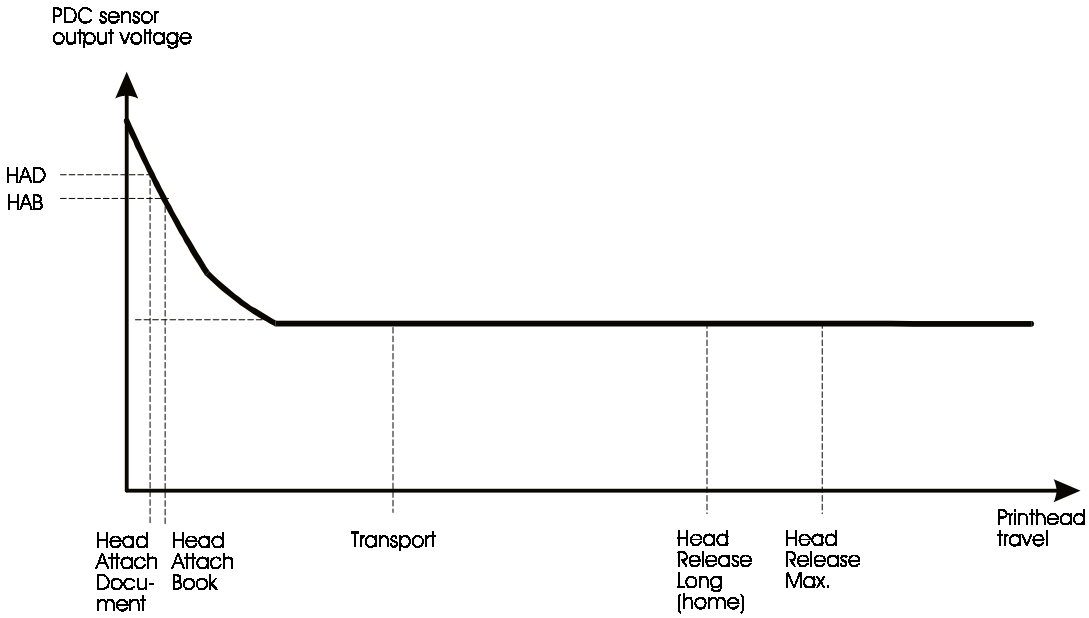


Figure 2-21 PDC sensor output voltage

Sensor element

The Hall-effect sensor is affected by a magnet fitted to the PDC sensing arm. A change in the magnetic flux generates a linear change in the output voltage level.

The Hall IC includes the circuits shown in the block diagram below. An internal voltage regulator supplies the Hall-effect generator and amplifier. An operator amplifier amplifies the relatively small Hall-effect voltage.

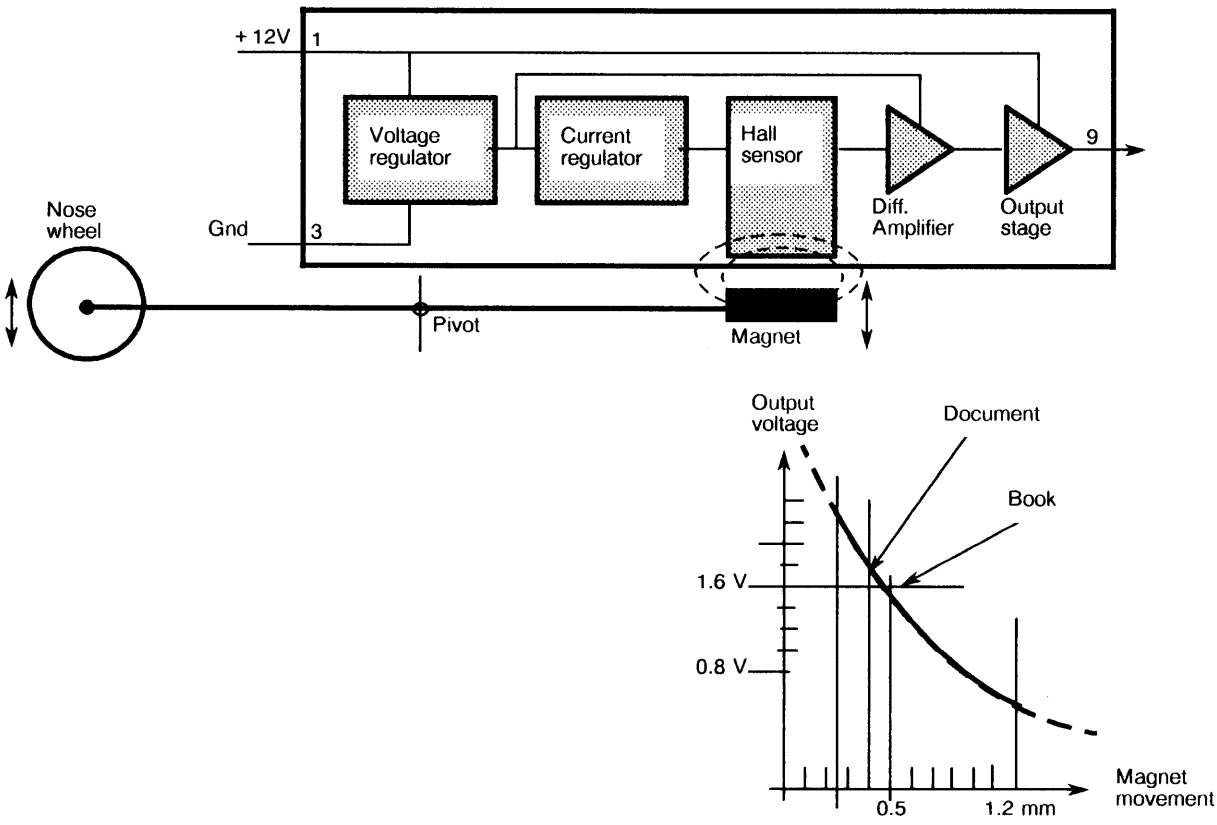


Figure 2-22 PDC sensor element

2.1.7 PDF - Position Detection Facility

An opto-sensor fitted below the printhead can be used as a contrast sensor to search for the left document edge.

2.1.8 Main board

(See Figure 2-27)

General

The main board has a 68000 CPU that controls all functions in the printer. The CPU program (firmware) resides in EPROM. The EPROM also contains default parameters, fixed character generators, stepper motor tables, etc.

The main board has connectors for the connection of motors, the sensor board, the printhead board, etc. An optional interface board can also be mounted on top of the main board in a “piggy-back” arrangement.

The main board, including CPU, DMA (Direct Memory Access) and other chips, controls all the stepper motors. The EPROM holds the necessary program instructions and motor control parameters.

Storage	Size	Chip
Main EPROM	128KB—2MB Standard = 512KB (2 x 256KB)	2 x 64KB or 2 x 128KB or 2 x 256KB or 2 x 512KB or 2 x 1M8
Main RAM	16KB—256KB Standard = 64KB	2 x 8KB or 2 x 32KB or 2 x 128KB 2 x 512KB
EEPROM	128x8	1x128

Table 2-2 Memory configuration

The DMA function positions the carriage, and hence the printhead, using a number of step pulses counted from the carriage home position.

A direct memory access controller (DMAC 8237) transfers needle data to the MPC interface chip and pulse-width data to two programmable timers in the MPC timer chip that controls all the stepper motors.

A parallel interface/timer (PI/T 68230) is used for various control signals transferred in both directions between the main board and the other functional parts of the printer.

A dual asynchronous receiver transmitter (DUART 68681) handles serial asynchronous communication with the host computer. The DUART also receives signals from:

- the ON-OFF switch on the document sensing board
- the setting switch on the diagnostic panel
- the host, when it issues a command for remote power OFF.

Carriage motor drive circuits

The direction and speed of the carriage motor are controlled by the DMA transfer of data from memory to the timer-MPC. The signals are then transferred to the carriage motor drive circuits via the decoder-MPC.

Stepper motor control and drive circuits

All motors in the printer are stepper motors, which are all driven in the same way. Pulses are supplied by the programmable timers. Internal thermal protection circuits supervise the drive circuits. If overheating occurs, the driver is automatically switched OFF.

The carriage motor is, however, driven by pulsed power transistors, and if the CPU detects that the carriage is not moving according to the supplied pulses, it stops the pulses.

Power ON/OFF logic

The state of the power supply unit is affecting by:

- the ON/OFF switch
- interface signal 107 when this is used for remote power off control
- mains power supply interruptions.

If the remote power OFF control function has been selected (see Chapter 6 of the *LB12/LB15 User's Guide*), a high signal level sets the PSU to standby mode, where only the voltage required for RAM backup is supplied.

When the mains power supply is restored after a power interruption, the PSU is set to the operating mode before the interruption occurred.

2.1.9 Capacitor board

(See Figure 2-27)

This board contains two capacitors that buffer the +36 V, and act as a reservoir for the current to the needle drive circuits.

2.1.10 Printhead board

(See Figure 2-27)

The needle data is transferred sequentially to a serial-to-parallel converter register on a printhead board mounted at the rear of the printhead. The needle drivers are also located on this board. These drivers receive, via the DMAC, all the needle data required to ensure that the appropriate needles are fired at the correct time, independent of the carriage speed. The interface-MPC generates a strobe signal used to ensure that the needles are fired in the correct positions.

2.1.11 Opto sensors

(See Figure 2-27)

General

The LB12/LB15 has seven opto-sensors, all connected to the document sensing board. The board contains various circuits for measuring the threshold voltage level of each sensor. The reading of a specific sensor is based on its current threshold level. The ON-OFF-switch and the ON-lamp are also located on this board.

The opto-sensors are:

1. Grasp sensor (stop pin position).

2. Print unit rotation sensor (or V-H sensor, for Vertical-Horizontal).
3. Carriage extreme right position sensor (or carriage-HOME sensor).
4. Document right edge sensor (or EDGE sensor).
5. Document edge, outer sensor.
6. PDF sensor.
7. AIF sensor

The outer document sensor sends light against an adjustable polished metal reflector. The reflector has a clearly-defined radius so the reflected light beam becomes very narrow, resulting in very accurate document positioning.

The sensor is connected to the document sensing board via connectors P2, P3 and P4.

The reflector can be adjusted to reflect more or less light. This requires a special tool; see Chapter 3 for adjustment instructions.

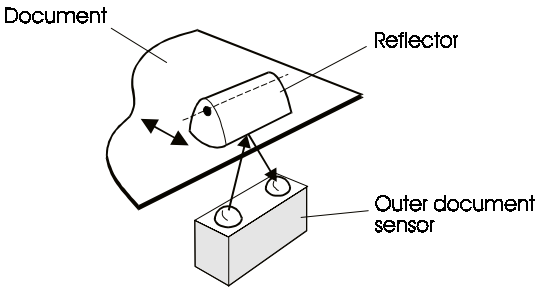


Figure 2-23 Light-reflecting opto-sensor

Each of the grasp, extreme right and V-H opto-sensors sends light, through an optical fiber, via an air-gap, to a receiver. Small metal or plastic plates or "flags" can move into the gaps, thus breaking the light beam.

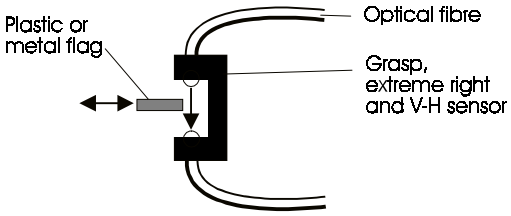


Fig 2-24a Light-breaking opto-sensors

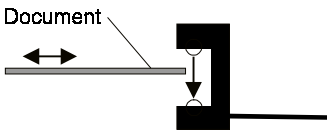


Fig 2-24b Document edge opto-sensor

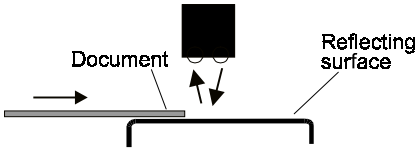


Fig 2-24c AIF opto-sensor

The grasp sensor, the print unit rotation sensor (V-H sensor), and the carriage extreme right sensor comprise light transmitters D2-D4 and receivers V1-V3. The output signals from these sensors have a high amplification rate to compensate for the successive light reduction that takes place in the optical fibers. The asserted SENSE signal tells the CPU that the light passage is NOT interrupted by a paper edge or a metal "flag".

All sensor signals are amplified in a number of circuits, TLC274C and selected in a multiplexor. The multiplexor output is the sensor output for the selected sensor. This sensor level is compared to an individually set reference level.

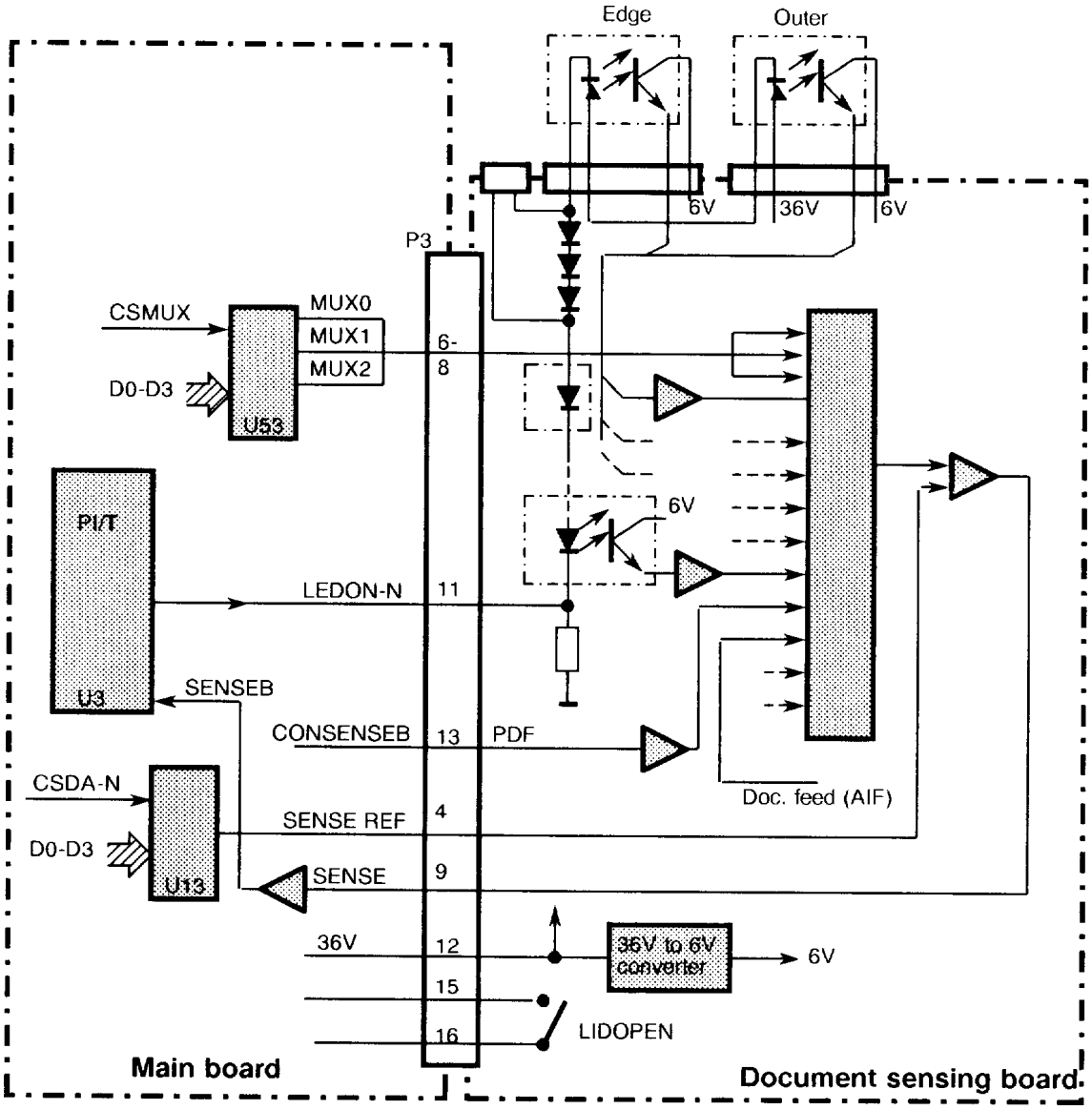


Figure 2-25 Opto-sensor logic

PDF sensor

The position detection facility sensor can be used to detect the left edge of a document or passbook. The sensor is connected to the main board via the printhead board.

The CPU actuates the PDF sensor by generating the signal CLEDON via the parallel interface timer PI/T. After being negated on the main board, CLEDON-N actuates the light transmitter in the opto-sensor. Its receiver output, CONSENSEB, becomes inverted in a comparator producing a positive signal that is sent to the document sensing board.

Sensor calibration

The threshold values are calibrated for each opto-sensor at each power-ON to compensate for component degradation and variations in component characteristics. A calibration reference is made by running a special calibration function (see Chapter 3, *Maintenance*).

During calibration, all sensors are set to their WHITE or OPEN state. The sensor outputs are then transferred, one at a time, to the comparator. For each sensor, the CPU changes the threshold voltage until the SENSE signal changes to HIGH level. That threshold voltage is then multiplied with a factor to obtain the calibrated threshold voltage to be used.

2.1.12 Joint board

The joint board connects the carriage motor to the main board. The joint board contains only connectors.

2.1.13 PSU and voltage indicator

(See Figure 2-27)

Voltage conversion is achieved in two steps on the PSU board. The first step is an AC/DC conversion, which generates +36 V used for the motors and the needle drive circuits on the printhead board.

The second step is a DC/DC conversion from +36 V to +5 V and –12 V. A +12 V voltage is generated on the main board by a voltage regulator supplied from the +36 V. Only the +5 V is provided with a LED indicator (ON lamp) located at the front of the printer.

2.1.14 Diagnostic panel (optional)

When numeric characters are to be displayed, the CPU transfers the character data to the two BCD-to-7-segment decoders on the diagnostic panel via the DBUS and the DBBUS. The CPU also generates the chip select signal CSDA-N by addressing the chip select decoder U42 on the main board via the ABUS. The selected display segments are switched ON by CSDGNS-N.

The status of all switches on the diagnostic panel, except the setting switch, are transferred to the parallel interface/timer U3 on the main board, where they are retrieved by the CPU. The status of the setting switch is available to the CPU via the DUART.

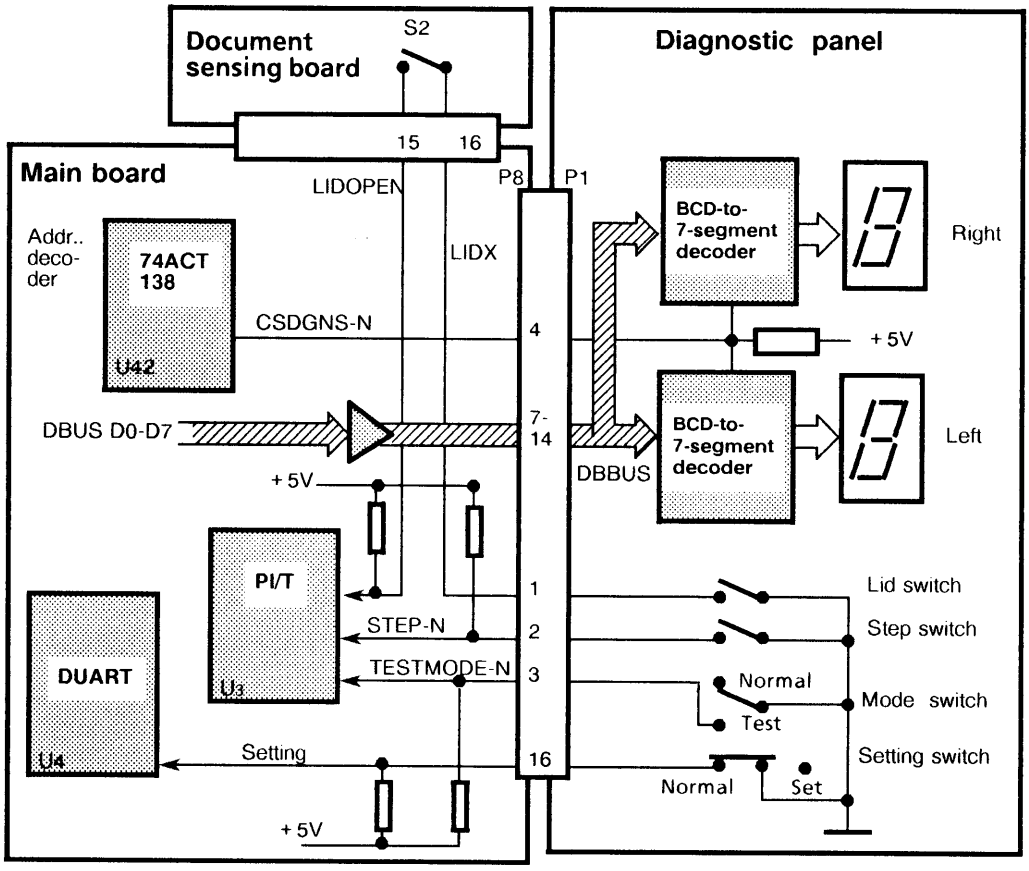


Figure 2-26 Diagnostic panel

2.1.15 Set-up panel

(See Figure 2-27)

The set-up panel is the same as the diagnostic panel, except that the printed board assembly has only a lid switch and a step switch. These switches function in the same way as the corresponding switches on the diagnostic panel.

Figure 2-27 LB12/LB15 block diagram

2.2 PRINCIPLES OF PRINTING

2.2.1 Printhead

The printhead has 18 needles arranged in two rows. The rows are positioned 0.53mm (45 x 11.7µm) on either side of the center line of the printhead. Thus, the total needle row separation is 1.06mm. The needles are numbered as shown below.

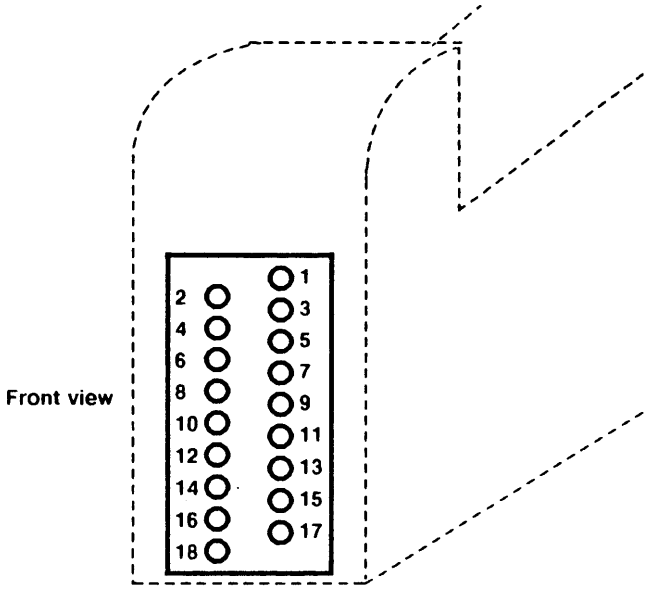


Figure 2-28 Printhead needle arrangement

2.2.2 Character formation

When using low-speed high-quality printing, both needle rows can print in every column of the character matrix. The needle rows are vertically positioned such that 18 partly overlapping dots can be printed in one column.

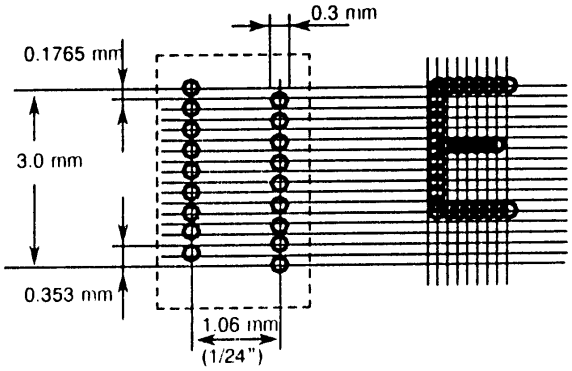


Figure 2-29 Character formation in high quality printing

When printing at 300cpi (9x12 matrix) only one needle row is used. A maximum of 9 non-overlapping dots can be printed in one column.

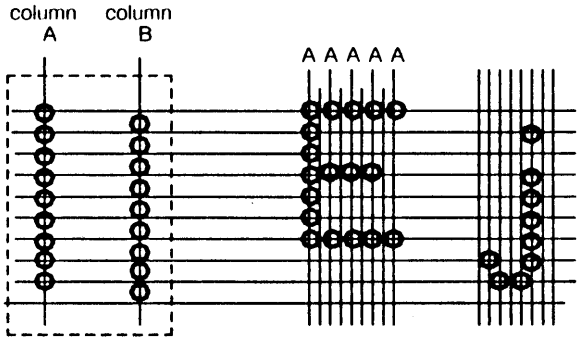


Figure 2-30 Character formation at 300cpi print speed

2.2.3 Character repertoires and character sets

A "character repertoire" is a defined collection of characters with no coded representation.

A collection of characters defined together with its coded representation is called a "coded character set", or simply, a "character set". Note that a character set does not define the graphical representation of the characters, i.e. the type-face to be used.

The total character repertoire that can be used by the printer is divided into one basic and several additional repertoires.

The basic repertoire consists of 190 characters, including 178 characters that form a subset of the basic Teletex repertoire defined in CCITT recommendation T.61. The basic repertoire is almost identical to that of EBCDIC.

The basic repertoire is represented by several pairs of 8-bit coded character sets. Each pair contains a primary set of 94 characters and a supplementary set of 96 characters. Each pair constitutes a national version and is defined in such a way that its primary set is identical to the corresponding national version of the 7-bit code.

An additional repertoire consists of up to 192 characters and is represented by one or two 8-bit coded character sets. Each of these sets is unique, i.e. there are no national versions. The EPROM part of the printer memory contains various character sets. Other character sets, containing for example logotypes and graphics characters, can be added by downloading them from the workstation controller into the printer's RAM area. This means that the number of available graphic characters is theoretically unlimited.

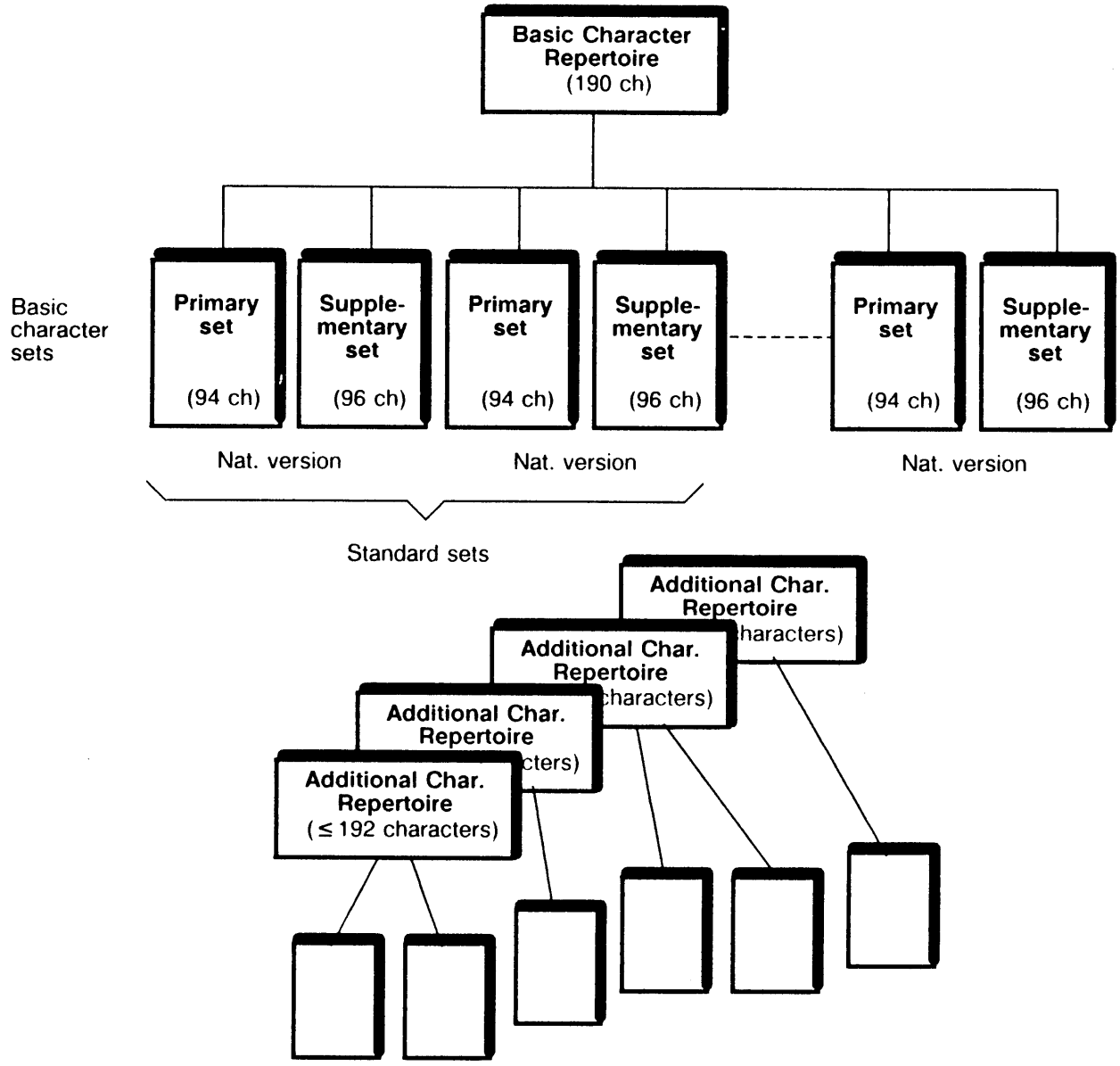


Figure 2-31 Character repertoires and character sets

2.2.4 Character sets

For information about character sets, refer to the *APP 6390 Application Programmer's Guide*.

2.2.5 Character generation

The character set handling used in the LB12/LB15 is based on the code extension techniques defined in the ISO 2022 standard for code extension. This technique means that the character repertoire is built up from a number of character sets and supplementary sets consisting of code tables. A set of graphic characters is called a G set and can be mapped into columns 02-07 or 10-15 of the 16 column character table.

Every character set is tied to an identifier, the Final (F) character, which must be used in the designation sequence, a two-character escape sequence, Esc, I, F. The Intermediate (I) character specifies the G set to which the selected character set is designated.

The application software specifies the standard character set to be used. Each standard character set contains information on which character corresponds to a specific code. The set contains only codes and does not describe the graphical layout of the characters. The layout is defined in the graphic sets stored in the character generator PROM.

Selecting a character set to be used is achieved in two steps. First, the character set is selected from the available sets and copied (designated) into one of four G sets. This is then transferred (invoked) into columns 02-07 or 10-15 of the character table for the display.

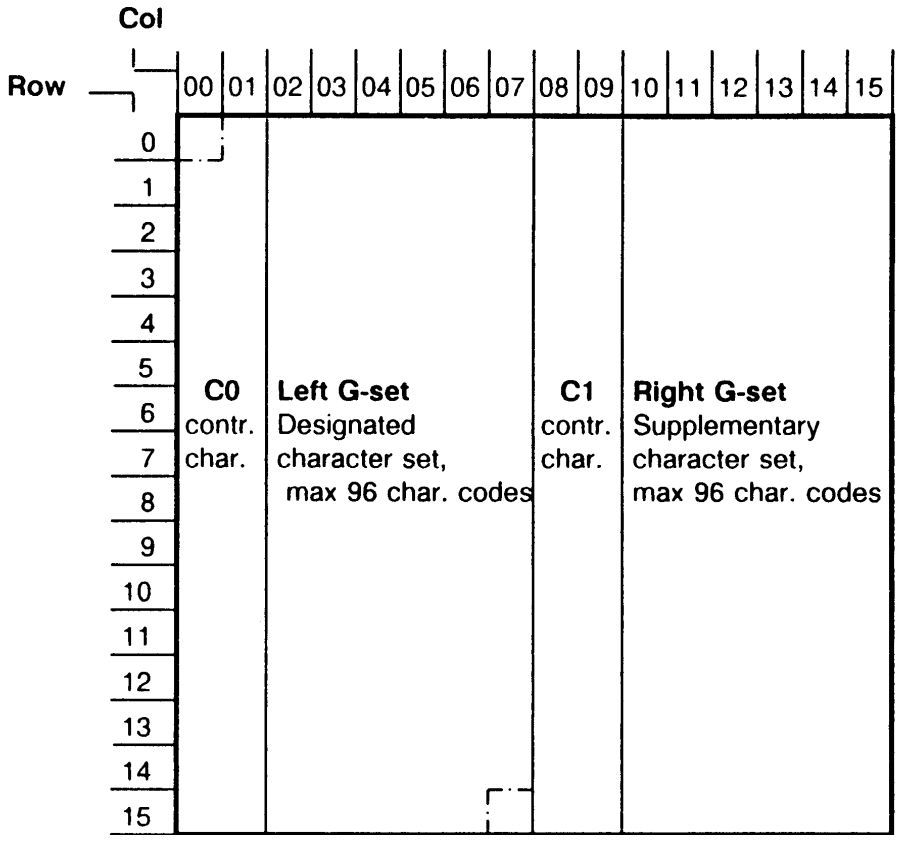


Figure 2-32 Character code table layout

The method used to indicate the graphic sets to be selected from all available sets, is called the Designation of G sets. Four sets, called G0, G1, G2, G3, can be designated at any particular moment. The contents of the G1 set, for example, depend on the graphical set designated to be a G1 set.

The G sets can either contain 94 codes or 96 codes.

- A 94-code position G set does not include code positions 02/00 and 07/15. When such a set is designated as G0, these two positions have the meanings of SPACE and DELETE.
- A 96-code position G set is one in which code positions 02/00 and 07/15 can have other meanings than SPACE and DELETE.

Only two of the four G sets can be selected and used at any given time. This selection is called Invocation. The primary and supplementary basic character sets contain national versions and are, as standard, designated as G0 and G1 sets respectively. They are then invoked to columns 02-07 and 10-15 of the 16-column character table.

G0 and G1 are, as standard, designated as ASCII primary set and ASCII supplementary set respectively, while characters within G2 and G3 can be used, by element-wise invocation, to set national version characters.

To replace the currently invoked G set by another G set, a “Shift Function” is used. There are two types of shift functions:

- Locking Shift, LS, (the whole G set is invoked)
- Single Shift, SS, (only the following character is invoked).

The designation of another character set to an already invoked G set automatically invokes the new set.

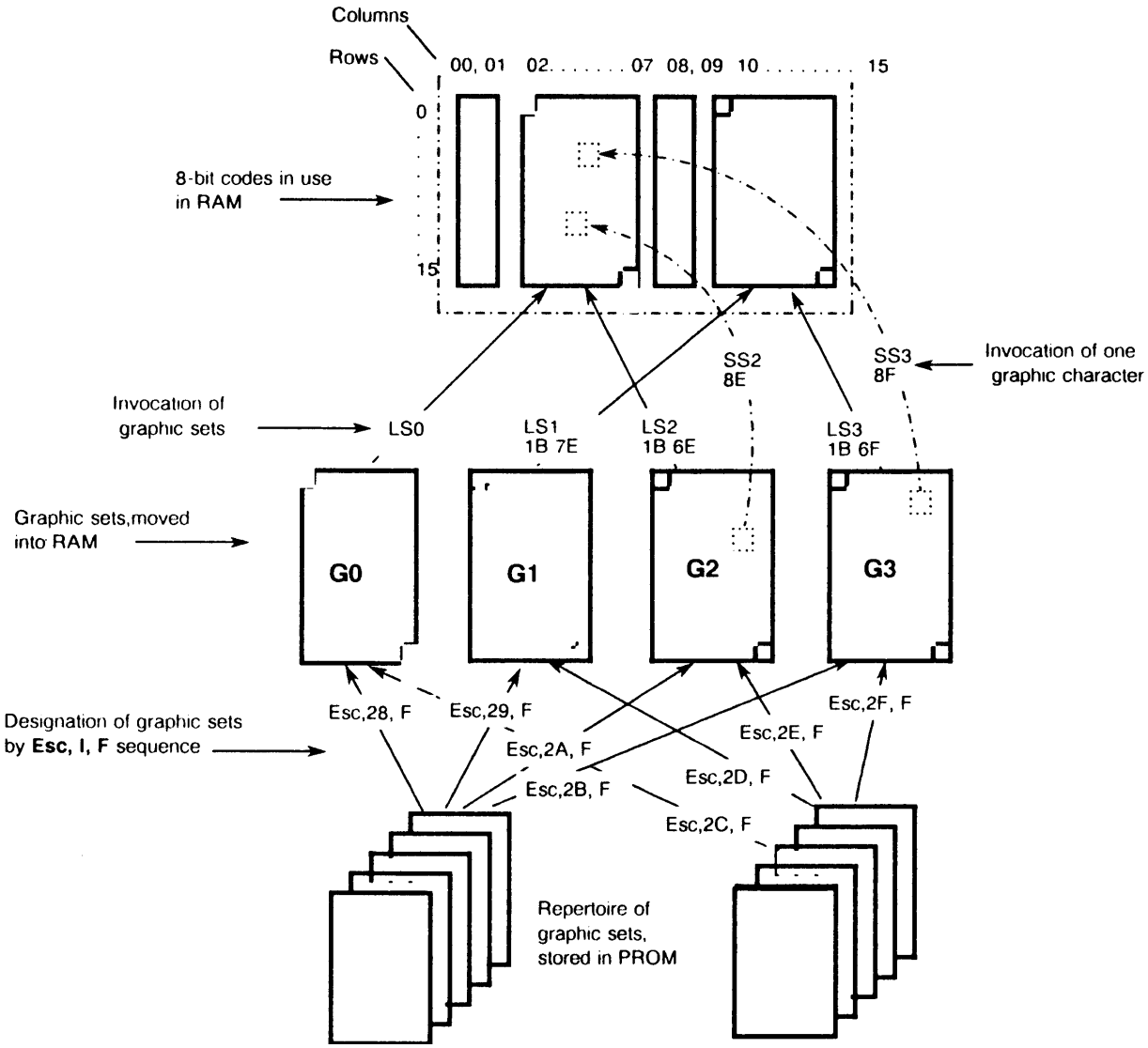


Figure 2-33 Code extension principles

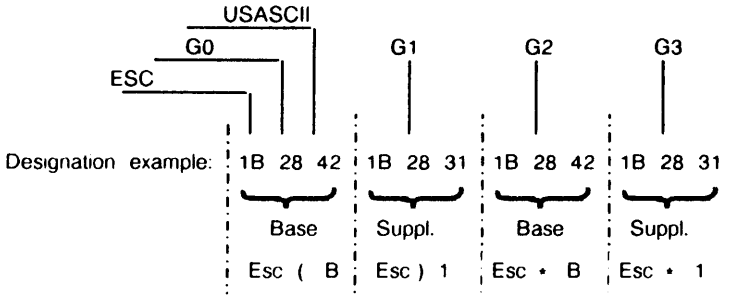


Figure 2-34 Selecting a character set

2.2.6 Graphic character representation

The graphical representation of a particular 8-bit code depends on the selected:

- character set
- character generator (font, matrix, pitch)
- transformation commands (if any).

2.2.7 Logotypes

Logotypes and other special graphical symbols can be printed if a special tailor-made character generator is loaded (RAM or PROM). Since most graphical symbols need more than one character position both horizontally and vertically, the symbol must be split up into several segments, with each segment corresponding to a normal character position.

2.2.8 IBM ProPrinter III emulation

For information, refer to the *APP 6390 Available Emulations Reference Manual*.

2.3 STEPPER MOTOR DRIVE PRINCIPLES

2.3.1 General

The LB12/LB15 has four stepper motors.These are:

- the carriage motor
- the PDC motor
- the grasp motor
- the document motor.

2.3.2 General motor drive principles

The method used to drive stepper motors is to switch the current direction through the stator coils, thus achieving a rotating magnetic field that moves the rotor in steps.

A simplified stepper motor is shown in the figure below. This simplified motor has two windings, four stator poles, and a two-pole rotor. The stator poles form two electromagnets. Their polarity changes when the current direction through their windings changes. In the example shown, the current is switched by a pair of two-pole switches, S1 and S2.

When switch S1 is in position A, the current in winding L1 flows in one direction. When the switch is position B, the current flows in the opposite direction. This shifts the magnetic poles of this stator pair. Similarly when switch S2 changes from position C to D, this shifts the magnetic poles of the other stator pair.

If both S1 and S2 are switched in the sequence shown in the table, the magnetic field changes and acts as it rotates. The rotor, which is a permanent magnet, moves and takes a stable position between the north (N) and south (S) poles formed by the stators.

Every time S1 or S2 is switched, the magnet field rotates 90°, corresponding to a full rotor step. The rotation speed is proportional to the switching frequency. The rotation direction depends on the switching sequence of S1 and S2. The switching sequence is also illustrated by a pulse diagram that illustrates that the switch changes are 90° phase shifted. After four changes, the rotor has rotated 360°.

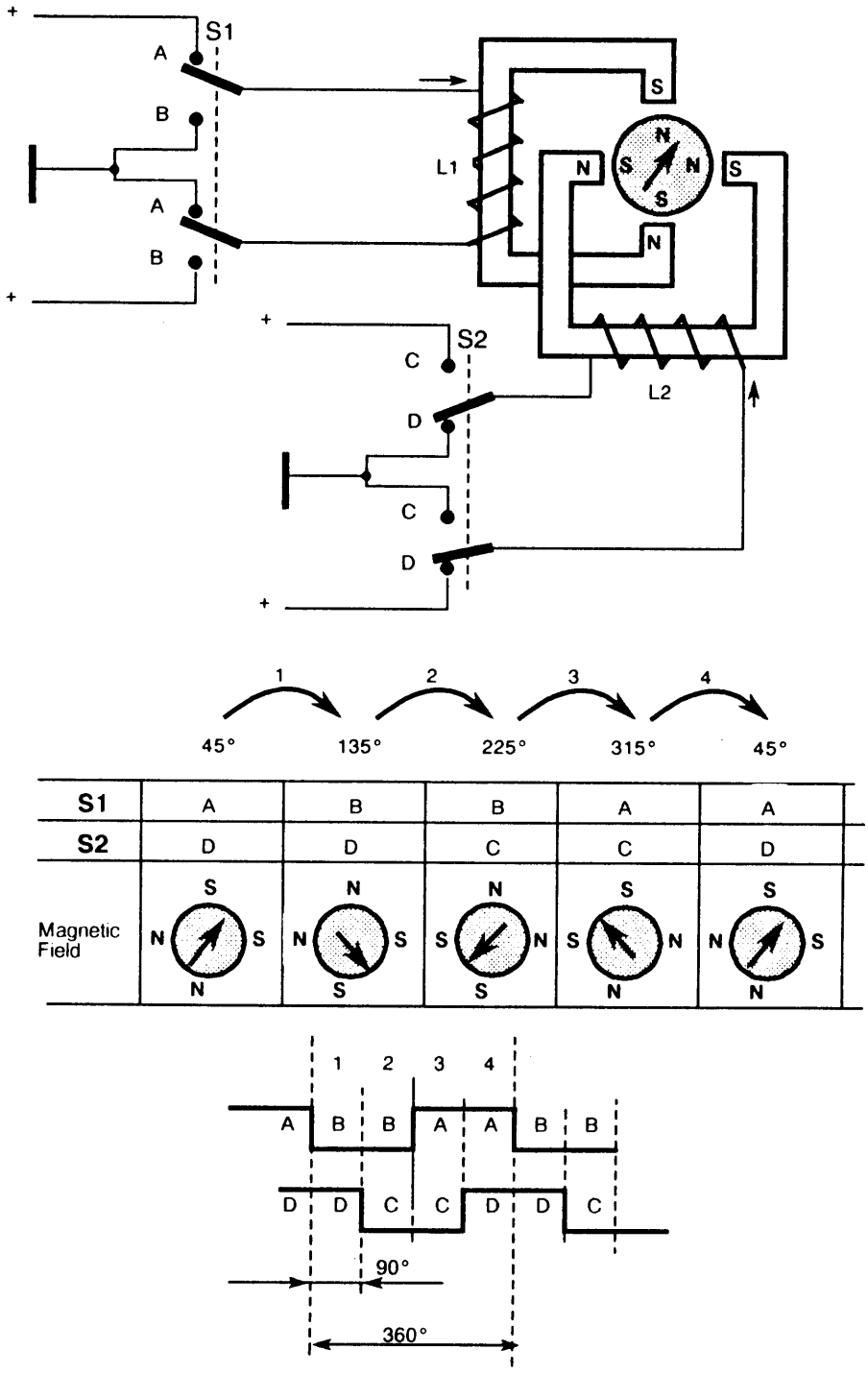


Figure 2-35 Simplified description of the stepper motor function

2.3.3 Stepper motor drive in the LB12/LB15 printers

All the stepper motors used in the LB12/LB15 printers have two windings. There are 200 stator and rotor poles. Thus, a full step is equal to 1.8°. Often, when a motor is stepped, the stepping angle is fixed. When the motor moves slowly, the stepping frequency is then in the region that makes it audible.

In the LB12/LB15 printers, a special micro-stepping technique is developed to reduce the noise from the stepper motors. Rather than a fixed stepping angle, a fixed stepping frequency of 31.25 kHz is used, which is not audible. A current is added to, or subtracted from, the current in the motor every 31.5µs.

The method used to drive the stepper motors is to use drive stages made up of four power MOS transistors, and pulse timing derived from tables stored in the memory. Pulse timing means that the pulse, which gives a basic 1.8° full step, is further divided into many short pulses, modulated according to precalculated tables stored in EPROMs.

2.4 NEEDLE FIRING PRINCIPLES

The needle activation procedure includes the preparation of the character generator and the generation of pulses to the printhead when printing different pitches, qualities and fonts, combined with attributes.

When a string of characters is to be printed, the coded representation of each character is stored in a 5.5KB FIFO register. The corresponding dot patterns are then retrieved from one of the character generators in EPROM or RAM, and are stored, column by column, in a 20KB circular needle buffer. The DMA controller then transfers the column data from the buffer to the parallel-to-serial logic in the MPC-interface chip. A string of 26 bits, containing the data for all needles, is sent for each column, and the needles are fired a few data clock cycles after the last bit in the string. The clock frequency is 1MHz.

The impact force can be individually varied for each needle by three timing parameters loaded into each needle driver register before printing of the character string starts. The pulses are generated only if the data bit for that particular needle is set to '1' in the character dot pattern. The selected needles in a column are fired when the carriage is in position to print that character column. Two column strobes are integrated into the carriage stepper motor tables. One strobe is used for left-to-right printing, with the other strobe is used for right-to-left printing.

2.5 FIRMWARE STRUCTURE

The firmware in the LB12/LB15 printers is divided into an ***operating system*** and various program modules called ***tasks*** and ***device drivers.***

The ***operating system***, called MTOS, is a real-time system that handles all the real-time administrative functions, such as:

- interrupt handling
- dispatching of tasks for processing
- input/output to the various drivers.

A ***task*** is a program started in order to run a specific function in the printer.

A ***device driver*** is a program that controls the hardware components related to a specific function.

2.6 MEMORY USAGE

The table below shows the approximate amount of memory used by the CPU firmware on the main board.

Firmware	EPROM	RAM
MTOS, operating system	12KB	8KB
Drivers	11KB	
Stepper motor tables	250KB	
Character generators	68KB	8KB
C code	167KB	22.5KB
System routines	4KB	
Needle buffer		20KB
Line buffer		5.5KB
Total	512KB	64KB

Table 2-3 Memory usage

2.7 MAGNETIC STRIPE FACILITY

2.7.1 Mechanics

The MSF mechanics consists of two side plates interconnected by two cross members (c) and two guide shafts (u). The rear shaft controls the carriage in all directions, the front shaft only vertically.

A leaf spring (s) is attached to the left side of the carriage. This spring has a pad that slides on top of the front shaft as the carriage moves. During read and write operations, the leaf spring keeps the R/W head (r) pressed against the passbook. When the carriage approaches its home position, a retraction tongue (p) passes under a fixed retraction roll (l) forcing the carriage, and thus the R/W head, slightly down. This prevents the R/W head from interfering with the document during its removal or insertion.

The carriage has a metal tongue or 'flag' (o) that interrupts the light beam of a carriage-home sensor (k) as the carriage reaches the right side.

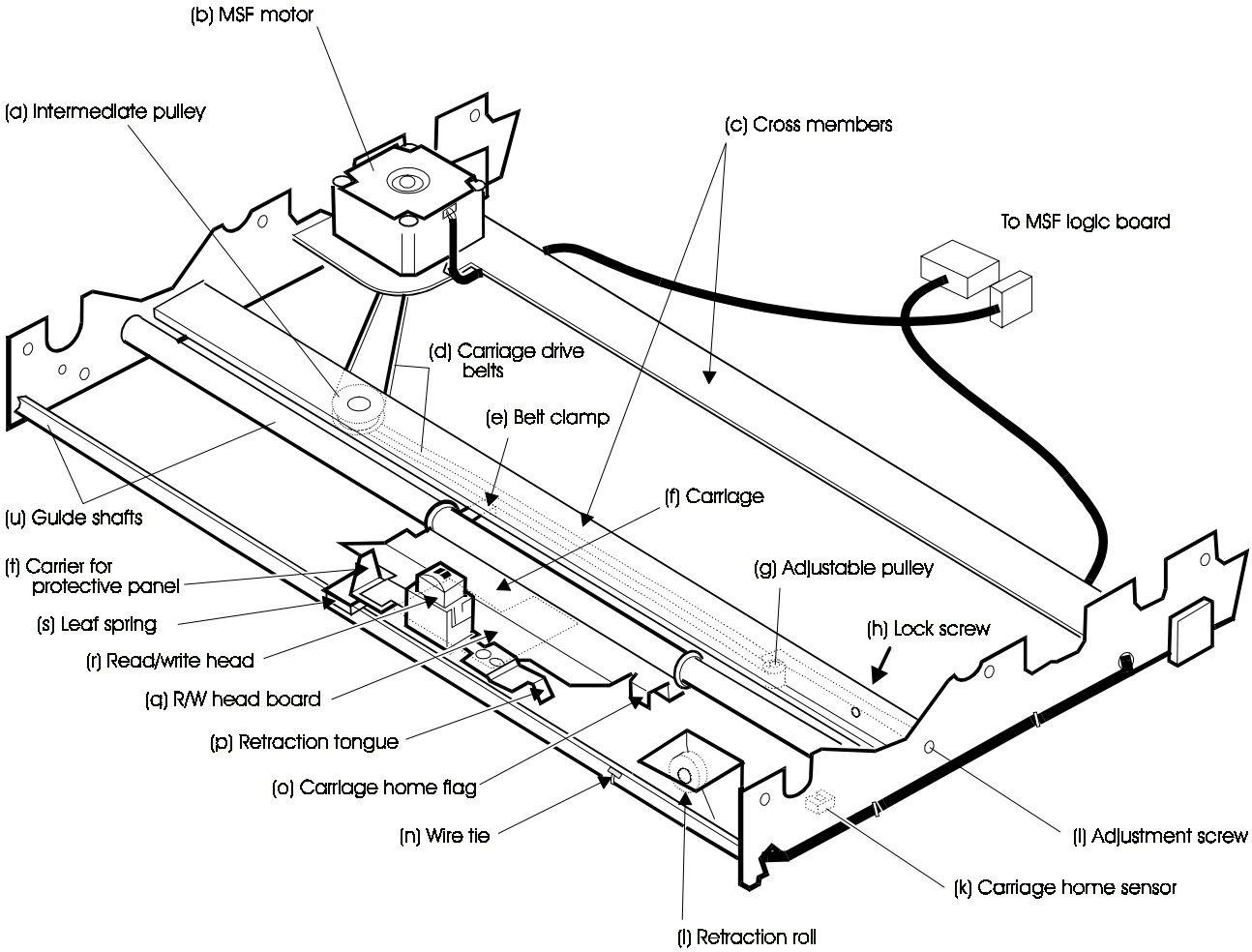


Figure 2-36 MSF mechanics

A R/W head circuit board (q) is mounted on the underside of the carriage. A cable connects the MSF logic board, at the back of the printer, to the carriage-home sensor and the R/W head board. The cable can be detached from the R/W head board, but the sensor is soldered to the cable leads.

The stepper motor (b) moves the carriage sideways by means of two toothed drive belts (d). You can adjust the tension of the left belt by repositioning the motor. You can adjust the tension of the right belt by loosening a lock screw (h) and turning an adjustment screw (i). The carriage is attached to the right drive belt by a clamp (e). The left side of the carriage has a carrier (t) that moves the plastic protective panel (not shown) as the carriage moves.

2.7.2 Electronics

(See Figure 2-38)

The main board CPU controls the reading and writing of the magnetically encoded characters. Some of the data, address and control signals used on the main board also extend to the MSF logic board. This board has an address decoder (base address $FE0000_{16}$) for the generation of further control signals.

The R/W head board has a read/decode IC (U2) recovering clock (strobe) and data signals from the F/2F data stream picked up by the read coil in the R/W head. The read coil is connected via a filter coupling that amplifies and decodes the information into the strobe signal RDSTROBE_N and the data signal RDDATA-N. A low level on the data signal means a logic ONE. A transition from high to low on the strobe signal indicates that data is valid.

The CARDPRES-N signal goes low when the read/decode IC detects flux changes. This signal is not used by the printer, but may be of interest during fault finding. All the above signals are HIGH when no flux changes are detected (see Figure 2-37).

A pulse of 1—100 µs on the SELECT signal resets the read/decode IC.

Reading

When a data bit has been decoded, the RDSTROBE-N signal clocks the data bit into a read data buffer. A read-buffer-full signal (RBF) is output from the read data buffer to the configuration/status register and to the interrupt generator. The latter generates interrupt INTROPT-N indicating that there is time to read or write a data bit. The CPU reads the configuration/status register and discovers that the read-buffer-full bit is set. The CPU now reads and stores the data bit via DBUS 7 (equal to DBUS 15 on the main board) and then clears the RBF status. The CPU is now ready for the next decoded data bit.

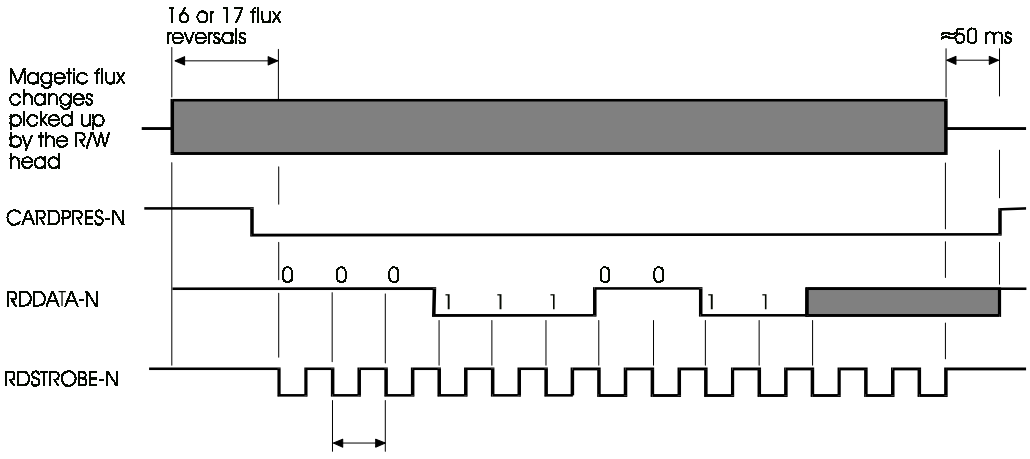


Figure 2-37 Data read signal timing diagram

Writing

The CPU loads the bit to be written into the write data buffer via DBUS 7. This activates the write-buffer-full signal WBF. The write clock (WRCLK) resets WBF, generating INTROPT-N. The CPU then sends new data. WBF also sets the write-buffer-full bit in the configuration/status register. The CPU sets the data bit in the write data buffer via DBUS 7. The frequency of the write clock WR_CLK is divided from a 4 MHz signal generated on the main board. This frequency is divided according to the contents of a 16-bit clock counter (which can be preset) loaded via the D-bus by the WRCLK_LB (low byte) and WRCLK_HB (high byte).

Control register

The control register is addressed by the WR_CTL bit from the address decoder. The five control signals generated by the register are:

- RDSTROBE_EN (read strobe enable). Enables RDSTROBE-N from the R/W head to generate the interrupt INTROPT-N.
- WRITE_EN (write enable) that enables the write clock (WRCLK) to generate interrupt INTROPT-N.
- SEL_CLK (select write clock). Used to select either the 4 MHz or the column interrupt signal COLINTR-N as input to the write clock generator. The 4 MHz is always used for the MSF.
- MLEDON that switches the MSF home position sensor ON and OFF.
- SELECT that sets the F/2F read/decode IC for 75 or 210 bpi packing density. Only the 210bpi density is used for the MSF. A pulse of 1—100 µs resets the read/decode IC.

Configuration/status register

The configuration/status register is addressed by the D_READ-N signal from the address decoder. The input signals are:

- ID0 and ID1 (board identity). ID0 is HIGH and ID1 is LOW, which identifies the board as an MSF read/write head board.
- CARDPRES-N (card present). Changes to LOW when the read head has detected 16 or 17 flux changes. Goes HIGH approximately 50 ms after the last detected flux change.
- MSF_HOME (MSF carriage home). Is LOW when the read head is in its rightmost position.
- RDDATA-N (read data bit). LOW means a logical 1.
- RBF (read buffer full). Indicates that one bit has been decoded and can be retrieved by the main board processor.

Stepper motor control

The function is similar to that of the stepper motors in the basic printer. Refer to Section 2.3.

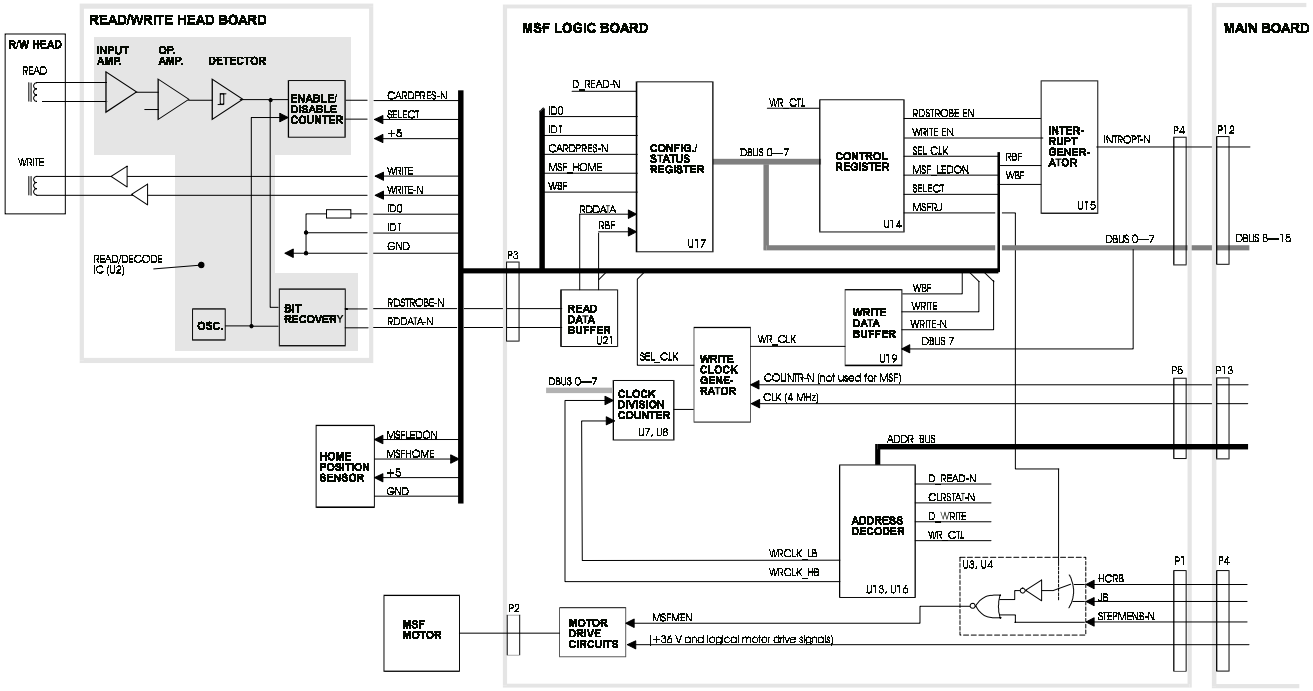


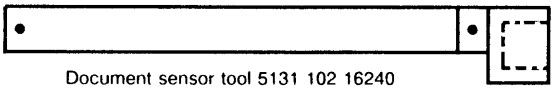
Figure 2-38 MSF block diagram

CHAPTER 3 MAINTENANCE

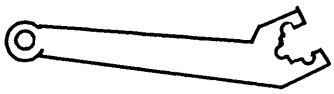
Page 3-1 through 3-66

3.1 TOOLS

- Magnifying pocket lens (8x)
- Cleaning solution (isopropanol or a similar alcohol)
- Oil Shell Tegula 27 or similar
- Grease ESSO Beacon EP 2 (other lubricants MUST NOT be used)
- Diagnostic panel, maintenance version (Part No. 5131 197 61400).



Document sensor tool 5131 102 16240



Reflector adjustment tool 5131 102 16260

Figure 3-1 Special tools required

3.2 BUILT-IN SPECIAL FUNCTIONS

In order to access the built-in special functions, a diagnostic panel (see Section 3.2.2 below) must be connected to the printer.

3.2.1 Introduction

The *LB12/LB15 User's Guide* describes how to select and run various special functions that adapt the printer to a specific application or environment.

This section deals with other special functions, most of which are used for testing, calibrating and adjusting various printer functions.

The special functions available, and their performance, depend on the revision level of the installed firmware. The output from these functions can vary in appearance and content, as a result of changes made to the printer firmware.

Special function **2** produces a printout that includes:

- the current firmware release
- the special functions available and the number you should use to select them.

We advise you to run special function **2** before you try to use any of the other functions (see the *LB12/LB15 User's Guide*).

3.2.2 Selecting and running the special functions

The *LB12/LB15 User's Guide* describes how to select and run special functions **2, 4, 60-1—60.8, 61-1—61-12, 62-1—62-8** and **63-1—63-4** using the diagnostic panel. The *LB12/LB15 User's Guide* also describes how to select and run the corresponding functions when you use the set-up panel. Of the above functions, only functions 2 and 4 are described further in this manual. The remaining special functions (used for testing, calibrating and adjusting) can be run only when a diagnostic panel is connected or from the host (function 1).

You can temporarily disconnect the flat cable from the set-up panel and connect the special diagnostic panel designed for maintenance purposes (see Section 3.1 and below).

3.2.3 The diagnostic panel

The diagnostic panel is described in the *LB12/LB15 User's Guide*, but further essential information is given below.

Mode switch

The program checks the switch position at specific times, for example after several printed lines, while a special function is running.

- NORMAL position means that the printer is controlled from a host via the data communication line.
- TEST position disables the line interface. The printer is controlled from the diagnostic panel.

Step/start switch

The program does not check the position of the switch while a printout function is running, for example while the printer is waiting for a document to be inserted.

Some of the special functions can be repeated by briefly pressing this switch.

To stop a running special function, set the *mode switch* to the NORMAL position or press the *step/start switch* to select another function. The current function then stops at the end of its current cycle. To stop a function before the end of the current cycle, for example in an EMERGENCY SITUATION, press the ON-OFF *switch* to set the printer in standby mode.

Setting switch

The NORMAL position is used for normal printer operation and when running print-out functions (1—49).

The SETTING position is used only for set-up and calibration (functions 60—99).

Commands and data from the data communications line are buffered in the printer if the *setting switch* is mistakenly set in the SETTING position while the *mode switch* is in the NORMAL position. Status code "**-7**" is displayed and signal 133 changes to OFF when the buffer becomes full (see the *LB12/LB15 User's Guide* for information about the signal line interface circuits).

NOTE

You cannot switch ON the printer unless the lid switch is pressed down and the front cover is fitted. To be able to switch ON the printer with its main cover removed, fit the front cover in its ordinary position and keep the lid switch fully depressed during the whole power ON sequence using a pen or similar item.

If Automatic Status Report is selected using function 61-5 or 61-6, but the printer is not connected to a host, to be able to run the special functions you must set the mode switch in the TEST position ***BEFORE*** *you switch ON the printer.*

Display

The table below describes the information shown on the display in various situations, and how the information is presented.

IF				THEN		
ON switch	**Lid switch Front cover switch**	**Mode switch position**	**STEP/START switch**	**Display if no error is detected**	**Display if error is detected**	**Function**
ON	Lid switch pressed. Front cover fitted	NORMAL	Not pressed	Line status Left digit= ProPrinter mode Right digit = Native mode	Status and error code alternate	Prints data from the line
ON	Not significant	TEST	Pressed	Function No. incremented	Function No. incremented	You can select function
ON	Not significant	TEST	Not pressed	Function No. or data	Error code and function No. alternate	Test result
OFF to ON	Lid switch pressed. Front cover fitted	NORMAL	Pressed for 15 seconds	RAM reset code (38) followed by cold start (35)	RAM reset code (38) followed by cold start (35)	Cold start, RAM reset
ON	Open	NORMAL	Pressed	Unchanged	Unchanged	Ribbon change position
OFF to ON	Lid switch pressed. Front cover fitted	NORMAL	Pressed for 3 seconds	RAM reset code (38)	RAM reset code (38)	RAM reset

Table 3-1 Displayed information and function with different switch settings

The frequency with which the error code alternates with the line status or function number indicates the type of error that has occurred.

Alteration frequency	**Type of error**
High (4 Hz)	Hardware error
Low (1 Hz)	Software error
No alteration	Critical errors (except codes 37, 38, 39 and 44) such as processor error, instruction error, bus error, or illegal interrupt

Table 3-2 Correlation between display alteration frequency and error type

List of status and error codes

Run special function 4 to print a list of the current line status and error codes.

3.2.4 Power ON test

The printer always runs a power ON test at transition from power OFF or standby mode to power ON mode. This test checks as much of the electronics and mechanics as possible without destroying any document. The test includes RAM and PROM tests and the storage of mechanical reference values. The test also performs the calibration of opto sensors and the printhead-to-paper distance.

3.2.5 Background test

A program called the Test Task always runs in background, monitoring the printer functions and collecting status information from other tasks. If a fault occurs, this task transfers fault information to both the diagnostic panel and the host computer.

3.2.6 RAM parameter values

The printer memory always contains the current parameter values for the selected type of document, character font, selected functions, internal status, etc. There are different sets of parameters for the various printer sub-units or functions. You should already be familiar with the parameters described in the *LB12/LB15 User's Guide*.

Most of the above parameters can also be changed from the application program via the line by the use of the Set Mode (SM) and Reset Mode (RM) commands. In addition, some parameters can be set and reset only via the line.

All the RAM parameters are separated into three levels based on their use. The method used to reset a parameter to its default value depends on the level to which the parameter belongs:

- **Level 1** *Power-ON reset* or *warm start.* All internal status, including error status, non-stored print-out parameters, parameters set with commands SM/RM >20 and power on calibration values are set to default values or to new calibrated values.
- **Level 2** *RAM reset.* Performed manually (see Table 3-1). This level performs the Level 1 reset but also resets the parameter values and internal status values set with the SCS command.
- **Level 3** *Cold start RAM reset***.** Performed manually with the cold start function, see Table 3-1 above. The cold start RAM reset performs the Level 1 and Level 2 reset functions and all the HW offset adjustments made using calibration function 74. Also the opto sensor values set using the calibration function 70 are set to their default values. Any character generator downloaded into RAM is cleared. After a Level 3 reset, you must perform the calibrations using functions 70, 71 and 74. If RAM character generators are to be included, these must be reloaded, and any functions previously selected using functions 60 or 61 must be reselected.

RAM level	Warm start (power-ON reset)	RAM reset	Cold start
1	- Internal status - SM >20, - Not saved parameters - Calibration values set at last power-ON	- Internal status - SM >20 - Not saved parameters - Calibration values set at last power ON	- Internal status - SM >20 - Not saved parameters - Calibration values set at last power ON
2		- Saved SLS/SCS parameters	- Saved SLS/SCS parameters - SM <20
3			- HW offset - Opto-sensor reference values - Character generators

Table 3-3 Parameters/values reset using different reset methods

3.2.7 About calibration functions 70—75

Most of the calibration functions are used to set calibration values for electronic and electromechanical functions. Function 73 displays the sensor values.

See Section 3.5.12 for full details about the calibration functions.

3.3 PREVENTIVE MAINTENANCE

Preventive maintenance should be carried out approximately once a year or after 2000 hours of printing, whichever comes first.

3.3.1 Preparations

1. Disconnect the mains cable.
2. Remove the cover.

3.3.2 Cleaning

1. Remove the ribbon cassette
2. Clean the printhead nose with a piece of dry lint-free cloth.
3. Clean the carriage guide shafts with a piece of dry lint-free cloth.
4. Clean the pressure (grasp) rolls and feed rolls using isopropanol or a similar alcohol.
5. Clean the print bar(s) with isopropanol.
6. Exchange the ribbon feed O-ring (5131 102 12270)
7. Mount the ribbon cassette and cover.
8. Connect the power cable.
9. Run special function 1 to check the print status.
10. Run special function 2 and check the printer configuration.

3.3.3 Inspecting the toothed belts

The tension of all toothed belts, with the except of the carriage drive belt, is not critical and can vary widely before the operation of the printer is affected.

When you carry out preventive maintenance, also check the toothed belts for excessive slackening.

3.3.4 MSF preventive maintenance

The only preventive maintenance required for the MSF is the regular removal of dust and paper particles from the edges of the plastic protective panel in the R/W head slot.

3.4 TROUBLESHOOTING

3.4.1 Introduction

Preparatory measures

If possible, start the fault-finding process by printing out the configuration and calibration report by running function 2. Also print out the list of status and error codes by running function 4.

When a fault has occurred, try to collect as much information as possible about it, such as:

- What are the symptoms?
- In what situation does the fault occur?
- How often does it occur in that situation?

With this information as a basis, use the fault-finding scheme described in section 3.4.2 to find the problem.

Main types of faults

The range of possible faults are divided into three main areas:

A. The printer seems to be dead.

This area deals with problems such as:

- *Nothing happens at power ON*

and

- *There is no contact with the controller*.

B. Intermittent faults.

In this area, you will find problems such as:

- *After a while, the printer behaves in a peculiar way*

and

- *Sometimes printing just stops*

C. Easily observed faults.

The types of problems found in this area are, for example:

- *Printed dots differ in contrast*

and

- T*he printer does not feed the document in*

3.4.2 Fault finding scheme

A. Printer is inoperable

Nothing happens at power-ON.

ON-lamp ON

Error code 38, 61, 63 or 76—79 blinks rapidly

1. Check the motor and its mechanical operation
2. Replace the main board

Error code 13—23, or 25—34 blinks rapidly

1. Check the PDC sensor, replace it if necessary
2. Check the PDC mechanical operation
3. Replace the main board
4. Replace the PCD motor

Error code 10 or 24 blinks rapidly

Replace main board

Error code 05, 06 or 50 blinks rapidly

1. Check the opto sensors connected to the sensor board
2. Replace the sensor board
3. Check mechanical operation of print unit rotation/home position
4. Check the bottom sensor

Error code 01, 03, 37, 39—43, 52, 55, 58, 62 or 75 blinks rapidly

Replace the main board

Error code 36 or 43—48 non-blinking

Replace the main board

Error code 34, 37—39 non-blinking

Power OFF the printer and power ON again to reset the RAM

Error code 35 (steady)

Power ON again for RAM reset. Check adjustments and settings by running special function 2. Check HW offsets by running function 71 and, if necessary, adjust by using function 74.

ON lamp OFF

1. Replace the PSU
2. Replace the main board
3. Look for a short circuit

No contact with the controller or host

Status code 0

Replace the main board

Status code 1

1. Check the signal cable
2. Check the interface parameter setup

Status code 4 or 5

Check the status of signals 106 and 133

106 OFF

1. Check the signal cable
2. Check the controller/host
3. Replace the main board

133 OFF

Replace the main board

Status code 2

Check the bottom and edge sensors

Status code 7

Check the setting switch

Status code 8

Press the lid switch down and fit the front cover

Status code 9

1. Check the signal cable
2. Check the setting performed by function 60-3
3. Replace the main board
4. Check the controller/host

B. Intermittent fault

The printer does not become locked when the fault occurs

Check the mechanical operation

The printer becomes locked when the fault occurs and power OFF/ON is required to continue using the printer

Steady or rapidly blinking error code (both indicate a hardware error)

Error code 38, 61, 63, or 76—79 (blinking rapidly)

1. Check the motor and mechanical operation
2. Replace the main board

Error code 13—23 or 25—34 (blinking rapidly)

1. Check the PDC sensor, replace it if necessary
2. Check the PDC mechanical operation
3. Replace the main board
4. Replace the PDC motor

Error code 01, 03, 37, 39, 40—43, 52, 55, 58, 62, or 75 (blinking rapidly)

Replace the main board

Error code 05, 06 or 50

1. Check the opto sensors connected to the sensor board
2. Replace the sensor board
3. Check mechanical operation of print unit rotation/home position
4. Check the bottom sensor

Error code 36 or 43—48 (steady)

Replace the main board

Error code 34 or 37—39 (steady)

Power OFF and then power ON again for RAM reset.

Error code 35 (steady)

Power ON again for RAM reset. Check adjustments and settings by running special function 2. Check HW offsets by running function 71 and, if necessary, adjust using function 74.

Error code 90—95

Replace the main board

Slowly blinking error code (indicates a software error)

Error code 23—27

Check the line interface parameters

Other error code

Check the application software

C. Easily observed fault

Printed dots differ in contrast

1. Replace the ink ribbon cassette
2. Replace the printhead
3. Replace the main board

Characters vary in quality

1. Replace the ink ribbon cassette
2. Check the ribbon feed mechanism
3. Replace the main board
4. Replace the capacitor board

Paper feed does not function well

Check the mechanical operation

3.4.3 Special functions for fault-finding

These special functions can be selected from the diagnostic panel. Function 1 can also be used by the on-line tests controlled from the host.

Functions 1—59 are used for various tests and printed reports.

The remaining special functions are used for set-up and calibration (see Section 3.5.12), i.e.

60—69 Printer set-up functions

70—79 Calibration

1. CONTINUOUS PRINTOUT

This function produces a printed character string in the document station. The string is printed as an endless loop with a one-character shift for each printed line.

1. Set the *mode switch* in the TEST position.
2. Select function 1 by pressing the *step/start switch*.
3. Insert an A4 document in the document station. The document is fed out when it is full. Printing continues if you insert a new sheet of paper.
4. Reset the *mode switch* to the NORMAL position to stop the printout function.

2. CONFIGURATION AND CALIBRATION SUMMARY

This function produces a printout containing configuration data, calibration values in use, special off-line functions included in the firmware, etc.

1. Set the *mode switch* in the TEST position.
2. Select function 2.
3. Nothing happens until you insert an A4 document.
   If you reset the *mode switch* to NORMAL after the printout has started, the printer produces a shortened printout giving only configuration and calibration data.
4. Reset the *mode switch* to NORMAL when the printout is complete.

The printout examples shown in Figure 3-2 and Figure 3-3 require further explanation.

In the section *Calibrated Threshold Values For Sensors*:

- the "Default " column values are the lowest acceptable values; they are stored in EPROM
- the column "Power On" shows the threshold values set automatically in RAM during the previous power-ON sequence
- the column "Test 70" shows the threshold reference values stored in RAM the last time function 70 was run.

```
ALL PURPOSE PRINTER                    Serial no......    Date ..........

Firmware release      05.13.04     STD Production PROM 12NC(U8/U9): 5131 196 23900/24000, revision 08

CONFIGURATION                    COMMUNICATION MODES              PROPRINTER MODES
Printer model       LB10/LB12    Parity              ODD          Force NLQII          NO
Communication port  SERIAL       Transfer rate       9600 Baud    Multipass printing   UNIDIR
Internal panel type DIAGNOSTIC   Communication mode  XON/XOFF     20 cpi disabled      NO
Auto insert AIF     YES          Nbr of data bits    8 bits       Code page            US
Read/write device   NONE         Nbr of stop bits    1 bit        Character set        2
Position detect PDF YES          Use of 107 (DSR)    OFF          Stroked zero         OFF
Operator's Panel    NO           Cover open protect  ON           Page Length          A4
Optional board      NONE         Remote Power OFF    OFF          Automatic LF         OFF
                                 GENERAL MODES                    Automatic CR         OFF
                                 Emulation mode      NATIVE       Auto book            OFF
                                 Status report mode  NO           Logical FF           OFF
                                 Doc pull out mode   NORMAL       MultiFF skip         OFF
                                 Paper out buzzer    OFF(ON in test) Double LF        NO
                                 Long grasp pull in  OFF          Default pitch        10cpi
                                 P6327 mode          OFF          Default quality      Draft
CHARACTER GENERATORS             DeLayed grasp       ON           Vertical offset      None
 in   Size  Free  nr             Cov. open buf clear OFF          Downloaded fonts     ACCEPT
 RAM  0008  0008  00             DeLayed power-off   OFF          ADDITIONAL MODES
PROM  0000  0000  19                                              Edge sensor          ON
                                                                  AIF mode             OFF
CALIBRATED THRESHOLD VALUES FOR SENSORS   Default   Power On   Test 70   Find left edge mode OFF
Document top/bottom outer (67% of white)  : 006       121        080    Safe handle mode    OFF
Document right edge (67% of white)        : 006       168        170    Btm nonprint area   6 mm
Carriage extreme right pos. (50% of white): 127       032        032    Custom special mode NONE
Stop pin & grasp mechanism (50% of white) : 127       126        126    Paper hold mode     OFF
Print unit position (50% of white)        : 127       032        032
AIF sensor          (75% of white)        : 008       194        195
PDF sensor          (200% of black)       : 040       078        078

OFF LINE SPECIAL FUNCTIONS
01  Printout test
02  Configuration and calibration printout
03  Production burn-in test.
04  Diagnostic Codes printout

40  MSF reading with document release
41  Repeated MSF reading
42  MSF write and read (acc to DIN32744)
43  Repeated MSF write and read
44  Fast repeated MSF write and read, statistics only
In tests 60-63, first select sub level, then press
step switch to select setting
60-1  Select parity (0=ODD 1=EVEN 2=IGNORE 3=NONE)
60-2  Select com speed (0=9600 1=19200 2=4800 3=2400
      4=2000 5=1200 6=600 7=300 8=150 Bits/s)
60-3  Signal 107 (DSR) (0=ignore 1=use)
60-4  Cover open protection (0=ON 1=OFF)
60-5  Select number of data bits (0=8 bits 1=7 bits)
60-6  Select number of stop bits (0=1 bit 1=2 bits)
60-7  Remote Power OFF control (0=disable 1=enable)
60-8  Communication mode (0=SDI-2 1=PROPRT 2=RS232C)
61-1  Handshake (0=HW acc to 60-8   1=XON/XOFF)
61-2  Emulation (0=Auto 1=native 2=Pro 3=4722 4=PR50)
61-5  Automatic status report mode 5 (0=off 1=on)
61-6  Automatic status report mode 6 (0=off 1=on)
61-7  Document pull out error mode (0=off 1=on)
61-8  Buzzer tone for paper low/out (0=off 1=on)
61-9  Long pull in after document grasp (0=off 1=on)
61-10 6327 compability mode (0=off 1=on)
61-11 DeLayed grasp (0=off 1=on)
61-12 Buffer clear when cover open (0=off 1=on)
61-13 DeLayed power-off (0=off 1=on)
63-1  Edge sensor default (0=ON 1=OFF)
63-3  AIF default (0=OFF 1=normal 2=spec2 3=spec3)
63-4  Find left edge default (0=OFF 1=ON)
63-5  Safe handle mode default (0=OFF 1=ON)
63-6  Bottom nonprintable area (0=6mm 1=0mm)
63-8  Customer special mode (0=none 1-15=set)
63-9  Paper hold mode default (0=OFF 1=ON)
63-10 MICR reader installed (0=CMC 1=E13B)
Test 62 refers to ProPrinterIII and 4722 modes
62-2  Force NLQII (0=no  1=instead of NLQ
      2=in book  3=NLQ or book  4=always)
62-3  Multipass printing (0=UNIDIR 1=BIDIR)
62-4  20 pitch (0=allowed 1=disabled)
62-5  Code page (0=US 1=International 2=Cyrillic)
62-6  Character set (0=II 1=I)
62-7  Stroked zero (0=off 1=on)
62-8  Page Length (0=A4 1=12inch 2=11inch)
62-9  Auto LF (0=off 1=on)
62-10 Auto CR (0=off 1=on)
62-12 Auto book (0=off 1=on)
62-13 Document FF mode (0=Physical 1=Logical)
62-14 MultiFF skip (0=off 1=on)
62-15 Double LF (0=off 1=on)
62-16 Default pitch (0=10cpi 1=12cpi 2=17cpi 3=20cpi
      4=Proport 5=12cpiFASTFONT)
62-17 Def quality (0=Draft 1=NLQ 2=NLQII 3=NLQIIalt)
62-18 Top row vertical offset.(set 10ths, then ones)
62-19 Downloaded fonts (0=ACCEPT 1=IGNORE)
70  Manual opto-sensor threshold level calibration
71-0 Print out guide to change HW offsets doc station
73  Display of individual sensor levels, exit with POF
    if PDC or PDF (0=VH 1=GRP 2=CARR 3=EDGE 4=OUTRIGHT
    7=AIF 8=PDC 9=PDF)
    If PDC, pressing the step switch changes PDC pos:
    HRL->HRM->HOC->HAT->HRL->HRM->HOC->HAD->HRL...
74-0..7 Adjust HW offsets (run test 71 first...)
74-8 Adjust printhead lift (insert doc for testprint)
75  Printout of PDC values and miscellaneous info
76  Reset Memory (37 or 41 displayed at next power on)
77  Sensor test (toggling 0<->1 when status changes).
```

Figure 3-2 Function 2 printout example

3. BURN-IN AND LINE INTERFACE TEST

A burn-in test fills an A4 sheet with printed characters and moves the mechanical parts as much as possible. The communications interface is tested to a limited extent if a loop-back plug is connected (see below). Any hardware error or interface test result is stored in RAM and is displayed at the next power-ON. When the test is complete, the printer alerts you by beeping every 20 seconds. Code 64 is displayed if the test completes without no errors detected.

The interface test is carried out in the intervals between the printouts. If an error is detected, a non-blinking error code is displayed.

Prepare the dummy connector by connecting the following poles:

Poles 2 and 3 (signals 103 and 104)

Poles 6 and 20 (signals 107 and 108)

Poles 5 and 9 (poles 106 and 133).

1. Insert the dummy connector.
2. Set the *mode switch* in the TEST position.
3. Select function 3. The display starts incrementing to enable you to select the number of test runs (max. 8).
4. Press the *step/start switch* when the desired number is shown. The display starts incrementing again to enable you to select the interval between the printout of every second printed line. Each unit corresponds to approximately 10 seconds (maximum of 8 x 10 seconds).
5. Select the desired number by pressing the *step/start switch*. If you do not press the switch, the default value '0' is selected automatically. The display starts incrementing again to enable you to postpone the start. Each unit corresponds to 4 hours (maximum of 3 x 4 hours).
6. Press the *step/start switch* when the desired number is shown. If you do not press the switch, the default value '0' is selected automatically.
7. Insert an A4 document and the test starts. You can stop the test at any time by pressing the ON *switch* twice.
8. Reset the *mode switch* to the NORMAL position when the test is complete.
9. Remove the dummy connector.

4. STATUS AND ERROR CODE PRINTOUT

This function prints the status and error codes valid for the firmware version in use.

1. Set the *mode switch* in the TEST position.
2. Select function 4.
3. The printout starts when you insert an A4 document into the document station.
4. Reset the *mode switch* to NORMAL when the printout is complete. See the printout example below.

```
LB1x Diagnostic Code Information
Firmware release          05.13.04

Line status
Digit left: ProprinterIII, IBM4722, or Olivetti PR50 mode
Digit right: native mode; alternating left/right:AUTO mode
 0  During power on: no operable host detected
 1  Idle, ready for reception or transmission
 2  Input buffer full
 3  Receiving data from host
 4  Transmitting data to host
 5  Parallel interface: INIT received
 6  Receiving and transmitting data. (3+4)
 7  Setting switch on
 8  Cover open (Ignored if cover open protection off)
 9  Received byte ignored. (Due to input buffer overflow,
    or use of DSR signal is selected, and DSR is low)

Special operator information (2 digits steady on)
90  During power on: connection to operable host detected
34  Default values at next power on incl. modes
35  Default values at next power on incl. modes and offsets
36  At power off normally indicated momentarily. At
    power on if 36V low after 5V reset
37  Default values at next power on (new program version)
38  Default values at next power on (COLD start). Flashes if
    step button not released, then changing to 35
39  Def values incl modes/offsets at next power on, RAMerror
45  Production BURN-IN test entered
50  Special Operator Mode or Trace Dump mode

Print processor error codes (2 digits steady on)
42  Print processor PROM checksum error (not used)
43  Print processor RAM memory error
44  W7 jumper on main board in power off position
    (FW power off disabled)
45  Power fail when W7 jumper in power off position
46  CPU Bus/address error
47  CPU code fault
48  CPU non code (interrupt) fault

Soft error codes (2 digits slow=0.5 Hertz flashing,
reset with DSR or when automatic status report used)
01  Column pos outside left margin / MSF char overflow
02  Column pos outside right margin  3)
03  Line number outside page  1,2)
04  Paper edge not found/ PDF sensor faulty
05  Free Line not found/ PDF sensor faulty (VPF order)
06  Line parameter < start line, or > last line (VPF),
    or linespace to small for VPF function (<1/6inch)
07  Document pulled out after grasp and before FF  2)
08  Document not suitable for sync 2)
09  Error detected in PROM generator
10  Loading character set checksum error
11  Loading character set memory overflow
12  Selected pitch not available
13  Selected matrix/font not available
14  Attempt to delete a PROM character set
15  Selected mode/matrix not allowed
16  RAM generator excluded because too many generators
17  Sloped character (italic) outside right margin
18  PROM generator excluded because too many generators
19  Too many tabulators set
20  Selected subdevice not available
21  Order code sequence not implemented
22  Order code sequence error
23  Rx Data parity error
24  Rx Data framing error
25  Rx Data overrun error
26  Rx Data low (break)
27  Rx Data Overflow ( = CT133/pin 9 ignored)
28  Wrong combination of commands
29  More than 21 parameters following CSI
30  Attempt to write on OCR subdevice
31  Parameters outside specified range
32  Function not available on selected subdevice
34  SCS/SLS RAM area disturbed, SDS was carried out
40  Cover opened or STOP button pressed, buffer cleared
41  START1 button pressed.    42  START2 button pressed
50  Doc has not passed sensor after FF (RIS/SDS)
59  FF mark not detected during FF order max time

Hard error codes (2 digits fast=1 hertz flashing,
reset only with power off/on)
01  Internal print error
02  Internal MPC logic error
03  Internal block handling error
05  Defect home sensor
06  Defect home sensor or carriage stopped before
    mechanical right side
10  Illegal combination of options
    (hard copy/receipt/journal)
13  HRLsensor, PDC shows too high value (>5) in HRL
14  HRLsensor, PDC shows too low value (<20) in HOC
15  No values for PDC curve, front cover probably
    incorrectly mounted/ no option print bar mounted
16  PDC HRL error, HRM position not OK
17  PDC HRL error, difference to HAB not big enough
18  PDC HRL error, difference to HRB not big enough
19  PDC HRL error, difference to TRP not big enough
20  Head attach early position not reached
21  PDC HRL error, difference TRP/TRPref not small enough
22  Head attach error, 0.4 and 0.8mm pos at same time
23  PDC time_out error
25  PDC HRL error, difference to OCR not big enough
26  Platen alignment error
27  PDC comparator error (low supply voltage)
28  PDC HRL error, difference to HRM not big enough
29  PDC calibration error, HAB voltage too low
30  PDC calibration: Too few/many values for PDC curve
31  PDC calibration: Measured values outside limit
32  PDC calibration: 0.8mm position outside PDC curve
33  PDC calibration: 0.4mm position outside PDC curve
34  PDC calibration: Platen to far away or too close
35  PDC order sequence error
37  No suitable carriage table found
38  Carriage motor/driver error (carriage can not
    reach requested position)
39  Carriage time-out (DMA error)
40  Defect EEPROM. (default values at next power-ON)
41  Default modes+offsets at next pwr-ON.(EEPROM error)
42  Default modes at next power-ON. (EEPROM error)
43  EEPROM not reliable - modes may be changed.
50  Doc was not fed out in connection with reset
52  Hard copy/receipt/journal timeout, DMA error
53  Journal motor/sensor error
55  Suggested step motor table does not exist
58  Unexpected step motor table value (0) found
61  V/H driver time out
62  V/H not defined error code (program error)
63  V/H wanted position not reached
64  SDI-2 production test, OK
65  Dito, mismatch ON_133-->ON_106 or ON_108-->ON_107
66  Dito, mismatch transmitted and received data
67  Dito, mismatch ON_133-->ON_106 or OFF_108-->OFF_107
68  Dito, mismatch OFF_133-->OFF_106 or OFF_108-->OFF_107
69  Dito, mismatch OFF_133-->OFF_106 or ON_108-->ON_107
75  Document, Grasp timeout, DMA error
76  VH time out, step motor disabled/sensor error
77  Grasp time out, step motor disabled/sensor error
78  Document time out, step motor disabled/sensor error
79  Hardcopy/Receipt/Journal time out, step motor disabl.

OCR/MICR/MSF codes (2 digits fast/1 Hertz flashing, reset
with DSR or a new OCR read command)
80  Accumulator for OCR test 55 full
86  Read after write error (MSF/MSR)
87  Read head error (MSF/MSR)
88  MSF home pos not reached
90  OCR board f-processor or RAM error
91  OCR board f-processor or Scratch Pad error
92  OCR board Decoder (U9) error
93  OCR board - Printer transmission error
94  OCR board - Printer reception error
95  OCR timeout error/unspecified error (connect error)
96  OCR buffer overflow (more than 90 characters read)

1) Document station: Attempt to position document for
   printing in non printable area
2) In the extended status order introducer and order
   will be set to 0
3) When PDF/Find left edge mode is used, order introducer
   and order in the extended status is set to 0
```

Figure 3-3 Function 4 printout example

3.5 CHECKS AND ADJUSTMENTS

3.5.1 Introduction

Checking the position of the pressure rolls

Occasionally, incorrectly positioned pressure rolls can cause printing and document feed problems. Before you start to run any special function, always check that the front and rear pressure rolls in the document station are correctly set.

All rolls in the document station should be set as far as possible from each other, but they should not be positioned such that any roll passes over a binder or the left edge of a document. The front and rear pressure rolls must be aligned.

1. Move the printhead to the right side (see below for a description of moving the printhead).
2. Push the roll sideways until it snaps into a new position.

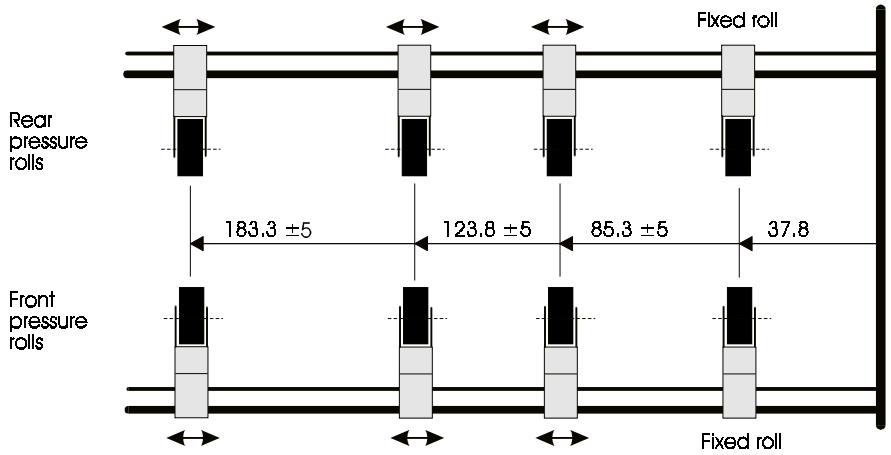


Figure 3-4 Pressure rolls position in the document station

Moving the printhead sideways manually

If you need to move the printhead sideways, pushing the printhead directly can damage the printhead suspension leaf springs. Push the carriage instead.

Turning the rotary print unit

- **Operable printer**

Switch ON the printer and turn the print unit in the same way as when exchanging the ink ribbon cassette.

- Non-operable printer

1. Check that the printhead is in the HRL position. If not, turn the PDC cam wheel manually to move the printhead as far as possible away from the print bar.

2. Move the carriage to the right and keep it pressed against the right-side plate while you:
   - press the lid release button to turn the print unit from the horizontal to the vertical position

     or
   - manually rotate the print unit from the vertical to the horizontal position.

3.5.2 Optical sensors on the sensor board

Check and adjustment

Special function 70 sets the threshold level of the optical sensors located on the document sensing board. Run this function if any of the following units has been replaced.

- Main board
- Document sensing board.

3.5.3 Front pressure (grasp) rolls

Turn the pulley counter-clockwise to its mechanical stop position.

Check

With the printer in its operating position, check that the distance between the front pressure rolls and the front feed rolls is 0.5—1.0mm.

Adjustment

1. Loosen the screw connecting the arm to the pressure rolls shaft.
2. Adjust the screw until the shaft can be turned but does not move freely.
3. Turn the shaft downwards until the front pressure rolls are the correct distance from the front feed rolls.

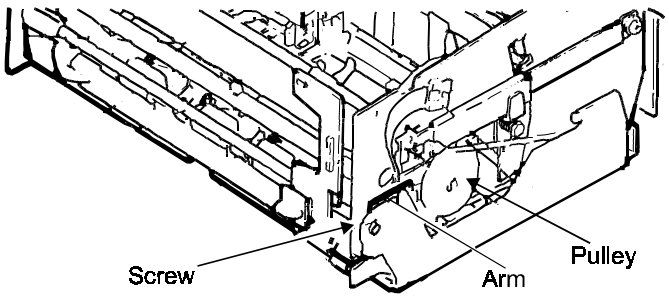


Figure 3-5 Adjusting the front pressure rolls

3.5.4 Grasp mechanism belt tension

Check

1. Apply a spring balance on the belt as illustrated in the figure below.
2. Move the balance until the belt is in the position shown in the close-up. The balance should now read 3.25 ±0.25 N (325 ±25 p).

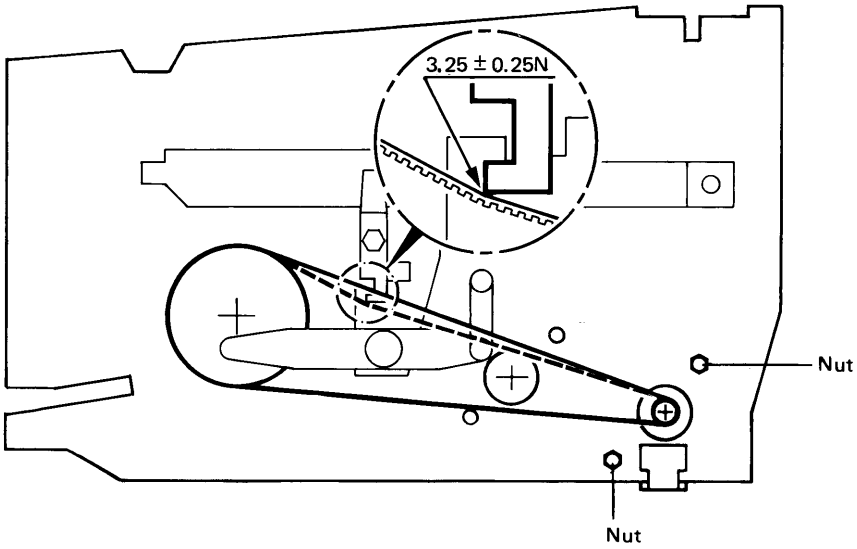


Figure 3-6 Drive belt for the grasp mechanism

Adjustment

1. Slightly loosen the nuts holding the grasp motor.
2. Slide the motor forward or backward until you obtain the correct reading.
3. Tighten the nuts.

3.5.5 Document feed mechanism belt tension

Check - lower belt

1. Apply a spring balance on the lower belt as illustrated.
2. Move the balance until the belt is in the position shown in the close-up. The balance should now read 2 ±0.25 N (200 ±25 p).

Adjustment - lower belt

1. Loosen the adjustable pulley slightly.
2. Slide the pulley backward or forward until you obtain the correct reading.
3. Fix the pulley.

Check - upper belt

The belt tension is less important. You need only check that the belt is sufficiently stretched to ensure that it does not jump out of mesh with the toothed wheels.

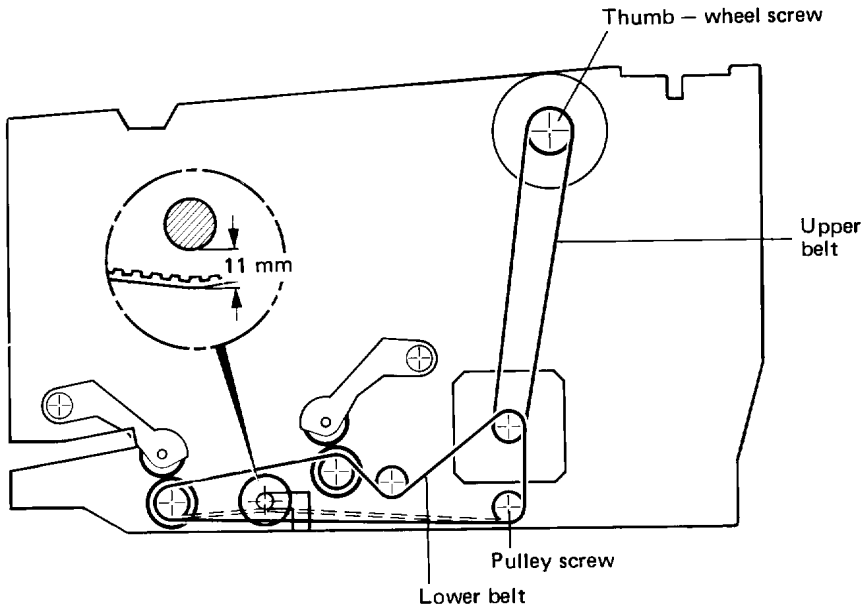


Figure 3-7 Drive belts for the document feed mechanism

Adjustment - upper belt

Loosen the thumb-wheel slightly and move it vertically to obtain a suitable tension.

3.5.6 Carriage drive belt

Turning the rotary print unit to horizontal position

CAUTION!

The printhead is mounted on precision suspension leaf springs. When moving the printhead manually, DO NOT PUSH THE PRINTHEAD. Push the carriage instead.

Operable printer

Switch ON the printer and turn the print unit in the same way as when preparing to replace the ink ribbon cassette (see the *LB12/LB15 User's Guide*).

Inoperable printer

1. Check that the printhead is in the HRL position. If not, turn the PDC cam wheel manually to move the printhead as far from the print bar as possible.
2. Move the carriage to the right and keep it pressed against the right-hand side plate while you turn the print unit manually from the vertical to the horizontal position.

IMPORTANT !
The printhead is always in the HRL position if you switch OFF the printer immediately after a completed power ON sequence.

Check

1. Apply a spring balance to the center of the lower part of the belt. Press the balance until the two parts make contact.
2. The two parts should now read 3.35 ±0.25 N (325 ±25 p).

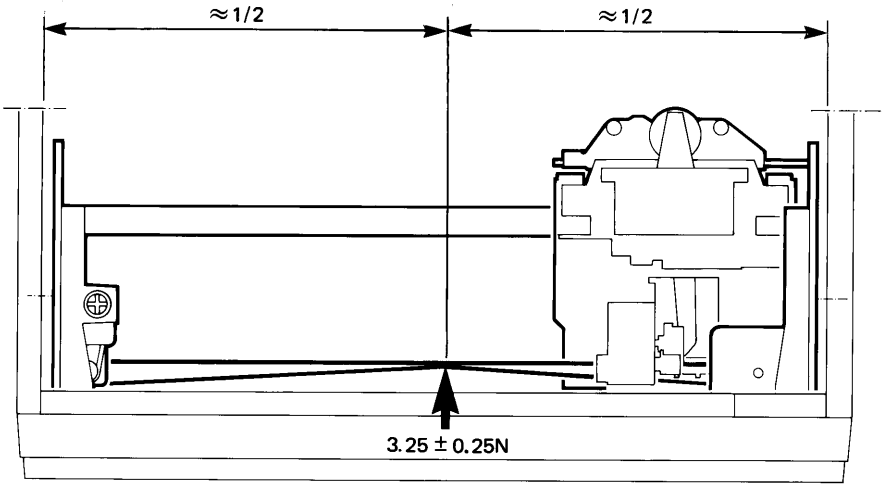


Figure 3-8a Checking the carriage drive belt tension

Adjustment

An adjustment screw is accessible through a hole in the left-hand side plate when the print unit is in horizontal position.

Turn the screw until you obtain the correct reading.

If the carriage drive belt has been replaced:

1. Move the carriage to the extreme right.
2. Loosen the two screws clamping the drive belt to the carriage.
3. Tighten them again while you keep the carriage pressed against the right-hand side.

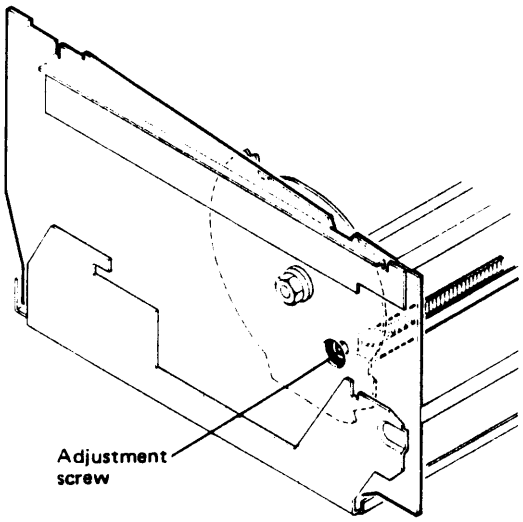


Figure 3-8b Adjusting the carriage drive belt

3.5.7 Printhead slide

Check

1. Apply a spring balance to the slide as illustrated.
2. Move the balance to press the slide to the book and document positions. The balance should now read 2—4 N (200—400 p).

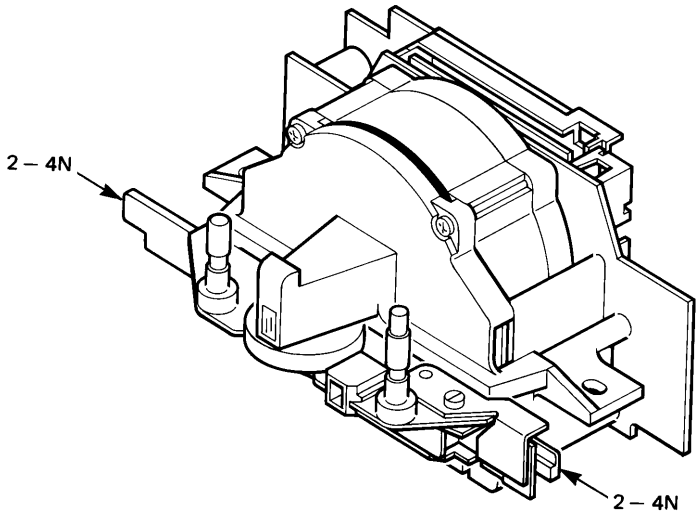


Figure 3-9 Printhead slide (check)

Adjustment

1. If the reading exceeds 4 N, bend the left end of the leaf spring slightly outward.
2. If the balance reads less than 2 N, remove the leaf spring and bend it the other way.

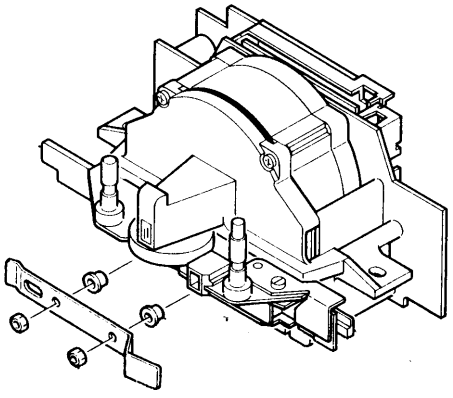


Figure 3-10 Printhead slide (adjustment)

3.5.8 Nose wheel

Check

1. Apply a spring balance to the nose wheel as illustrated.
2. Push the wheel slightly inward with the balance. The balance should now read 1—1.5 N (100—150 p).

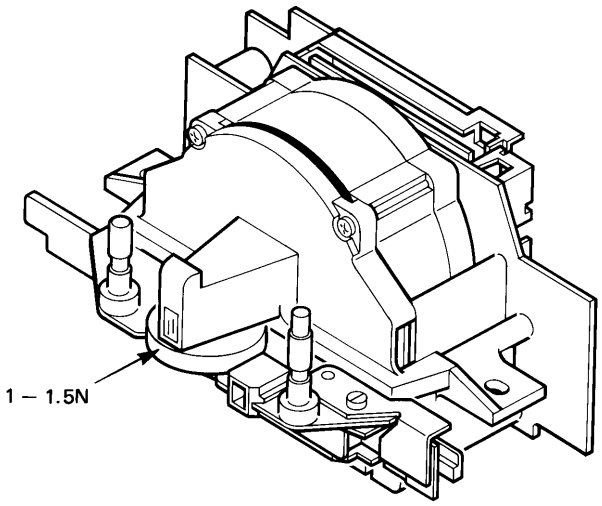


Figure 3-11 Printhead nose wheel

Adjustment

See the previous figure.

1. If the reading exceeds 1.5 N, bend the right end of the leaf spring slightly outward.
2. If the reading is less than 1 N, loosen the spring and bend it the other way.

3.5.9 PDC sensor

The printer adjusts the printhead-to-paper distance automatically during the printing process. The PDC function calibrates itself at power ON. No check or adjustment is required.

If, however, you exchange the slide or any part belonging to the PDC sensor or its support bracket, you must also check and, if necessary, adjust the minimum gap between the permanent magnet and the Hall element in the PDC sensor.

Checking the PDC sensor gap

CAUTION!

A non-metallic 0.1—0.2 mm thick feeler gauge (for example, a folded piece of 80 g standard copying paper) should be used to prevent wear in the insulation of the sensor parts. ***DO NOT USE A METALLIC GAUGE****.*

IMPORTANT !
This check, and the adjustment described below, can be carried out with the printhead mounted in the print unit.

1. Push the slide to its left (document) position.
2. Gently press the nose wheel inward as far as possible.
3. Check that the gauge can pass easily into the sensor gap (see the next figure)

Adjusting the PDC sensor gap

1. Loosen the lock screw.
2. Insert the gauge (see the description above) into the sensor gap.

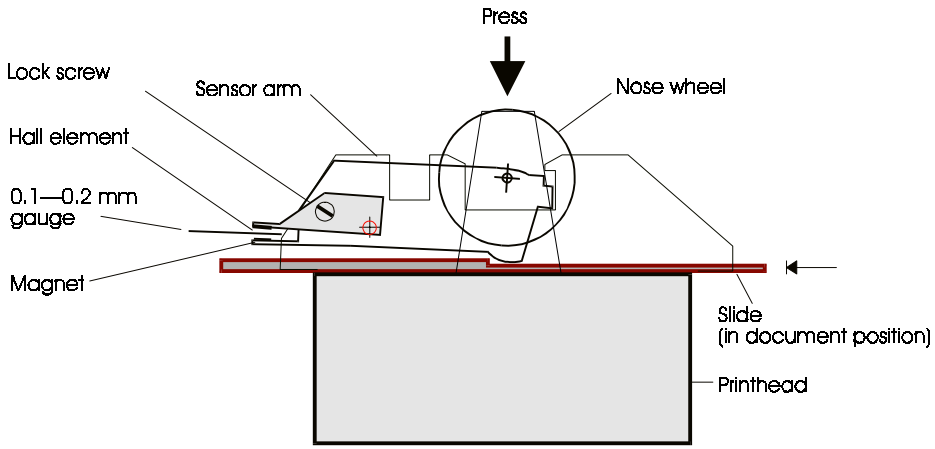


Figure 3-12 Adjusting the PDC sensor gap

3. Gently press the nose wheel inward as far as possible and hold it in this position.
4. Gently press the Hall element against the sensor magnet with the gauge in between, and tighten the lock screw.
5. Release the nose wheel.

6. Switch ON the printer and run special function 75. This produces a printout of PDC calibration values (see Section 3.5.12). The HAT value, at the bottom of the printout, should be 140—190. If not, repeat the adjustment. If you cannot obtain the correct value, exchange the printhead.

3.5.10 Carriage bearing

CAUTION!

The printhead is mounted on precision suspension leaf springs. When moving the printhead by hand, DO NOT PUSH THE PRINTHEAD. Push the carriage instead.

Check

See the figure below. Check that the pressure rolls (B, C and E) press against the guide bars, but not too hard. You should be able to prevent the rolls from rotating by holding them firmly while you push the carriage aside. If there is play, this may result in bad print quality. Too much pressure between the parts results in excess friction in the carriage movement causing a heavy load on the carriage motor, bad printing quality, etc.

Adjustment

1. Generate a printout using special function 2, for reference use later.
2. With the print unit in the horizontal position, loosen the two screws (not shown) that clamp the carriage drive belt to the carriage. Continue to loosen them until the belt does not move when you move the carriage.
3. Remove the printhead from the carriage.
4. Loosen the two screws (J) and (D) by two turns.

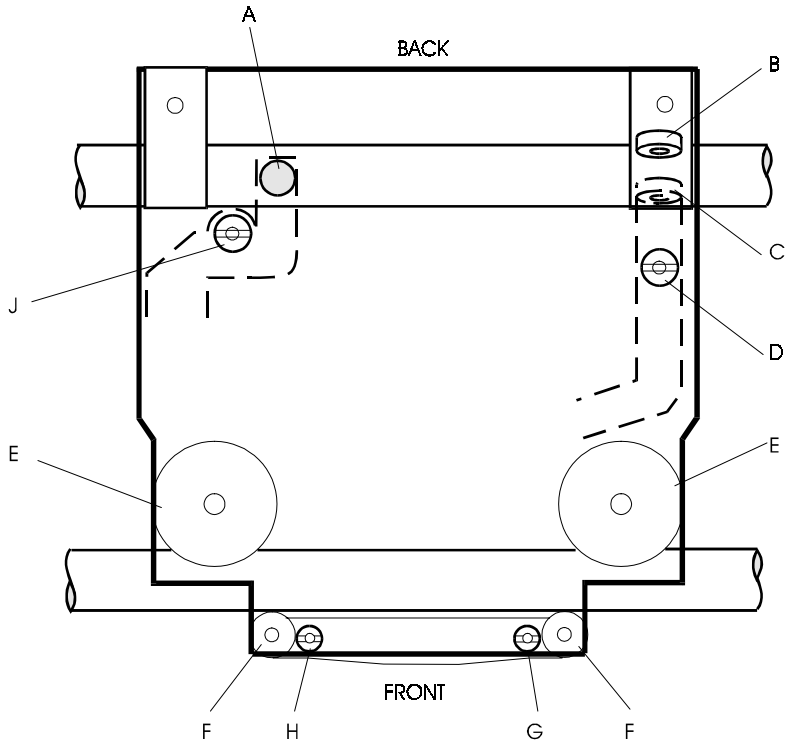


Fig 3-13 Carriage adjustment

Use the carriage adjustment tool (5131 103 24610) as follows:

1. Turn the latch handle and the eccentric disk handle as shown
2. Insert the claws of the tool under the carriage, but on top of the large rolls.

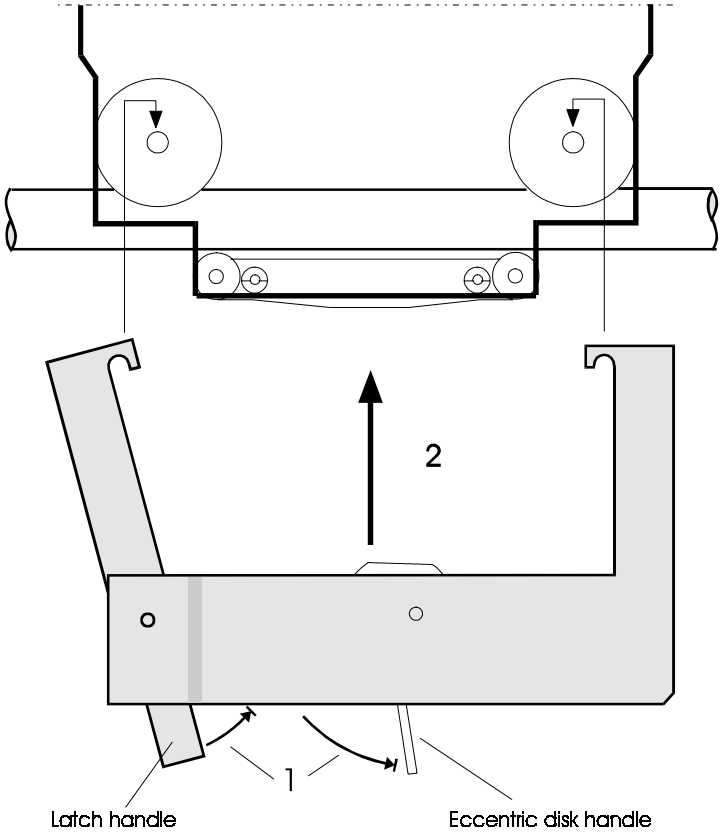


Figure 3-14 Fitting the carriage adjustment tool

3. Release the latch handle and push the eccentric disk handle back to the left while checking that the claws have gripped the roll shafts.
4. Loosen the two screws that hold the front pressure rolls assembly.
5. Gently slide the carriage back and forth a couple of times without touching the handles. The tool automatically applies the correct force between the guide shaft and the rolls.
6. Tighten the left screw slightly. It is vital that you tighten this screw first.
7. Tighten the right screw firmly.
8. Tighten the left screw firmly.
9. Remove the tool in the reverse order.

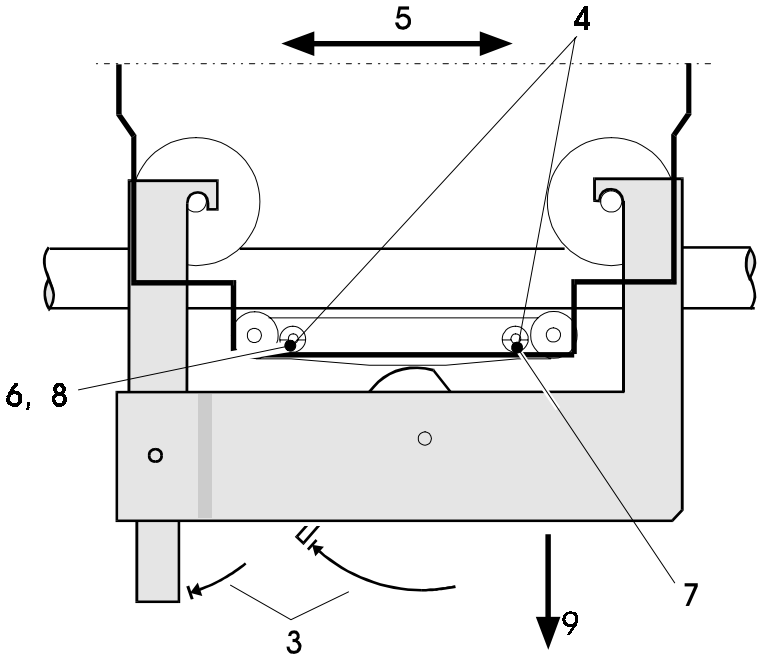


Figure 3-15 Carriage adjustments

10. There must be no play between the rear guide shaft and the two rear pressure rolls (Band C). Adjust the force with the right adjustment screw (D) until you can move the carriage by turning any of the rolls (B or C). **Do not tighten the screw any further**.

11. Apply a spring balance with range 0—1,5 N (150 p) to one of the printhead support brackets (K) and use the balance to push the carriage aside. Read **the maximum initial force** required, that is, before the carriage starts moving. Tighten the left adjustment screw (J) until the required force has increased by 0.5 N (50 p) compared with the initial reading. Check in both directions. If, for example, the initial force is 0.25 N (25 p), adjust to 0.75 N (75 p). The force must not exceed 2 N (200 p).

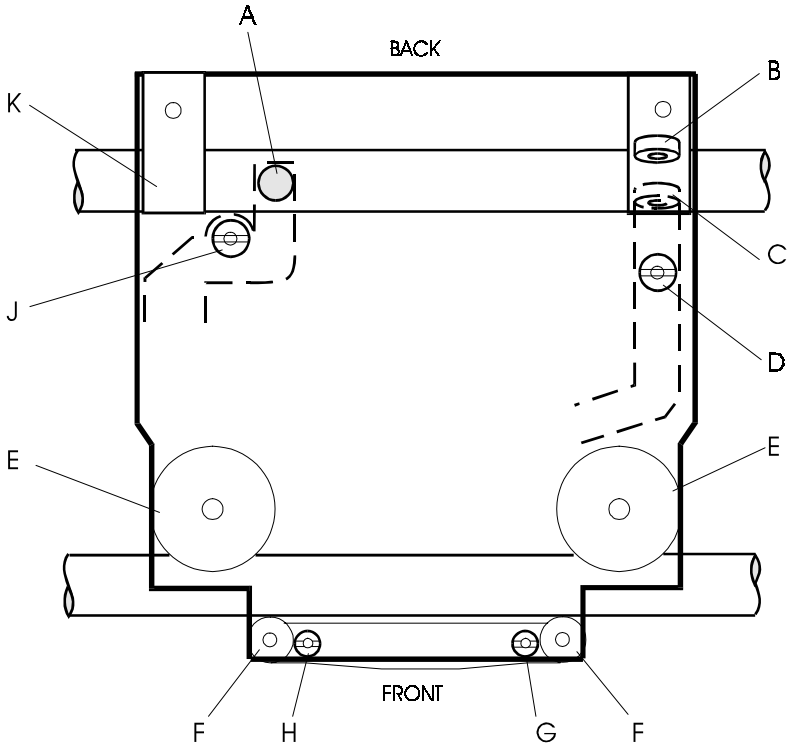


Fig 3-16 Carriage adjustment

12. Fit the carriage drive belt to the carriage.

13. Apply a spring balance with range 0—10 N (0—1000 p) to the carriage and push the carriage aside. The balance should read 0.5 ±0.1 N (500 ±100 p) in both directions. If not, repeat all the carriage adjustments.

14. Mount the printhead.

15. Fit the ink ribbon cassette and generate printouts using special function 02. Compare the printout with the one you produced before starting the carriage adjustments.

3.5.11 Ink ribbon feed

If the ink ribbon becomes loose or twisted or is subject to excessive mechanical wear, this can be caused by an incorrectly mounted or adjusted printhead or print bar.

Checking the ribbon feed

1. Install a new ink ribbon cassette.
2. Switch ON the printer and be prepared to switch it OFF when the printhead is in the mid position of the document station printbar during the power-ON calibration.
3. Switch OFF the printer.
4. Remove the front cover.
5. Remove the top cover since you need to be able to see the printhead nose from the rear of the printer.
6. Push the carriage left and right several times, but not so far aside that the position of the slide changes. Check, while moving the head, that the ink ribbon does not slacken or become twisted or folded in front of the nose. If so, check the printhead mounting as described below.

Checking the printhead mounting

1. Remove the ink ribbon cassette.
2. Press the slide to its right position.
3. Check that the printhead nose is parallel with the printbar. To check this, look through the hole in the left side plate where the printbar is fitted. Place a light source on the other side of the printhead.
4. If the nose and the printbar are not parallel, exchange the printhead.

3.5.12 Special functions

70. SETTING OF OPTO-SENSOR REFERENCE THRESHOLD LEVELS

Function 70 registers the output voltage level of each opto-sensor in its WHITE or OPEN state, that is, while no document or metal flag interrupts the light beam. The voltage levels are then multiplied by factors that give the calibrated threshold level values. These values are only to be used as a reference to observe the deterioration of the sensors. The firmware never uses these values.

The sensor output levels are also read every time the printer is switched ON. The threshold level values are calculated in the same way, but this information is stored in another location in RAM. The power ON values are used during normal operation.

The threshold values set by function 70 and the values from the latest power ON, are printed on the CONFIGURATION & CALIBRATION SUMMARY produced using function 2. By comparing the values, any sensor deterioration that has occurred since the last time function 70 was run can be detected.

The reference values, set by the factory using function 70, must not be changed unless one of the following conditions exists:

- a cold start has been performed
- the main board has been exchanged

- a mechanical part that affects a sensor function has been changed
- an opto-sensor has been exchanged.

1. Switch ON the printer.
2. Set the *mode switch* in the TEST position.
3. Push the *setting switch* to the SETTING position.
4. Check that no document is inserted in the document station.
5. Push the printhead to its extreme right position (such that the home position detection arm is pushed out), and hold it there.

CAUTION!

The printhead is mounted on precision suspension leaf springs. When moving the printhead manually, DO NOT PUSH THE PRINTHEAD. Push the carriage instead.

6. Select function 70. The threshold levels are set immediately.
7. Push the *mode switch* and *setting switch* back to the NORMAL position.

71-0. GUIDE DOCUMENT FOR HW OFFSETS, DOCUMENT STATION

This function checks the document station offsets and produces a printout showing information such as:

- current offset values
- default offset values
- patterns, lines and tables to be used when measuring the offsets and selecting adjustment values.

Instructions are given below describing how to print out the guide document in different ways. This is followed by descriptions of how to use the document to check the offset values. If necessary, use function 74 to adjust the offsets, then repeat function 71-0 to check the result.

1. Set the *mode switch* to TEST.
2. Push the *setting switch* to SETTING.
3. Select function 71-0 by pressing the *step/start switch* momentarily when the number '0' is shown. The printer now expects you to insert an A4 sheet into the document station.
4. Insert the paper against the stop pins and carefully move it to the right until it is grasped. The printout takes place (see Figure 3-23).

   If you keep the *step/start switch* pressed while you insert the paper, you will get a printout that also contains some of the information printed using functions 2 and 75. The main use of this is in workshop maintenance.
5. Push the *mode switch* and *setting switch* back to the NORMAL position.

- Checking the top sync offset

In the top right and left corners of the printed guide 18 short graduation lines are printed at different distances from the top edge. Due to the thickness of the lines, they have been placed in three adjacent stacks. Below each stack is a column of adjustment values, one for each of the lines in the stack above. Thus, the value '+9' in the first column belongs to the top line in the first stack.

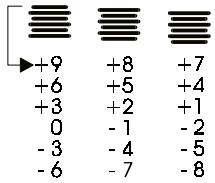


Figure 3-17 Top sync offset graduation lines

1. Check which graduation line is positioned exactly 4mm from the top edge of the document (measure from the paper edge to the centre of the line). The example below shows that the third line in the middle stack meets this condition. The corresponding correction value is +2.

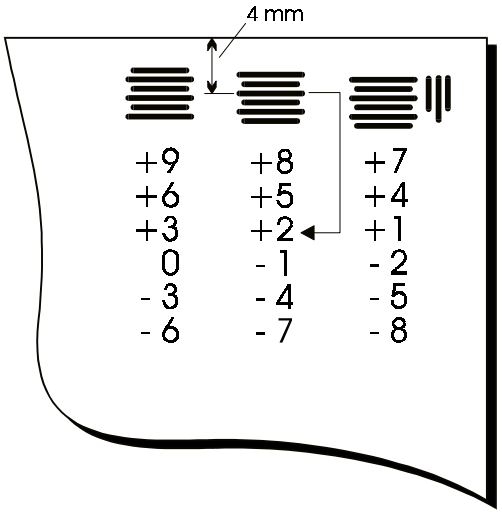


Figure 3-18 Finding the top sync offset correction value, example

2. Repeat the measurement in the top left corner. If the two correction values differ by more than two units, you must run function 71-0 again, making sure that the paper becomes correctly aligned.
3. Run function 74-0 to set the new offset value.

- Checking the bottom sync offset

Checking the bottom sync offset is similar to checking the top sync offset. Measure 8.0mm from the paper edge to the centre of the graduation line.

The example below shows that the third line in the middle stack meets the condition. The offset correction value is '+2'.

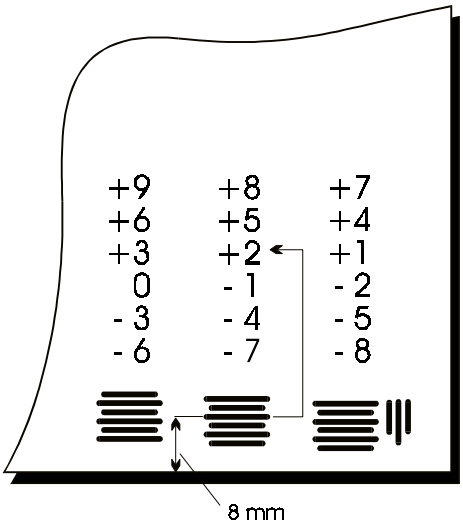


Figure 3-19 Finding the bottom sync offset correction value, example

Run function 74-1 to set the new offset value.

- Lateral print position

The right and left corners of the guide document are marked as shown below.These marks are used during the manufacturing phase. The lateral print position cannot be adjusted in the field.

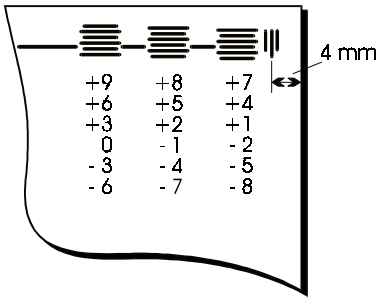


Figure 3-20 Lateral position mark

- PDF offset correction

A PDF mark is printed in the left upper corner of the guide document. The center line of this mark should be positioned 4.0mm from the paper edge. The distance between the lines in the mark is 0.5mm.

Measure the necessary correction as a number of 0.5mm steps.

Adjust the offset using function 74-6.

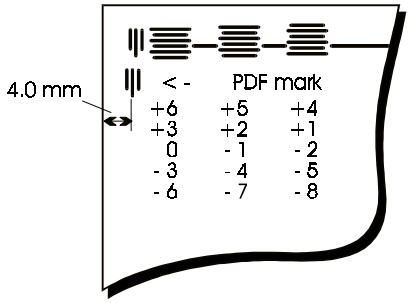


Figure 3-21 Measuring the PDF offset correction

- Checking the paper feed

Check that the distance between the PAPER FEED REFERENCE LINE and the PAPER FEED TOP LINE is 253—255 mm. Measure both the left and the right side. The difference must not exceed 0.5 mm.

- Checking the print needles

The guide document contains a line on which each needle (1—18) has produced a number of dots.

- Checking the paper feed motor drive belt

The needle test line described above ends with a printout used to check the tension of paper feed motor drive belt.

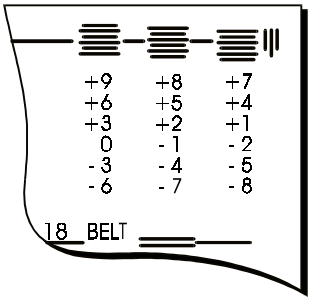


Figure 3-22 Checking the paper feed motor drive belt

If the tension is correct, the rightmost single line should be centered in relation to the double line.

- Bi-directional printing test

The guide document contains eight lines of the letter 'E'. The print direction is changed for each line shift. The four upper lines are printed with high quality whereas the remaining lines are printed with draft quality.

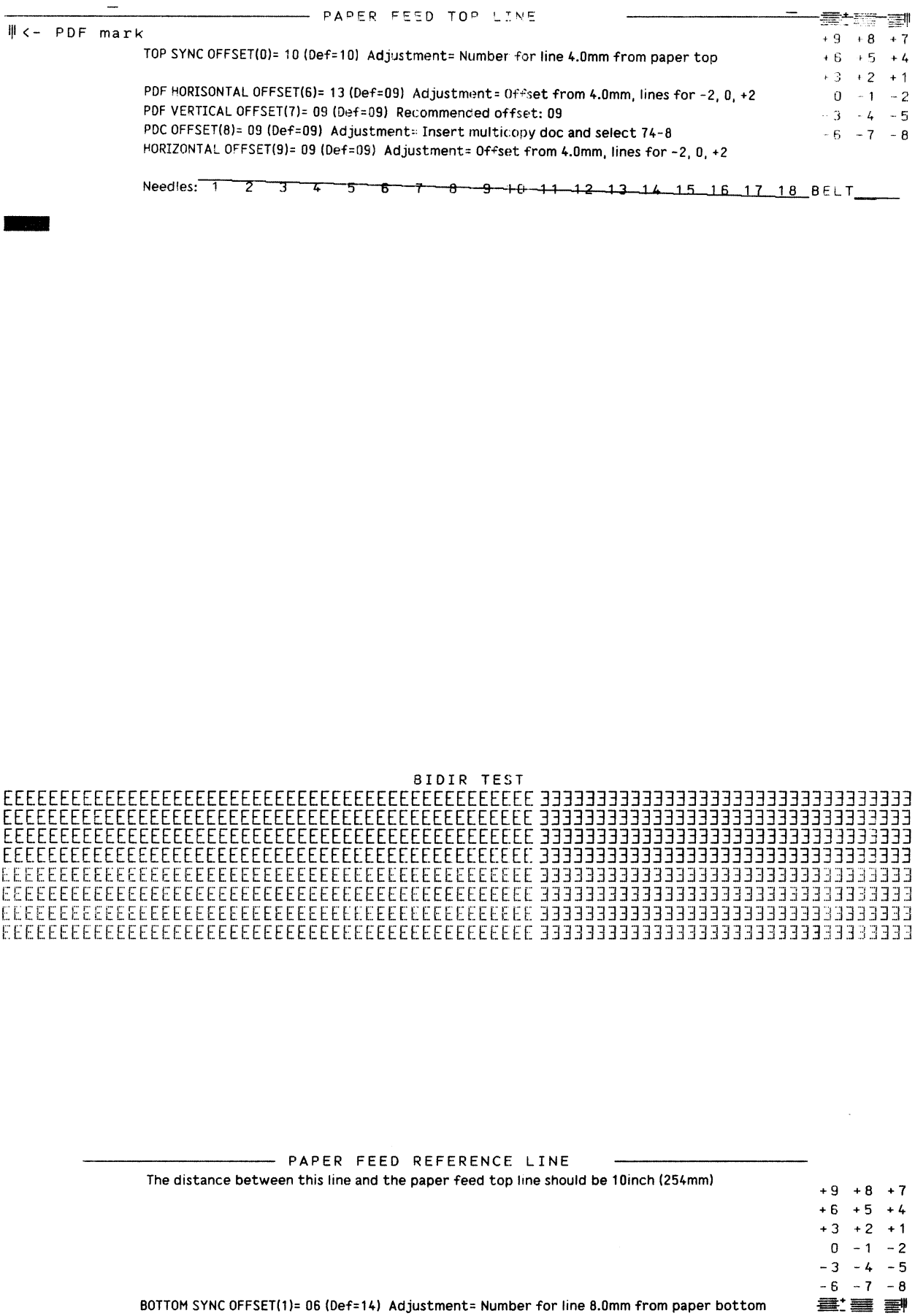


Figure 3-23 Function 71-0, printout of the guide for hardware offsets

73. DISPLAYING INDIVIDUAL SENSOR VALUES

This function can be used to check the condition of sensors and to adjust opto sensor reflectors and the PDC function.

1. Set the *mode switch* in the TEST position.
2. Select function 2. The printer produces the configuration and calibration summary.
3. Check this printout to find the number of the sensor you wish to examine.
4. Push the *setting switch* to the SETTING position and step to function 73. A ring counter starts incrementing 0, 1, 2, . . . 9.
5. Select the sensor of interest by pressing the *step switch* when the required sensor number appears.
6. The most significant digit and the two least significant digits of the sensor value alternate on the display. The value can be compared with the value printed out using function 2. The value on the diagnostic panel is the absolute value. The value produced by special function 2 is the threshold value.

- Carriage home position, stop pin/grasp and print unit rotation sensors

The values must be higher than 99. If they are not, replace the sensor board.

IMPORTANT !
Always check the sensor values after exchanging the main board.

- Document sensors and reflectors

The maximum values must exceed 68 (= 44 in test 2). If they do not, exchange the sensor board or the document sensors.

- PDF sensor

Check the section *Calibrated Threshold Values for Sensors* in the document printed using function 2.

The power-ON value should be in the range 50—256. If it is not, exchange the printhead.

- PDC sensor

1. Switch ON the printer and run function 75. If a PDC error codes is detected, exchange the printhead.
2. Check that the HAB value exceeds the TRP value by more than 55 units and that the HAT value is in the range 120—240. If both conditions are not met, exchange the printhead.
3. Check that HRL<7, HOC>15 and TRP>15 units. If not, exchange the printhead.

74. ADJUSTING THE HW OFFSETS

This function is used to adjust the hardware offsets for the document station. First run function 71-0 to obtain a printout of the desired hardware offsets.

Function 74 has the following sub-levels.

0 =Top sync offset

1 = Bottom sync offset

6 = Inner stop pins offset

1. Set the *mode switch* in the TEST position.
2. Push the *setting switch* to the SETTING position.
3. Select and run function 74. Sub levels 0—6 are displayed cyclically.
4. Press the *step/start switch* to select the offset you wish to adjust. The display shows the present offset value while the switch is kept depressed. This value is the same as the value in the printout produced using function 71-0.
5. When you release the *step/start switch*, the offset value changes one step at a time alternating upward 10, 11, 12 . . . and downward 8, 7, 6.
6. Select the offset value (= present offset value ± correction value) by pressing the *step/start switch* again when the required value is displayed.

   PDF offset adjustment: The PDF mark printed using function 71-0 can only be moved in 0.5mm steps. The offset value, however, increments in 0.25mm steps, so you may need to change the offset two steps to move the PDF mark in the printout.
7. When you release the switch, the display again starts cycling through sub levels 0—6 and you can select another offset to be adjusted.
8. Push the *mode switch* and *setting switch* back to NORMAL.
9. Run function 71-0 to see the result of your adjustment.

75. PRINTOUT OF PDC CALIBRATION VALUES

Running this function produces a printout (see the figure below) primarily intended for production testing. The information can also be used for workshop-level maintenance.

The various elements of the printout are described below:

- HRL sensor

This information indicates whether or not the PDC mechanism has the new HRL sensor fitted.

- MPC reset logic

This is valid only for special printer versions.

```
ALL PURPOSE PRINTER                Serial no......    Date ..........

HRL sensor        YES
DMA type            8237B
MPC reset Logic   NO
MPC count = 00


Test 75: Printout of PDC calibration values (decimal values)


PLaten calibration values, right to Left, unit 50um, option stn(s)

000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000


PLaten calibration values, right to Left, unit 50um, document stn

127 127 127 127 126 126 126 126 126 126 126 126 126 126 126 126
126 126 126 125 125 125 125 125 125 125 125 125 125 125 125 125
124 124 124 124 124 124 124 124 124 124 124 124 124 124 124 124
124 124 124 124 124 124 124 124 124 124 124 124 124 124 124 124


Reference table voltages (index 0-31), forward, stepwise, unit 20mV, option stn(s)

000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000
000 000 000 000 000 000 000 000 000 000 000 000 000 000 000 000


Reference table voltages (index 0-31), forward, stepwise, unit 20mV, document stn

084 087 091 095 099 103 107 112 117 122 127 132 137 142 148 154
160 166 172 179 186 222 255 255 255 255 255 255 255 255 255 255


05M MID OFF PRE REG DUMMY    Index to reference table, option stn(s)
000 000 000 000 000 000

05M MID OFF PRE REG DUMMY    Index to reference table, document stn
014 009 001 010 018 000


HRL TRP HAT HRM HOC HAB   PDC values, unit 20mV, option stn(s)
000 000 000 000 073 000

HRL TRP HAT HRM HOC HAB   PDC values, unit 20mV, document stn
000 073 182 072 072 148
```

Figure 3-24 Printout from special function 75

- Platen calibration values, optional station(s)

This table describes the profile of the upper print bar.

During the start up procedure at power-ON, the carriage moves along the print bar using the PDC sensor to record any deviations from a correctly manufactured and mounted print bar (see Section 2.1.6).

The table shows the values stored in RAM during the last power-ON sequence. If the table contains only '000' this means that no optional print station is installed.

The value in the top left corner corresponds to the right end of the print bar and the bottom right value corresponds to the left end. Max. and min. values are underlined.

The difference between the max. and min. values must not exceed 15 units (= 750µm).

- Platen calibration values, document station

Same as above, except:

The difference between the max. and min. values must not exceed 8 units (= 750µm)

The max. and min. values must not deviate by more than ±6 units from the mean value.

- Reference voltages

The tables show the output voltage from the PDC sensor as the printhead is moved from the TRP (head transport) position to the HAT position.

- HA values

A printout of the option and document head attach values (index values) is also included. The index value points to a position in the corresponding reference voltage table.

- PDC values

These two tables show the PDC sensor output values for specific printhead positions. The values are stored in RAM during the start of special function 75.

If the printer has no upper print bar installed, the TRP value will be 000 and the HAB value will be 255.

The values for the upper print bar are recorded at the left side of the print bar. The values for the document station are recorded at the right side of the print bar.

1. Set the *mode switch* in the TEST position.
2. Push the *setting switch* to the SETTING position.
3. Select function 75.
4. Insert an A4 sheet of paper in the document station.
5. Push the *mode switch* and *setting switch* back to NORMAL. If you do this immediately after the printout has started, only one page is printed. If the *mode switch* is in the TEST position when the first page is printed, a second page is printed if you insert another sheet of A4 paper. The contents of the second page are useful only for developers during a debug phase.

76. RAM RESET

Run this function only if you suspect that a fatal error has occurred, and that the error may have been caused by corrupted RAM values.

The function resets the RAM cells holding some of the parameters described earlier in this section. Function 76 also halts the CPU.

1. Set the *mode switch* in the TEST position.
2. Push the *setting switch* to the SETTING position.
3. Select function 76. The printer is powered down automatically.
4. Push the *mode switch* and *setting switch* back to NORMAL.
5. Switch ON the printer again. Some parameter values have now been replaced by default values stored in PROM.
6. Check the configuration and, if necessary, change it by running the setup functions.

77. SENSOR TOGGLING

This test can be used to check the operation of all sensors.

1. Set the *mode switch* in the TEST position.
2. Push the *setting switch* to the SETTING position.
3. Select and run function 77. The display toggles between "1" and "0" when the sensor status changes.
4. Push the *mode switch* and *setting switch* back to NORMAL.

3.5.13 MSF drive belts

Check

Check for wear and excessive slackness.

Adjust

Short drive belt

Adjust by repositioning the motor.

Long drive belt

Adjust by loosening the adjustment screw slightly (see Figure 2-36) and sliding the pulley support bracket to the left or right.

IMPORTANT !
Do not stretch the drive belts too much. Better too loose than too stretched. Check that the belt does not generate noise when you move the carriage. If so, slacken the belt.

3.5.14 MSF tests

If the printer has a set-up panel instead of the full diagnostic panel, you must disconnect the cable from the set-up panel and connect the cable to a diagnostic panel (part No. 5131 195 37000).

For the latest information about the tests available, run special function 2.

Read with document release (special function 40)

Use a passbook with information recorded on a magnetic stripe in accordance with DIN 32744 and ISO 8484 standards.

1. Set the *mode switch* in the TEST position.
2. Select function 40.
3. Insert a blank piece of paper in the document station. Insert the passbook. The book is fed out when reading is complete and the result is printed on the paper in the document station.
4. The test is repeated until you set the *mode switch* to NORMAL.

Repeated reading (special function 41)

1. Set the *mode switch* in the TEST position.
2. Select function 41.
3. Insert the passbook. This function is similar to function 40.
4. To exit the test, set the *mode switch* to NORMAL.

Write and read with document release (special function 42)

1. Set the *mode switch* in the TEST position.
2. Select function 42.
3. Insert the passbook. The printer writes test data on the stripe and then reads it. The written and read strings are compared and the passbook is released. The string written comprises the following 45 characters, in accordance with DIN 32744 standards:

   123456789012345678901234567890123456789012345

4. Insert a blank document to obtain a printout of the character string read, together with status information resulting from the comparison. You can repeat the insertion of a blank piece of paper for successive write/read sequences.
5. To interrupt and exit from the test, set the *mode switch* to NORMAL.

Repeated write and read (special function 43)

This is similar to function 42, but the document is not released after each write/read sequence. The passbook is released, and the result printed on an inserted blank document, only when an error occurs.

Repeated read without document release (special function 44)

This is similar to function 42, but with no result printout in the event of errors. Statistics information is printed out only after a completed test.

3.6 REMOVAL AND REPLACEMENT

This section describes only the activities that require special attention.

3.6.1 Printhead

Removal

1. Loosen the flat cable at the rear of the printhead. The cable holder is snapped in and covers the printhead cable. The snapped-in cable assembly also contains wires for the PDC motor that need not be disconnected.
2. Disconnect the capacitor board and the HRL sensor from the printhead board.
3. Remove the two screws holding the printhead in place and remove it.

Replacement

1. Mount the printhead in the reverse order. No adjustment is necessary.
2. After replacing the printhead, check the print quality by running special function 1.

3.6.2 PDF sensor

Removal

1. Remove the printhead from the carriage.
2. Observe how the PDF sensor cable is routed and fixed on the printhead.
3. Loosen the cable and pull out the sensor.

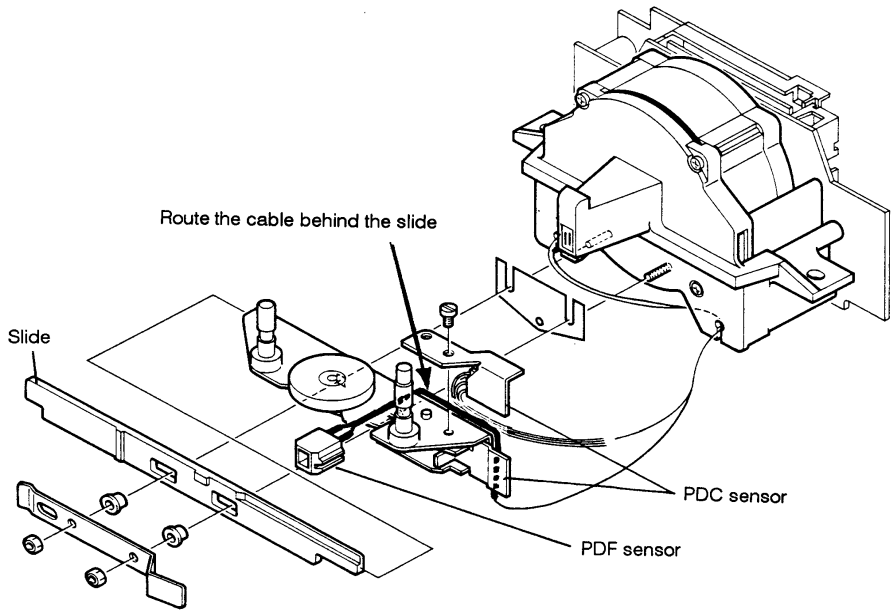


Figure 3-25 Removing the PDF sensor (the sensor can be removed without dismantling the sensor mechanism as shown in this figure)

Replacement

1. Mount the new sensor by reversing the procedure described above for removal. Route the cable as shown in the figure above.
2. Mount the printhead on the carriage.
3. Switch ON the printer and run special function 2 to print out the configuration and calibration summary. The calibrated threshold value for the PDF sensor, at power ON, should be 50—256.

3.6.3 PDC sensor

Removal

See Figure 3-25.

1. Remove the printhead from the carriage.
2. Observe the route of the sensor cable and disconnect it from the printhead board.
3. Remove the lock screw holding the adjustable sensor bracket to the ink ribbon guide bridge. You cannot replace only the sensor element because it is cemented to the bracket.

Replacement

See Figure 3-25.

1. Mount the sensor by reversing the procedure described above for removal.
2. Mount the printhead on the carriage.
3. Adjust the PDC sensor (see Section 3.5.9).

3.6.4 PDC motor

Removal

1. Turn the rotary print unit to the horizontal print position.

IMPORTANT !
Observe the routing of the cables.

2. Disconnect the PDC motor cable from the connector on the motor.
3. Disengage the tie-rod, together with the cam follower, by removing the circlip at the top of the motor support plate.
4. Remove the two screws (see arrows) connecting the motor support plate to the carriage and gently remove the parts.

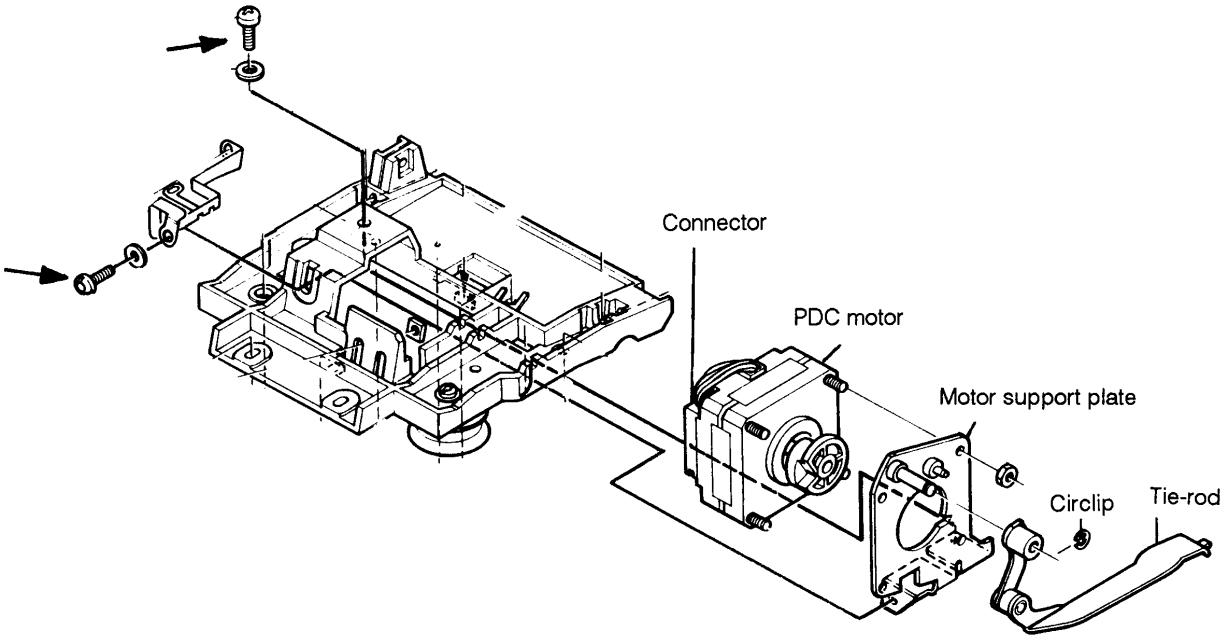


Figure 3-26 Removing the PDC motor (this figure is intended for parts identification only)

Replacement

Mount the parts by reversing the procedure described above for removal. Route the cables in their previous positions.

3.6.5 Main board

Removal

1. Disconnect the power and data cables from the printer.
2. At the back of the printer, loosen the two lower screws.
3. Remove the document guide.
4. Remove the upper front panel.
5. Remove the printer cover.
6. Remove the lower front panel by pulling it straight out (see figure below).

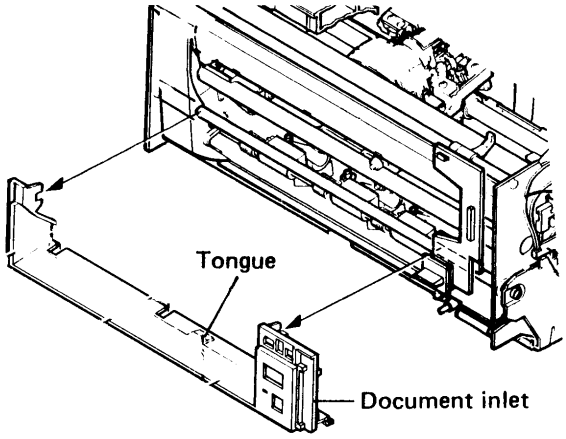


Figure 3-27 Removing the document inlet

7. Turn the printer upside down.
8. Disconnect the flat cable connected to the sensing board.
9. Remove the two screws at the bottom of the bottom plate.

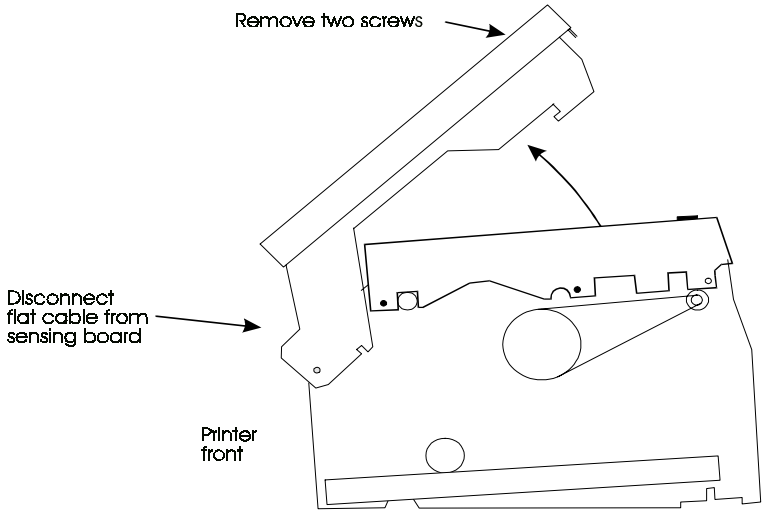


Figure 3-28 Preparing to remove the main board

10. Disconnect the sensor board and data cables from the main board.
11. Swing the bottom plate down in front of the printer (the two screws serve as hinges).
12. For the LB15 only, disconnect the two MSF cables, remove the four front screws that attach the MSF mechanics assembly to the printer body, and raise the assembly almost to the vertical position (see the figure below).

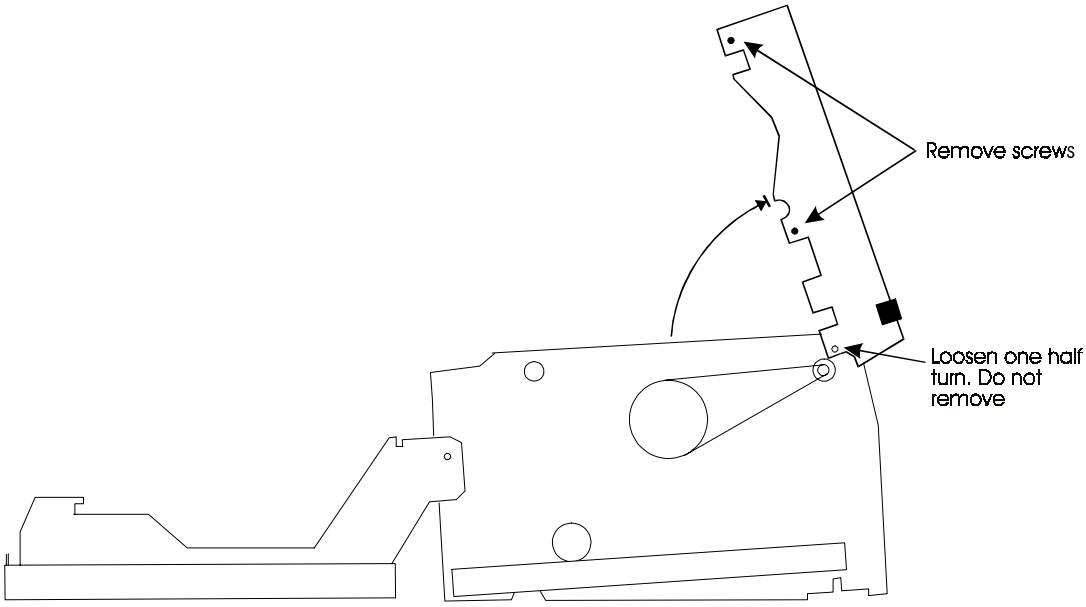


Figure 3-29 Removing the main board

13. Disconnect all remaining cables from the main board.
14. Loosen the four screws and washers.
15. Dismantling the remaining parts is a straightforward operation and requires no further instructions.

Replacement

To install a new main board:

1. Mount the main board.
2. Run function 70 to calibrate the opto-sensors.
3. Run function 71 to check the hardware offsets.
4. Run function 2 to print out the Configuration & Calibration Summary.
5. Configure the printer using the special functions.

3.6.6 MSF logic board

Removal

1. Follow the instructions given for the removal of the main board (see Section 3.6.5), steps 1-12.
2. Remove the MSF logic board by loosening the two screws that fasten it to the main board. The board is held in position by two connectors P4 and P5. The right side of the MSF board has a support that is not fastened to the main board.

Assembly

1. Position the two screw holes against the spacers, ensuring that the connectors are correctly positioned.
2. Press the board down firmly on to the main board.
3. Reassemble the printer by following steps 12 through to 1, i.e. in reverse order, of the procedure given for the assembly of the main board in Section 3.6.5.

3.6.7 Rotary print unit

The following parts can be exchanged without removing the rotary print unit from the printer:

- Printhead
- Carriage motor
- Ink ribbon gear box
- Capacitor board
- PDC motor

If, however, you prefer to remove the entire print unit, do as follows.

Removal

1. Follow the instructions given for the removal of the printer main board (see Section 3.6.5), up to and including step 11.
2. Disconnect the flat cable assembly from the main board.
3. Remove the metal cable guide plate by pulling it straight out, and push the flat cable out through the opening at the front.

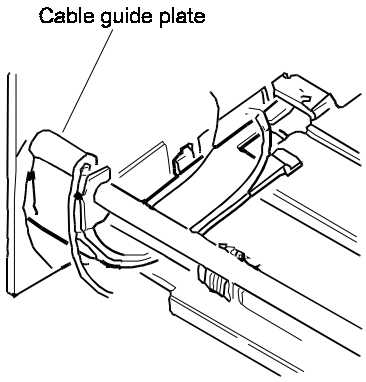


Figure 3-30 Removing the flat cable assembly (this figure is intended for parts identification only)

4. Swing the bottom plate back and turn the printer to its normal position.
5. Turn the print unit the to the ink ribbon installation/removal position. Remove the setup/diagnostic panel (g) and the power supply unit (f).
6. Unhook the spring (h) attached to the left side plate.
7. Pull out and turn the bracket (e).
8. Remove the arm (d).
9. Remove the detection plate (b) fitted through the right ribbon cassette support from the inside.
10. Remove the stop pins (a), one on each print unit side plate.

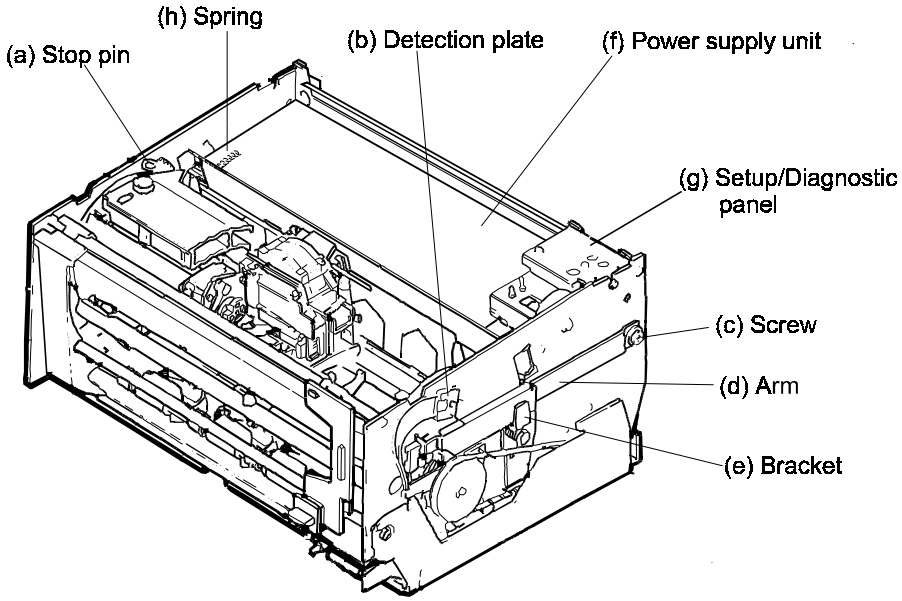


Figure 3-31 Preparing to remove the print unit

11. Remove the pivot bearing on the right side (12mm hexagonal head).

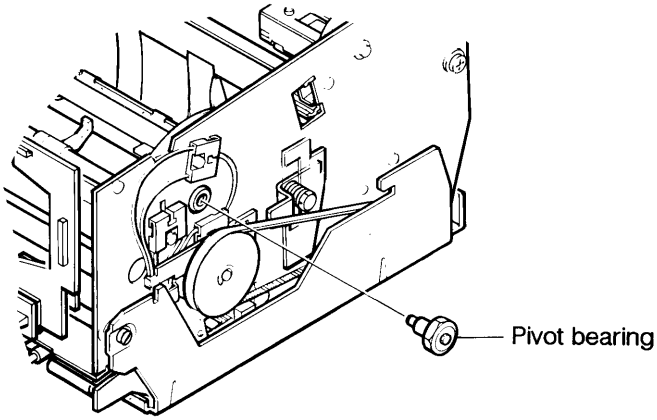


Figure 3-32 Removing the right side pivot bearing

12. Remove the bearing on the left side (screw, hub, disk and O-ring).

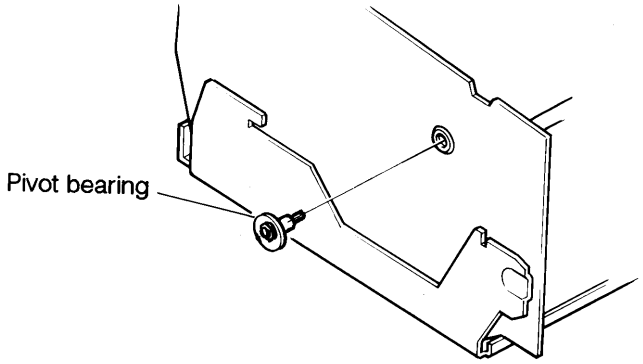


Figure 3-33 Removing the left side pivot bearing

13. Lif the print unit up and remove it.

Replacement

No adjustments are required.

1. Mount the parts by reversing the procedure described above for removal.
2. Check that the adjustable rear end of arm (d) in Figure 3-31 is in its uppermost position.
3. Check the position of the inner tongue of the cable guide plate (see Figure 3-30).
4. After completing replacement, check the printout quality by running special function 1.

3.6.8 Carriage motor

Removal

1. Turn the print unit to the vertical position.
2. Turn bracket (e) away from arm (d).
3. Remove screw (c).
4. Remove arm (d).

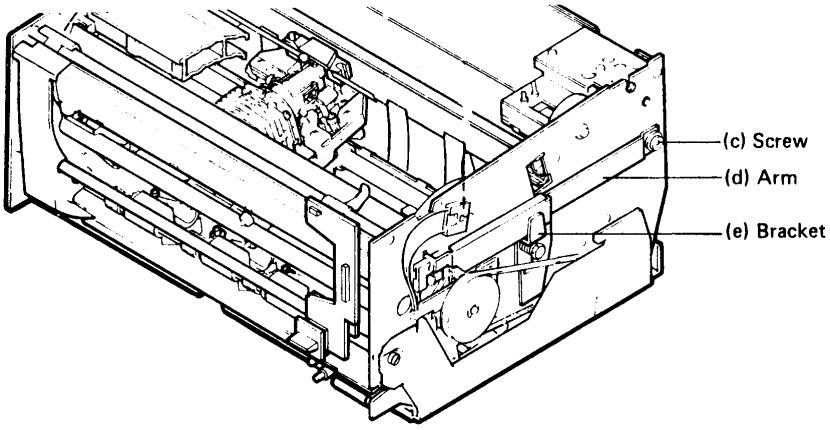


Figure 3-34a Preparing to remove the carriage motor

5. Remove three screws accessible through holes in the right printer side plate (see below).

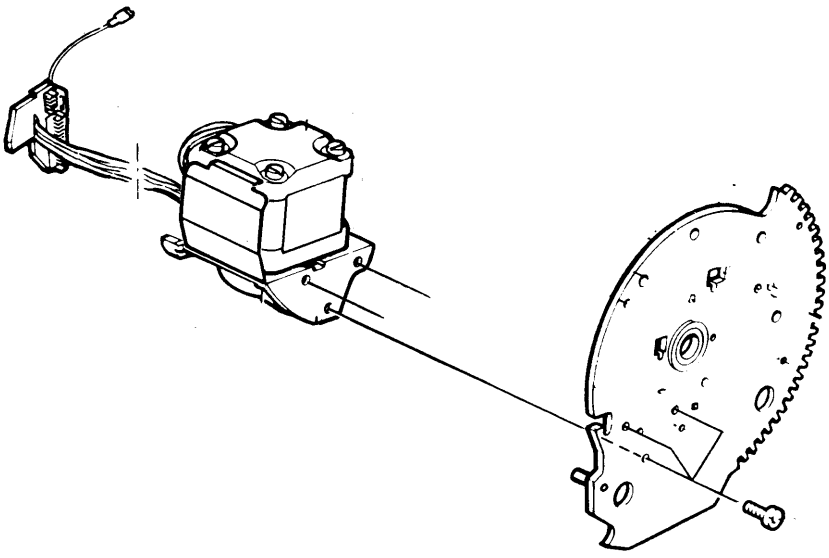


Figure 3-34b Preparing to remove the carriage motor

6. Turn the print unit to the horizontal position.

7. Disengage the top edge of the wide black plastic flat cable guide by pulling it straight out.
8. Disengage the bottom edge of the wide plastic cable guide by pulling it up slightly.
9. Gently bend out the protective plate to the front of the carriage motor and pull out the cables hidden behind the plate.
10. Remove the metal cable clamping plate at the back of the wide plastic cable guide. Plastic snap locks hold the plate.
11. Disengage the ground lead, originating from the joint board, from the left side plate.
12. Loosen the joint board from the wide cable guide by pulling it out.

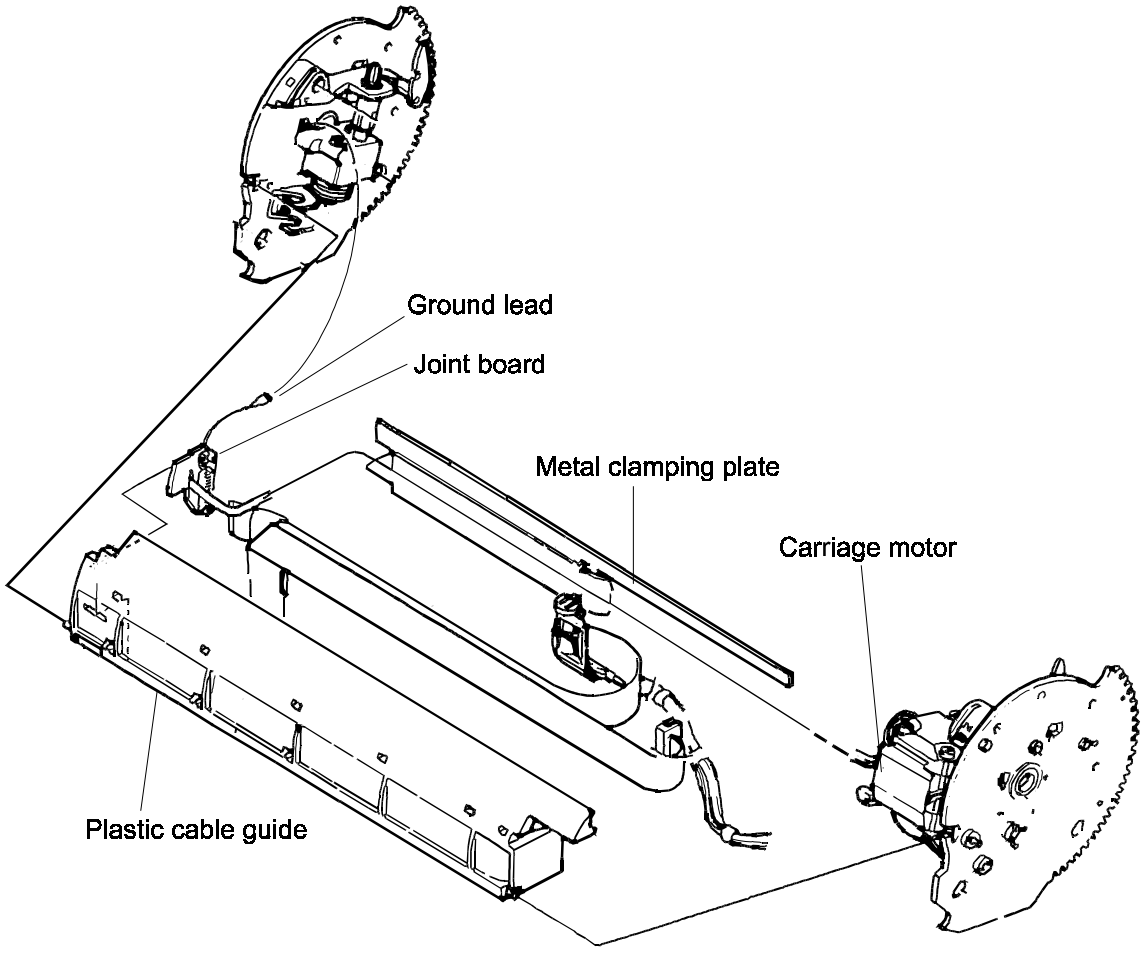


Figure 3-35 Removing the carriage motor (this figure is intended for parts identification only)

13. Pull the carriage motor to the left and remove it.
14. Remove the motor from its support (three nuts).

Replacement

1. Mount the motor by reversing the procedure described above for removal. Do not forget to connect the ground lead to the side plate and that the rear end of arm (d) in Figure 3-34a should be in its uppermost position.
2. Adjust the carriage drive belt tension as described in Section 3.5.6 .
3. Check the printout quality by running special function 1.

3.6.9 Ink ribbon gear box

Removal

1. Remove the ink ribbon drive belt (O-ring).
2. Remove the two screws holding the gear box. The screws are accessible through the left side plate when the print unit is in the vertical position.

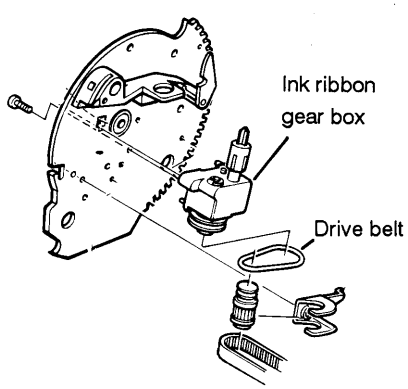


Figure 36 Removing the ink ribbon gear box. This figure is intended for parts identification only. No other parts need to be removed or loosened

Replacement

1. Fit the gear box by reversing the procedure described above for removal.
2. Mount the ink ribbon drive belt.

3.6.10 Capacitor board

Removal

1. Turn the print unit to the horizontal position.
2. Move the printhead to the HAB position by turning the PDC cam wheel.
3. Disconnect the capacitor board cable from the print head board.
4. Turn the print unit to the vertical position.
5. Remove the screw holding the capacitor board to the bracket on the under side of the carriage, and remove the board.

Replacement

Fit the capacitor board by reversing the procedure described above for removal.

IMPORTANT !
Remember to move the printhead back before you turn the print unit again.

3.6.11 Document sensing board

Removal

1. Remove the cover and the document guide.
2. Remove the document inlet by pulling it straight out.

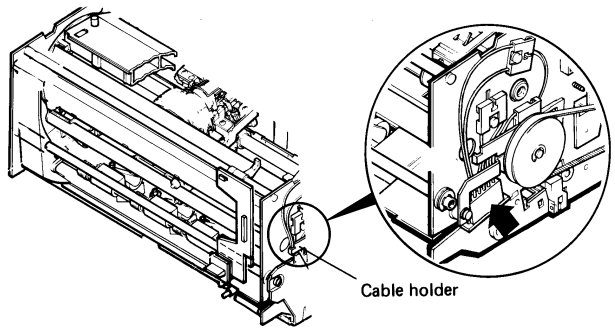


Figure 3-37a Removing the document sensing board

3. Tilt the printer up on its left side.
4. Remove the two rear screws in the bottom plate.
5. Slightly loosen the two screws joining the bottom plate to the right and left side plates.
6. Swing the bottom plate out.
7. Disconnect the optical fiber cables connector from the document sensing board (see arrow).
8. Disconnect all other cables from the board.

9. Carefully remove the two screws that fix the sensing board assembly to the plastic holder whilst, at the same time, taking care of the compression spring and the washer shown in the figure below. The wire spring holds these parts in position on a rod that is part of the front pressure roll shaft assembly (the wire spring should be transferred to the new sensing board).
10. Remove the sensing board.

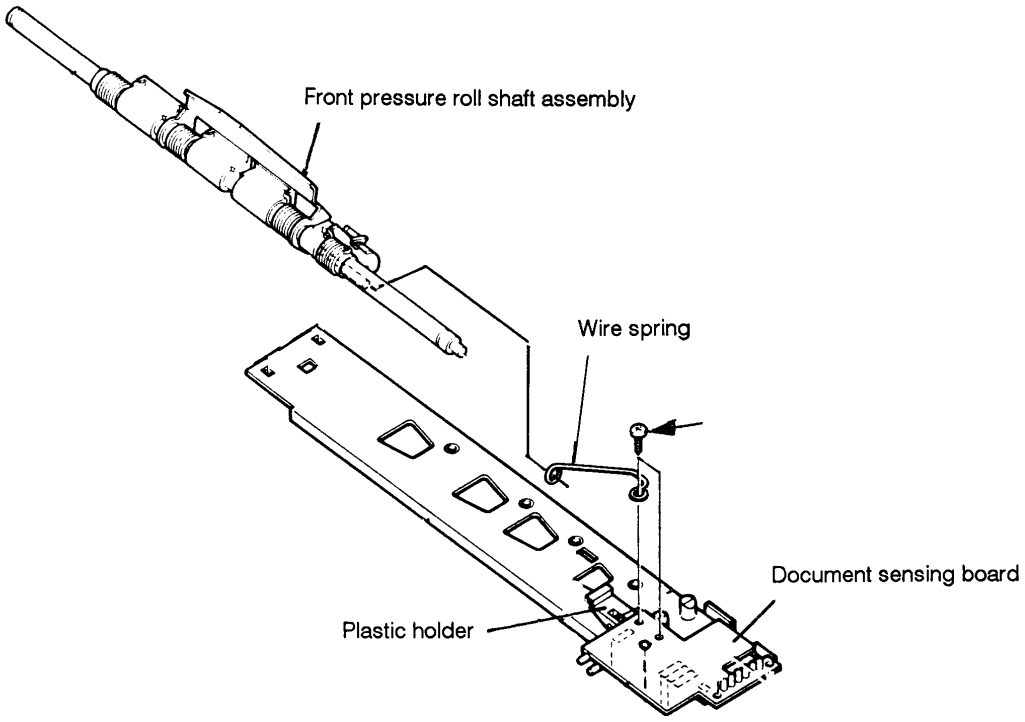


Figure 3-37b Removing the document sensing board (this figure is only intended for parts identification)

Replacement

1. Mount the board by reversing the procedure described above for removal. Do not forget to transfer the wire spring to the new document sensing board.
2. When you fit the document inlet, check that its plastic tongue enters the corresponding hole in the bottom plate.
3. Run special function 70 to calibrate the opto-sensor threshold values.
4. Run special function 2 to check the sensor values.
5. Run special function 73 for verification.

3.6.12 Document sensors

Removing a document sensor

1. Remove the cover and the document guide.
2. Remove the document inlet by pulling it straight out (snap fittings).
3. Tilt the printer on its left side.
4. Remove the two rear screws in the bottom plate.
5. Slightly loosen the two screws joining the bottom plate to the right and left side plates.
6. Swing the bottom plate out.

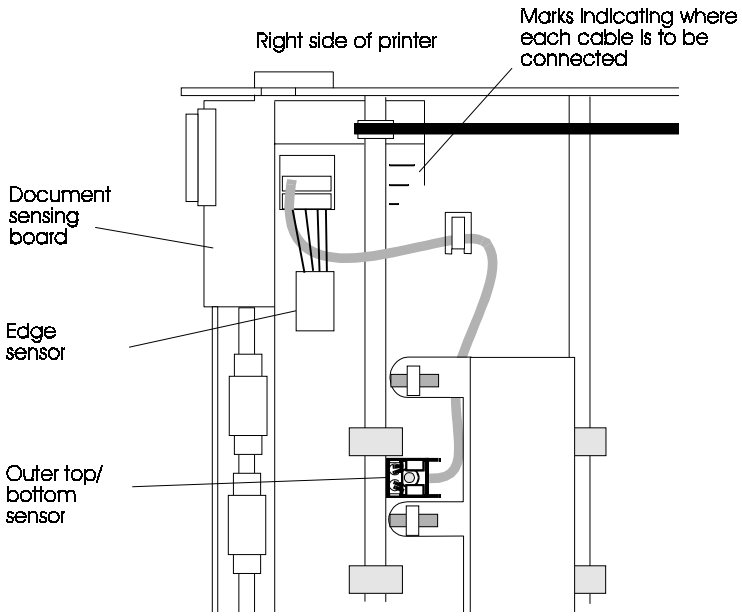


Figure 3-38 Position of the document sensors. The figure shows the printer on its left side with the bottom plate swung out

Now follow the relevant description given below for the type of sensor that you want to remove.

Removing an outer bottom sensor

7. The sensor is held by two plastic hooks that snap onto a metal stud. Use a small screw driver or similar to loosen the faulty sensor.

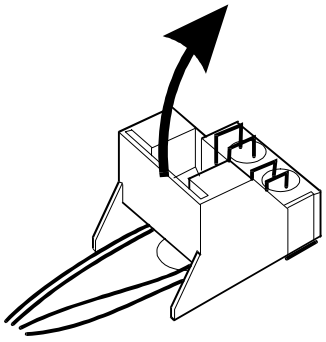


Figure 3-39 Removing an outer bottom sensor

8. Disconnect the sensor cable from the sensing board and remove the sensor.

IMPORTANT !
The sensor's plastic hooks are damaged when you remove the sensor. Always fit a new sensor.

Removing a document right edge sensor

7. The sensor is hooked onto the sensing board plastic holder.
8. Disconnect the sensor cable from the sensing board.
9. Loosen the outer feed rolls sensor.
10. Loosen the opto-sensor.

Fitting a document sensor

Follow the general description given for removing a document sensor, i.e. up to and including step 6, then follow the appropriate description given below for the type of sensor that you want to fie.

Fitting an outer bottom sensor

7. Check that the sensor lens is fully pressed into the sensor housing, or the lens may obstruct the document feed.
8. Prepare the sensor by positioning its leads behind the edge of each hook. This ensures that the stud does not damage the lead insulation.

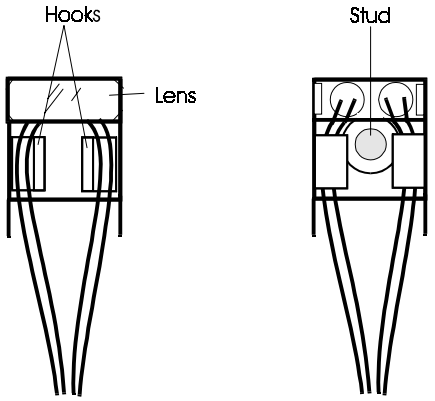


Figure 3-40 Preparing an outer bottom sensor

9. Fit the sensor as shown below. This prevents the plastic hooks on the new sensor from becoming damaged.

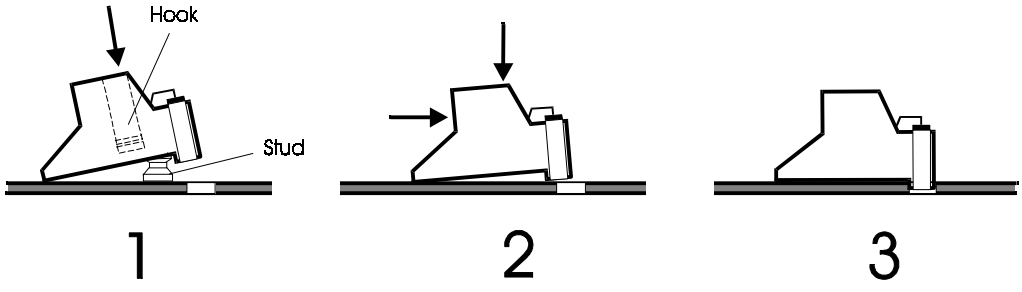


Figure 3-41 Fitting an outer bottom sensor

10. Connect the sensor cable to the document sensing board. The plate above the front pressure roll shaft has three scores of different lengths (see Figure 3-38). These scores indicate to which connector each cable should be connected. The length of the scores correspond to the lengths of the cables. Thus, the longest cable should be connected to the connector opposite the longest score and so on.
11. Swing back the bottom plate and secure it with the two rear screws.
12. Lower the printer.
13. Adjust the sensors as described in the next section.

Fitting a right edge sensor

8. Hook the new sensor onto the sensing board. Check that the lens is positioned correctly in the hole of the metal plate.
9. Connect the cable to the sensing board.

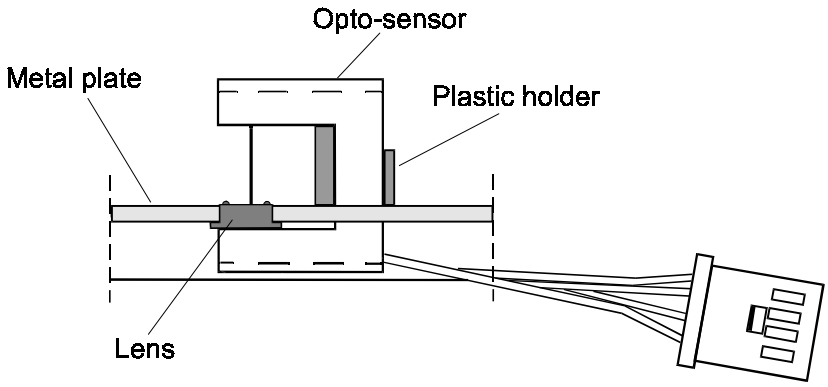


Figure 3-42 Fitting a right edge sensor

Checks and adjustments

1. Using a diagnostic panel, run special function 73 and select the desired sensor by pressing the *step switch* when the sensor number appears (see the printout from special function 2 for sensor numbers).
2. Read the displayed value. Regarding the outer top/bottom sensor, check the value both when the grasp rolls are fully lifted and when they are lowered to the feed position. The value for all sensors should exceed 68. If they do not, exchange the reflector above the sensor as follows:
   2.1. Remove the reflector by turning it with the reflector adjustment tool (Part No: 5131 102 16260). The reflector is fixed with cement, and is loosened by this operation.
   2.2. Mount the new reflector.
   2.3. Turn the reflector in either direction using the reflector adjustment tool, until you obtain the maximum reading (this must exceed 68). Regarding the outer top/bottom sensor, check the value both when the grasp rolls are in the lifted and the lowered position. The difference between the values in the upper and lower positions must not be > 20%.
   2.4. Fix the reflector with a drop of Loctite 290.
3. Using the document sensor tool (Part No: 5131 102 16240, place a piece of white paper under the tool's leaf spring.

4. Insert the document sensor tool with the leaf spring up, until the piece of paper covers the sensor.
5. Read the sensor value on the display. This covered-sensor value should be 50% of the uncovered sensor value. If it is not, clean the reflector or exchange the sensor.
6. Return to normal printer operation by setting the test switch to NORMAL.

3.6.13 Exposing the MSF mechanics

Removal

1. Follow the instructions given for the removal of the printer main board (see Section 3.6.5), up to and including step 11.
2. Dismantling the remaining parts is a straightforward operation, and requires no further instructions.

Assembly

1. Fit the screws at the rear of the bottom plate.
2. Connect the flat cable to the sensing board at the printer front.
3. Turn the printer back to normal operating position and mount:
   - the lower front panel
   - the cover
   - the document guide
   - the upper front panel.
4. Connect the cables to the electronics package and secure the connectors and flat cables by fitting the cover plate and the securing plate.
5. Mount the electronics unit on the printer body.

3.6.14 MSF R/W head

Removal

1. Expose the MSF mechanics by following the instructions given for the removal of the printer main board (see Section 3.6.5), up to and including step 11.
2. Disconnect the cable from the MSF head circuit board.
3. Loosen the drive belt clamp from the carriage by removing the clamp's screw and sliding the clamp aside.
4. Loosen the two rear screws half a turn.
5. Remove the four front screws fixing the MSF mechanics assembly to the printer body (see the figure below) and raise the assembly to AN almost vertical position (see the figure below). The carriage swings down by its own weight.

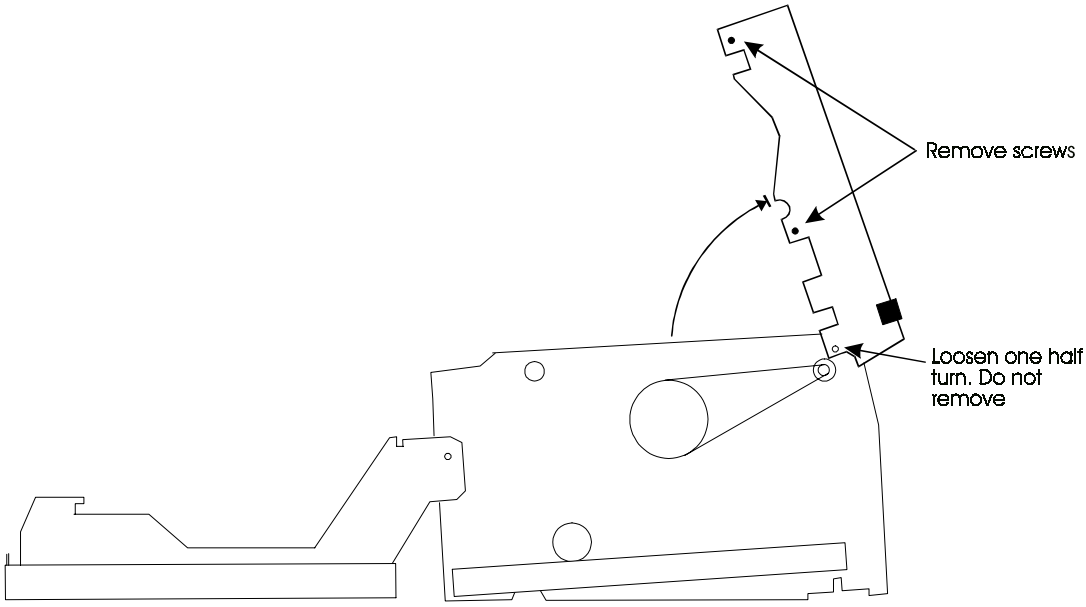


Figure 3-43 Raising the MSF mechanics assembly

6. Remove the screw holding the MSF head board and a piece of insulating plastic foil.
7. Remove the slot-headed screw fixing the MSF head. A small L-shaped plate under the screw is also loosened.
8. Remove the head with its circuit board and the piece of plastic foil.

Assembly

1. Insert the MSF head through the opening in the carriage and mount the head and the L-shaped plate.
2. Mount the circuit board with its insulating foil, but do not tighten the screw.
3. Pull and stretch the tiny leads from the head and place them in a neat loop between the circuit board and the piece of plastic foil. Use a small screwdriver or similar but be careful not to damage the leads.
4. Fasten the circuit board by tightening the screw firmly.
5. Lower the MSF mechanics assembly carefully while:
   - swinging up and holding the carriage against the carriage guide bar, ensuring that the head enters properly between its guiding plates.

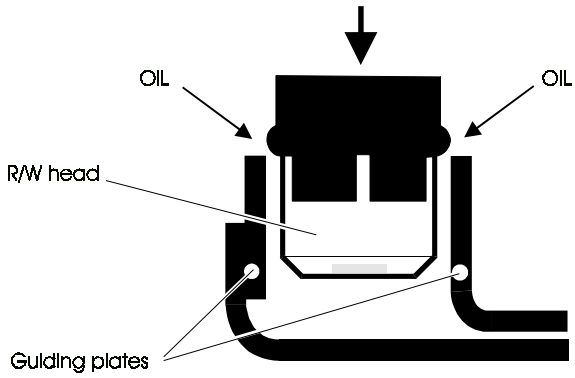


Figure 3-44 Lowering the R/W head between the guide plates

- checking that the carrier for the protective cover enters the corresponding slot in the cover.

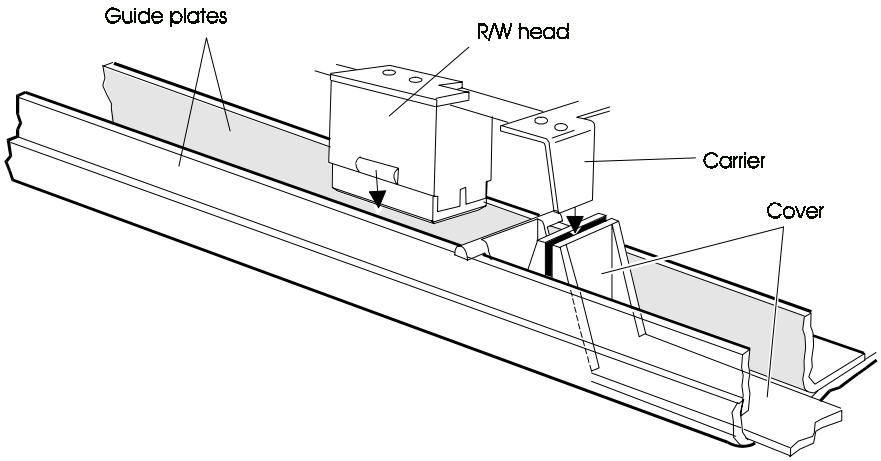


Figure 3-45 Engaging the protective cover carrier

6. Mount the four screws that hold the MSF mechanics assembly to the basic printer.
7. Tighten the two rear screws.
8. Connect the cable to the MSF head board.
9. Slide the belt clamp on to the carriage and secure the clamp with the screw.
10. Check that the teeth of the drive belt enter the slots of the belt clamp. Slide the belt down in the slots as far as possible.

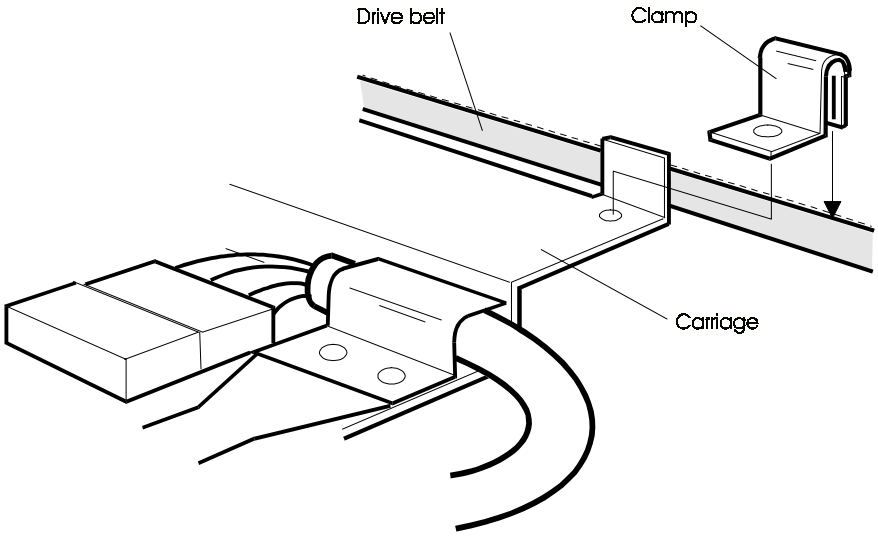


Figure 3-46 Engaging the carriage with the drive belt

10. Move the carriage aside a few times to check that it moves smoothly.
11. Move the carriage to its home position (to the left).
12. Reassemble the printer by following steps 12 through to 1, i.e. in reverse order, of the description given in Section 3.6.5 for the removal of the main board.

3.6.15 Home position sensor

Removal

1. Expose the MSF mechanics by following the instructions given for the removal of the printer main board (see Section 3.6.5), up to and including step 11.
2. Disconnect the cable from the R/W head board connector.
3. Remove the metal cable clamp that fixes the cable to the carriage. The leaf spring is also loosened.

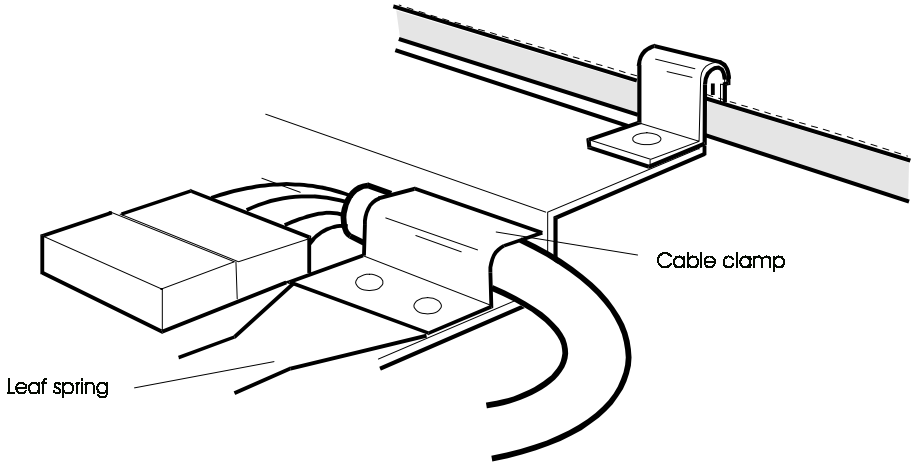


Figure 3-47 Disconnecting the cable from the R/W head board

4. Move the carriage to the middle position.
5. Remove the metal cable clamp snapped on to the front guide shaft.

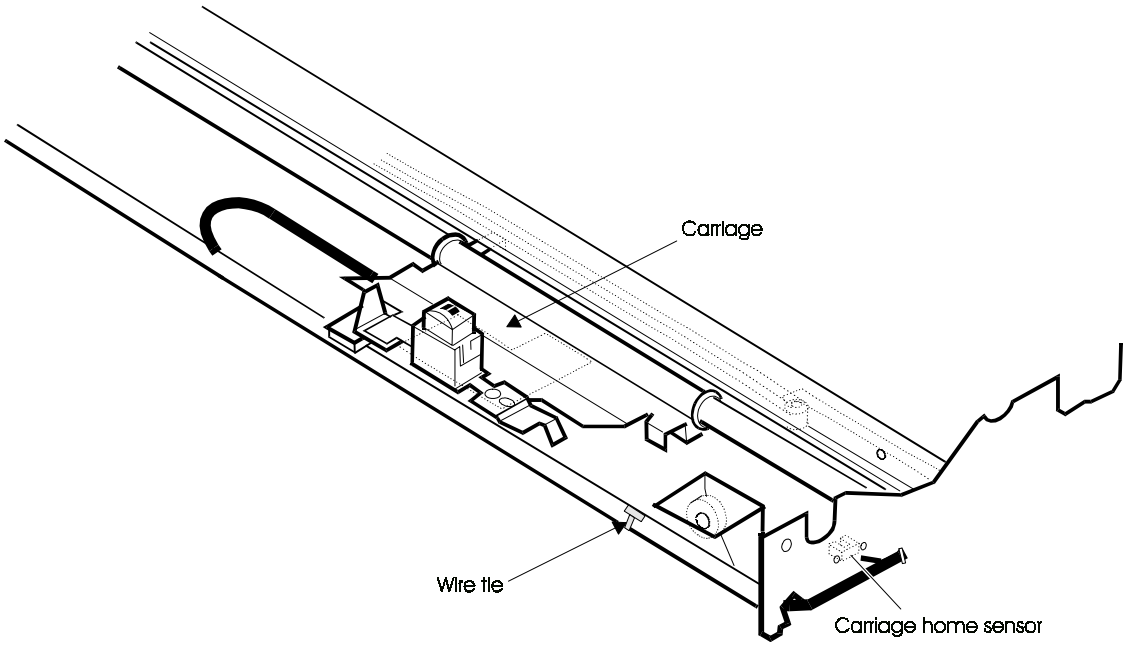


Figure 3-48 Removing the carriage home sensor

6. Remove the two screws holding the carriage-home sensor.
7. Cut the plastic cable straps

8. Remove the four front screw that hold the MSF mechanics assembly to the printer body and raise the assembly a few millimetres, but not so much that the R/W head leaves its guide plates.
9. You can now remove the cable together with the sensor.

Assembly

1. Fasten the MSF mechanics assembly again.
2. Use the cable clamp to fix the R/W head cable to the guide shaft. The metal cable shield should be inserted all the way under the clamp.
3. Clamp the cable to the carriage, not forgetting to fit the leaf spring (consisting of two pieces) with the plastic pad facing upwards (with the printer upside down).
4. Connect the cable to the R/W head board.
5. Route the cable out through the side plate and mount the sensor.
6. Strap the cable to the side plate. The strap closest to the sensor should be placed around the piece of shrink tube fitted on the cable. Twist the cable so that the tiny sensor leads are protected between the cable and the side plate.
7. Move the carriage aside, to check that it moves smoothly and that the new cable does not become too stretched in the leftmost carriage position (physical stop).
8. Reassemble the printer by following steps 12 through to 1, i.e. in reverse order, of the description given in Section 3.6.5 for the removal of the main board.

CHAPTER 4 SITE PREPARATION

Pages 4-1 through 4-4

4.1 INTRODUCTION

This chapter gives you the information you need to ensure that the printer is positioned in such a way as to ensure optimum performance, both for the printer and the operator. The information focuses on requirements regarding heat dissipation, accessibility for maintenance, operator convenience, and operator safety.

By conforming to the measurements given in the figures below, the installation will meet all the above requirements. For cooling purposes in particular, it is essential that there is sufficient space behind and above the printer.

To disconnect the signal cable, you must loosen two screws at the back of the printer. The best way to do this is to turn the printer around by at least 90º. This means that there must be sufficient space on the desk and that it must be possible to pull out the signal cable approximately 0.5m.

4.2 MEASUREMENTS

The dimensions of the LB12/LB15 printers are shown below.

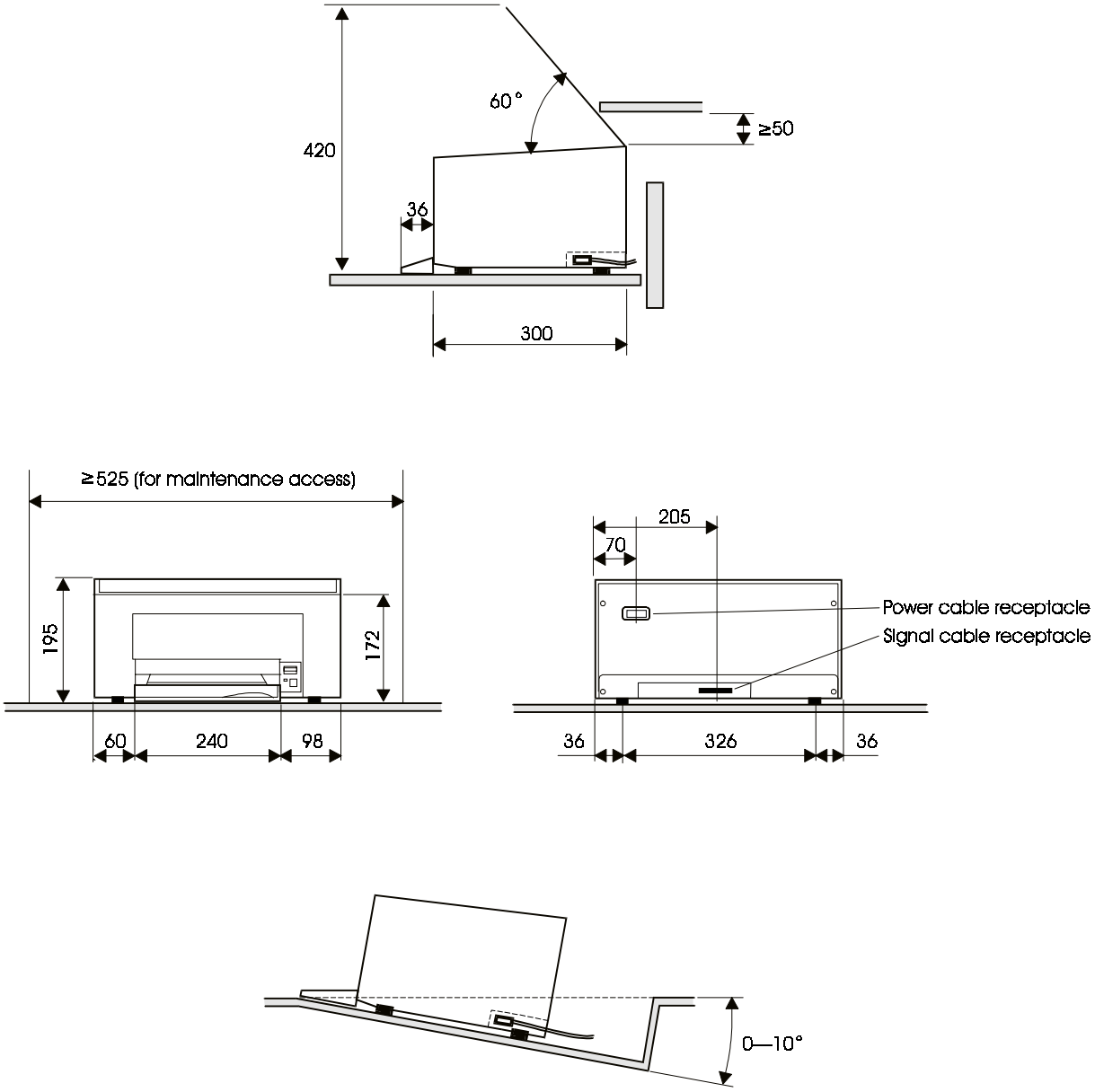


Figure 4-1 Dimensions of the LB12/LB15 printers