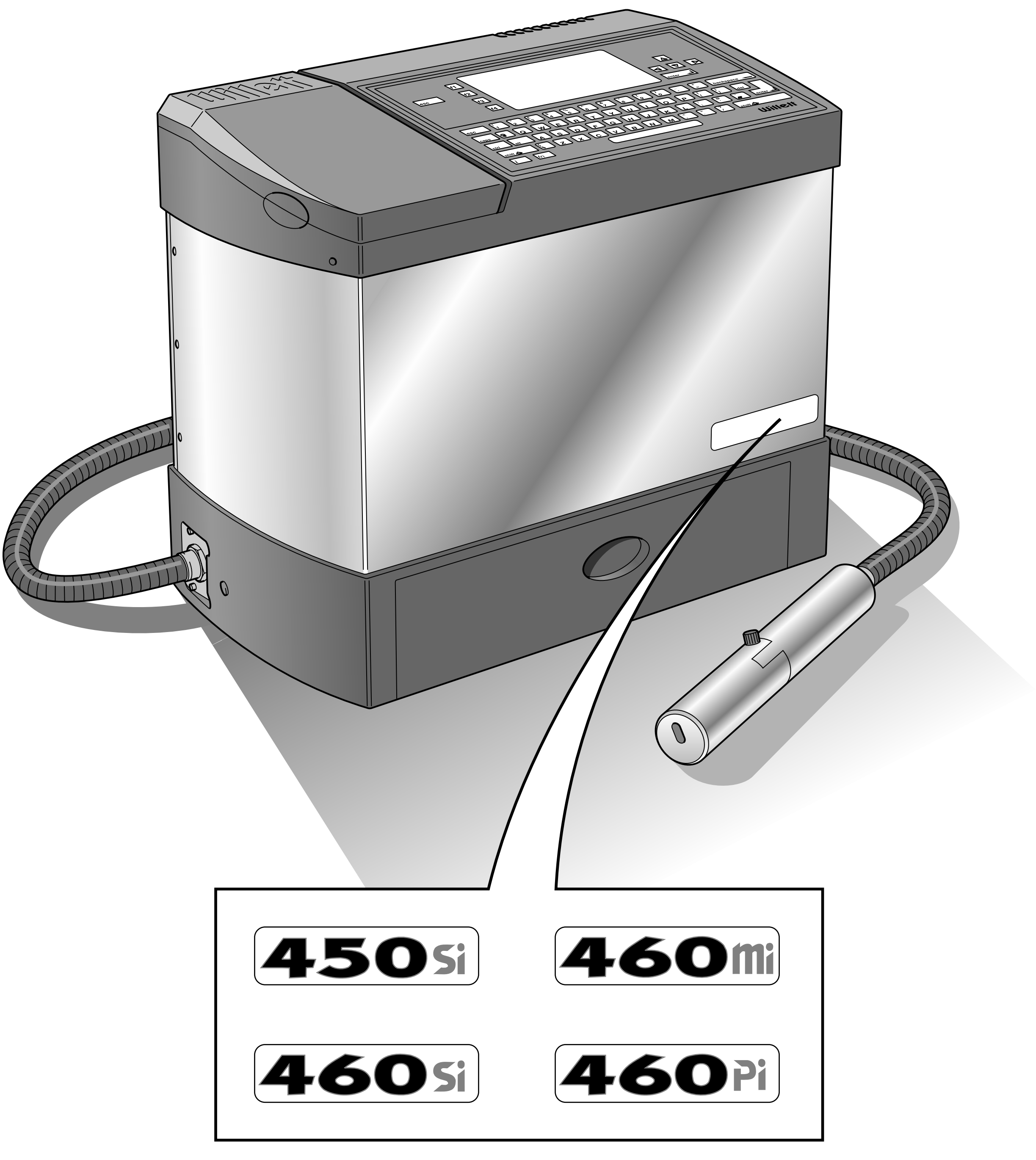
Willett

400 SERIES CONTINUOUS INK JET TECHNICAL MANUAL



400 Series Continuous Ink Jet

UPDATE (1)	DATE (2)	SIGNATURE (3)
Inclusive of 450 Si, 460 Mi, 460 Pi and associated software updates	January 1997	
Issue 1.1 Inclusive of 460Pi and associated software update	November 1997	
Issue 2.0 New issue of I/O board	March 1998	
Issue 2.1 Inclusive of technical updates	June 1998	

Part Number:

User Guide	306-0400-101
Owner Manual	306-0400-102
Technical Manual	306-0400-103

CONTENTS

CONTENTS (Continued)

PUBLICATION CONTENTS

PREFACE

Willett is the leading international manufacturer and single source supplier of industrial coding, labelling and bar code printing products.

Willett maintains a competitive position by harnessing new technology through incremental improvements, this innovative leadership is the result of close liaison with customers and markets worldwide.

Effective training ensures that Willett Systems are operated and maintained efficiently to minimise servicing. With prompt local support, reliability is guaranteed.

The quality policy of Willett is to aim for zero defects in all products, information, advice and service.

Willett has manufacturing sites in Europe, North America, South America and Asia. Products are supplied through a network of Willett companies and distributor partners in over 80 countries, providing premier service and technical support capability.

The Willett name and Willett logo are trade marks of Willett International Limited.

PRODUCT RANGE

Hardware

In addition to Continuous Ink Jet (CIJ) products, Willett supplies the following products:

Programmable laser coders that provide clear, permanent, non-contact marking on a wide range of products.

Product labellers using airjet and touch technology provide the greatest versatility with gentle product handling for product identification, decorative and promotional labelling.

Electronic foil printers to print text and graphics onto flexible packaging materials.

Ink jet markers and bar coders provide high definition variable information printing, addressing and bar coding systems for cases and cartons.

Label printer applicators and bar codes provide just-in-time identification for manufacturing, warehousing, shipping and distribution.

Pallet and marking systems are used for large size product identification labels. A wide range of bar code formats.

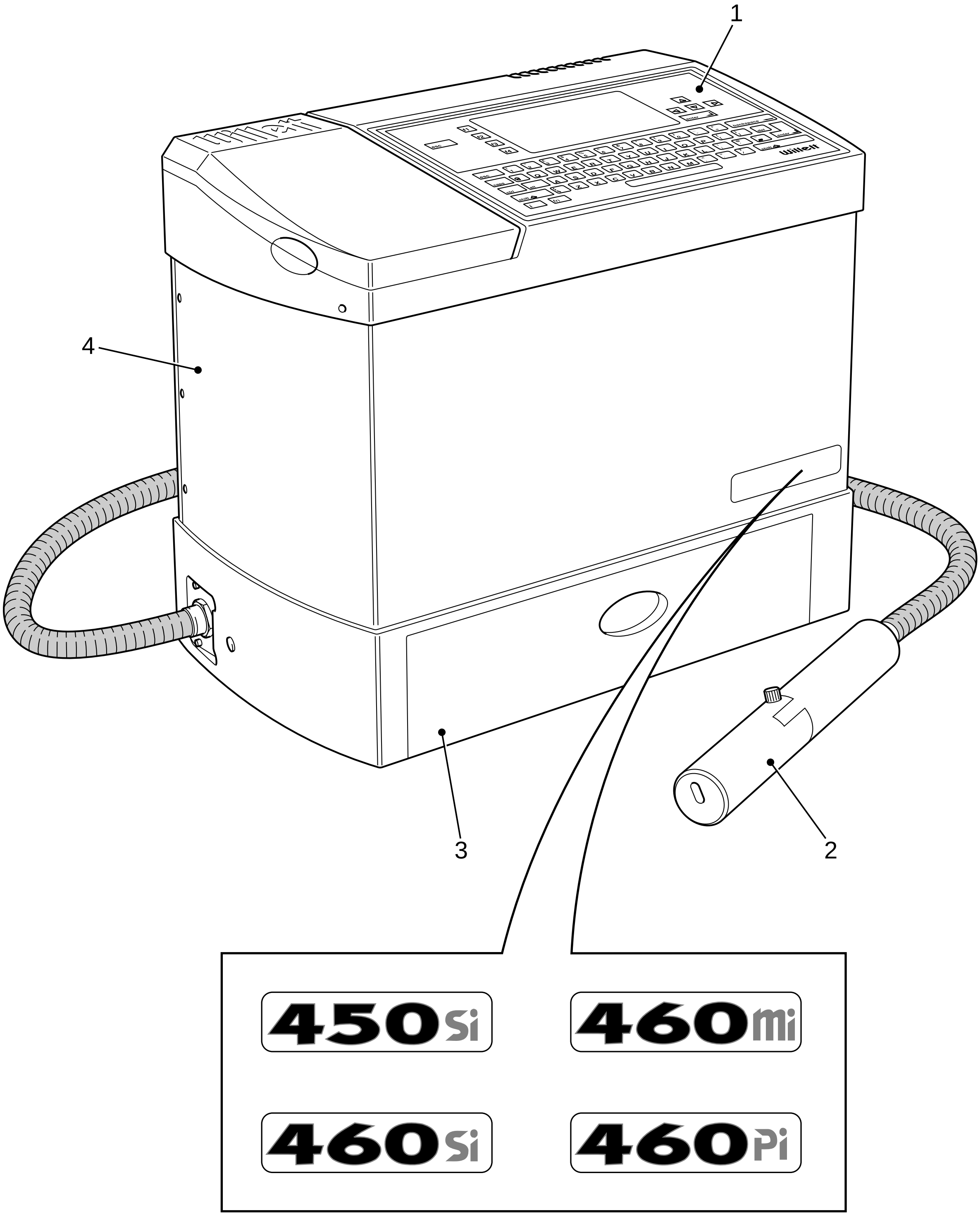
Computer control systems to program the above products are available.

Inks and ribbons

Willett is at the forefront of ink technology and variable information printing products are supported by an extensive range of Willett inks or ribbons to print on a large variety of surfaces.

Software

Willett provides proprietary software for its variable information range of printing products. For more complex requirements, special applications are available. Willett can also provide bespoke solutions to customers.



1 Control panel
2 Printhead
3 Filter compartment
4 Cabinet

Fig 1 400 Series CIJ - basic components

INTRODUCTION

General

1 The 400 Series CIJ range of printers are designed to produce high quality print on a wide range of products and packaging materials. The printer range comprises the following:

1.1 460Si: Standard dye based ink model.

1.2 460Mi: Micro dye based ink model.

1.3 460Pi: Pigment based ink model.

1.4 450Si: Similar to 460Si but with limited software functionality and connection options.

2 The printer is fitted with a cylindrical printhead connected to the cabinet by a flexible umbilical cable. The printhead can be positioned in any orientation to suit the product, while the cabinet is generally positioned to one side of the production line.

3 The printer is operated from a control panel located on top of the main cabinet. The panel features a QWERTY keypad and Liquid Crystal Display (LCD). The display gives a visual indication of printer status and print message selection.

Software

4 The standard software allows the user to control and monitor the printer and also to create and edit multiple field print messages.

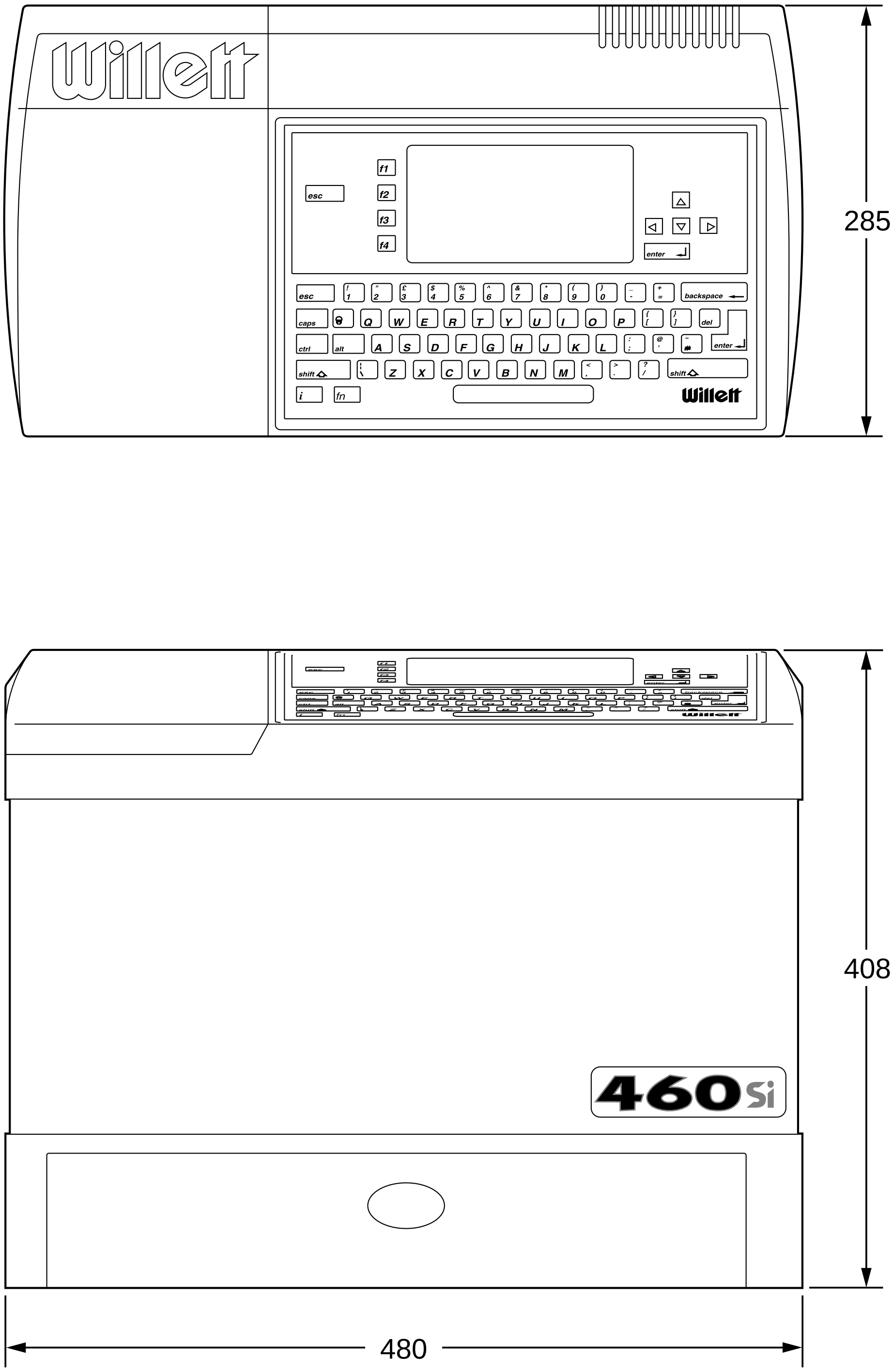


Fig 2 Printer cabinet dimensions (mm)

MACHINE DATA

Electrical supply

5 The printer requires an electrical supply of 80-264 volts AC, at a frequency of 50 or 60 hertz. Typical power consumption is 200 watts.

Weight

6 The printer dry weight is 18.3 kg.

Environment

7 Environmental data is as follows:

7.1 Operating temperature range: 5 to 40 Celsius (C).

7.2 Rate of change of ambient temperature: 10 C per hour.

7.3 Humidity: 0-90% relative, non condensing.

7.4 Storage range: 5-50 C when stored in original packaging.

7.5 Industrial Protection Rating: IPX4.

Dimensions

8 Dimensions are as follows:

8.1 See Figs 2 and 3 for machine dimensions.

8.2 Umbilical length: 3 m.

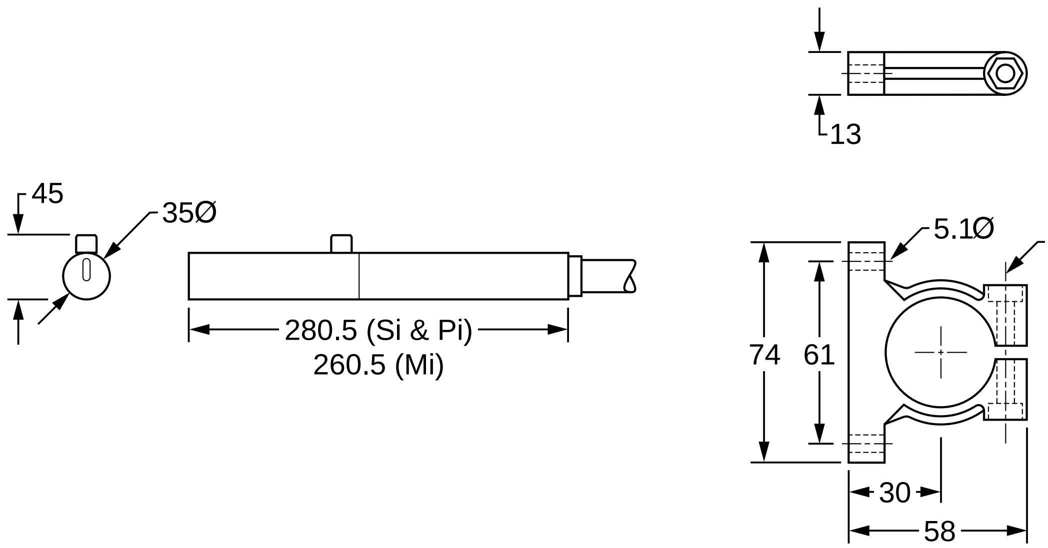


Fig 3 Printhead and mounting bracket dimensions (mm)

Ink consumption

9 The number of ink drops that can be printed per litre (l) is 1309 million for Si models, 6599 million for 460Mi models and 824 million for Pi models. The actual consumption depends upon the font selected and the average number of drops per character in that font (see Table 1). Nozzle orifice diameter is listed in Table 2.

TABLE 1 INK CONSUMPTION

Serial	Font	Drops per character (See Note)	Characters per litre			Remarks
			450Si, 460Si	460Mi	460Pi	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	7 x 5	12	110 million	549.9 million	68.7 million	
2	16 x 11	62	21.1 million	106.7 million	13.2 million	Not 450Si
3	24 x 17	143	9.1 million	46.1 million	5.7 million	Not 450Si

Based on the assumption that 35% of total matrix is printed.

TABLE 2 NOZZLE ORIFICE DIAMETER

Serial	450Si/460Si	460Mi	460Pi
(1)	(2)	(3)	(4)
1	60μ	35μ	70μ

Ink and solvent capacity

10 The ink and top up capacities are as follows:

10.1 Mixer reservoir: 0.34l operating capacity.

10.2 Ink reservoir: 1.2l capacity.

10.3 Top up reservoir: 1.2l capacity.

Print height

11 At the optimum throw distance of 8 mm for the Si and Pi or 1 mm for the Mi, the print heights are as follows:

11.1 Si and Pi:

11.1.1 Minimum print height (7 x 5 font); 2 mm.

11.1.2 Maximum print height (24 x 17 font); 10 mm.

11.2 Mi:

11.2.1 Minimum print height (5 x 5 font); 0.8 mm.

11.2.2 Maximum print height (24 x 17 font); 5 mm.

Maximum print speeds

12 Table 3 lists maximum print speeds for the 400 Series.

TABLE 3 MAXIMUM PRINT SPEEDS

Serial (1)	Machine type (2)	Lines in message (3)	Printed dots (4)	Font height (5)	Font rasters (6)	Columns per second (7)	Characters per second per line in message (8)
1	450Si	1	7	7	5	9600	1600
		1	9	9	6	4266	609
		2	16	7	5	2400	400
2	460Si & 460Pi	1	5	5	5	12800	2133
		1	7	7	5	9600	1600
		1	9	9	6	4266	609
		1	12	12	8	3200	355
		1	16	16	11	2400	200
		1	16HS	16	11HS	3072	256
		1	19	19	14	1155	102
		1	25	24	17	1037	57
		2	12	5	5	3200	533
		2	16	7	5	2400	400
		2	16HS	7	5HS	3072	512
		2	20	9	6	1037	148
		2	26	12	8	984	109
		3	19	5	5	1536	256
		3	25	7	5	1037	173
		4	26	5	5	984	164
3	460Mi	1	5	5	5	15000	2500
		1	7	7	5	8571	1428
		1	9	9	6	4285	612
		1	12	12	8	4285	476
		1	16	16	11	3000	250
		1	19	19	14	1538	102
		1	24	24	17	1052	58
		2	12	5	5	4285	714
		2	16	7	5	3000	500
		2	20	9	6	1052	150
		2	26	12	8	1000	111
		3	19	5	5	1538	256
		3	25	7	5	1052	175
		4	26	5	5	1000	166

13 To calculate the maximum line speed at which the printer can print a message, proceed as follows:

13.1 MAX LINE SPEED (metres per second) =

$$\frac{\text{COLUMNS PER SECOND x MESSAGE LENGTH (millimetres)}}{\text{CHARACTERS IN LONGEST LINE OF MESSAGE x RASTERS PER CHARACTER X 1000}}$$

13.2 MAX LINE SPEED = WIDTH OF LARGEST CHARACTER x CHARACTERS PER SECOND.

13.3 MINIMUM MESSAGE LENGTH (millimeters) =

$$\frac{\text{LINE SPEED (metres per second) x CHARACTERS IN LONGEST LINE OF MESSAGE x RASTERS PER CHARACTER x 1000}}{\text{COLUMNS PER SECOND}}$$

LEGISLATION

14 Willett International Limited is a BS5750/ISO9000 approved company (certification number FM14003 dated 9 December 1991).

15 The 400 Series Continuous Ink Jet (CIJ) printers are built to conform with the following legislation.

15.1 EN55022: 1987 - Emissions.

15.2 IEC801: parts 2 to 6 inclusive - Immunity standards.

15.3 Machinery directive 89/392/EEC - Essential health and safety.

15.4 BS5304 - Machinery design.

15.5 EN60204 (BS2771) - Electrical safety in machinery.

15.6 EN292: 1991 - Safety of machinery.

15.7 EN60950 - Safety standards of Information Technology (IT) equipment.

WARNINGS, CAUTIONS AND NOTES

General

16 The warnings and cautions which appear in this manual are of vital importance to personnel and equipment safety. Prior to any attempt to operate, maintain, diagnose failure or repair all or part of the equipment, all warnings and cautions should be read and completely understood.

17 Warnings and cautions concerning particular procedures are provided in the section relevant to that action, they are summarised in this preliminary information.

Warnings

18 A warning identifies an operating or maintenance procedure, practice or statement, which if not strictly followed could result in death/injury to personnel or serious equipment damage.

19 A warning will be in upper case, bold, large print (14 point) and will be preceded by a road traffic stop sign as follows:

Cautions

20 A caution identifies an operating or maintenance procedure, practice or statement, which if not strictly followed could result in equipment damage.

21 A caution will be in lower case, bold, large print (14 point) and will be preceded by a road traffic caution sign as follows:

Notes

22 A note indicates an operating or maintenance procedure, practice or statement which is essential but not of known hazardous nature as indicated by a warning or caution.

23 A note will be in lower case, large print (14 point) and will be preceded by a road traffic information sign as follows:

SUPPLEMENTARY WARNINGS AND CAUTIONS

24 The following warnings and cautions supplement the specific warnings and cautions appearing elsewhere in the manual. They are general warnings which must be read, completely understood and applied by all personnel involved with the operation and/or maintenance of the machine.

(1) LETHAL HAZARD. WHEN CARRYING OUT MAINTENANCE WORK, SWITCH OFF THE HOST MACHINE MAIN ISOLATOR UNLESS IT IS NECESSARY TO PERFORM MACHINE MOVEMENTS.

(2) LETHAL HAZARD. WHEN WORKING ON ELECTRICAL EQUIPMENT, OBSERVE ALL STATUTORY ELECTRICAL SAFETY CODES AND PRACTICES.

(3) LETHAL HAZARD. THE PRINTER USES EXTREMELY HIGH VOLTAGES, THEREFORE ONLY TRAINED AND AUTHORISED PERSONNEL MUST CARRY OUT MAINTENANCE WORK.

(4) PERSONAL INJURY. CAUTION SHOULD BE TAKEN TO PREVENT SOLVENTS ENTERING THE EYES. USE GOGGLES OR A FACE MASK WHEN USING SOLVENTS.

(5) PERSONAL INJURY. WHEN HANDLING INKS ALWAYS WEAR PROTECTIVE GLOVES AND CLOTHING.

(6) PERSONAL INJURY. IMMEDIATELY AFTER USE REMOVE ANY TISSUE OR CLOTHS THAT BECOME SATURATED WITH INK OR TOP UP. DISPOSAL OF SUCH ITEMS SHOULD BE SUCH THAT THERE IS NO DANGER OF A FIRE RISK OR A HEALTH HAZARD.

(7) PERSONAL INJURY. IN THE EVENT THAT A CONTAINER IS LEFT CONTAINING INK OR TOP UP, IT SHOULD BE RESEALED. HOWEVER, SINCE ONLY FULL BOTTLES ARE RECOMMENDED FOR USE WHEN REPLENISHING INK OR TOP UPS, IT IS RECOMMENDED THAT PARTIALLY FILLED BOTTLES BE DISCARDED IN A WAY THAT WILL NOT POSE A FIRE RISK OR HEALTH HAZARD.

(8) PERSONAL INJURY. IF SKIN IS CONTAMINATED BY INK OR TOP UP, WASH WITH SOAPY WATER. DO NOT USE TOP UP TO CLEAN INK STAINS FROM THE SKIN.

(9) PERSONAL INJURY. WHEN SETTING UP THE NOZZLE, DIRECT THE INK STREAM INTO A BEAKER OR SUITABLE CONTAINER. IT IS RECOMMENDED THAT ANY INK COLLECTED IN THIS WAY IS NOT RE- USED AS THIS INTRODUCES POSSIBLE CONTAMINATION INTO THE PRINTER. IT SHOULD BE DISPOSED OF SO THAT THERE IS NO FIRE RISK OR HEALTH HAZARD.

(10) FIRE HAZARD. THE INK AND TOP UPS ARE HIGHLY FLAMMABLE, DO NOT SMOKE OR USE NAKED FLAME IN THE VICINITY OF THE CHEMICAL.

(11) VAPOUR HAZARD. PROLONGED BREATHING OF TOP UP VAPOUR MAY CAUSE DROWSINESS AND/OR EFFECTS SIMILAR TO ALCOHOLIC INTOXICATION. USE ONLY IN WELL VENTILATED, OPEN AREAS.

(12) TOXIC HAZARD. DO NOT DRINK. THE CLEANING AGENT IS POISONOUS IF TAKEN INTERNALLY.

(1) EQUIPMENT DAMAGE. Use brushes and lint free cloths for cleaning. Do not use high pressure air, or cotton waste.

(2) EQUIPMENT DAMAGE. Do not fit or remove any connector on the printer whilst power is on.

ABBREVIATIONS

25 This manual uses the following abbreviations:

A	Amperes
AC	Alternating current
ASCII	American standard code for information interchange
C	Celsius
CCITT	Comité consultatif international telegraphique et telephonique
CIJ	Continuous ink jet
CPU	Central processing unit
DC	Direct current
DOS	Disk operating system
DWPD	Double byte Willett packed decimal
EHT	Extra high tension
HRC A/S	High rupturing capacity anti-surge
HWPD	Huge Willett packed decimal
Hz	Hertz
IBM	International business machines
I/O	Input/output
IT	Information technology
Kg	Kilogrammes
kHz	KiloHertz
LAN	Local area network
l	Litre
LCD	Liquid crystal display
LED	Light emitting diode

mA	MilliAmperes
mm	Millimetres
ms	Milliseconds
PC	Personal computer
PEC	Photoelectric cell
PROM	Programmable read only memory
PSTN	Public switch telephone network
PSU	Power supply unit
px	Proximity
RAM	Random access memory
RDS	Remote diagnostics system
RID	Remote input device
RTC	Real time clock
SWPD	Single byte Willett packed decimal
VMS	Viscosity monitoring system
WIS	Willett interface software
WYSIWYG	What you see is what you get

INFORMATION

General

26 The 400 Series CIJ technical documentation comprises three separate manuals and information levels as follows:

26.1 User Guide - level one.

26.2 Owner Manual (incorporating the User Guide) - level two.

26.3 Technical Manual (incorporating the User Guide and Owner Manual) - level three.

Figures and tables

27 The illustrations used in the manual are numbered according to the section they are used in (eg Fig 1.3 is the third figure in Section 1).

28 All figures used numbered annotation and keys (eg Fig 1.3 (2) is item 2 of the third figure in Section 1).

29 Tables are numbered in a similar manner to figures. Columns and items (Serials) are numbered for easy reference.

Associated publications

30 The following associated publications are available:

30.1 Remote Diagnostics System (RDS): Part Number 306-3700-113.

30.2 Willett Communications Protocol: Part Number 306-0400-104.

CONTENTS

(1) LETHAL HAZARD/SERIOUS EQUIPMENT DAMAGE. ONLY PERSONNEL TRAINED BY WILLETT SHOULD ATTEMPT THE INSTALLATION PROCEDURE.

(2) LETHAL HAZARD. DISCONNECT THE PRINTER FROM THE MAINS SUPPLY PRIOR TO ATTEMPTING ANY INTERNAL ADJUSTMENTS OR MAINTENANCE.

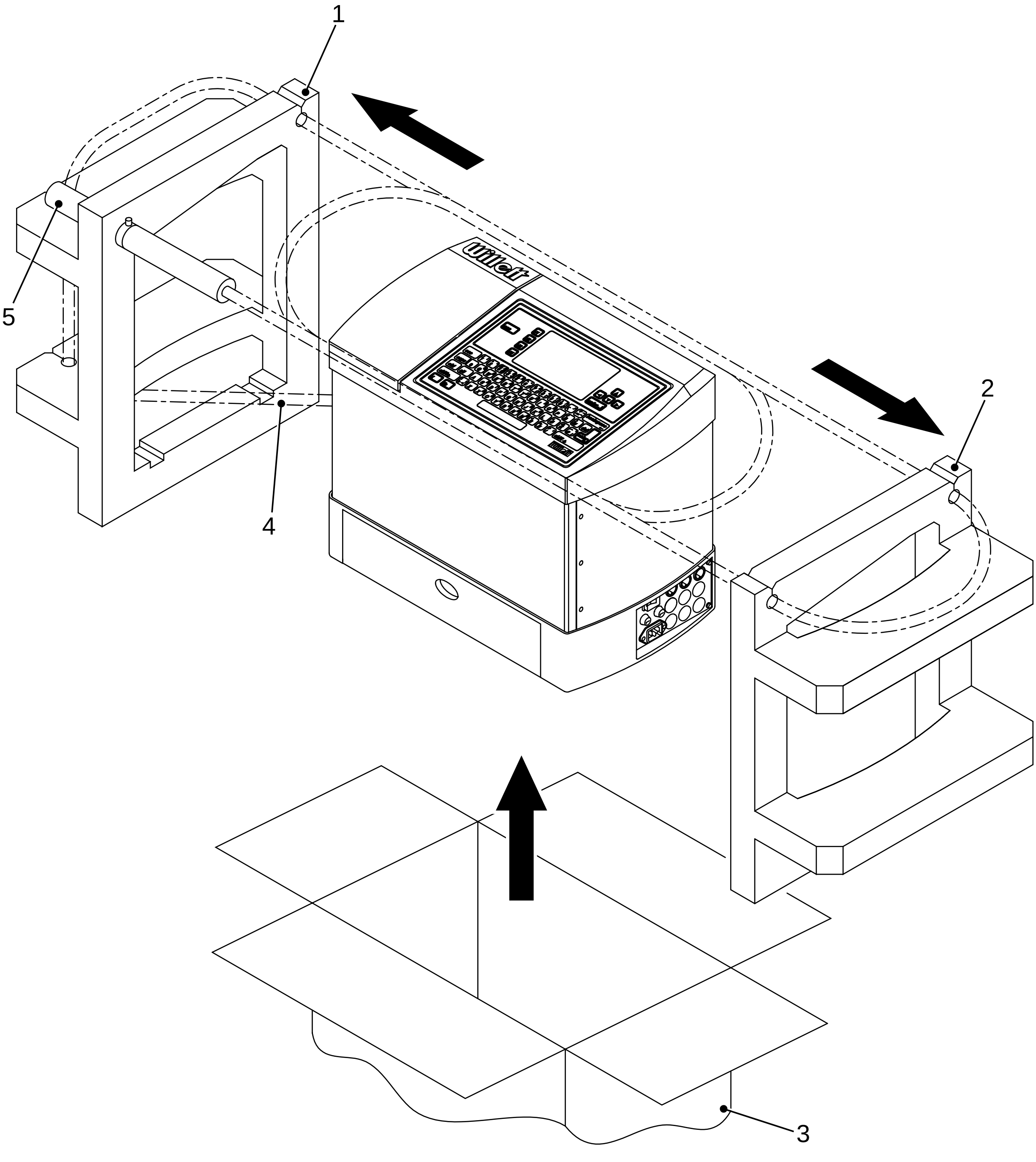
INTRODUCTION

1 The printer is tested and commissioned prior to despatch to the customer, if further on-site commissioning is required then refer to Section 11 - Failure Diagnosis and Repair (Level 3).

2 Each installation must be approached on an individual basis due to variations in production line build specifications. Supposedly identical production lines can vary significantly due to customer requirements or modifications.

3 Each installation must be preceded by a site survey to establish the necessary information relevant to the production line and printer. In some cases it may be impossible to install a printer; it is therefore of vital importance that all the installation criteria are met before attempting installation. The site survey form must be completed as fully as possible by the sales engineer.

4 Missing or ambiguous information should be clarified by telephone or fax prior to the installation procedure.



1 Left-hand insert
2 Right-hand insert
3 Carton
4 Umbilical
5 Printhead

Fig 9.1 Unpacking the printer

UNPACKING

DEGRADED PERFORMANCE. The Pi Series carton is fitted with tilt indicators, if a tilt condition is indicated then the stirrer bar in the mixer tank must be checked for position on the mixer tank wear plate (Section 11).

5 Open the top flaps of the carton (Fig 9.1 (3)) and gently pull the complete machine and inserts (1 and 2) upwards from the carton.

6 Place the printer and inserts on a clean level surface, remove the printhead (5) from the left-hand insert (1), remove the umbilical (4) from its transit routeing.

7 Remove the left-hand insert and right-hand insert (2). Place the printer on a clean level surface for commissioning (Para 8).

COMMISSIONING

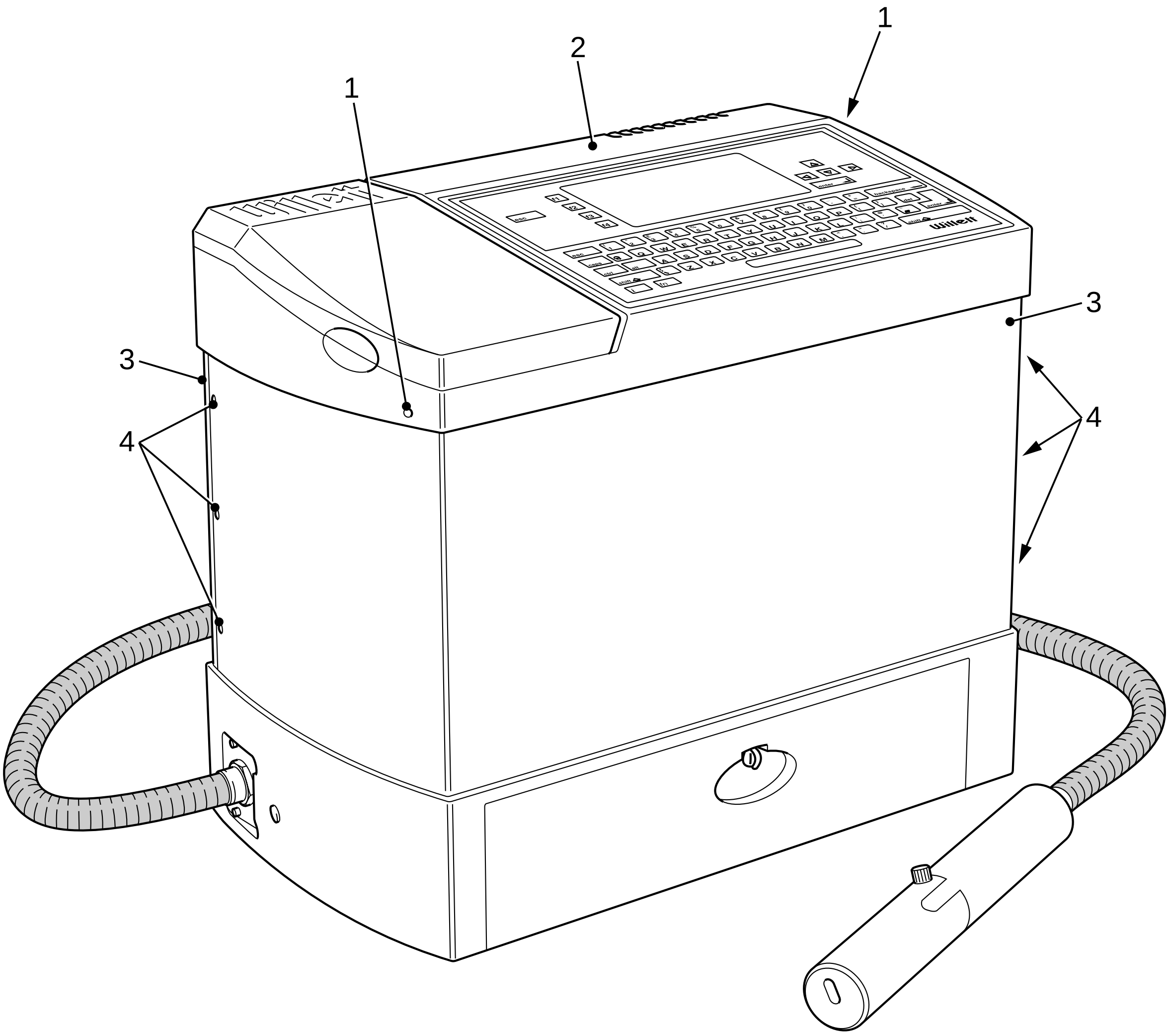
Access

8 Screw the two top cover fasteners (Fig 9.2 (1)) in until they release the top cover catches (the top cover (2) will raise slightly). Unscrew both top cover fasteners, leave them captive.

9 Raise the top cover until the spring loaded locating pins on the extender legs slot into their relevant locating holes.

10 Turn the six side cover fasteners (4) by a quarter turn anti-clockwise, these fasteners are captive in their respective side covers (3).

EQUIPMENT DAMAGE. Take care not to damage the printer base, internal components or wiring when removing or refitting the side covers.



1	Top cover fasteners	3	Side cover
2	Top cover	4	Side cover fasteners

Fig 9.2 Cover fastener location

Orientation of the side covers should be noted for refitting.

11 Remove the side covers (see Caution and Note above).

Preparation

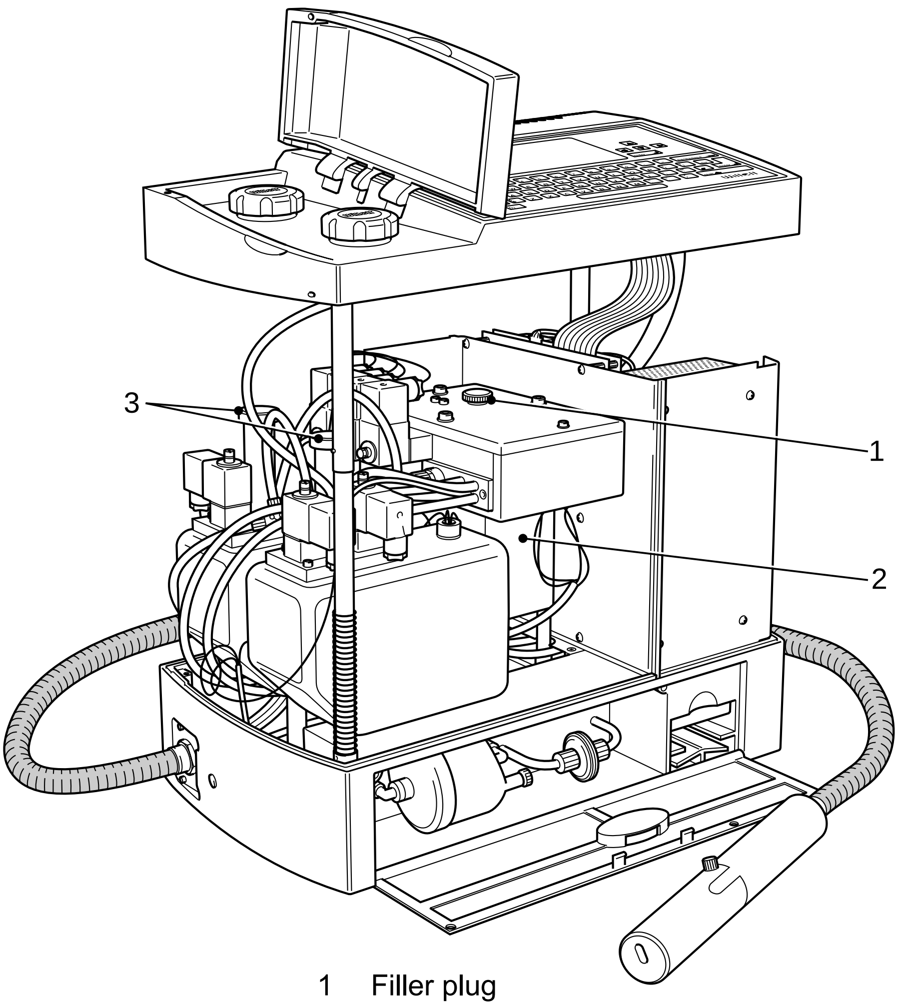
12 Fit the red caps (supplied with the printer parts kit) over the ink and solvent top up reservoir filler tubes (Fig 9.3 (3)).

13 Remove the black rubber shipping cap from the breather tube, retain the cap. Fit the breather tube to the blue fitting located on the underside of the top cover.

14 Ensure that the correct fuses (Fig 9.4 (2 and 5)) are fitted for the local mains electrical supply, see Table 9.1.

TABLE 9.1 MAINS ELECTRICAL FUSE RATINGS

Serial (1)	Mains Voltage (2)	Fuse Rating (3)
1	110 V AC	5 A
2	230 V AC	3.15 A



1 Filler plug
2 Ink mixer bowl
3 Filler tubes

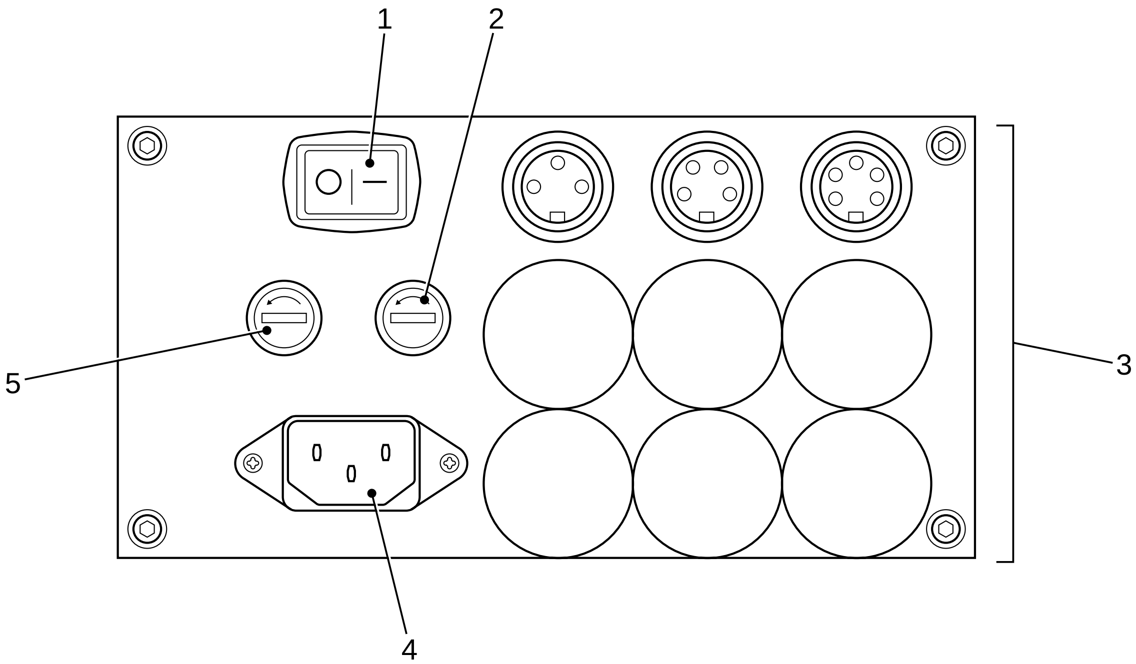
Fig 9.3 Ink mixer bowl filler plug location

15 Connect the mains inlet socket (4) to the mains electrical supply, set the On/Off switch (1) to (ON).

(1) The machine PSU will automatically adjust to the mains voltage.

(2) If the LCD is not visible, press F3, then press Ctrl and L. Press any key to set the contrast when the LCD is visible.

(3) If the menu system cannot be accessed by pressing F3, press Ctrl and Z, then P, enter the MASTER password and repeat step (2).



1 On/Off switch
2 Supply (live) line fuse holder
3 Connector provision
4 Mains inlet socket
5 Return (neutral) line fuse holder

Fig 9.4 Connector panel

16 Access the Password menu and enter the MASTER password.

17 Remove the filler plug (Fig 9.3 (1)) and prime the mixer bowl (2) with approximately 250 ml of the correct ink using a syringe and a length of 4 x 6 mm tube.

The Ink Out icon will cease to be displayed when approximately 250 ml is added to the mixer bowl.

18 Ensure that the complete 250ml is added before proceeding.

19 Refit the filler plug (1) to the top of the FMS.

20 Refit the side covers, ensure that the orientation is correct as noted at Para 11, secure the side cover fasteners (Fig 9.2 (4)).

21 Remove the two red caps from the ink and top up filler tubes (Fig 9.3 (3)).

22 Push in the locating pins on each of the extender legs and lower the top cover (Fig 9.2 (2)) into position. It will be necessary to exert a small amount of pressure to locate the cover properly.

EQUIPMENT FAILURE. Ensure that the top cover is lowered to the correct working position and that the filler tubes are correctly located in the ink and solvent top-up reservoirs before proceeding.

23 Pour the remaining ink into the ink reservoir (4 slot spider). Fill the top-up reservoir (3 slot spider) with 1 litre of the appropriate top-up solvent.

Procedure

24 Enter the System menu, select Fill Mixer Tank and press ↵, the pump will start and the mixer tank will fill, the pump will stop when the ink level is satisfactory.

25 Remove the printhead cover, nozzle seal and gutter plug (retain the seal and plug for refitting if the machine has to be transported).

26 Mount the printhead to a suitable support.

27 Disable Gutter Detect as follows:

27.1 Access the System menu.

27.2 Select the Gutter Fault Shutdown Disable option and press ↵.

27.3 Using the ⇥ key to set Gutter Fault to *Disable* in the Machine Control sub-menu (Fig 9.5), press ↵.

28 Disable Charge Check as follows:

28.1 Access the System menu.

28.2 Select the Charge Error Shutdown Disable option and press ↵.

28.3 Using the ⇥ key to set Charge Error to *Disable* in the Machine Control sub-menu (Fig 9.5), press ↵.

Fig 9.5 Machine Control sub-menu (functions disabled)

29 Press F1 to start the jet, ensure that the printhead alignment is correct, if adjustment is required then refer to Section 11.

30 Enable the Gutter Detect and Charge Check by enabling the *Gutter fault* and *Charge error* options in the Machine Control sub-menu (Fig 9.6) press ↵.

Fig 9.6 Machine Control sub-menu (functions enabled)

31 Fit the printhead cover.

32 Input a message (Section 6).

The message should contain a six digit incrementing counter.

33 Select the created message for printing and position an earthed print collector dish under the printhead.

34 Access the Print menu, select Continuous Print and press ↵. Use the ⇥ key to select *Time Mode* in Continuous mode and *50* in the *Time Mode Delay* options of the Continuous print sub-menu (Fig 9.7), press ↵.

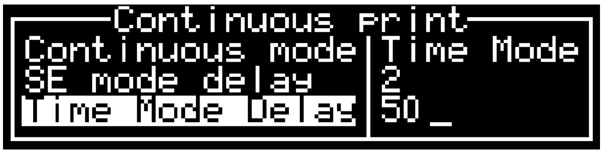


Fig 9.7 Continuous print sub-menu

35 Access the Configure menu, select Photocell Levels. Use the ⇥ key to change the state of the photocell 1 level to *Active high* in the Photocell levels sub-menu, press ↵.

36 Access the Configure menu, select Photocell Levels. Use the ⇥ key to change the state of the photocell 1 level to *Active low* in the Photocell levels sub-menu (Fig 9.8), press ↵.

Fig 9.8 Photocell levels sub-menu

37 The machine should now be printing, it should be left to complete a minimum of 250000 prints, use the counter created at Para 32 to monitor the number of messages printed.

38 Monitor the printer to ensure that the system functions correctly.

39 At regular intervals access the Calibrate menu, select the Diagnostics Screen and press ↵, monitor the machine parameters and check that they remain stable. Table 9.2 lists typical Diagnostics Screen values.

The values provided in Table 9.2 are typical and must not be interpreted as exact, the figures will vary slightly for each machine, depending on the model, ink type and ambient conditions.

TABLE 9.2 DIAGNOSTICS SCREEN VALUES

Serial (1)	**Machine Parameter (2)**	**Typical Value (see Note above) (3)**	**Dependancy (4)**
1	Ink pressure	29-32	Ink type
2	Cabinet temperature	35	Ambient temperature
3	Viscosity setpoint	19 (Mi) 29 (Si & Pi)	Model
4	Mixer OK	ON	
5	Solvent low	ON	
6	VMS low	ON/OFF	
7	Phase angle	(Si & Mi = 09) (Pi = 12)	Model
8	Ink temperature	25	Ambient temperature
9	Set idle pressure (**Pi only**)	10 (1 bar)	
10	Head temperature	25-35	Ink type
11	Viscosity actual	19 (Mi) 29 (Si & Pi)	Correct viscosity
12	Mixer low	ON	
13	Mixer high	OFF	
14	Ink low	ON	
15	VMS high	ON/OFF	
16	Phase profile	08-09	

40 After 25000 prints have been satisfactorily completed, press F1 and ensure that the printer performs a clean shutdown.

Passwords

41 Liaise with the customer and find out which machine functions they want available to relevant personnel and which passwords they want to use.

DEGRADED PERFORMANCE. Machine functions that only Willett trained personnel can access are set at Password Level 3 (MASTER password), these functions must not be given as customer options.

42 Set the password levels according to the customer requirement (see Caution above).

You must be at Password Level 3 to set Password Levels.

43 Set the Passwords for Levels 1 and 2 (see Note above).

Shifts

44 Liaise with the customer to confirm his shift requirements (if any). Set a shift as follows:

44.1 Access the Configure menu, select Set Shifts and press ↵. The Set Shifts sub-menu (Fig 9.9) will be displayed.

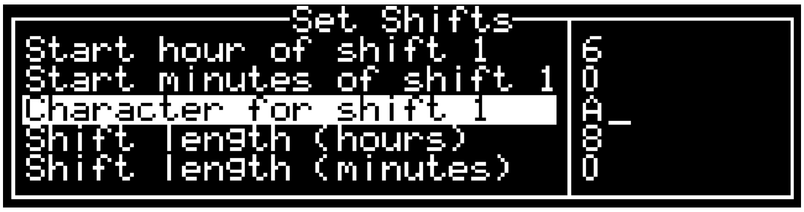


Fig 9.9 Set Shifts sub-menu

44.2 If we were dividing the day into three shifts with each shift numbered from 1 and starting shift 1 at 0700 then the sub-menu settings would be as follows:

44.2.1 Start hour of shift 1: *7*.

44.2.2 Start minutes of shift 1: *00*.

44.2.3 Character for shift 1: *1*.

Before the Character for shift 1 can be altered, it must be deleted using the *backspace* or *del* key.

44.2.4 Shift length (hours): *8*.

44.2.5 Shift length (minutes): *00*.

44.3 Using the Shift criteria used above, the insertion of a shift at approximately 0330 would provide a shift number of 3 as shown at Fig 9.10.

Fig 9.10 Shift message

INSTALLATION

General

45 A typical installation is shown at Fig 9.11, this shows the printer (7) mounted on a printer stand (6). The printhead (4) is configured to print vertically via a clamp (2) and bracket (3) assembly. A lamp stack (1) is fitted to the printer stand.

46 Optimum throw distances from the printhead to the product are as follows:

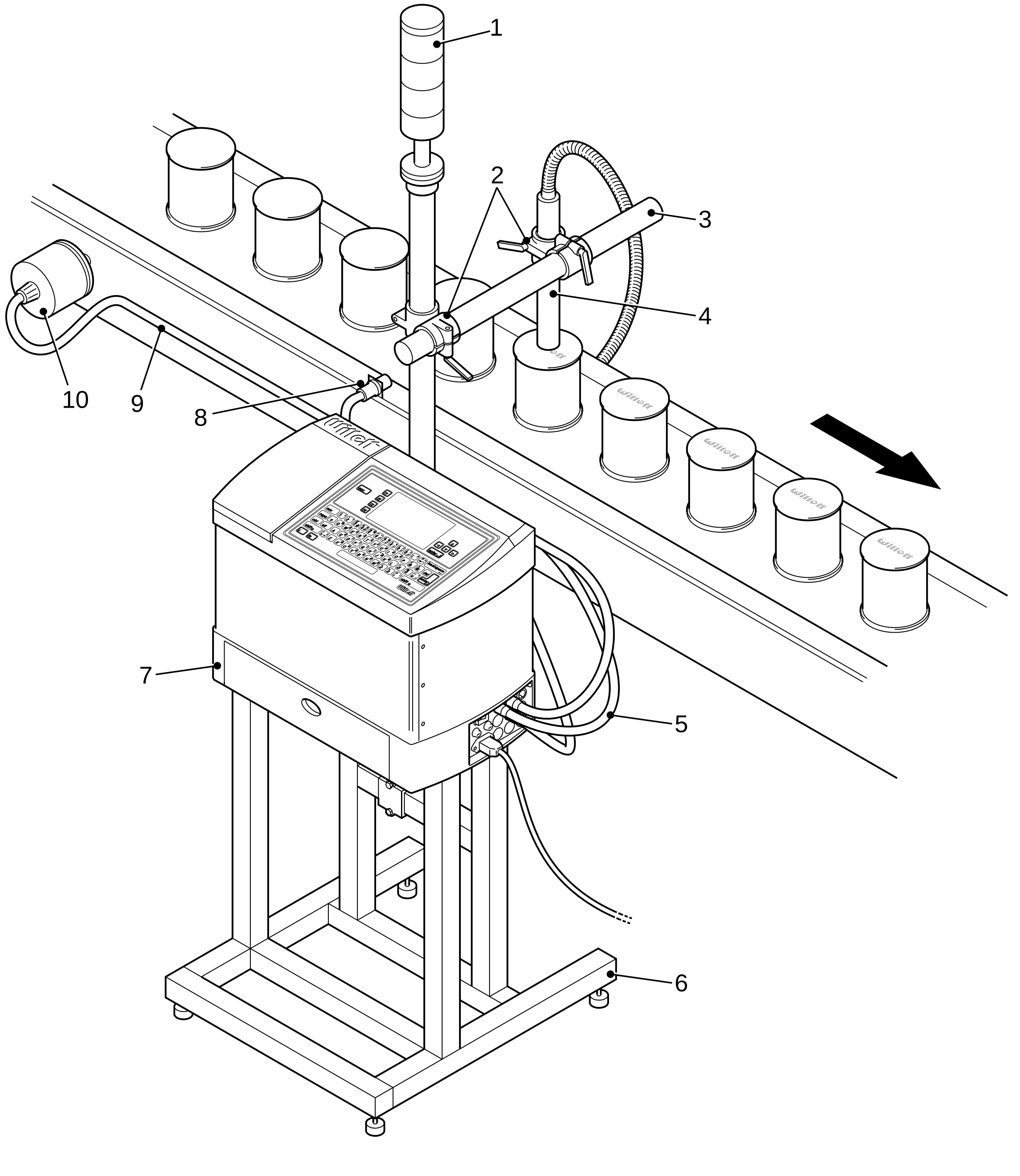
46.1 460Mi; 1 mm.

46.2 450Si, 460Si and 460Pi; 8 mm.

Shaft Encoder

<u>Internal source</u>

47 If no external shaft encoder is to be fitted then the Shaft Encoder Source (Configure menu) should be set to *Internal*.



1	Lamp stack	6	Printer stand
2	Clamp	7	Printer
3	Bracket	8	Photocell
4	Printhead	9	Shaft encoder cable
5	Photocell cable	10	Shaft encoder

Fig 9.11 Typical layout

(1) If the line speed varies then a shaft encoder must be fitted in order to maintain constant message width.

(2) A Width (Message Parameters) of 1 will provide the fastest print that the printer can achieve in each font using the Internal Shaft Encoder option. The message width is increased by approximately 3% for each increment.

<u>External source</u>

48 Fig 9.11 shows an external shaft encoder (10) connected via a cable (9) to the SHAFT ENCODER connector on the connector panel.

49 The printer is configured to accept two shaft encoder (quadrature) outputs, this allows the printer to compensate for changes in direction of the production line. See Section 5 - Machine Overview for the connector pin allocation.

STOP

LETHAL HAZARD. DISCONNECT THE PRINTER FROM THE MAINS SUPPLY PRIOR TO ATTEMPTING ANY INTERNAL ADJUSTMENTS OR MAINTENANCE.

EQUIPMENT DAMAGE. An antistatic wrist strap must be worn when working on printed circuit boards.

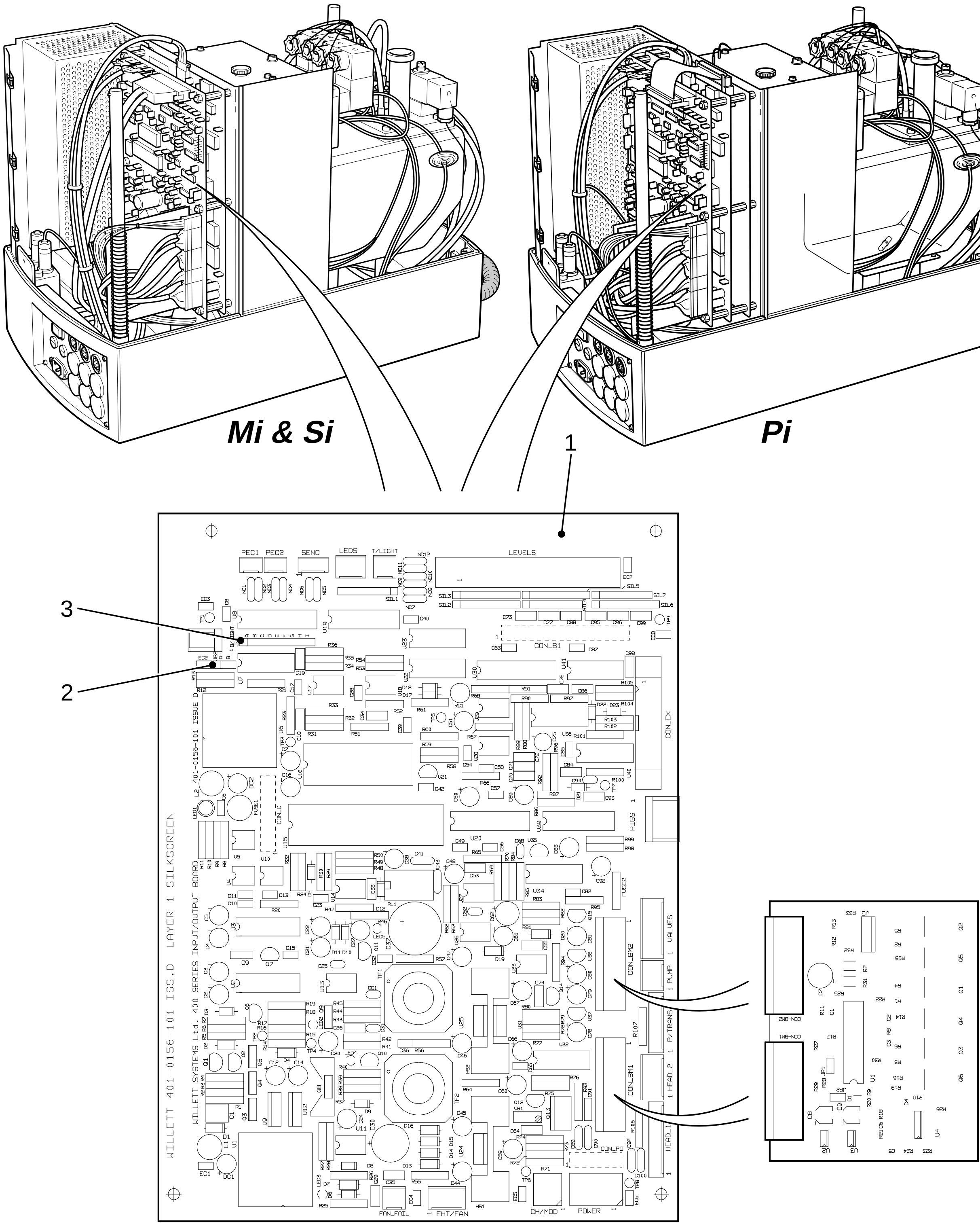
50 If a quadrature shaft encoder is to be used then jumper JB2 (Fig 9.12 (2)) must be set to the B position.

(1) If a quadrature shaft encoder is used then special software has to be downloaded to the machine.

(2) If a quadrature shaft encoder is used then the Width Value must be set to 1.

(3) If a quadrature shaft encoder is used then Print Trigger 2 is disabled.

51 The Shaft Encoder Source (Configure menu) should be set to *External*.



1 Input/Output board
2 Sensor 2/Quadrature shaft encoder jumper JB2
3 Print trigger 1 and 2 jumper JB1

Fig 9.12 Input/Output board product Sensor and shaft encoder jumper location

Product sensors

52 Fig 9.11 shows a photocell (8) connected via a cable (5) to PRINT TRIGGER 1 on the connector panel.

53 The printer can be configured to use two product sensors (PRINT TRIGGER 1 and PRINT TRIGGER 2), this option would require the use of non standard system software.

STOP

LETHAL HAZARD. DISCONNECT THE PRINTER FROM THE MAINS SUPPLY PRIOR TO ATTEMPTING ANY INTERNAL ADJUSTMENTS OR MAINTENANCE.

EQUIPMENT DAMAGE. An antistatic wrist strap must be worn when working on printed circuit boards.

54 Photocells can be NPN or PNP devices. Jumper JB1 (Fig 9.12 (3)) on the I/O board should be set to accommodate the device type. Table 9.3 lists the settings for jumper JB1.

TABLE 9.3 JUMPER JB1 SETTINGS

Serial (1)	Print trigger (2)	Device type (3)	Jumper 1 (4)	Pins (5)	Jumper 2 (6)	Pins (7)
1	1	NPN	A	1-2	C	3-4
2	1	PNP	B	2-3	D	4-5
3	2	NPN	F	6-7	H	8-9
4	2	PNP	G	7-8	I	9-10

55 When the jumper has been set, connect the printer to the mains supply and set the On/Off switch to I (ON). Select the Photocell Setup option from the Configure menu and set the relevant Photocell level(s) to *Active high* or *Active low* dependant upon the device type (NPN = Active high: PNP = Active low).

System connections

56 The fitting and removal of system connection options is described in Section 11 - Failure Diagnosis and Repair (Level 3).

INK INFORMATION

57 Table 9.4 lists the available ink, top-up, washdown and FIN numbers for the 400 Series.

TABLE 9.4 400 SERIES PART NUMBERS

Serial (1)	Ink (2)	Top-Up (3)	Washdown (4)	Fluid Identification No. (5)	Model (6)
1	MK 3901D BLACK 201-0001-601	201-0001-701	201-0001-702	110/110/47/32/35	Si
2	MK 3903F RED 201-0001-603	201-0001-703	201-0001-705	120/120/43/32/35	Si
3	MK 3904G BLUE 201-0001-604	201-0001-704	201-0001-705	120/112/46/32/35	Si
4	MK 3906J GREEN 201-0001-606	201-0001-706	201-0001-705	120/120/43/31/30	Si
5	ET 3907A BLACK 201-0001-607	201-0001-707	201-0001-722	190/180/33/30/35	Si
6	MK 3911E BLACK 201-0001-611	201-0001-711	201-0001-702	195/195/33/32/35	Si
7	ET 3913G BLUE 201-0001-613	201-0001-713	201-0001-722	130/120/43/30/35	Si
8	MK 3914 THERMO 201-0001-614	201-0001-714	201-0001-768	167/142/40/32/35	Si
9	MK 3915J BLACK 201-0001-615	201-0001-715	201-0001-705	225/178/39/31/35	Si
10	MK 3919C BLACK 201-0001-619	201-0001-719	201-0001-702	245/174/41/32/35	Si
11	ET 3924J BLUE 201-0001-624	201-0001-724	201-0001-717	090/090/48/31/35	Si
12	MK 3926A BLACK 201-0001-626	201-0001-726	201-0001-702	145/145/40/32/35	Si
13	MK 3938D CLEAR 201-0001-638	201-0001-738	201-0001-702	138/138/40/28/35	Si
14	MK 3942J BLACK 201-0001-642	201-0001-742	201-0001-702	130/125/42/31/35	Si
15	MK 3944A BLACK 201-0001-644	201-0001-744	201-0001-702	230/220/33/29/35	Si
16	EA 3953A BLACK 201-0001-653	201-0001-753	201-0001-755	130/130/39/32/35	Si
17	MA 3956D VIOLET 201-0001-656	201-0001-756	201-0001-757	139/119/46/31/30	Si
18	3958F RED 201-0001-658	201-0001-759	201-0001-760	100/120/37/32/25	Si
19	MK 3966E THERMO 201-0001-667	201-0001-766	201-0001-768	173/173/40/32/35	Si
20	DCJC RED 201-DCJC-434	201-DCJC-486	201-DCJH-477	100/120/37/32/25	Si
21	MK 3940G BLACK 201-0001-640	201-0001-701	201-0001-702	550/400/24/33/35	Mi
22	MK 3946C YELLOW 201-0001-646	201-0001-746	201-0001-252	396/243/38/32/35	Pi
23	MK 3949F BLACK 201-0001-649	201-0001-746	201-0001-252	276/179/44/29/35	Pi
24	MK 3943K WHITE 201-0001-643	201-0001-746	201-0001-252	164/153/42/32/35	Pi

Ink and solvent storage

PERSONAL INJURY. DO NOT EXPOSE PERSONNEL TO HIGH CONCENTRATIONS OF SOLVENT VAPOUR.

58 All inks and solvents should be stored and used in a well ventilated area and protected in case of fire.

59 Store and ship the inks and solvents out of direct sunlight within a 5 - 50°C temperature range.

60 When shipping inks or solvents, comply with the local laws and regulations.

61 The risk of fire is an important consideration when storing/shipping inks and solvents. Aqueous inks and solvents present a low fire risk as they will not burn or support combustion. Inks based on water/alcohol mixtures may burn if sufficient alcohol is present. Solvent based inks pose a greater fire risk. Consult the appropriate product data sheet on the exact nature of the ink/solvent.

62 Use powder or dry foam to extinguish fires and ensure electrical supply is turned off. A fire blanket may be used to smother small local fires. If in doubt consult the local fire authority.

63 Wipe up any spillage immediately with absorbent material and dispose of safely. If spillage is large, ventilate the area.

64 Dispose of ink and solvents in accordance with the local regulations.

65 Do not dispose of inks and solvents into the local drains.

FIRMWARE DOWNLOAD

General

66 It may be necessary to download new operating software to the flash memory in the printer, this is achieved by using Microsoft Windows version 3.1 Terminal mode.

67 Both methods are used in conjunction with the Debug Monitor option from the System menu.

Requirements

68 The following equipment is required:

68.1 An IBM compatible PC (installed with Microsoft Windows version 3.1 (Para 70)).

68.2 A copy of the new operating software on disk.

The 450Si is not equipped with the COMM1 connector. The RS232 jumper assembly (100-0370-158) must be fitted prior to the download, see Section 11 for fitting instructions.

68.3 A suitable serial communications cable to connect between the PC and printer connector COMM1 (see Section 5 for connection details).

Checking the communications link

69 The following procedure may be employed to check the communications link between a PC and a 400 Series unit prior to attempting to download new software:

69.1 Using a pre-configured connection cable (see Section 5), connect Com1 of the PC to COMM1 of the 400 Series unit.

69.2 On the PC, run the Terminal programme (Windows Accessories Group). Select the **Communications** option from the **Settings** menu and set the following options:

69.2.1 Baud Rate: 9600

69.2.2 Data Bits: 8

69.2.3 Stop Bits: 1

69.2.4 Parity: None

69.2.5 Flow Control: None

69.2.6 Connector: Com1 (assuming Com1 is the port to be used)

69.3 Click OK to confirm the settings.

If required, this set up can be saved for future use by selecting **Save As** from the **File** menu and saving the communications set up as 400.trm (for example).

69.4 Ensure that COMM1 on the 400 Series unit is set to corresponding baud rate, data bits, stop bits and parity settings.

69.5 From the 400 Series unit Data Logging menu, select the Serial Port Functionality option and set Status to Disable.

69.6 Press ↵ to make the setting and exit from the Data Logging menu.

69.7 From the 400 Series unit System menu enter the Debug Monitor and set Com1 to the active port.

69.7.1 The prompt **MON>** should appear in the PC Terminal Window.

69.7.2 Pressing ↵ on the PC should result in the prompt **MON>** appearing a second time, eg:

MON>
MON>

69.8 These actions confirm that the communications link is effective.

69.9 Press X and then ↵ on the PC to return the 400 Series unit to normal control.

69.10 From the 400 Series unit Data Logging menu, select the Serial Port Functionality option and reset Status to Enable.

Microsoft Windows

70 To use Microsoft Windows version 3.1 for a firmware download, proceed as follows:

70.1 Connect the serial communications cable between the serial port of the PC and printer connector COMM1.

70.2 Select the Debug Monitor option from the System menu. Select **LCD** and press ↵. The printer screen will display **MON>**.

70.3 Access Windows Terminal (normally located in Accessories group (Fig 9.13).

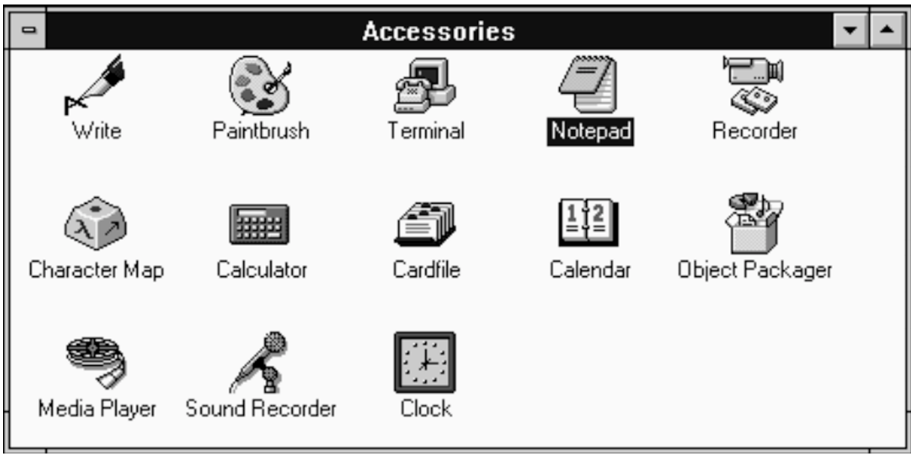


Fig 9.13 Accessories group

70.4 Type **BO** on the printer keypad, press ↵, confirm boot with Y key. The screen will go blank. The Terminal Window will now display **MON>**.

70.5 On the PC, type **ER** and press ↵ to erase the printer flash EEPROM.

70.6 The PC Terminal Window will display the message; **Blank check failed, Erasing Flash**.

70.7 After approximately 10 seconds the Terminal Window will display the message, **Blank check passed**.

70.8 The PC Terminal Window will the display; **MON>**.

70.9 On the PC type **DU<SPACE>1** and press ↵. A zero (0) will be displayed in The Terminal Window.

70.10 On the PC; press Alt + T (**Transfers** menu), select **Send Text File** and press ↵.

70.11 To select the new operating software file from the **Send Text File** Window, proceed as follows:

70.11.1 From the **Drives**: menu, select **a:**

70.11.2 From the **List Files of Type** menu, select **All files [*.*]**

70.11.3 Select the relevant file eg **4601-001.fla** and press ↵. The file will now download to the printer.

An indicator at the bottom on the Terminal Window will display the progress of the download.

70.12 After approximately 20 minutes the Terminal Window will display **MON>**

70.13 Type **RUN** on the PC keyboard and press ↵ to activate and run the new operating software.

Boot monitor recovery procedure

71 If a data communications error occurs whilst downloading a new software Flash File or the system memory becomes corrupted, the system may lock up. If this situation occurs, use the following recovery procedure:

71.1 Switch off the 400 Series unit.

71.2 Remove the I/O board to allow access to the CPU (Fig 9.14).

71.3 Connect test point TMR1 to the chassis (0 V) with a test lead.

Refer to Fig 9.14. TMR1 is the test point closest to R12.

71.4 Replace I/O board and connections.

71.5 Connect a PC to the comms port.

71.6 Switch on the 400 Series unit.

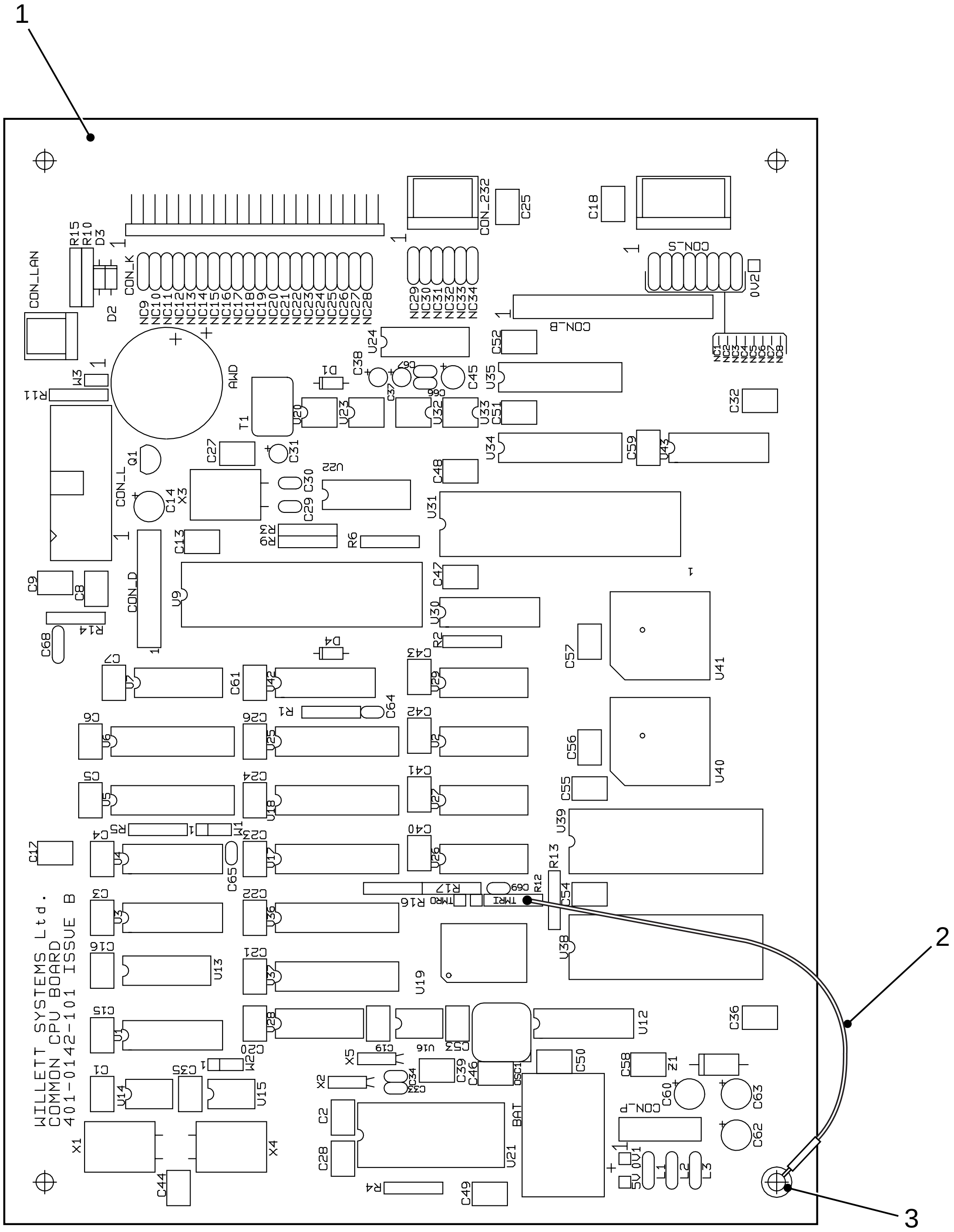
71.7 Run the PC in Windows Terminal Mode and establish communication.

71.8 Type ER on PC terminal.

71.9 Switch off the 400 Series unit and remove the test lead from the CPU.

71.10 Switch on and download new software using the download procedure.

72 The 400 Series unit will now be operational.



1 CPU board
2 Test lead
3 Pillar (0 V)

Fig 9.14 Connection of TMR1 to chassis

CONTENTS

CONTENTS (Continued)

CONTENTS (Continued)

CONTENTS (Continued)

GENERAL

1 The printer comprises four assemblies:

1.1 Cabinet.

1.2 Printhead.

1.3 Electronics system.

1.4 Ink system.

CABINET

Top cover

2 The top cover (Fig 10.1 (5)) is moulded from a plastic material and houses the following:

2.1 The control panel (3).

2.2 A hinged reservoir filler cover (1) that gives access to the ink and top up reservoir fillers.

2.3 A vent (2) that allows heat and vapour to escape from the enclosure.

3 The top cover is secured in position by two fasteners (4), when raised it gives access to the internal components of the printer, it is supported on two telescopic struts.

Side covers

4 The two side covers (Fig 10.1 (9)) are similar, they have different length fasteners fixed to them, thus they require the correct orientation when fitting. The side covers should be fitted with the long fasteners at the opposite side from the printhead umbilical cable.

5 The covers are secured using quick release fasteners (6) which have combined slotted/pozi heads to facilitate removal. When the covers are removed the fasteners are retained in the cover by captive plastic washers.

Base

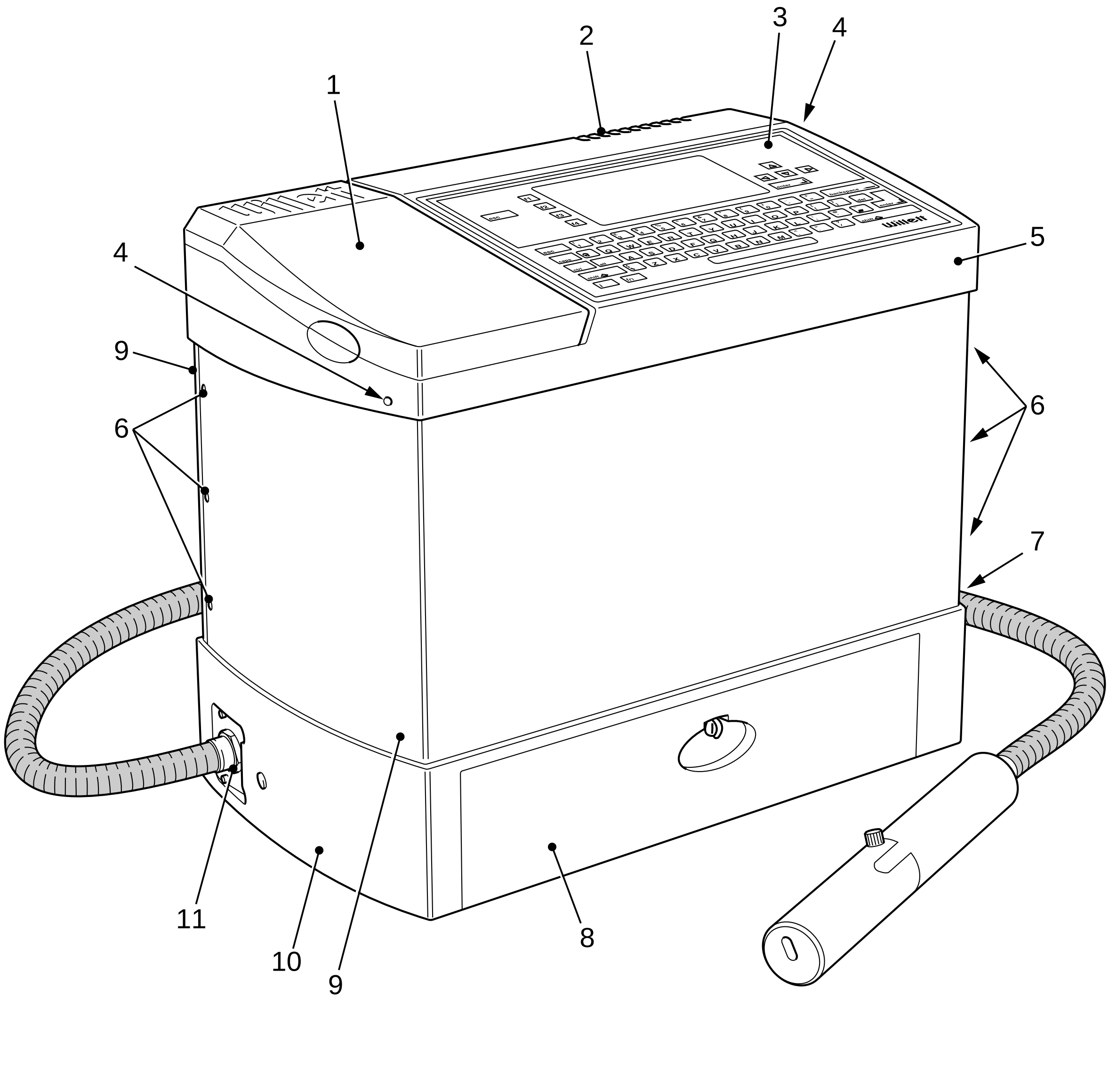
6 The base (Fig 10.1 (10)) is moulded from plastic and houses the following:

6.1 The ink system filters (see Para 42) and the electronic system cooling fan filter.

6.2 A hinged cover (8), which gives access to the ink system filters and the electronic system cooling fan filter.

6.3 The connector panel (7) (see Para 12).

6.4 The printhead umbilical outlet (11).



1	Reservoir filler cover	7	Connector panel
2	Vent	8	Filter cover
3	Control panel	9	Side cover
4	Top cover fastener	10	Base
5	Top cover	11	Umbilical outlet
6	Side cover fasteners		

Fig 10.1 Printer cabinet

PRINTHEAD

General

7 Three types of CIJ printhead are used with the 400 series printers. The 460 Si and 450 Si models use a standard printhead. The 460 Mi uses a shortened version which generates smaller characters. The 460 Pi incorporates a larger nozzle for use with pigmented ink. The printheads operate in the same way; there are minor differences in construction and operating parameters as described in the following paragraphs.

Construction

8 The printhead (Fig 10.2) consists of a chassis on which are mounted the following components:

The EHT block for the Pi is almost identical to the Si. Care must be taken to ensure that the correct EHT block is fitted. The finish on the front contour of the Pi EHT block is smoother than the Si equivalent. The letter **P** is stamped on the end face near the charge electrode on the Pi EHT block.

8.1 The nozzle assembly (4) which forms the ink into a stream of droplets as described below:

8.1.1 The feed pipe (11) delivers ink from the ink system to the nozzle assembly.

8.1.2 The purge pipe (13) removes air from the ink system when the nozzle assembly is being purged and is used to apply a vacuum to the nozzle during a nozzle flush.

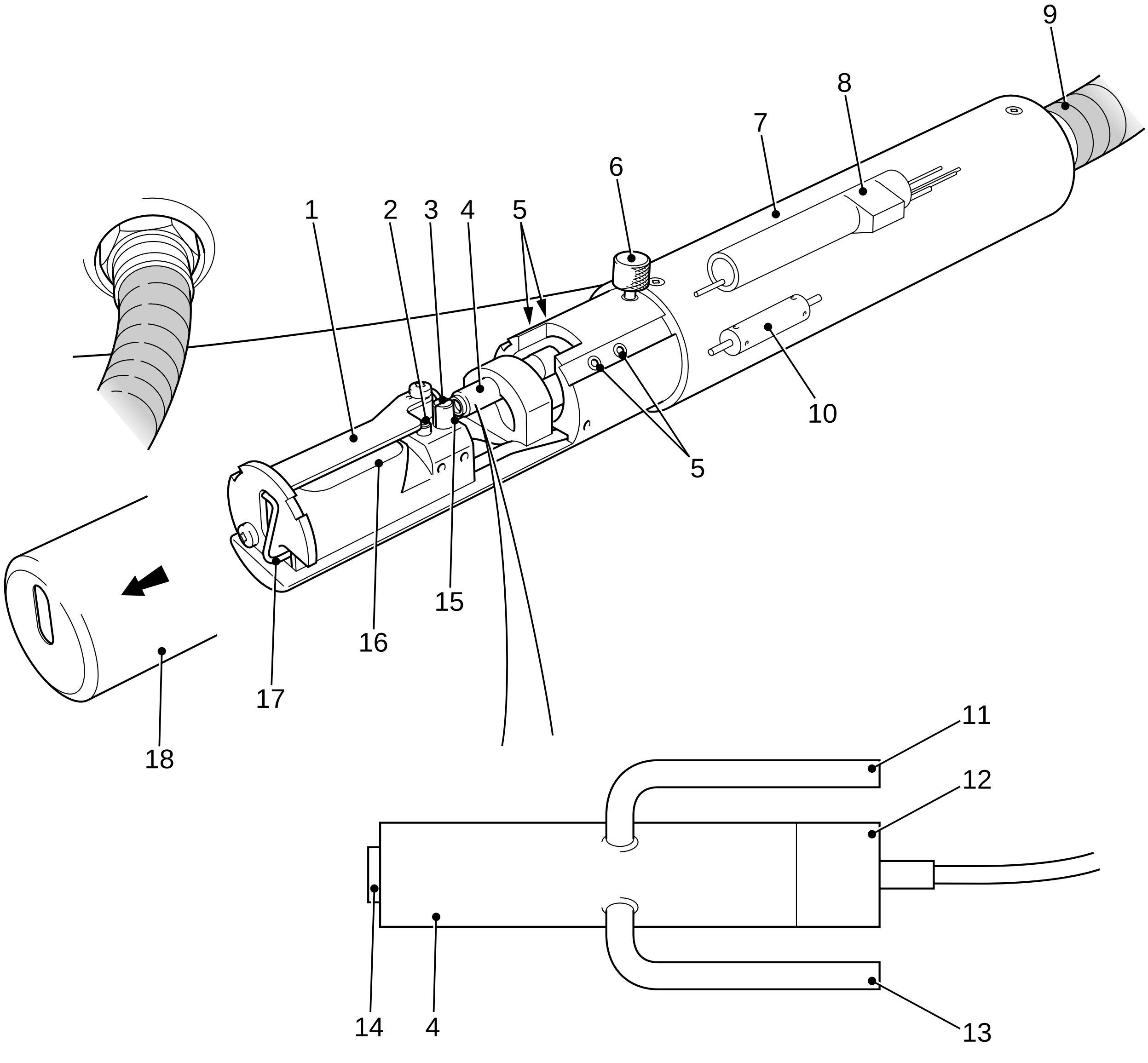
8.1.3 The ceramic transducer (12) is fed with a modulation signal. The transducer causes the nozzle assembly to vibrate along its length so that the ink stream from the nozzle jet orifice is formed into individual droplets.

8.1.4 The nozzle jet orifice (14) has a diameter of 60 microns (Si models), 35 microns (Mi model) or 70 Microns (Pi model).

8.2 The Light Emitting Diode (LED) (15) is located behind the charge electrode (3). The LED is strobed at the modulation frequency so that the position of individual droplets can be observed with a magnifying glass (x10 minimum).

8.3 The charge electrode applies an electrical charge to each individual ink droplet. The charge applied to the droplet is variable and affects the position of the droplet on the substrate.

8.4 The phase detector (2) senses the strength of the electrical charge applied to the ink droplets.



1 Ground potential deflector electrode
2 Phase detector
3 Charge electrode
4 Nozzle assembly
5 Dual cover switch
6 Knurled screw
7 Rear cover
8 Head heater
9 Umbilical
10 Gutter detect
11 Feed pipe
12 Ceramic transducer
13 Purge pipe
14 Nozzle jet orifice
15 LED
16 High voltage deflector electrode
17 Gutter
18 Front cover

Fig 10.2 Printhead

8.5 The ground potential deflector electrode (1) and the high voltage deflector electrode (16) are parallel rectangular plates. The deflector electrodes generate a constant electrostatic field through which the electrically charged ink droplets pass. The charged ink droplets are deflected by the electrodes, the amount of deflection is dependent on the charge applied to the ink droplet.

8.6 The gutter (17) is the return path for ink droplets which are not used for printing. The gutter delivers the ink back to the ink system.

8.7 The front cover (18) is secured to the printhead by a knurled screw (6). The front cover protects the printhead components. Removal of the cover is sensed by the printer via the dual cover switch (5). When the cover is removed the voltage to the deflector electrodes is turned off. The front cover on the Mi printhead is 20 mm shorter than the standard cover, and has a narrower slot at the front.

8.8 The rear cover (7) protects the printhead internal electrical wiring and ink system tubing.

8.9 The umbilical (9) contains the electrical wiring and ink system tubing from the printer.

8.10 The head heater (8) maintains the temperature of the ink; it consists of a heating element and a temperature sensor.

8.11 The gutter detect assembly (10) senses when ink is present in the gutter. Its ink feed tubes are metallic and a signal is fed to one of them. A signal return lead is connected to the other. When ink (which is conductive) is present, the signal passes through it to the return lead. This *gutter detect* signal is then fed, via the umbilical, to the I/O board in the electronics system.

9 A circuit diagram of the printhead electrical and ink systems is shown at Fig 10.3.

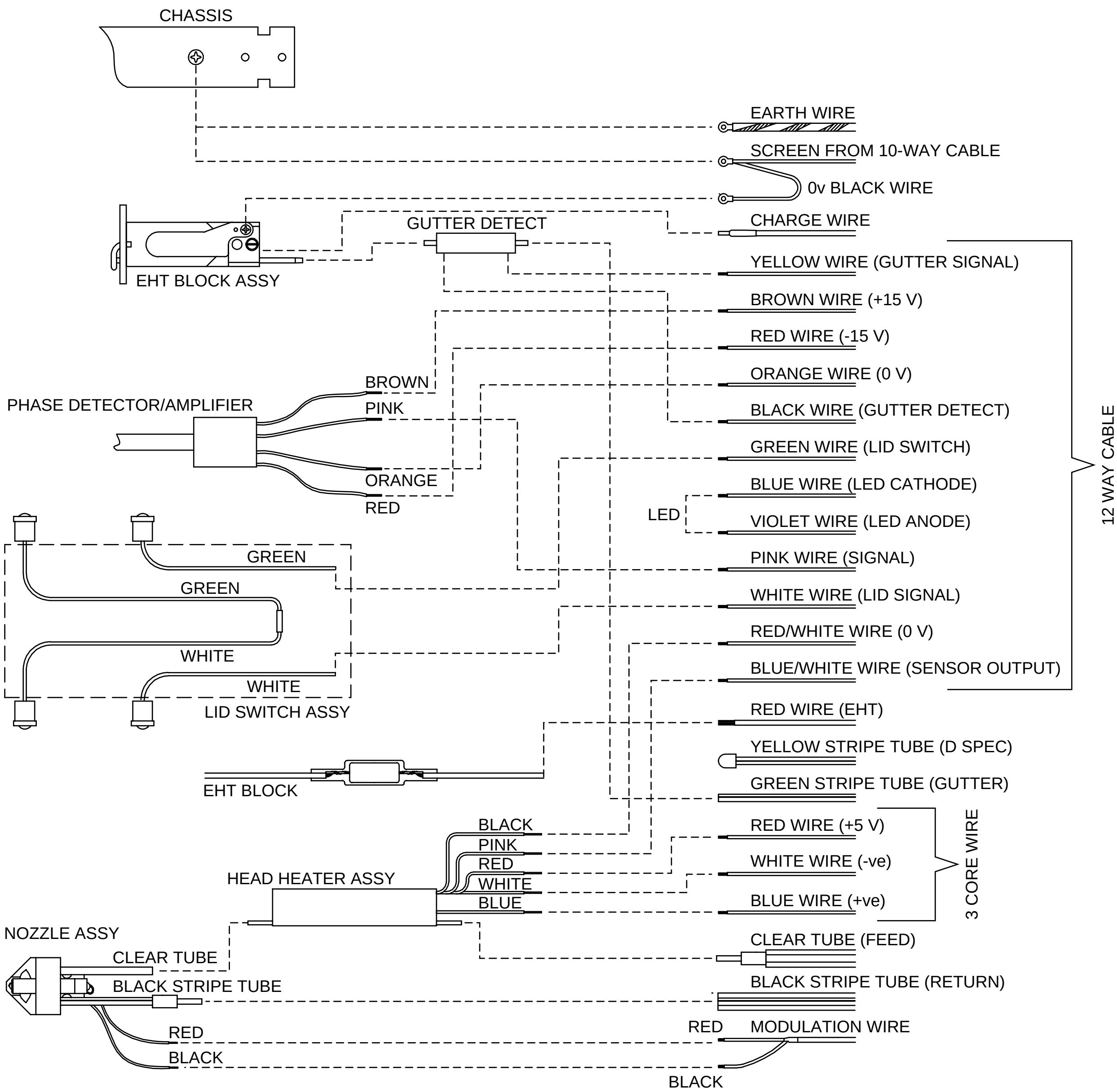


Fig 10.3 Printhead electrics and ink system circuit diagram

ELECTRONICS SYSTEM

10 The printer electronics system comprises the following:

10.1 Control panel.

10.2 Connector panel.

10.3 Control electronics.

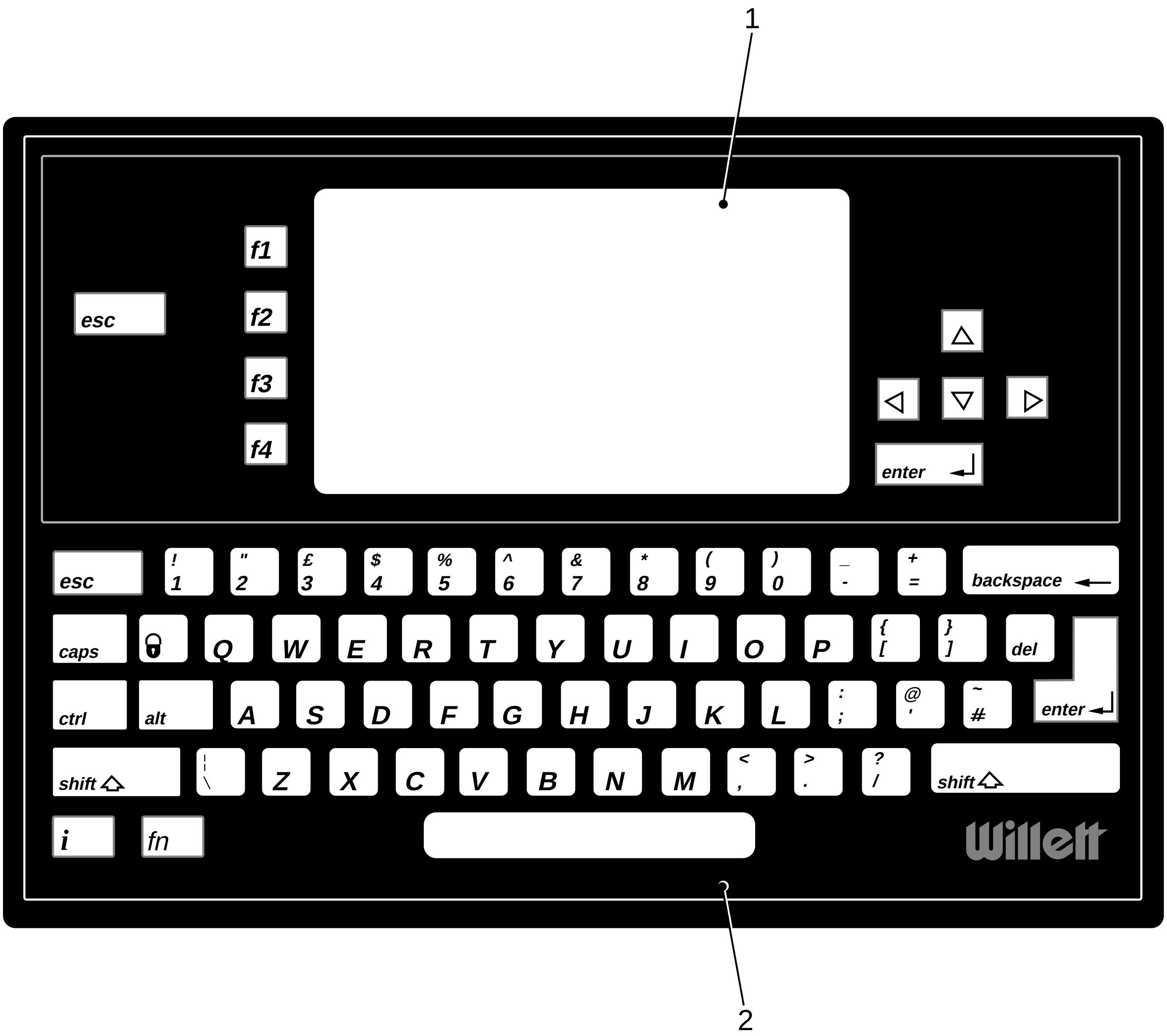
10.4 Electronics modules.

Control panel

11 The control panel (Fig 10.4) consists of the following:

11.1 A 70 key industrial grade membrane keypad (Fig 10.4 (2)). The keypad is self-adhesive for ease of mounting and is fixed to an aluminium plate, which is secured to the top cover by six screws.

11.2 A 240 x 128 pixel backlit Liquid Crystal Display (LCD) (1). The display has a viewing area of 120 mm x 64 mm. The display is mounted on four insulated studs, on the same aluminium plate as the keypad and is secured by four nylon nuts.

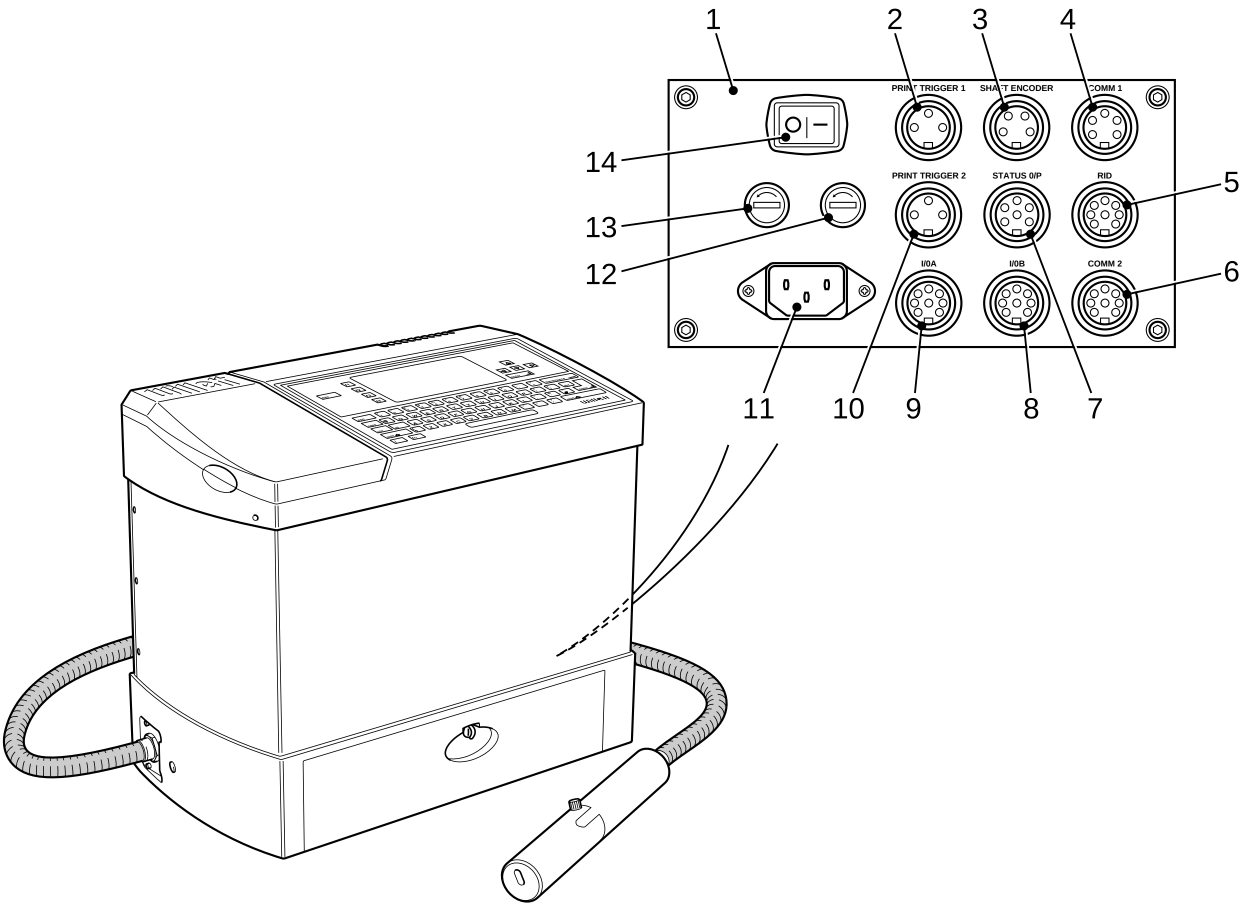


1 Liquid Crystal Display (LCD)
2 Keypad

Fig 10.4 Control panel

Connector panel

12 The connector panel (Fig 10.5 (1)) is a stainless steel pre-drilled plate fitted to the printer base and secured by four screws. The connector panel is fitted with the components listed below. Pin allocation details for the DIN connectors can be found in Section 5, Paras 14 to 34. Fitting instructions for the option A and B system connections are in Section 11.



1 Connector panel
2 Print trigger 1 connector (standard)
3 Shaft encoder connector (standard)
4 Comm 1 connector (standard) (not 450 Si)
5 Remote Input Device (RID) connector (option) (not 450 Si)
6 Comm 2 connector (option) (not 450 Si)
7 Status O/P connector (option)
8 I/OB connector (option) (not 450 Si)
9 I/OA connector (option) (not 450 Si)
10 Print trigger 2 connector (option) (not 450 Si)
11 Mains inlet connector
12 Supply (live) line fuse holder
13 Return (Neutral) line fuse holder
14 On/Off switch

Fig 10.5 Connector panel

12.1 A mains inlet connector (11) with a single pole rocker switch (14) and fuseholders (12 and 13) for supply and return lines.

12.2 A 3 way DIN connector (2) for print trigger 1.

12.3 A 4 way DIN connector (3) for a shaft encoder.

12.4 A 5 way DIN connector (4) for an RS232 serial communications link (not 450 Si). RS232 can only be used over relatively short distances (15 metres maximum).

12.5 A 3 way DIN connector (10) for print trigger 2 (Not 450 Si) (Option A system connection see Section 9).

12.6 A 6 way DIN connector (7) for a set of status traffic lights (Option A system connection).

12.7 An 8 way DIN connector (5) for a Remote Input Device (RID) (Not 450 Si) (Option A system connection).

12.8 A connector (6) for a modem (Not 450 Si) (Option A system connection). A cable gland is fitted in this position.

12.9 If a modem (Para 12.8) is not used, a 3 way DIN connector for RS485 half-duplex communications link (Option B system connection) can be fitted (Not 450 Si) in this position.

12.10 If a modem (Para 12.8) or RS485 link (Para 12.9) are not used, an 8 way DIN connector for a 20mA local area network (Option B system connection) can be fitted (Not 450 Si) in this position.

12.11 Two 8 way DIN connectors (8, 9) for 8 opto coupled inputs (Not 450 Si) (BCD message select, an Option B system connection).

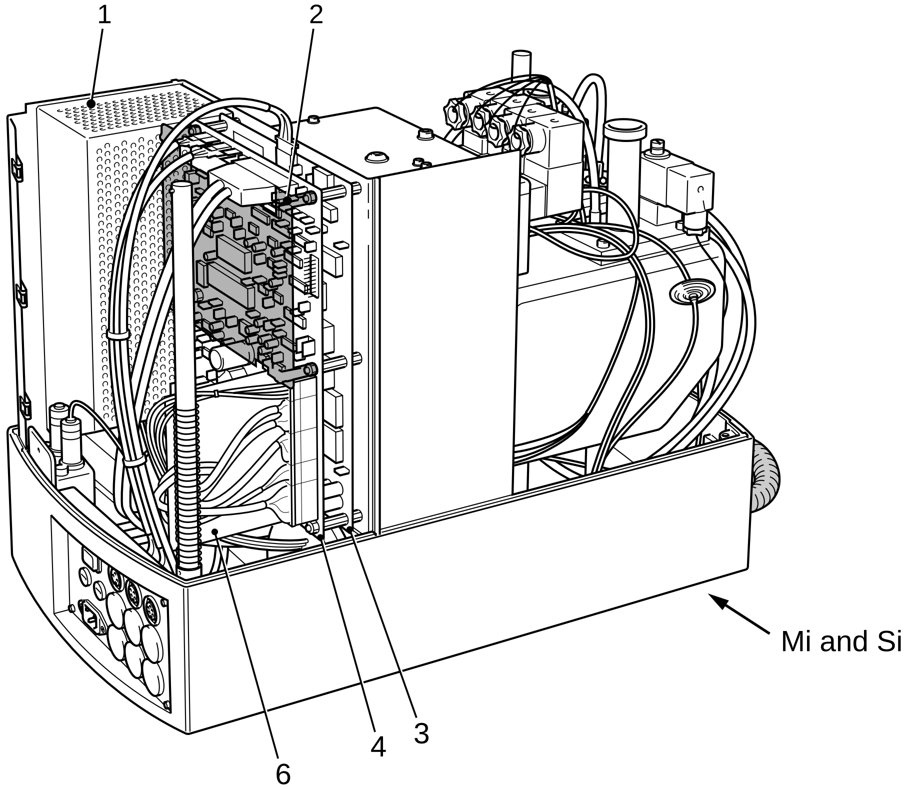
12.12 If the 8 opto coupled inputs (Para 12.11) are not used, a 7 way DIN connector (9) for change over relay status outputs (Option B system connection) can be fitted (Not 450 Si). The relays are linked to the status traffic lights and operate as follows:-

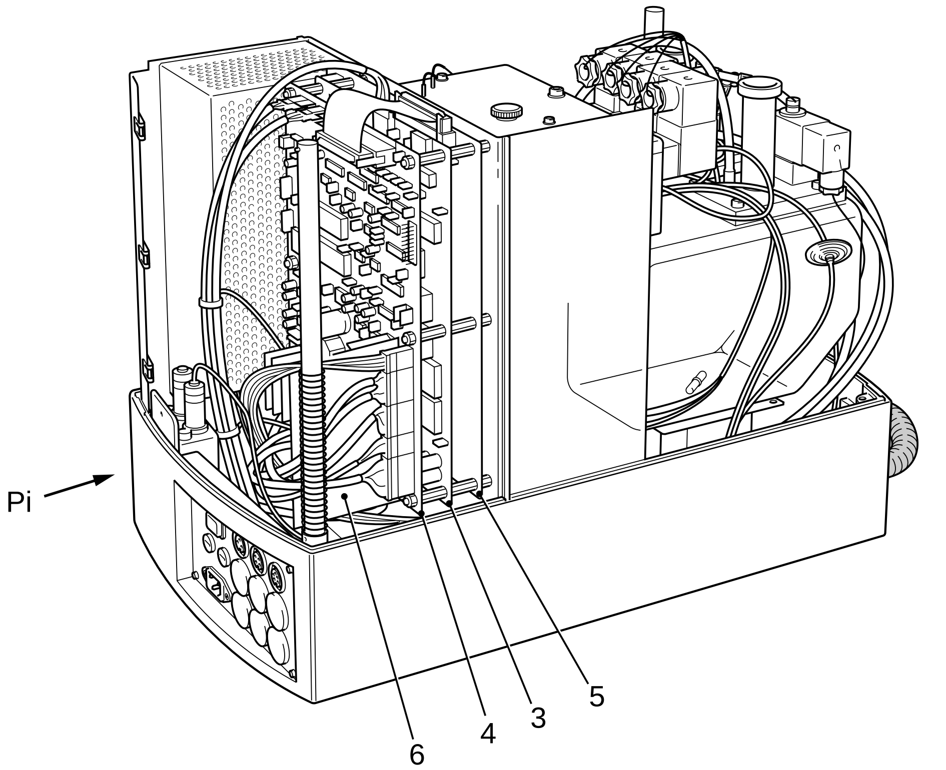
12.12.1 When the red lamp is illuminated, relay A is energised.

12.12.2 When the amber lamp is activated, relay B is energised.

12.13 These relays can be incorporated into a control system to stop a customer’s conveyor if a serious printer fault occurs.

12.14 If the 8 opto coupled inputs (Para 12.11) are not used, an 8 way DIN connector (8) for 4 uncommitted opto coupled outputs (Option B system connection) can be fitted (Not 450 Si).





1	PSU module	4	I/O board
2	Expansion board (optional)	5	Levels interface board (Pi only)
3	CPU board	6	Ink pump motor driver board

Fig 10.6 Control electronics

Control electronics

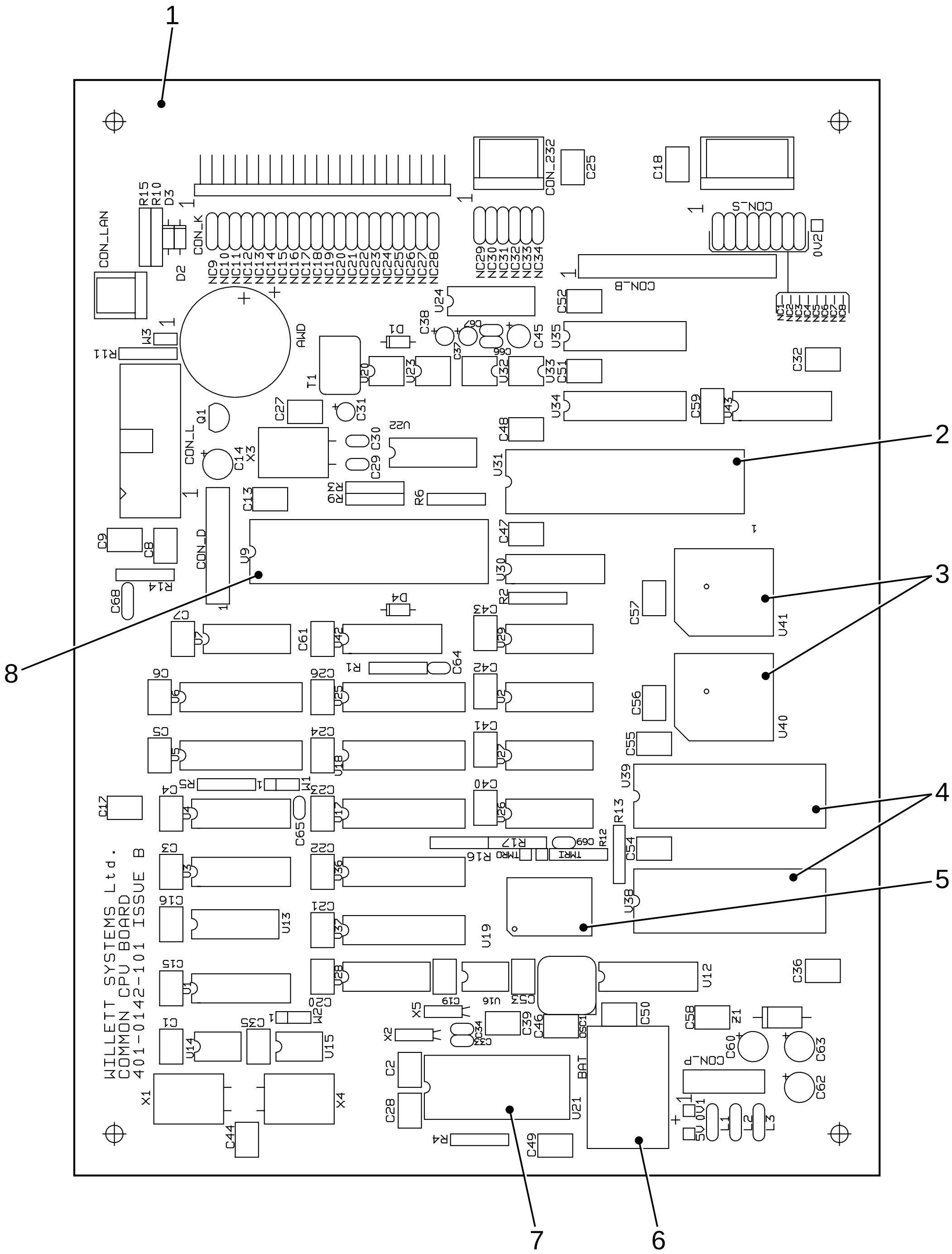
General

13 The control electronics in 400 series printers is based on a common Central Processing Unit (CPU) board (Fig 10.6 (3)), and an INPUT/OUTPUT (I/O) board (4). The 460 Pi is fitted with a Levels Interface Board (5).

14 In addition to the CPU and I/O boards, the 460 Si, Mi and Pi can also be fitted with an Expansion (EXP) Board (2) that plugs on to the I/O board. This EXP board adds the functionality of external message selection, time of flight compensation, etc. to the 460 Si, Mi and Pi as an added feature but is NOT included with the base machine.

15 For the 400 series printer to operate as designed, it has three other electronic component parts. These are the modular power supply (PSU) (1), the Liquid Crystal Display (LCD) (Fig 10.4 (1)) and the integral KEYPAD (2). The PSU connects directly to the I/O board, but the LCD and KEYPAD connect directly to the CPU. Note that the LCD backlight inverter connects to the I/O board.

16 The 460 series of machines can be interrogated over a serial link in order to assess performance. This serial link can be a direct RS232 connection to a local personal computer or via a MODEM and the telephone network.



1	CPU board	5	IC U19
2	IC U31	6	Ni-MH battery
3	IC U40 and U41	7	IC U21
4	IC U38 and U39	8	IC U9

Fig 10.7 CPU board major components

CPU board

Major components

17 The CPU board (Fig 10.7 (1)) (Fig 10.9 for circuit diagram) contains the hardware and software for system control. It comprises the following major components:

17.1 The CPU board (1) is a multi-layered motherboard which monitors and controls all of the major printer functions. The board interfaces with the I/O board, PSU module, expansion board (if fitted) and external devices (if connected) to provide an integrated product coding system.

17.2 Integrated Circuit (IC) U31 (2) produces keyboard drive signals to determine which key has been pressed.

17.3 IC U40 and IC U41 (3) are flash memory devices and are programmed by Willett to hold the following information:

17.3.1 The application software.

17.3.2 Printer default setup.

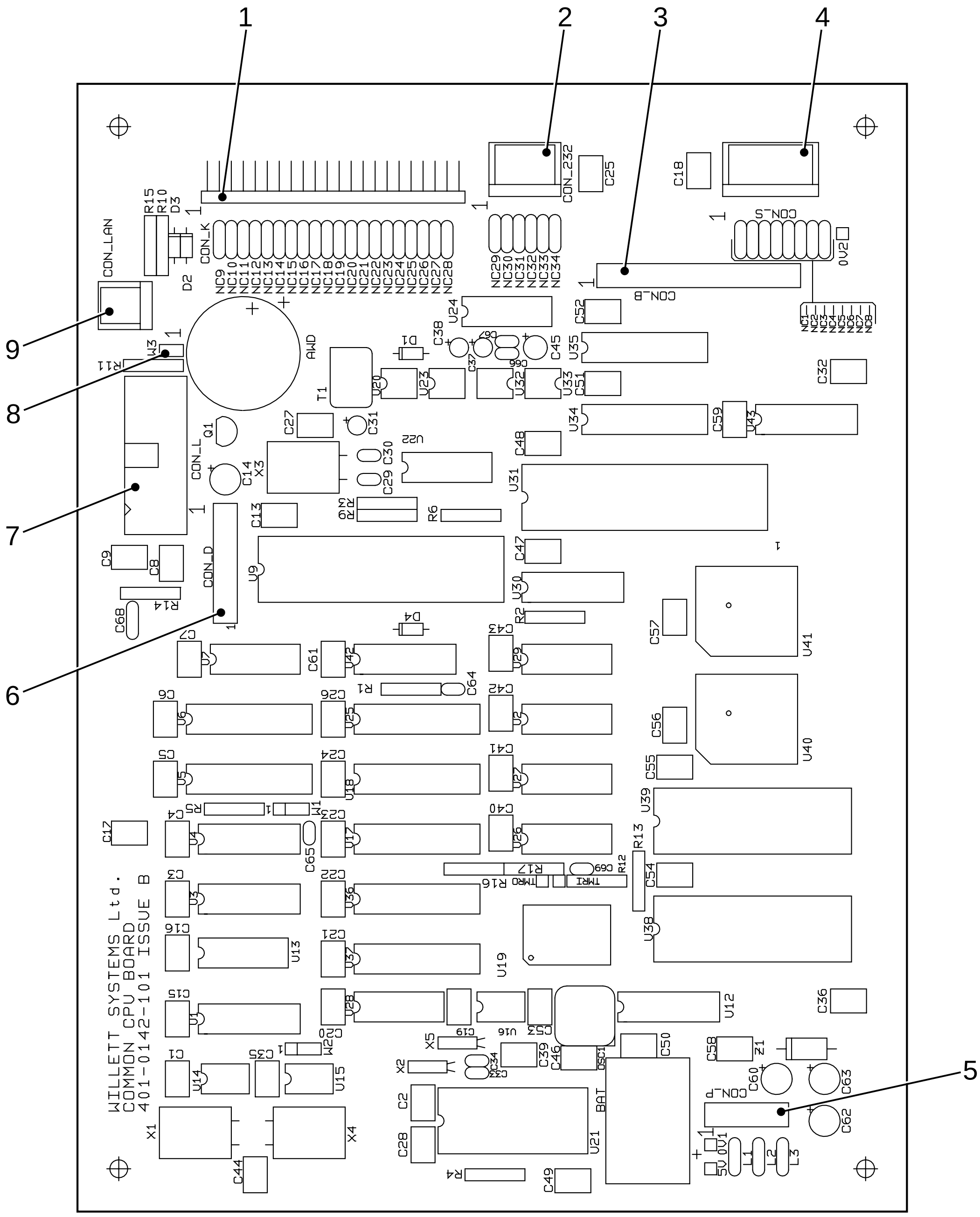
17.4 IC U38 and IC U39 (4) are two integrated circuit Random Access Memory (RAM) devices which contain the printer configuration, calibration and message storage memory. They are backed up by a Nickel Metal Hydride (Ni-MH) battery to avoid loss of data when the printer is switched off.

17.5 IC U19 (5) is the microprocessor that monitors incoming data from the I/O ports and translates software commands into machine statements which control the electronic system and ink system to produce a printed message.

17.6 IC U21 (7) is a Real Time Clock (RTC) which contains a clock/calendar. It has a battery backup so that the current time and date do not have to be manually set each time the printer is switched on.

17.7 The Ni-MH battery (6) supplies the voltage necessary to retain Real Time Clock (RTC) and RAM data when the printer is switched OFF. The battery is automatically charged when the printer is switched ON.

17.8 IC U9 (8) is a Dual Universal Asynchronous Receive Transmit (DUART) which can be configured to interface with different devices to transmit and receive data.



1 CON_K
2 CON_232
3 CON_B (Interboard connector)
4 CON_S
5 CON_P (Interboard connector)
6 CON_D (Interboard connector)
7 CON_L
8 Link W3
9 CON_LAN

Fig 10.8 CPU board connectors

Connectors

18 The CPU board connectors are as follows; pinout details are given in the table associated with each one:

18.1 CON_K (Fig 10.8 (1)) is connected to the keypad (See Table 10.1).

18.2 CON_232 (2) is a RS232 serial communications port (COM1) and can be connected to any other device which supports RS232 (Table 10.2).

18.3 CON_B (3) is an interboard connector which connects the CPU board to the I/O board (Table 10.4).

18.4 CON_S (4) is a high speed synchronous port (Table 10.5).

18.5 CON_P (5) is an interboard connector which connects the CPU board to the I/O board (Table 10.6).

18.6 CON_D (6) is an interboard connector which connects the CPU board to the I/O board (Table 10.7).

18.7 CON_L (7) is connected to the LCD (Table 10.8).

18.8 CON_LAN (9) is a serial communications port (COM2). The logic level signals at this connector are converted by the optional expansion card for use with a modem, 20 mA current loop or RS485 interface.

TABLE 10.1 CPU CON_K KEYPAD CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	GND	EMC earth connection
2	2	ALT	ALT key
3	3	CTL	Control key
4	4	SFT	Shift key
5	5	0V	
6	6	SL7	Scan line 7
7	7	RL0	Return line 0
8	8	RL1	Return line 1
9	9	RL2	Return line 2
10	10	RL3	Return line 3
11	11	SL0	Scan line 0
12	12	SL1	Scan line 1
13	13	SL2	Scan line 2
14	14	SL3	Scan line 3
15	15	SL4	Scan line 4
16	16	SL5	Scan line 5
17	17	SL6	Scan line 6
18	18	RL4	Return line 4
19	19	RL5	Return line 5
20	20	RL6	Return line 6
21	21	RL7	Return line 7
22	22	GND	EMC earth connection

TABLE 10.2 CPU CON_232 RS232 SERIAL INTERFACE

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	TXDA	Transmit data
2	2	DTR	Data terminal ready
3	3	RXDA	Receive data
4	4	DCD	Data carrier detect
5	5	COM	Common
6	6	-	+8V

TABLE 10.3 CPU CON_LAN SERIAL PORT

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	+15 V	+15 VDC power
2	2	VCC	+5 VDC power
3	3	RXDB	Receive data
4	4	TXDB	Transmit data
5	5	DTR	Data terminal ready
6	6	0 V	Common
7	7	RXDB	Receive data (via inverter)
8	8	TXDB	Transmit data (via inverter)

(1) Pins 7 and 8 of the CPU CON_LAN serial port are for use with a modem.

(2) Link W3 (Fig 10.8 (8)) must be fitted if COM2 is to be used with the optional expansion card and internal modem.

(3) Link W3 must be removed if COM2 is to be used with the expansion card 20 mA current loop or RS485 interface.

TABLE 10.4 CPU CON_B I/O BOARD INTERFACE

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	0 V	Common
2	2	Sel2	Not used
3	3	ex1	Photocell 1 input
4	4	ex2	Phase detector
5	5	ex3	A-D end of conversion
6	6	ex4	Phase detector
7	7	ex5	Photocell 2/shaft encoder quadrature input
8	8	sel3	Print/phase
9	9	strobe	LED strobe
10	10	PWM	Pump control (pulse width modulation)
11	11	opto I/O	Expansion board enable
12	12	adc	A/D converter output enable
13	13-20	cb0 to cb7	Control bus bits 0 to 7
14	21-28	db0 to db7	Data bus bits 0 to 7
15	29	qddc	D/A converter output enable
16	30	levels	Optical level sensors select
17	31	I/O	PPI enable
18	32	sft-enc	Shaft encoder input
19	33	extra1	Traffic light enable
20	34	contrast	LCD contrast voltage

TABLE 10.5 CPU CON_S RID SYNCHRONOUS PORT

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	TXD	Asynchronous transmit output
2	2	RXD	Asynchronous receive input
3	3	0 V	Asynchronous data common
4	4	SCLK	Synchronous clock
5	5	SDATA	Synchronous data
6	6	SDEN0	Synchronous enable 0
7	7	SDEN1	Synchronous enable 1
8	8	0 V	Synchronous common

TABLE 10.6 CPU CON_P POWER INPUT CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1 to 4	0 V	Common in out from PSU (via I/O)
2	5 to 8	+5 V	+5 V input from PSU (via I/O)
3	9 and 10	+15 V	+15 V input from PSU (via I/O)
4	11 and 12	-15 V	-15 V input from PSU (via I/O)
5	13 and 14	GND	via I/O

TABLE 10.7 CPU CON_D CHARGE DATA TO I/O

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1 to 8	00 - 07	Droplet charge data
2	9 and 10	0 V	Common
3	11 to 20	-	Not used at present

TABLE 10.8 CPU CON_L LCD INTERFACE

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	GND	Ground
2	2	0 V	
3	3	VCC	+5 V
4	4	CONTRAST	LCD contrast
5	5	WR	Write
6	6	RD	Read
7	7	lcd ce	LCD chip enable
8	8	la1	Control bus bit 7
9	9	-	Not connected
10	10	$\overline{\text{RESET}}$	LCD controller reset
11	11 to 18	ad0 to ad7	Data lines
12	19	0 V	Font Select
13	20	sel5	Select inverse video

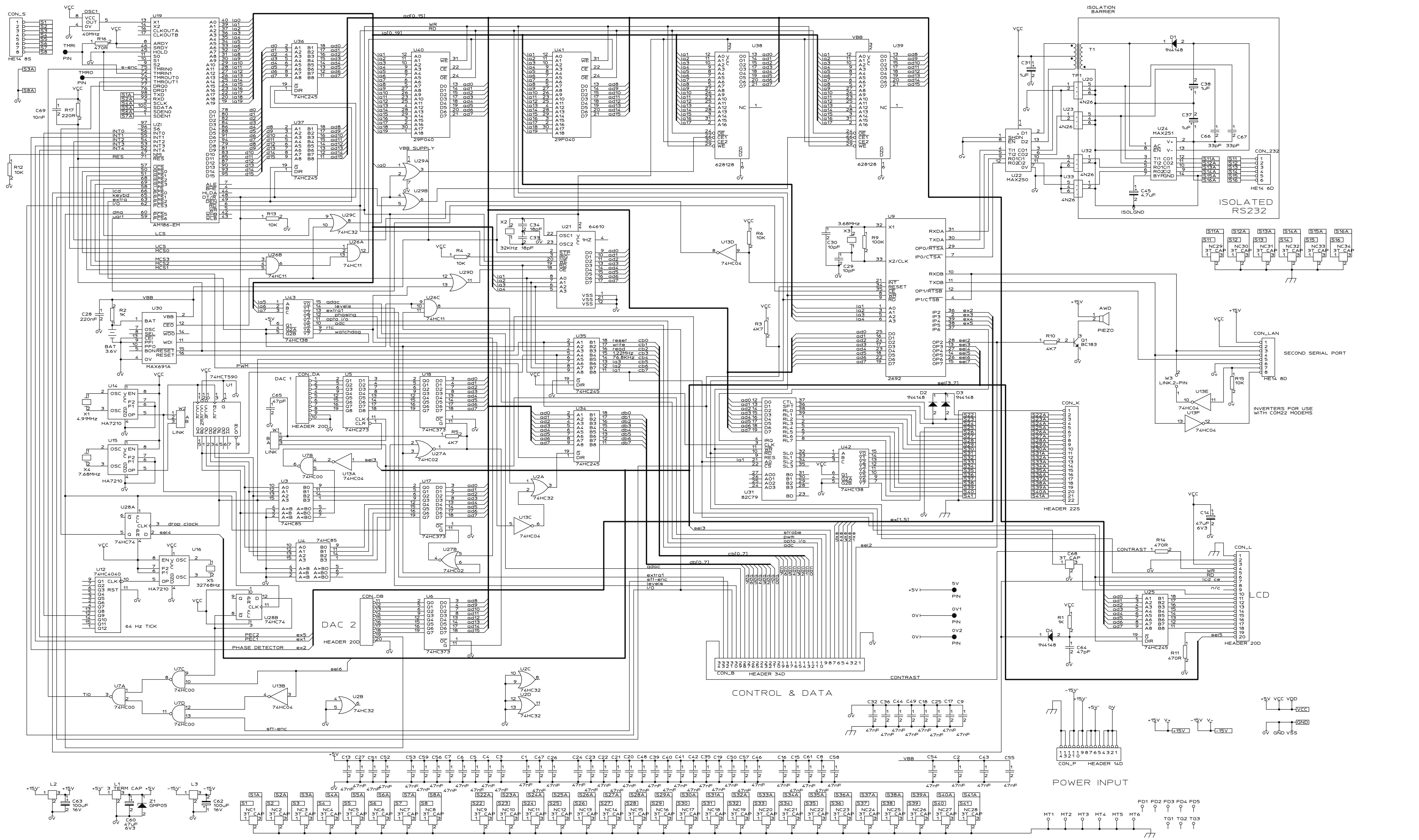


Fig 10.9 CPU board circuit diagram

I/O board

19 The I/O board (Fig 10.6 (4)) (Fig 10.13 for circuit diagram) is mounted over the CPU board and interfaces the printer to the following:

19.1 The ink system (Si and Mi).

19.2 The levels interface board (Pi).

19.3 Product sensors.

19.4 External devices.

20 The I/O board is connected to the CPU board via interboard connectors CON_B1, CON_D and CON_P0.

This manual (Issue 2.0) describes the Issue 2 I/O board. See Para 72 for component cross references between the Issue 1 I/O board and Issue 2 I/O board.

Major components

21 The following major components are fitted to the I/O board (Fig 10.10 (1)):

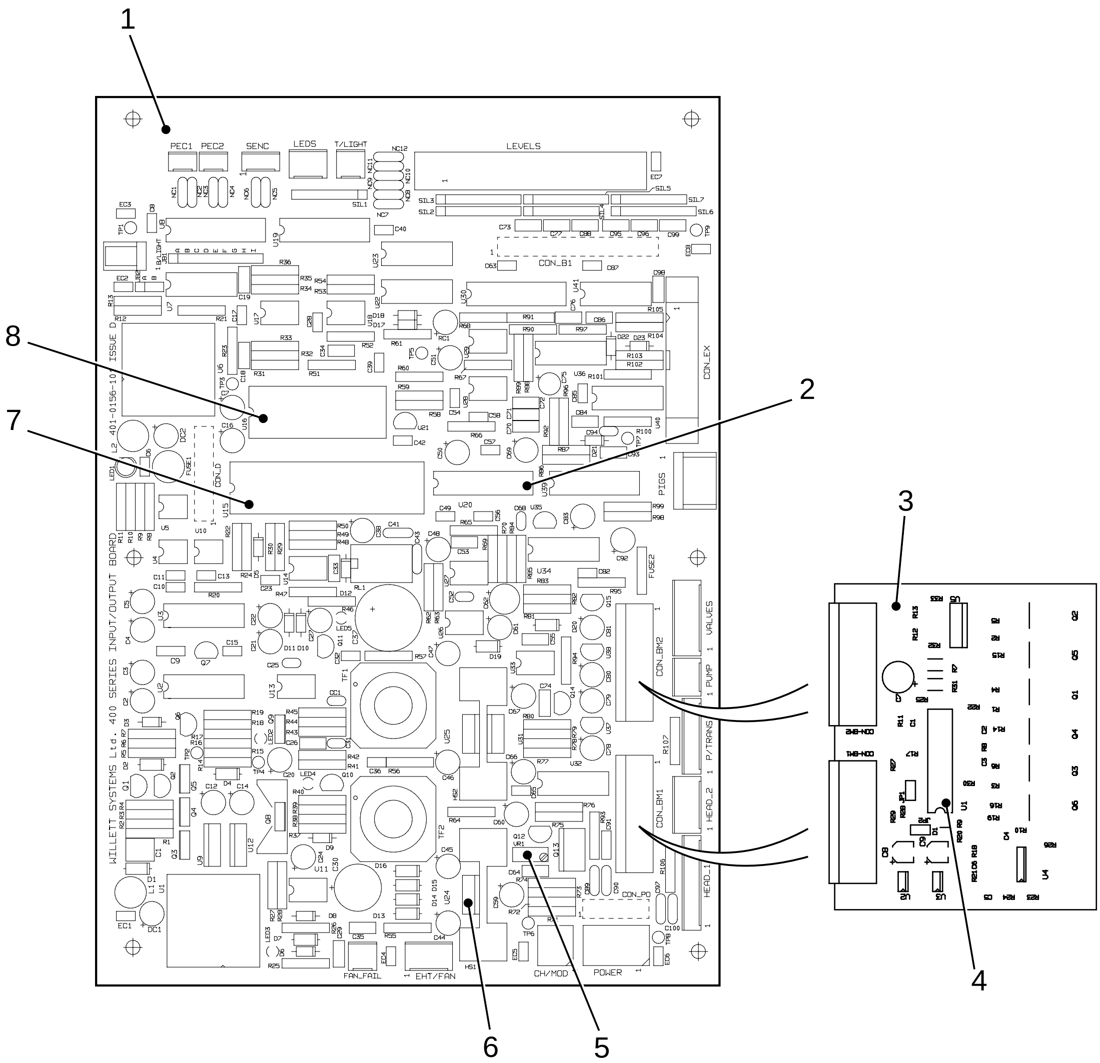
21.1 IC U20 (2) is a Quadruple Digital to Analogue Converter (QDAC) which converts digital inputs into analogue 0 to +5 volt signals to control functions on the I/O board.

21.2 The ink pump motor drive board (3) acts as an interface between the I/O board and the ink system pump motor, it is connected to the I/O board via connectors CON_BM1 and CON_BM2. IC U1 (4) acts as the ink pump motor controller. A circuit diagram of the board is supplied at Fig 10.14.

21.3 The 300 VDC power supply (6) provides the voltage supply to the charge amplifier which is used to charge the ink droplets.

21.4 IC U15 (7) is a Programmable Peripheral Interface (PPI) which is used to read the states of various sensors and control functions and to switch control valves and some supervisory lines.

21.5 IC U16 (8) is an Analogue to Digital Converter (ADC) which is used to convert analogue inputs from the ink system into an 8 bit value for ink system control.



1	I/O board	5	VR1
2	IC U20	6	285 V DC power supply
3	Ink pump motor driver board	7	IC U15
4	IC U1	8	IC U16

Fig 10.10 I/O board major components

Connectors

22 The I/O connectors are as follows (pinout details are given in the associated tables 10.9 to 10.30):

22.1 PEC1 (Fig 10.11 (1)) is connected to product sensor 1 via the connector panel (Table 10.9).

22.2 PEC2 (2) is connected to product sensor 2 via the connector panel (Table 10.9).

22.3 SENC (3) is connected to a shaft encoder via the connector panel (Table 10.10).

22.4 LEDS (4) is connected to an optional set of LEDs that can be mounted on the front panel to mimic the traffic lights (Table 10.11).

22.5 T/LIGHT (5) is connected to the status traffic lights via the connector panel (Table 10.12).

22.6 LEVELS (6) is connected to the ink system level sensors (Si and Mi) or levels interface board (Pi) (Table 10.13).

22.7 CON_B1 (7) is an interboard connector which connects the I/O board to the CPU board (Table 10.14).

22.8 CON_EX (8) is an interboard connector which connects the I/O board to the optional expansion board (Table 10.15).

22.9 PIGS (9) will be used in future models for an ink heater/cooler system (Table 10.16)

22.10 VALVES (10) is connected to the ink system solenoid valves (Table 10.17).

22.11 CON_BM2 (11) is used to connect the ink pump motor driver board (Table 10.18).

22.12 PUMP (12) is connected to the ink system pump (Table 10.19).

22.13 P/TRANS (13) is connected to the ink system temperature sensor and the pressure transducer (Table 10.20).

22.14 HEAD_2 (14) is connected to printhead connector 2 via the umbilical (Table 10.21).

22.15 CON_BM1 (15) is used to connect the ink pump motor driver board (Table 10.22).

22.16 HEAD_1 (16) is connected to the printhead connector 1 via the umbilical (Table 10.23).

22.17 CON_P0 (17) is an interboard connector which connects the I/O board to the CPU board. It carries the DC voltages from the PSU (Table 10.24).

22.18 POWER (18) is connected to the PSU (Table 10.25).

22.19 CH/MOD (19) is connected to the printhead via the umbilical (Table 10.26).

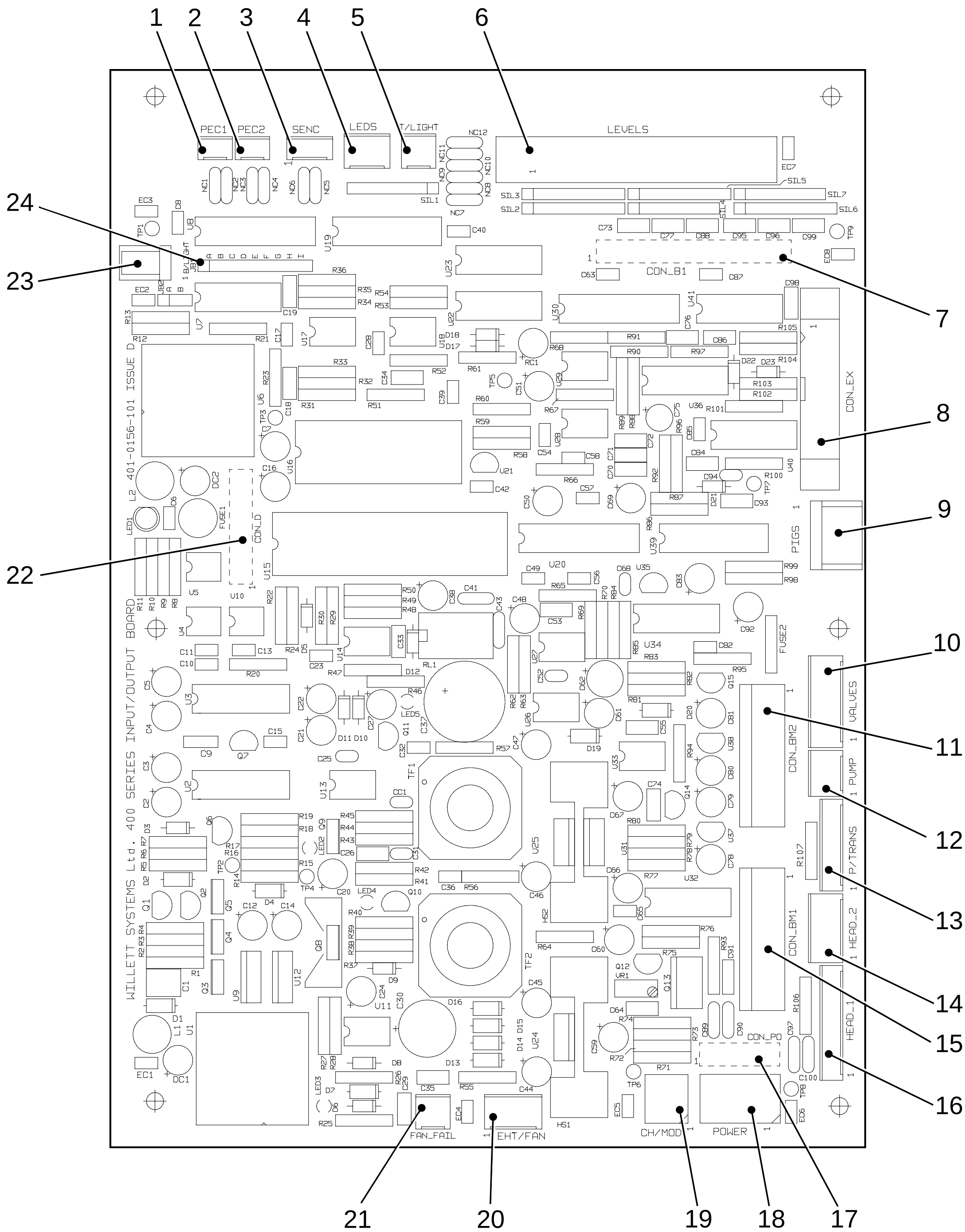
22.20 EHT/FAN (20) is connected to the cooling fan and EHT module (Table 10.27).

22.21 FAN_FAIL (21) is connected to the fan failure sensor PCB (Table 10.28).

22.22 CON_D (22) is an interboard connector which connects the I/O board to the CPU board (Table 10.29).

22.23 B/LIGHT (23) is connected to the backlight of the Liquid Crystal Display (LCD) (Table 10.30).

22.24 JB1 is used to configure the photocell inputs PEC1 and PEC2.



1	PEC1	9	PIGS	17	CON_P0
2	PEC2	10	VALVES	18	POWER
3	SENC	11	CON_BM2	19	CH/MOD
4	LEDS	12	PUMP	20	EHT/FAN
5	T/LIGHT	13	P/TRANS	21	FAN_FAIL
6	LEVELS	14	HEAD_2	22	CON_D
7	CON_B1	15	CON_BM1	23	B/LIGHT
8	CON_EX	16	HEAD_1	24	JB1

Fig 10.11 I/O board connectors

TABLE 10.9 I/O PEC1 AND PEC2 CONNECTORS

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	+V0	Positive DC supply to sensor
2	2	EXT PEC 1/2	Input from sensor
3	3	0 V	Common

TABLE 10.10 I/O SENC CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	+V0	Positive DC supply to shaft encoder
2	2	SHAFT ENCODER A	Input A from shaft encoder
3	3	SHAFT ENCODER B	Input B from shaft encoder
4	4	0 V	Common

TABLE 10.11 I/O LEDS CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	Red +	Red LED anode (+)
2	2	Yellow +	Yellow LED anode (+)
3	3	Green +	Green LED anode (+)
4	4	Strobe +	Strobe LED anode (+)
5	5	Red -	Red LED cathode (-)
6	6	Yellow -	Yellow LED cathode (-)
7	7	Green -	Green LED cathode (-)
8	8	Strobe -	Strobe LED cathode (-)

EQUIPMENT DAMAGE. The LEDs connector must not be used to drive anything other than LEDs as specified or damage may occur.

TABLE 10.12 I/O T/LIGHT CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	+24 V	+24 V DC to all lights
2	2	0 V RED	Negative supply for red lamp
3	3	0 V AMBER	Negative supply for amber lamp
4	4	0 V GREEN	Negative supply for green lamp
5	5	+24 V	+24 V DC to strobe/siren
6	6	0 V STROBE	Negative supply for strobe

TABLE 10.13 I/O LEVELS CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	+5 V	+5 V, Mixer low sensor LED anode (not Pi)
2	2	+5 V	+5 V, Mixer low sensor phototransistor collector (not Pi)
3	3	0 V	0 V, Mixer low sensor LED cathode (not Pi)
4	4	lev1	Mixer low sensor output
5	5	+5 V	+5 V, Mixer OK sensor LED anode (not Pi)
6	6	+5 V	+5 V, Mixer OK sensor phototransistor collector (not Pi)
7	7	0 V	0 V, Mixer OK sensor LED cathode (not Pi)
8	8	lev 2	Mixer OK sensor output
9	9	+5 V	+5 V, Mixer high sensor LED anode (not Pi)
10	10	+5 V	+5 V, Mixer high sensor phototransistor collector (not Pi)
11	11	0 V	0 V, Mixer high sensor LED cathode (not Pi)
12	12	lev3	Mixer high sensor output
13	13	+5 V	+5 V, VMS low sensor LED anode (not Pi)
14	14	+5 V	+5 V, VMS low sensor phototransistor collector (not Pi)
15	15	0 V	0 V, VMS low sensor LED cathode (not Pi)
16	16	lev4	VMS low sensor output
17	17	+5 V	+5 V, VMS high sensor LED anode (not Pi)
18	18	+5 V	+5 V, VMS high sensor phototransistor collector (not Pi)
19	19	0 V	0 V, VMS high sensor LED cathode (not Pi)
20	20	lev5	VMS high sensor output
21	21	+5 V	+5 V, Ink res. low sensor LED anode (not Pi)
22	22	+5 V	+5 V Ink res. low sensor phototransistor collector (not Pi)
23	23	0 V	0 V, Ink res. low sensor LED cathode (not Pi)
24	24	lev6	Ink res. low sensor output

(Continued)

TABLE 10.13 I/O CONNECTOR LEVELS (SI AND MI) (Continued)

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
25	25	+5 V	+5 V, Solvent res. low sensor LED anode (not Pi)
26	26	+5 V	+5 V, solvent res. low sensor phototransistor collector (not Pi)
27	27	0 V	0 V, Solvent res. low sensor LED cathode (not Pi)
28	28	lev7	Solvent res. low sensor output
29	29	+15 V	
30	30	0 V	
31	31	-15 V	
32	32	0 V	
33	33	GND	
34	34	GND	

TABLE 10.14 I/O CON_B1 CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	0 V	
2	2	-	Not used
3	3	pec1	Photocell 1 output
4	4	phase det	Phase detector
5	5	ADEOC	A-D end of conversion
6	6	phase det	Phase detector
7	7	pec2	Photocell 2/shaft encoder quadrature output
8	8	print/phase	Print/phase
9	9	strobe	LED strobe
10	10	pwm	Pump control (pulse width modulation)
11	11	opto I/O	E
12	12	adc	A/D converter output enable
13	13 to 20	cb0 to cb7	Control bus bits 0 to 7
14	21 to 28	db0 to db7	Data bus bits 0 to 7
15	29	qddc	D/A converter output enable
16	30	levels	Optical level sensors enable
17	31	pcs3	PPI enable
18	32	shaft enc	Shaft encoder output
19	33	extra 1	Traffic light enable
20	34	contrast	LCD contrast

TABLE 10.15 I/O CON_EX CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	VCC	+5 V DC
2	2 to 9	db0 to db7	Data bus bits 0 to 7
3	10		External message select
4	11		Opto-isolated output select
5	12	cb6	Control bus bit 6 (not used)
6	13	cb7	Control bus bit 7 (not used)
7	14	cb0	Control bus bit 0 (not used)
8	15	TACHO	For use with external DC tacho
9	16	0 V	
10	17	0 V	
11	18	+24 V	
12	19	-24 V	
13	20	GND	

TABLE 10.16 I/O PIGS CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	+24 V	
2	2	BULK HEAT	
3	3	+24 V	
4	4	0 V	
5	5	HEATER	Heater/cooler on/off
6	6	0 V	

TABLE 10.17 I/O VALVES CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	+24 V	+24 V DC to solvent top up valve V1
2	2	-ve	Solvent top up valve control signal
3	3	+24 V	+24 V DC to Ink top up valve V2
4	4	-ve	Ink top up valve control signal
5	5	+24 V	+24 V DC to VMS diverter valve V3
6	6	-ve	VMS diverter valve control signal
7	7	+24 V	+24 V DC to solvent flush valve V4
8	8	-ve	Solvent flush valve control signal
9	9	+24 V	+24 V DC to feed valve V6
10	10	-ve	Ink feed valve control signal
11	11	+24 V	+24 V DC to gutter valve V8
12	12	-ve	Gutter valve control signal
13	13	+24 V	+24 V DC auto power off
14	14	-ve	Auto power off control signal
15	15	+24 V	+24 V DC to purge valve V10
16	16	-ve	Purge valve control signal

TABLE 10.18 I/O CON_BM2 CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	B OUT	Stator drive B (green)
2	2	A OUT	Stator drive A (black)
3	3	C OUT	Stator drive C (white)
4	4	+6 V	Hall effect sensor +ve supply
5	5	HC	Position signal from Hall effect sensor C (green)
6	6	0 V	Hall effect sensor -ve supply
7	7	HB	Position signal from Hall effect sensor B (white)
8	8	HA	Position signal from Hall effect sensor A (blue)

TABLE 10.19 I/O PUMP CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	B OUT	Stator drive B
2	2	A OUT	Stator drive A
3	3	C OUT	Stator drive C
4	4	+6 V	Hall effect sensor +ve supply
5	5	HC	Position signal from Hall effect sensor C
6	6	0 V	Hall effect sensor -ve supply
7	7	HB	Position signal from Hall effect sensor B
8	8	HA	Position signal from Hall effect sensor A

TABLE 10.20 I/O P/TRANS CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	+10 V	+10 V DC supply voltage to transducer
2	2	+ve	+ve output from transducer
3	3	-ve	-ve output from transducer
4	4	0 V	0 V to transducer
5	5	BULK INK TEMPERATURE	Output from mixer tank temperature sensor
6	6	0 V	0 V to temperature sensor
7	7	+5 V	+5 V DC to temperature sensor
8	8	GND	

TABLE 10.21 I/O HEAD 2 CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	VCC	+5 V DC
2	2	Not used	
3	3	Not used	
4	4	0 V	
5	5	VCC	+5 V DC
6	6	Fire sensor	Fire sensor (not used at present)
7	7	0 V	
8	8	+5 V	+5 V DC to temp sensor
9	9	HE temp	Head temp sensor output
10	10	0 V	0 V to temp sensor
11	11		Head heater return
12	12	+24 V	+24 V to head heater

TABLE 10.22 I/O CON_BM1 CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	+24 V	)
2	2	0 V	) Supplies to motor
3	3	+15 V	) control board
4	4	-15 V	)
5	5	ENABLE	Enable ink pump motor
6	6	PRESS TRANS I/P	Pressure transducer input
7	7	REQ PRESS I/P	Requested pressure input
8	8	GND	

TABLE 10.23 I/O HEAD 1 CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	+12 V	+12 V DC to phase detector amplifier
2	2	-12 V	-12 V DC to phase detector amplifier
3	3	0 V	0 V connection to phase detector amplifier
4	4	GUTTER DETECT	Oscillator signal to gutter detect
5	5	0 V	0 V connection to gutter detect
6	6	0 V	0 V connection to LED cathodes
7	7	STROBE LED	Strobe signal to LED anode
8	8		Signal from phase detector amp
9	9	LID SWITCH	+ve to lid switch
10	10	0 V	0 V connection to lid switch

TABLE 10.24 I/O CON_P0 CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1 to 4	0 V	0 V
2	5 to 8	+5 V	+5 V DC to CPU
3	9 and 10	+15 V	+15 V DC to CPU
4	11 and 12	-15 V	-15 V DC to CPU
5	13 and 14	GND	

TABLE 10.25 I/O POWER CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	+15 V	+15 V DC from PSU
2	2	0 V	0 V from PSU
3	3	+5 V	+5 V DC from PSU
4	4	-15 V	-15 V DC from PSU
5	5	+5 V	+5 V DC from PSU
6	6	+24 V	+24 V DC from PSU
7	7	0 V	0 V from PSU
8	8	-24 V	-24 V DC from I/O board

TABLE 10.26 I/O CH/MOD CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	CHARGE	Charge amplifier output
2	2	0 V CHARGE	Charge amplifier 0 V
3	3	mod 1a	Modulation 0 V
4	4	mod 1b	Modulation signal output

TABLE 10.27 I/O EHT/FAN CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	0 V	0 V
2	2	+24 V SW	+24 V DC (switched)
3	3	PUMP	+24 V DC
4	4	+24 V SW	+ 24 V DC (switched) fan
5	5	FAN	-ve fan supply
6	6	EHT +	+ve supply to EHT module
7	7	EHT -	-ve supply to EHT module
8	8	VCC	+5 V DC
9	9	Lev 8	Spare digital input
10	10	0 V	0 V

TABLE 10.28 I/O FAN_FAIL CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	+ve in	Fan fail +ve input
2	2	+5 V	+5 V DC supply to fan fail PCB
3	3		
4	4		
5	5	0 V	0 V supply to fan fail PCB
6	6	-ve in	Fan fail -ve input

TABLE 10.29 I/O CON_D CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1 to 8	dd0 to dd7	Droplet charge data
2	9	-	Not used
3	10	0 V	Common
4	11-20	-	Not used

TABLE 10.30 I/O B/LIGHT CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	+24 V	+24 V DC to backlight inverter
2	2	-ve BKLT	Backlight -ve supply
3	3	GND	

I/O board test points and LEDs

23 The I/O board is fitted with test points as follows:

23.1 TP1 (Fig 10.12 (14)); 0 V.

23.2 TP2 (8); +285 V DC charge amplifier supply.

23.3 TP3 (12); ink temperature at viscometer delivery line.

23.4 TP4 (7); charge voltage to printhead.

23.5 TP5 (13); ink system pressure (1 V ≃ 1 bar).

23.6 TP6 (3); modulation drive voltage to printhead.

23.7 TP7 (2); phase detector output prior to hedgehog clipping.

23.8 TP8 (4); 0 V.

23.9 TP9 (1); +5 V (can be used with logic probe).

24 The I/O board is fitted with status LEDs as follows:

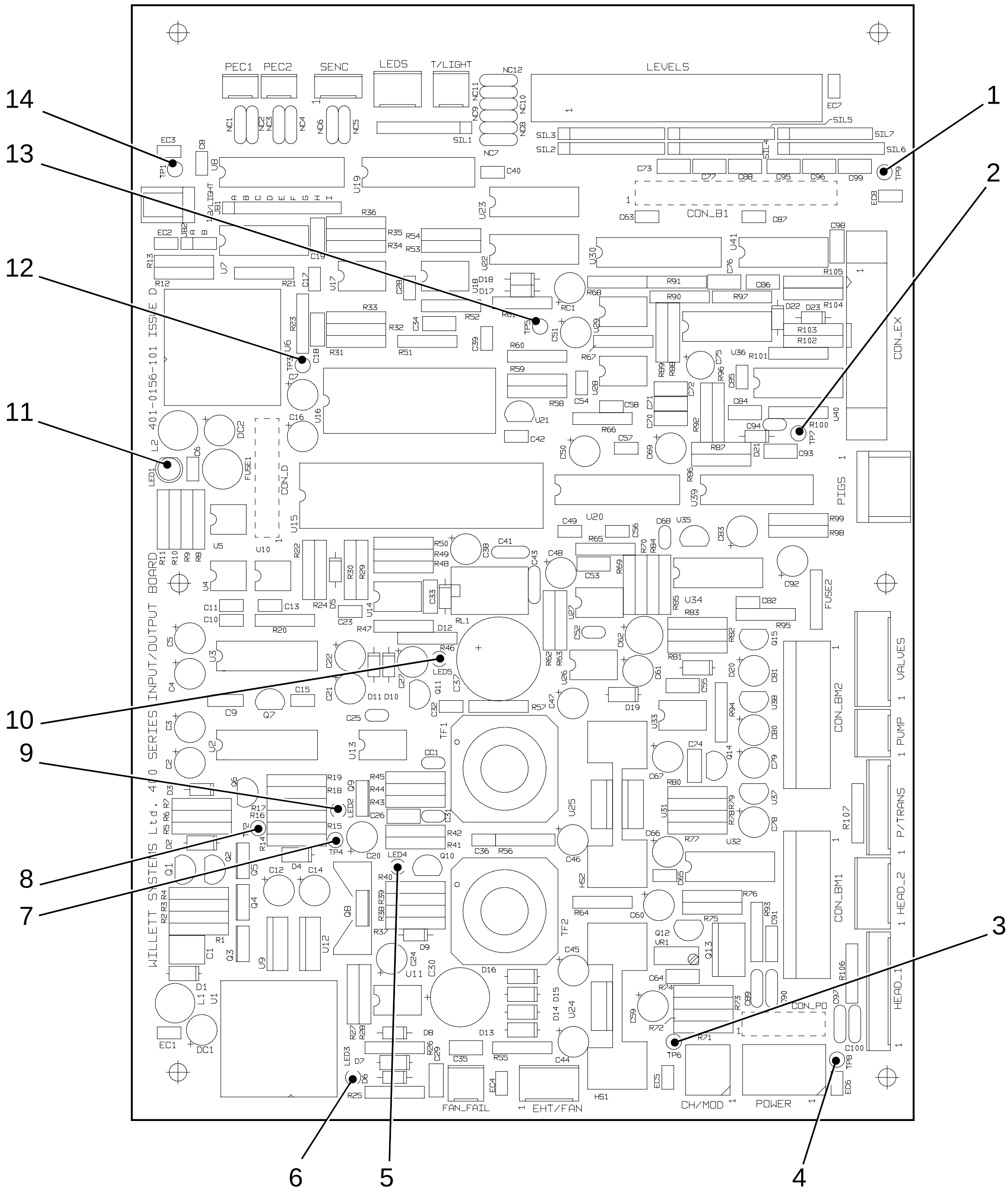
24.1 LED1 (Fig 10.12 (11)); green; customer 10 V isolated supply present.

24.2 LED2 (9); red; charge amplifier supply.

24.3 LED3 (6); yellow; -24 V.

24.4 LED4 (5); red; -15 V charge amplifier.

24.5 LED5 (10); green; +24 V valve/fan/heater supply.



1	TP9	8	TP2
2	TP7	9	LED2
3	TP6	10	LED5
4	TP8	11	LED1
5	LED4	12	TP3
6	LED3	13	TP5
7	TP4	14	TP1

Fig 10.12 I/O board test points and LEDs

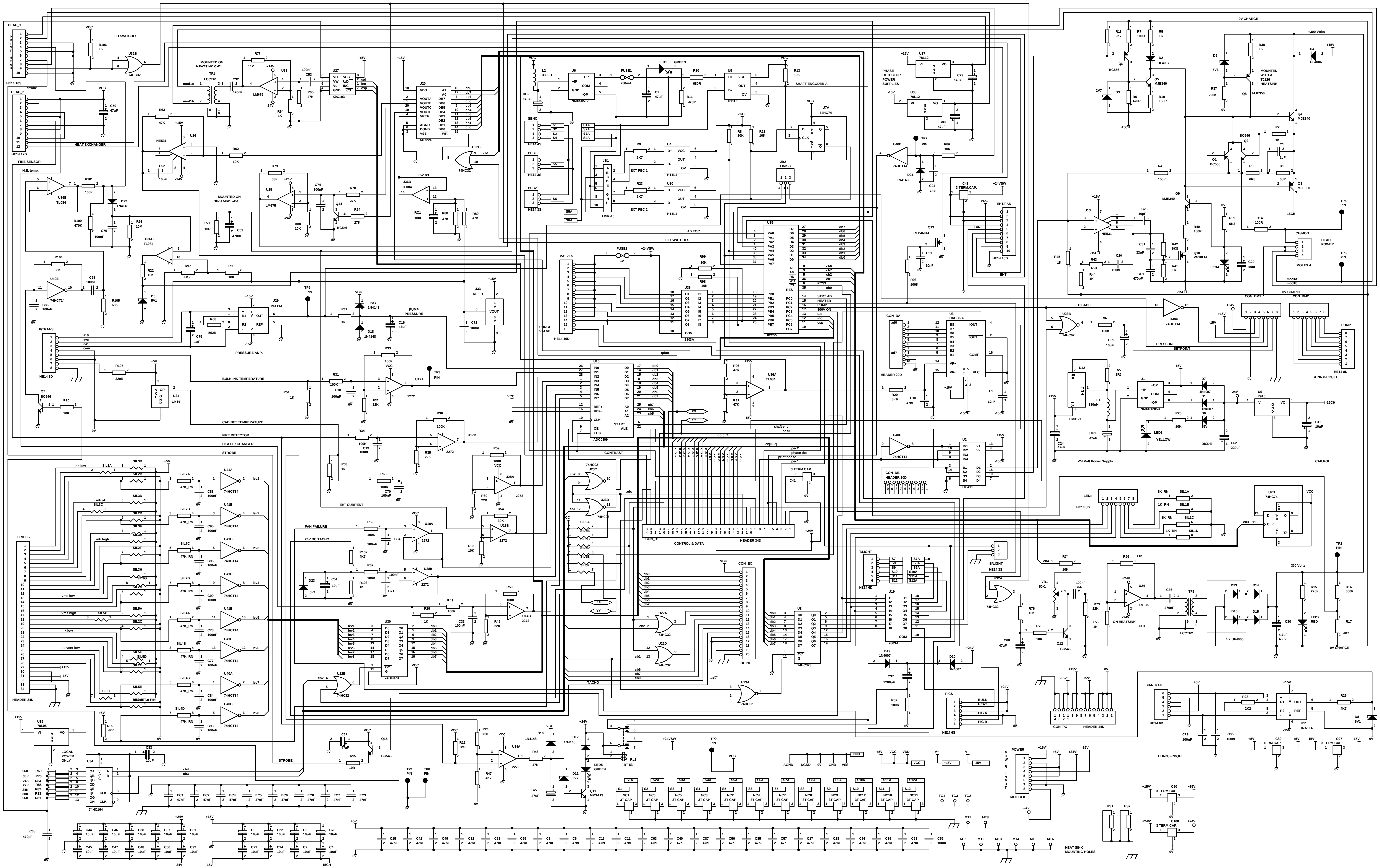


Fig 10.13 I/O board circuit diagram

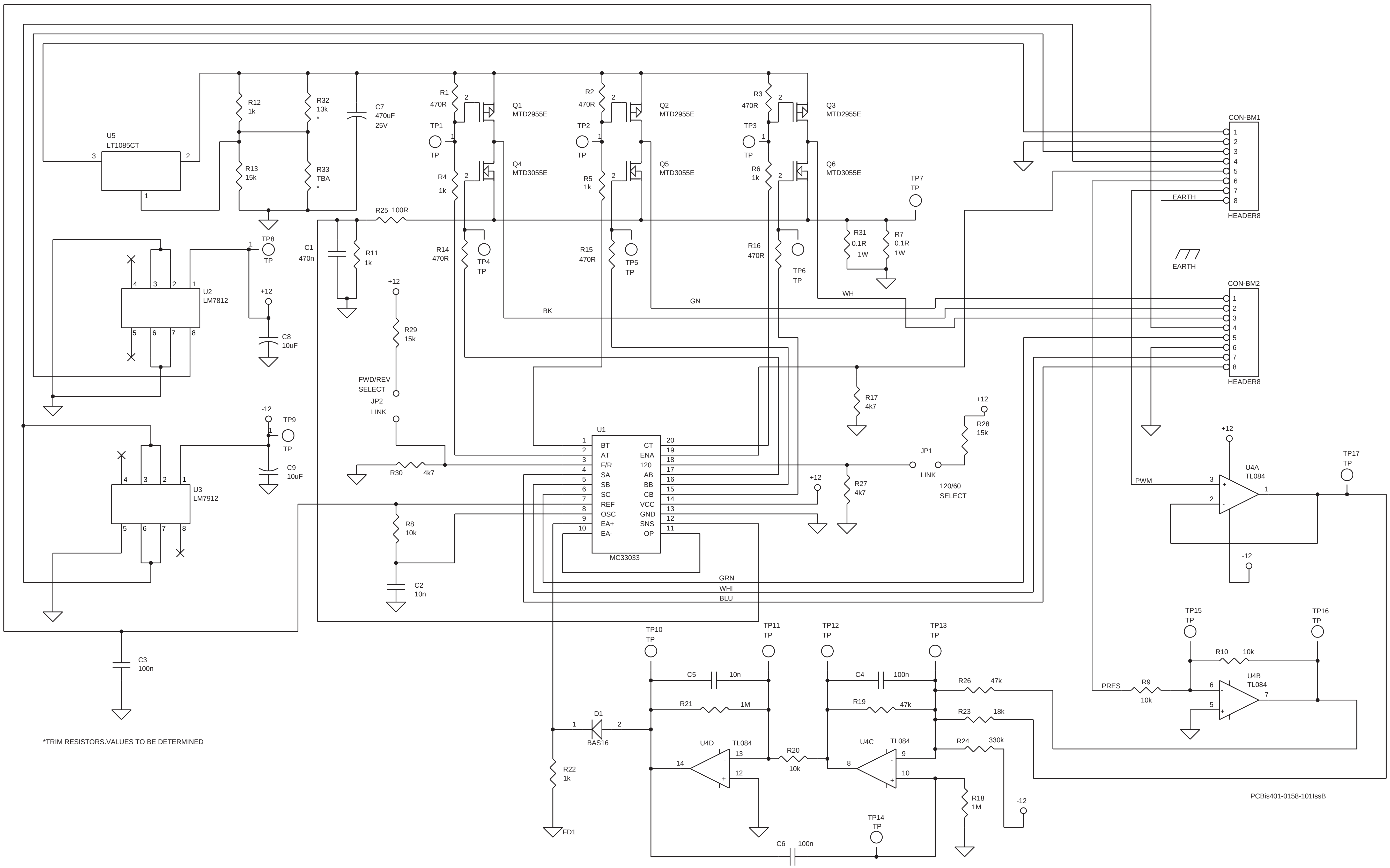


Fig 10.14 Ink pump motor driver board circuit diagram

Levels interface board (Pi only)

General

25 The levels interface board (Fig 10.16 for circuit diagram) is fitted to Pi machines to interface the level sensors to the I/O board and to supply the stirrer motors.

26 Pi machine level sensors use conductivity probes rather than the photo electric sensors used on Si and Mi machines because the pigmented ink can settle on the photo electric sensors and cause inconsistencies in level detection.

Major components

27 Major components of the levels interface board are as follows:

27.1 IC U6 (Fig 10.15 (1)) and IC U7 (10) are tachometer circuits that provide a speed feedback signal for the stirrer motors.

27.2 IC U5 (2) is a quad operational amplifier that amplifies the stirrer motor current pulses in order to trigger the tachometer ICs, and inverts the output of U6 and U7, with an offset to drive the stirrer motors via emitter followers.

27.3 The fuses (4) are fast blow devices that protect the following circuits:

27.3.1 Fuse F1 (50 mA); mixer low circuit.

27.3.2 Fuse F2 (50 mA); mixer OK circuit.

27.3.3 Fuse F3 (50 mA); mixer high circuit.

27.3.4 Fuse F4 (50 mA); VMS low circuit.

27.3.5 Fuse F5 (50 mA); VMS high circuit.

27.3.6 Fuse F6 (50 mA); ink tank sensor circuit.

27.3.7 Fuse F7 (50 mA); solvent tank sensor circuit.

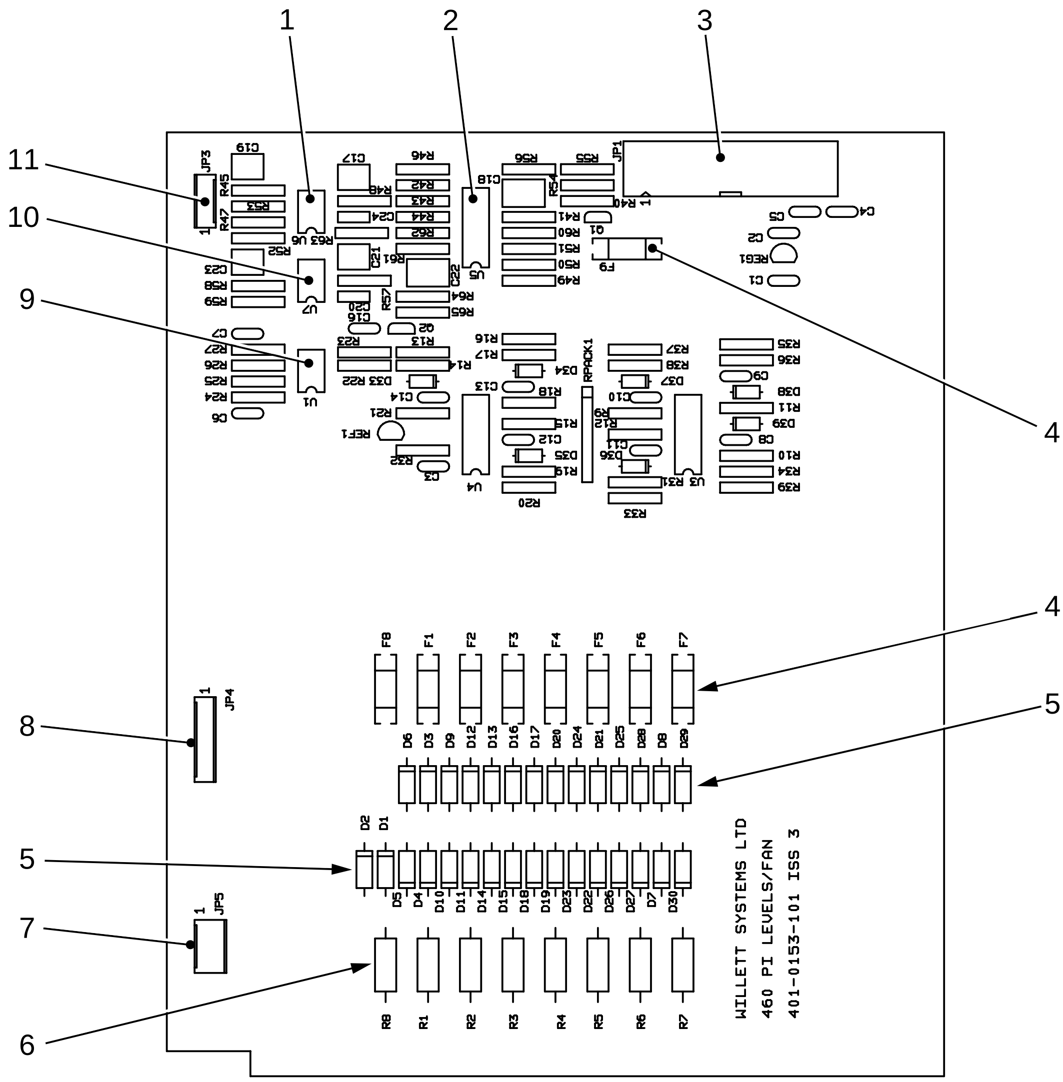
27.3.8 Fuse F8 (50 mA); common line circuit level detectors.

27.3.9 Fuse F9 (250 mA); stirrer motors circuit.

27.4 The zener diode barrier (D1 to D30) (5) are all 13 V, 5 W devices that limit the energy available at the probes to less than the amount that could cause ignition of solvent.

27.5 The resistor barrier (R1 to R8) (6) are all 470 Ω, 2.5 W wire wound devices that complement the zener barrier.

27.6 IC U1 (9) is an oscillator and filter that is used to supply the AC signal probes via the zener and resistor barriers.



1 IC U6
2 IC U5
3 Connector JP1
4 Fuses
5 Zener diode barrier
6 Resistor barrier
7 Connector JP5
8 Connector JP4
9 IC U1
10 IC U7
11 Connector JP3

Fig 10.15 Levels interface board major components and connectors

Connectors

28 The following connectors are fitted to the levels interface board:

28.1 Connector JP1 (Fig 10.15 (3)) is connected to the I/O board LEVELS connector via a 34 way cable (Table 10.31).

28.2 Connector JP5 (7) is connected to the ink system sensors (Table 10.32).

28.3 Connector JP4 (8) is connected to the ink and solvent reservoir sensors (Table 10.33).

28.4 Connector JP3 (11) is connected to the stirrer motors (Table 10.34).

TABLE 10.31 LEVELS INTERFACE BOARD JP1 CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	Not connected	
2	2	Not connected	
3	3	Not connected	
4	4	MIXER LOW	Mixer tank low signal to I/O board
5	5	Not connected	
6	6	Not connected	
7	7	Not connected	
8	8	MIXER OK	Mixer tank OK signal to I/O board
9	9	Not connected	
10	10	Not connected	
11	11	Not connected	
12	12	MIXER HI	Mixer tank high signal to I/O board
13	13	Not connected	
14	14	Not connected	
15	15	Not connected	
16	16	VMS LOW	VMS low signal to the I/O board
17	17	Not connected	
18	18	Not connected	
19	19	Not connected	
20	20	VMS HIGH	VMS high signal to I/O board
21	21	Not connected	
22	22	Not connected	

(Continued)

TABLE 10.31 LEVELS INTERFACE BOARD JP1 CONNECTOR (Continued)

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
23	23	Not connected	
24	24	INK LOW	Ink reservoir low signal to I/O board
25	25	Not connected	
26	26	Not connected	
27	27	Not connected	
28	28	SOLVENT LOW	Solvent reservoir low signal to I/O board
29	29	+15 V	Supply to levels interface board
30	30	0 V	Supply to levels interface board
31	31	-15 V	Supply to levels interface board
32	32	0 V	Supply to levels interface board
33	33	GND	
34	34	GND	

TABLE 10.32 LEVELS INTERFACE BOARD JP5 CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	0 V	Mixer low common probe
2	2	2-3 V	Mixer low signal probe
3	3	0 V	Mixer OK common probe
4	4	2-3 V	Mixer OK signal probe
5	5	0 V	Mixer high common probe
6	6	2-3 V	Mixer high signal probe
7	7	0 V	VMS low common probe
8	8	2-3 V	VMS low signal probe
9	9	0 V	VMS high common probe
10	10	2-3 V	VMS high signal probe

TABLE 10.33 LEVELS INTERFACE BOARD JP4 CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	0 V	Ink reservoir low common probe
2	2	2-3 V	Ink reservoir low signal probe
3	3	0 V	Solvent reservoir low common probe
4	4	2-3	Solvent reservoir low signal probe
5	5	0 V	
6	6	0 V	
7	7	0 V	
8	8	0 V	

TABLE 10.34 LEVELS INTERFACE BOARD JP3 CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	Not connected	
2	2	+ve	Stirrer motor 1 +ve (mixer tank)
3	3	-ve	Stirrer motor 1 -ve (mixer tank)
4	4	+ve	Stirrer motor 2 +ve (ink reservoir)
5	5	-ve	Stirrer motor 2 -ve (ink reservoir)

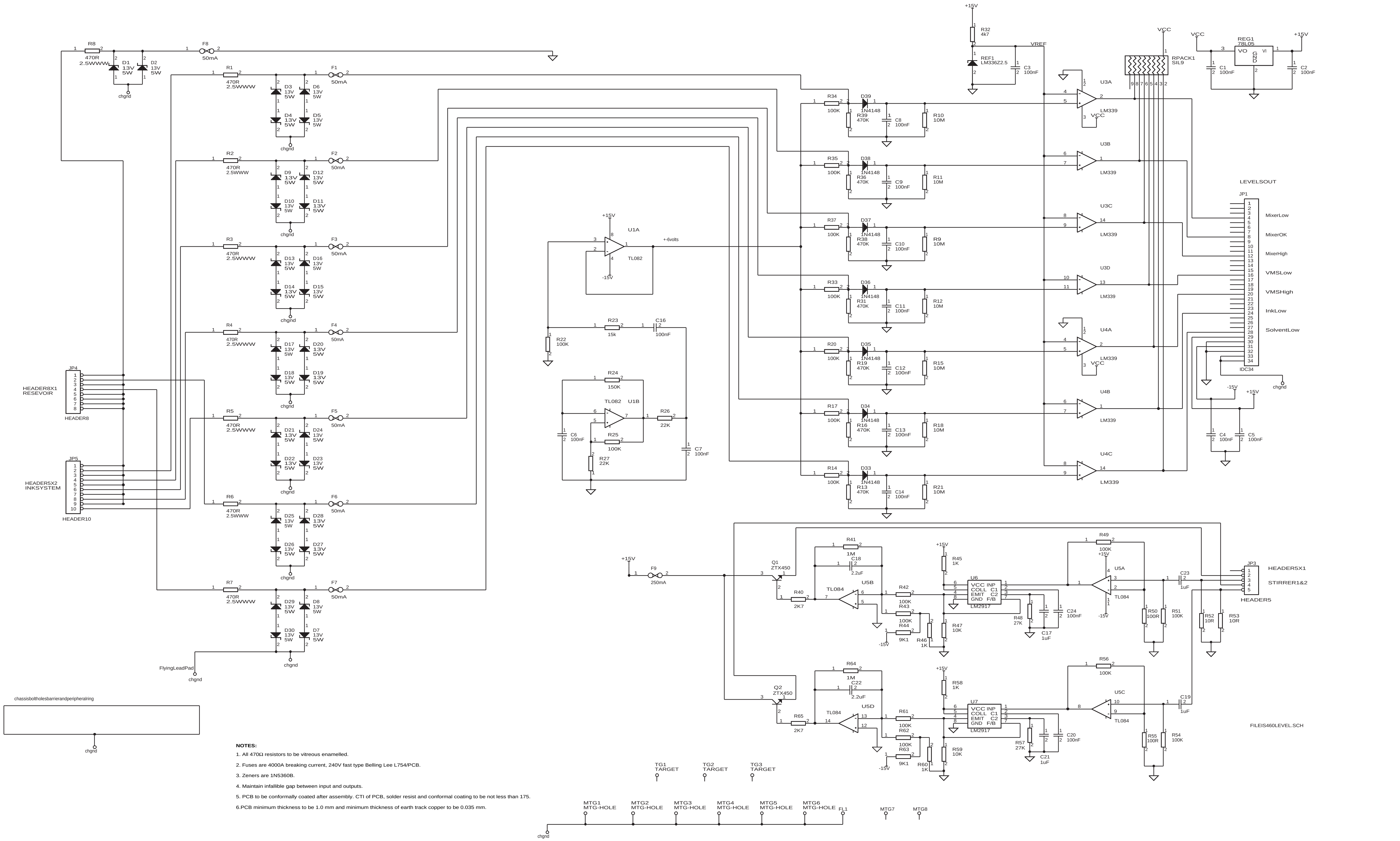


Fig 10.16 Levels interface board circuit diagram

PSU board

29 The PSU is a switchmode power supply with the following general specifications:

29.1 Input voltage; 88 VAC to 260 VAC.

29.2 Input frequency; 47 Hz to 63 Hz.

29.3 Inrush current (cold); 15 A at 115 VAC, 30 A at 230 VAC.

29.4 Operating temperature; 0 to 50 C.

29.5 Storage temperature; -20 to 85 C.

29.6 Cooling; Free air convection.

29.7 Efficiency; 80% typical.

29.8 Holdup time; 20 ms.

29.9 Overvoltage type; crowbar, trip point 5.9 V to 7 V.

29.10 Overload protection; Foldback.

29.11 Switching frequency; >30 Kilohertz (KHz).

29.12 Designed to comply with; UL478, 1012, CSA22.2, VDE0806.

29.13 EMI; Meets FCC class "B".

30 The output specifications of the PSU are listed in Table 10.35.

TABLE 10.35 PSU OUTPUT SPECIFICATIONS

Serial	Output Voltage	Load			Tolerance +/-	Ripple Noise	Line Reg	Load Reg
		Min	Rated	Max				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	+5 V	0.5 A	4 A	8 A	1%	50m V	1%	1%
2	+15 V	0 A	0.5 A	1 A	10%	100m V	2%	8%
3	-15 V	0 A	0.5 A	1 A	10%	100m V	2%	8%
4	+24 V	0.1 A	2 A	2.5 A	5%	150m V	1%	5%

(1) Each output can provide up to a maximum load, but total load cannot exceed 85 W continuously.

(2) +5 V output is adjusted to +/- 1% at 60% rated load at factory.

(3) Tolerance is measured with all outputs at 60% rated load.

(4) Line regulation is measured from low line to high line at rated load.

(5) Load regulation is measured by +/- 40% load change from 60% rated load, and all other outputs is kept at 60% rated load.

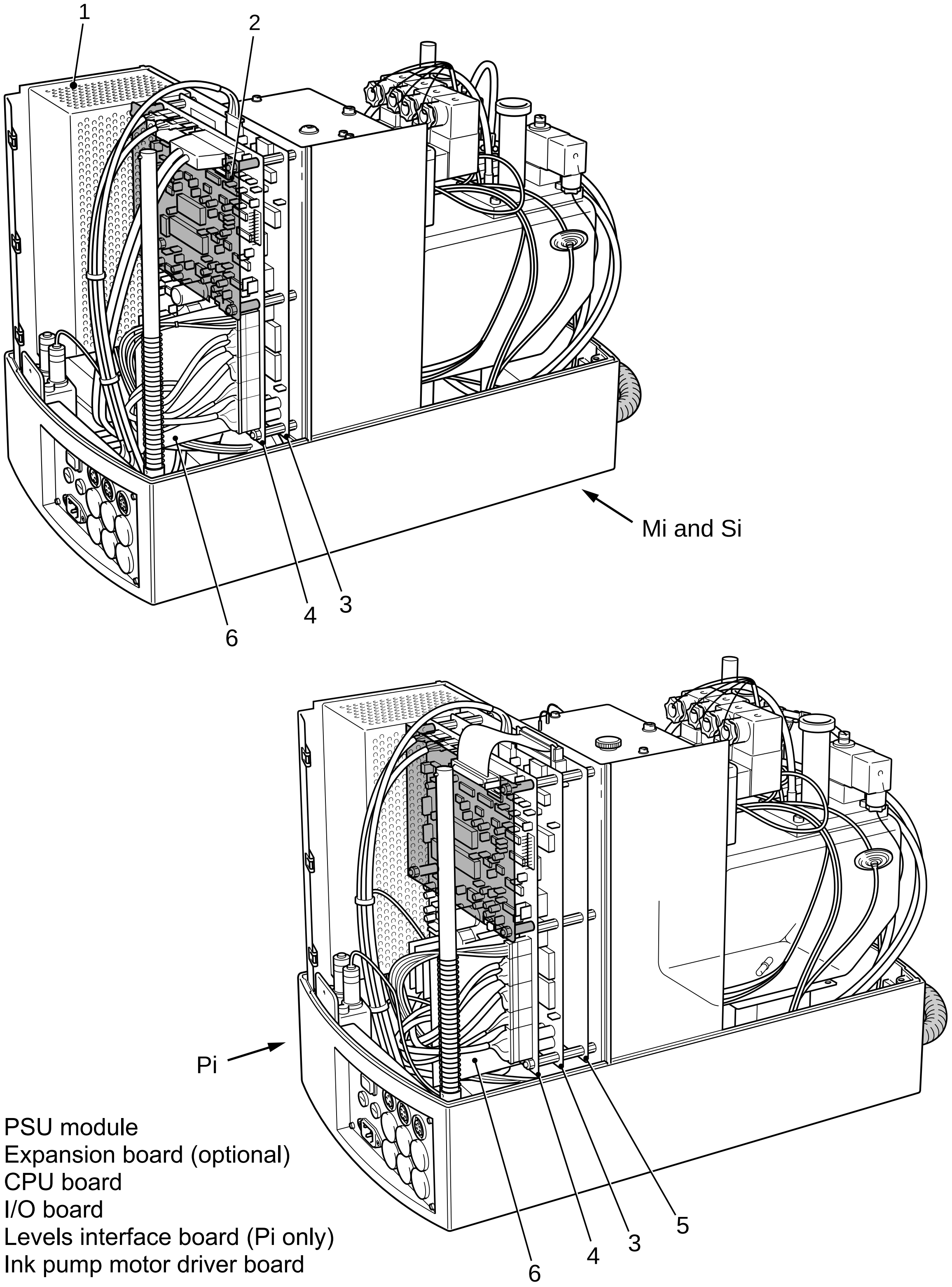
(6) Ripple and noise is measured by using a 12" twisted wire terminated with a 47μF capacitor.

(7) Efficiency is measured at rated load.

(8) All parameters except line regulation are specified at 115/230 VAC input, rated load, 25^{o}C ambient.

Expansion board

31 The expansion board (Fig 10.6 (2)) (when fitted) is mounted over the I/O board and interfaces the printer to option B system connections. It cannot be fitted to the 450 Si. A circuit diagram is provided at Fig 10.18.

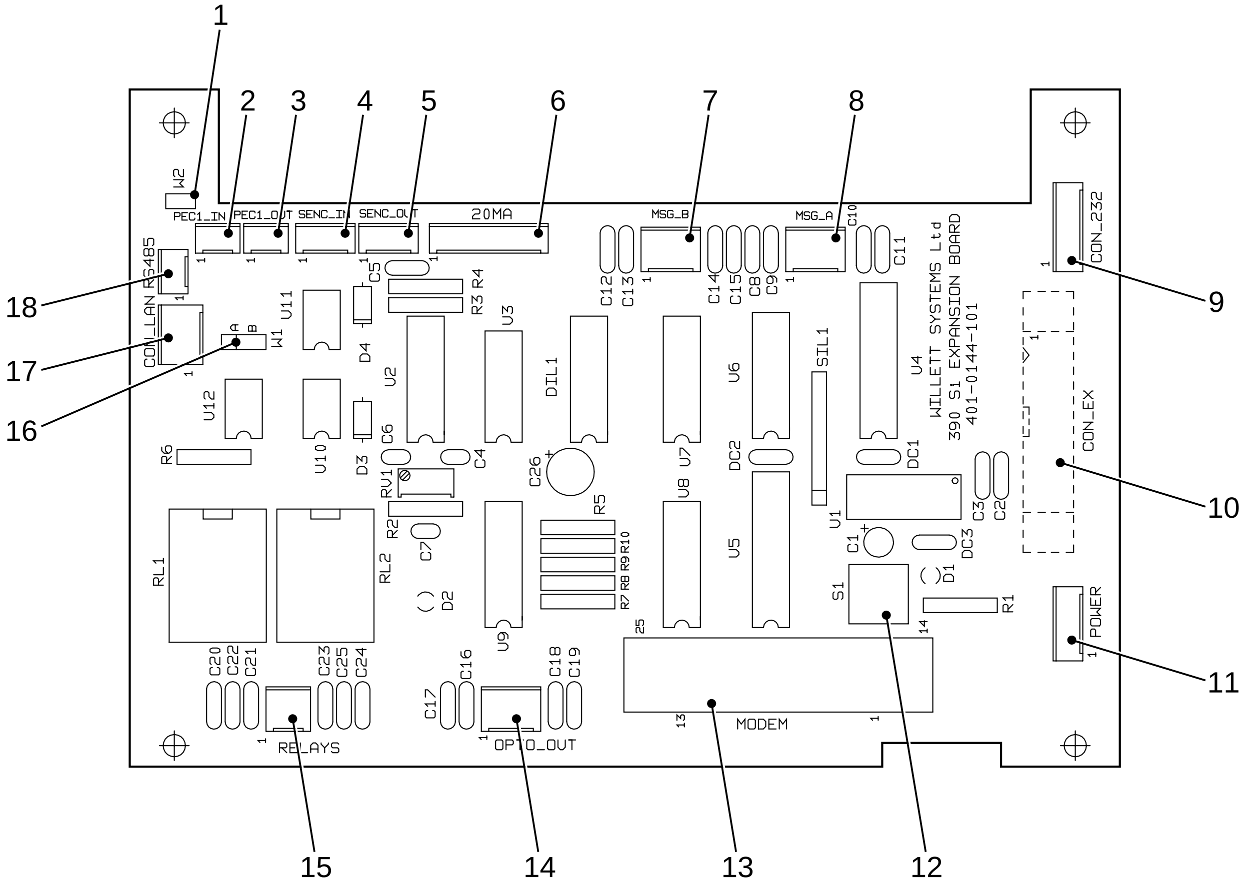


1 PSU module
2 Expansion board (optional)
3 CPU board
4 I/O board
5 Levels interface board (Pi only)
6 Ink pump motor driver board

Fig 10.6 Control electronics

Connectors and jumpers

32 The expansion board is connected to the I/O board by an interboard connector.



1	Jumper W2	10	CON_EX
2	PEC1_IN	11	POWER
3	PEC1_OUT	12	S1
4	SENC_IN	13	MODEM
5	SENC_OUT	14	OPTO_OUT
6	20mA	15	RELAYS
7	MSG_B	16	Jumper W1
8	MSG_A	17	CON_LAN
9	CON_232	18	RS485

Fig 10.17 Expansion board connectors and jumpers

33 The expansion board connectors and jumpers are listed below. Pinout details for the connectors are listed in the associated tables (10.36 to 10.49).

33.1 W2 (Fig 10.17 (1)) is used to terminate an RS485 network connection.

33.2 PEC1_IN (2) is connected to the product sensor via the connector panel (Table 10.36).

33.3 PEC1_OUT (3) is connected to the PEC1 connector located on the I/O board (Table 10.37).

33.4 SENC_IN (4) is connected to a shaft encoder via the connector panel (Table 10.38).

33.5 SENC_OUT (5) is connected to the SENC connector located on the I/O board (Table 10.39).

33.6 20 mA (6) is for connection to a 20mA current loop communications link (COM2) via the connector panel (Table 10.40).

33.7 MSG_A (8) and MSG_B (7) are the connectors for 8 opto coupled inputs for BCD message select (Tables 10.41 and 10.42).

33.8 CON_232 (9) is a serial communications port which is configured for the RS232 protocol and is connected to the CPU board (Table 10.43).

33.9 CON_EX (10) is an interboard connector which connects the expansion board to the I/O board (Table 10.44).

33.10 POWER (11) is for connection to an external PSU for the use of special modems.

33.11 S1 (12) is a 4 pole DIP switch which is used to set the expansion board to cater for the following modem configurations:

33.11.1 With 1 and 4 set to ON and 2 and 3 set to OFF, power is supplied to the MODEM connector by DC to DC converter U1. This setting is for use with a standard Willett modem.

33.11.2 With 1 and 4 set to OFF and 2 and 3 set to ON, an external power supply is fed to the MODEM connector via pins 1 and 2 of the POWER connector.

33.11.3 With 1, 2, 3 and 4 set to on, power is supplied to the MODEM connector from U1 (for standard Willett modem). A +10 V, 150 mA supply is also made available at pins 1 and 2 of the POWER connector for use with external sensors etc.

33.12 MODEM (13) is for connection to the Willett modem, which fits directly onto the connector (Table 10.45).

33.13 OPTO-OUT (14) is the connector for 4 uncommitted opto coupled outputs via the connector panel (Table 10.46).

33.14 RELAYS (15) is the connector for the change over relays output via the connector panel (Table 10.47).

33.15 Jumper W1 (16) must be set to A if an RS485 LAN is to be used and to B if a 20 mA current loop is to be used.

33.16 CON_LAN (17) is for connection to the CPU board (Table 10.48).

33.17 RS485 (18) is for connection to an RS485 communications link (COM2) via the connector panel (Table 10.49).

TABLE 10. 36 EXPANSION BOARD PEC1_IN CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	VDD	Positive DC supply to sensor
2	2	-	Output from PEC1
3	3	VSS	0 V common

TABLE 10.37 EXPANSION BOARD PEC1_OUT CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	VDD	Positive DC supply to sensor
2	2	-	Output from PEC1
3	3	VSS	0 V common

TABLE 10.38 EXPANSION BOARD SENC_IN CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	VDD	Positive DC supply to shaft encoder
2	2	-	Output A from shaft encoder
3	3	-	Output B from shaft encoder
4	4	VSS	0 V common

TABLE 10.39 EXPANSION BOARD SENC_OUT CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	VDD	Positive DC supply to shaft encoder
2	2	-	Output A from shaft encoder
3	3	-	Output B from shaft encoder
4	4	VSS	0 V common

TABLE 10.40 EXPANSION BOARD 20mA CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	TX +	Transmit loop +ve
2	2	-	Linked to pin 6
3	3	RX +	Receive loop +ve
4	4	-	Linked to pin 8
5	5	TX -	Transmit loop -ve
6	6	-	Linked to pin 2
7	7	RX -	Receive loop -ve
8	8	-	Linked to pin 4

TABLE 10.41 EXPANSION BOARD MSG_A CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	db0	Data bit 0
2	2	0 V	
3	3	db1	Data bit 1
4	4	0 V	
5	5	db2	Data bit 2
6	6	0 V	
7	7	db3	Data bit 3
8	8	0 V	

TABLE 10.42 EXPANSION BOARD MSG_B CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	db4	Data bit 4
2	2	0 V	
3	3	db5	Data bit 5
4	4	0 V	
5	5	db6	Data bit 6
6	6	0 V	
7	7	db7	Data bit 7
8	8	0 V	

TABLE 10.43 EXPANSION BOARD CON_232 CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	TXD	Transmit data
2	2	DTR	Data terminal ready
3	3	RXD	Receive data
4	4	DCD	Data carrier detect
5	5	Common	Common
6	6	-	Not used

TABLE 10.44 EXPANSION BOARD CON_EX CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	VCC	+5 V DC
2	2 to 9	db0 to db7	Data bus bits 0 to 7
3	10	-	External message select
4	11	-	Opto-isolated output select
5	12 to 14	-	Not used
6	15	TACHO	
7	16	0 V	
8	17	0 V	
9	18	+24 V	
10	19	-	Not used
11	20	GND	

TABLE 10.45 EXPANSION BOARD MODEM CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	Not used	
2	2	TXD	Transmit data
3	3	RXD	Receive data
4	4 to 6	Not used	
5	7	Ground	
6	8	DCD	Data carrier detect
7	9	Positive supply	
8	10 to 14	Not used	
9	15	Positive supply	
10	16 to 19	Not used	
11	20	DTR	Data terminal ready
12	21 to 25	Not used	

TABLE 10.46 EXPANSION BOARD OPTO_OUT CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	01+	Opto-output 1 +ve
2	2	01-	Opto-output 1 -ve
3	3	02+	Opto-output 2 +ve
4	4	02-	Opto-output 2 -ve
5	5	03+	Opto-output 3 +ve
6	6	03-	Opto-output 3 -ve
7	7	04+	Opto-output 4 +ve
8	8	04-	Opto-output 4 -ve

TABLE 10.47 EXPANSION BOARD RELAYS CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	-	RL1 normally open contact
2	2	-	RL1 normally closed contact
3	3	-	RL1 changeover contact
4	4	-	RL2 normally open contact
5	5	-	RL2 normally closed contact
6	6	-	RL2 changeover contact

TABLE 10.48 EXPANSION BOARD CON_LAN CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	Not used	
2	2	VCC	+5 V DC
3	3	RXDB	Receive data
4	4	TXDB	Transmit data
5	5	DTR	Data terminal ready
6	6	0 V	Common
7	7 and 8	Not used	

TABLE 10.49 EXPANSION BOARD RS485 CONNECTOR

Serial (1)	Pin No. (2)	Signal (3)	Function (4)
1	1	-ve	Data A
2	2	+ve	Data B
3	3	Common	

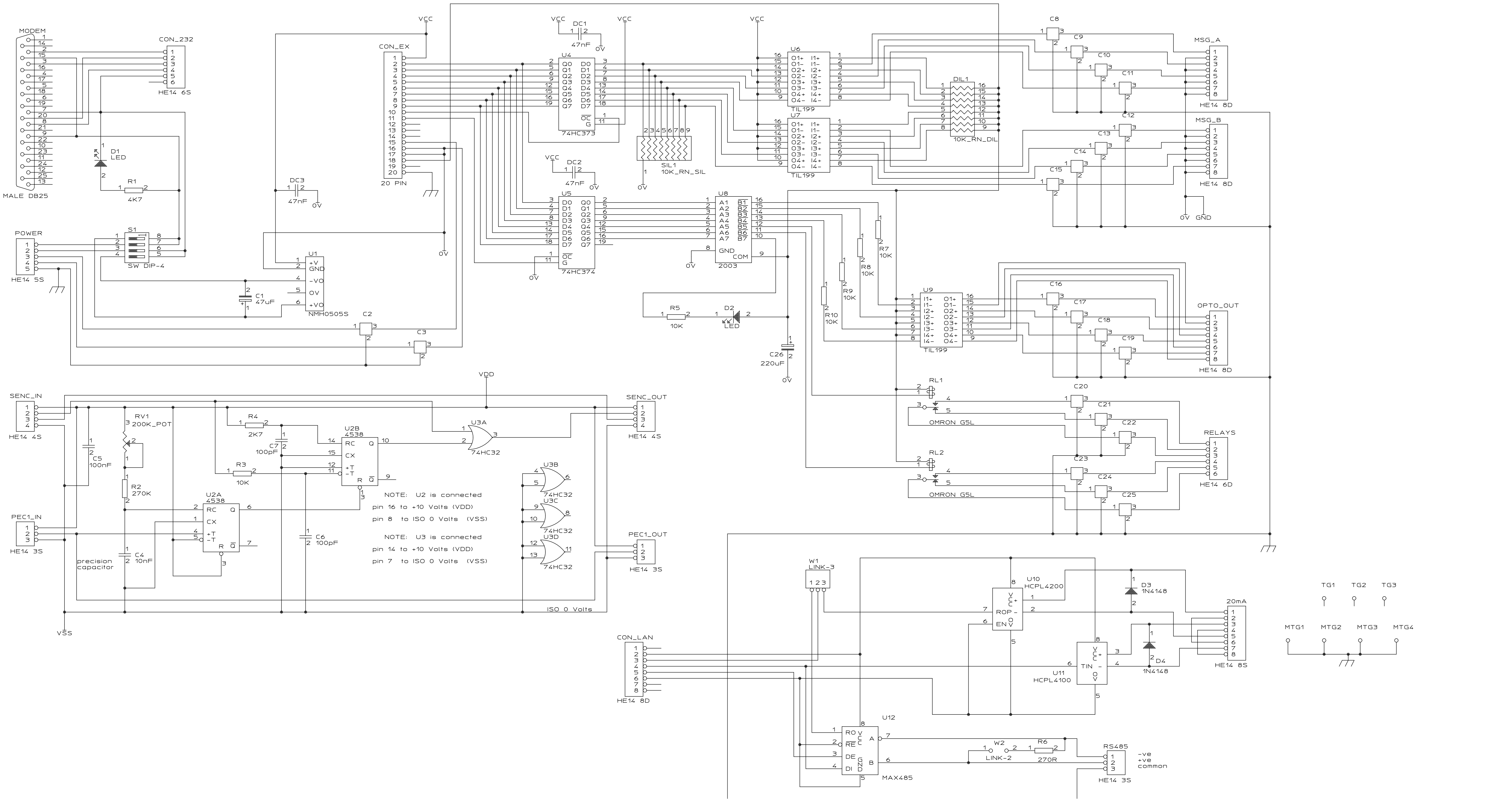


Fig 10.18 Expansion board circuit diagram

Electronics modules

34 The following electronics modules complete the electronics system:

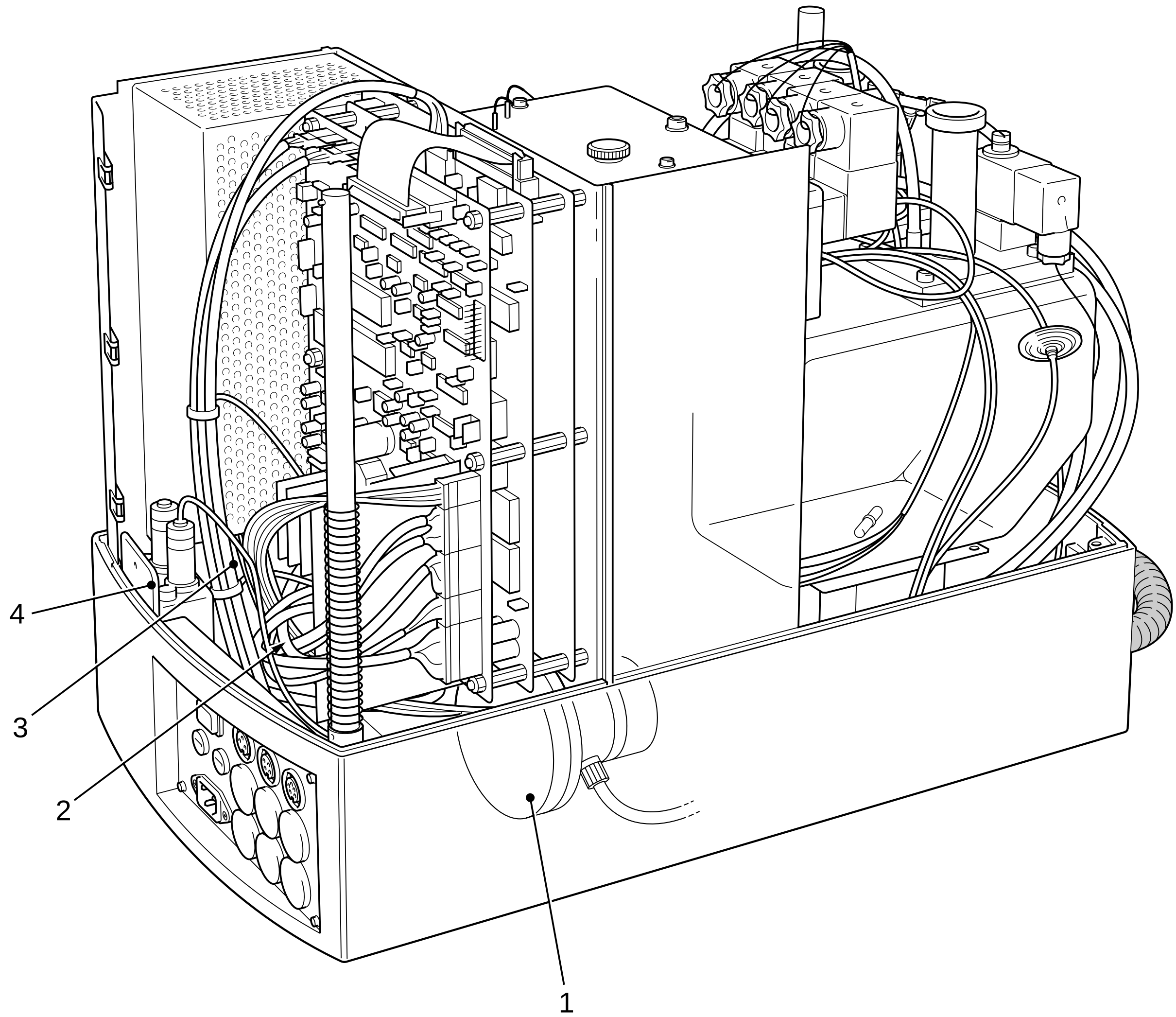
34.1 The Extra High Tension (EHT) module (Fig 10.19 (4)).

34.2 Electronics compartment cooling fan (2).

34.3 Ink system pump (1).

34.4 Fan failure card (2).

34.5 Stirrer motors (Pi only).



1 Ink system pump
2 Fan failure card
3 Electronics compartment cooling fan
4 EHT module

Fig 10.19 Printer electronics modules

EHT module

35 The EHT module (Fig 10.19 (3)) generates the extra high tension voltage required by the high voltage deflector electrode.

Electronics compartment cooling fan

36 The electronics compartment cooling fan (Fig 10.19 (2)) blows filtered air over the electronics system to cool it. The fan is also used to dilute and disperse vapour produced from the ink system. A fan failure card (4) monitors the flow of cooling air in the filter compartment, if the fan fails then the flow of cooling air stops, this is detected by the fan failure card which outputs an alarm signal to the CPU via the I/O board.

Ink system pump

37 The ink system pump (Fig 10.19 (1)) provides the flow of ink to drive the ink system. The motor is a brushless DC type except on white pigmented 460 Pi machine which uses a brushed motor. The pump head is a geared type producing ink flow from two rotating meshed gears.

Mains input circuit

38 The AC mains supply (Fig 10.20) is supplied, via three core cable to the mains connector on the connector panel. At the mains connector the live and neutral lines are fed to the On/Off switch via a filter, the earth line is connected directly to an earth lug on the PSU. The output from the On/Off switch is fed to connector TB1 on the PSU via fuses 1 and 2. Fuse ratings are 3.15 A for a 220/240 V supply and 5 A for a 110 V supply.

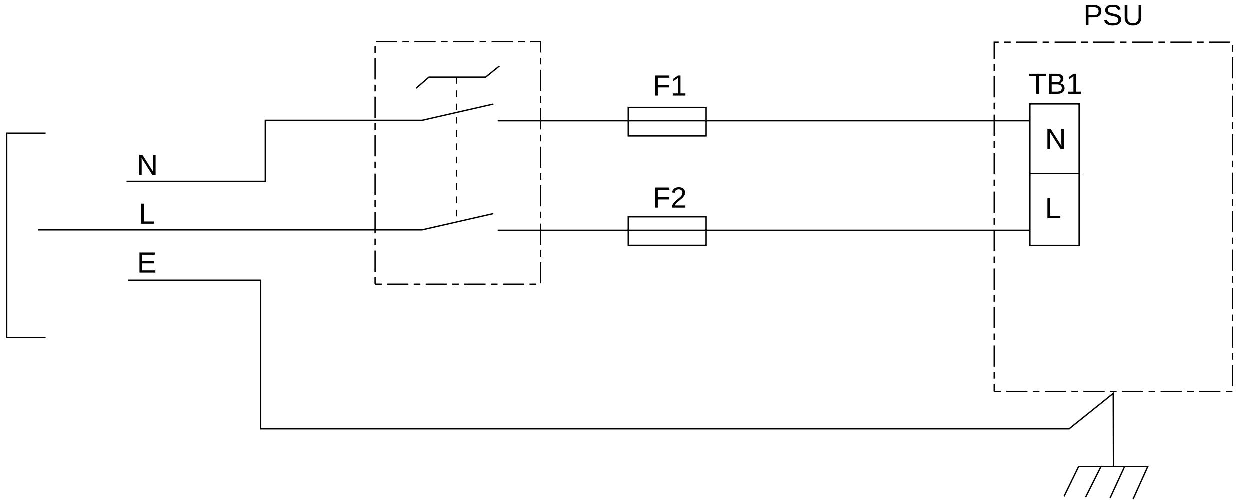


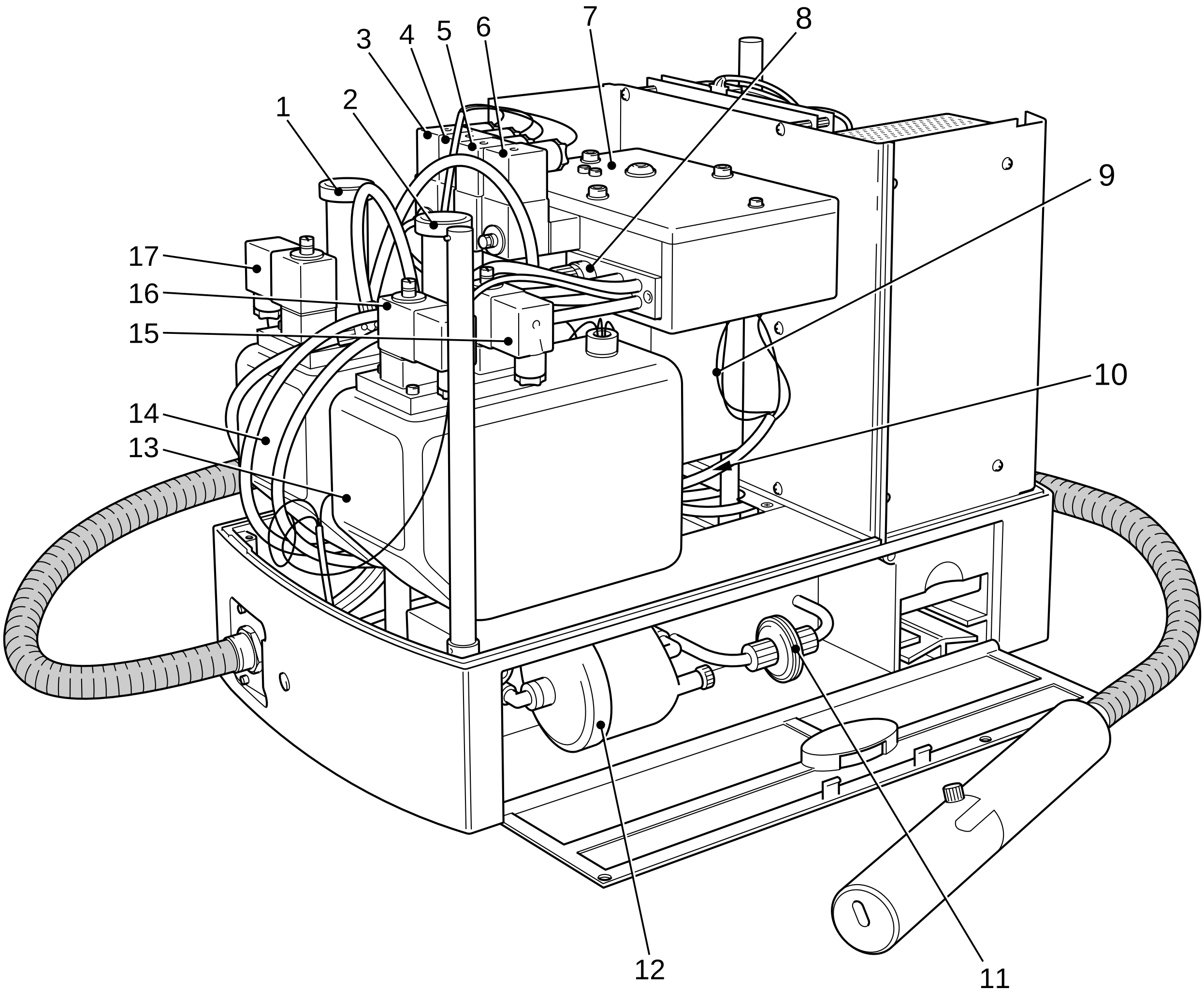
Fig 10.20 Mains input circuit

Both live and neutral lines are protected by fuses.

INK SYSTEM

General

39 The ink system provides a continuous supply of ink to the printhead at the correct pressure and at the correct temperature/viscosity combination. The ink system is housed in the printer cabinet and the components are interconnected by PTFE tubing. Fig 10.21 shows the ink system components.



1	Ink manifold	10	Ink system pump
2	Top up manifold	11	Pre-pump filter
3	Solenoid valve V6 (Feed)	12	Main filter
4	Solenoid valve V8 (Gutter)	13	Top up reservoir
5	Solenoid valve V3 (VMS)	14	Ink reservoir
6	Solenoid valve V10 (Purge)	15	Solenoid valve V4 (Solvent Flush)
7	FMS	16	Solenoid valve V1 (Top Up)
8	Pressure transducer	17	Solenoid valve V2 (Ink Top Up)
9	Mixer tank		

Fig 10.21 Ink system components

Solenoid valves

40 The flow of ink in the ink system is controlled by 7 solenoid operated spool valves. The valves (Fig 10.22) are all of the same design. The valves are single-acting, operated by an electrical actuator (solenoid) with spring return. The flow will be from the common port (C) (3) to the normally open port (R) (1) when the valve is not energised (off). When energised (on) the flow will be from the common port to the normally closed port (P) (2).

40.1 Top Up Valve V1 (Fig 10.21 (16)) controls the flow of top up from the top up reservoir (13) to the mixer tank (9).

40.2 Ink Top Up Valve V2 (17) controls the flow of ink from the ink reservoir (14) to the mixer tank (9).

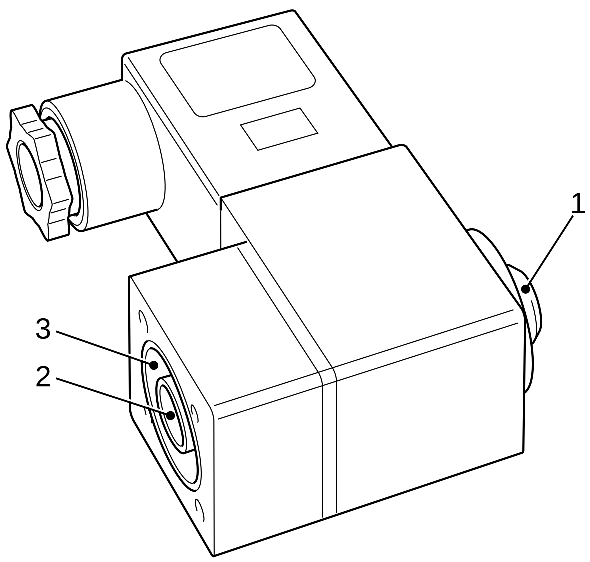
40.3 The Viscosity Monitoring System (VMS) Valve V3 (5) controls the flow of ink from the ink system to the VMS.

40.4 Solvent Flush Valve V4 (15) controls the flow of top up from the top up reservoir to the nozzle when flushing ie, when the Stop Jet sequence is initiated.

40.5 Feed Valve V6 (3) controls the flow of ink to the nozzle for printing.

40.6 Gutter Valve V8 (4) controls the flow of ink from the gutter back to the mixer tank or from the nozzle return (via valve V10) to the mixer tank.

40.7 Purge Valve V10 (6) controls the flow of ink from the nozzle return to the mixer tank (via valve V8).



1 Normally open port (R)
2 Normally closed port (P)
3 Common port (C)

Fig 10.22 Solenoid valve

Top up and ink reservoirs

41 The ink and top up reservoirs (Fig 10.21 (14, 13)) are of similar design and each have a capacity of 1.2 litres. Located on the top of each reservoir is a manifold (1,2) which consist of the mounting points for the solenoid valves (1 valve on the ink manifold 2 on the top up manifold) and the filler tube for top up or ink. Each reservoir houses an internal low level sensor.

Ink system filters

42 The ink system has two filters:

42.1 The pre-pump filter (Fig 10.21 (11)) is a 40 micron filter which filters the ink from the mixer tank before it enters the pump.

42.2 The main filter (12) is a 5 micron or 20 micron (Pi only) absolute filter which filters the ink from the pump before it enters the delivery side of the ink system.

Fluid management system (FMS)

43 The FMS (Fig 10.21 (7)) has solenoid valves V3 (5), V6 (3), V8 (4) and V10 (6) externally mounted on it. It houses the following components:

43.1 Mixer tank (Fig 10.23 (4)).

43.2 Mixer tank level high sensor (7).

43.3 Mixer tank level OK sensor (6).

43.4 Mixer tank level low sensor (5).

43.5 Mixer tank ink temperature sensor (8).

43.6 Viscosity Monitoring System (VMS) (1).

Viscosity Monitoring System (VMS)

44 The VMS constantly monitors the viscosity of the ink in the system. This is done by filling a VMS chamber with ink and timing how long it takes the ink to drain from the chamber. High and low levels sensors (Fig 10.23 (2) and (3)) in the chamber detect when it is full and empty.

Ink system pump

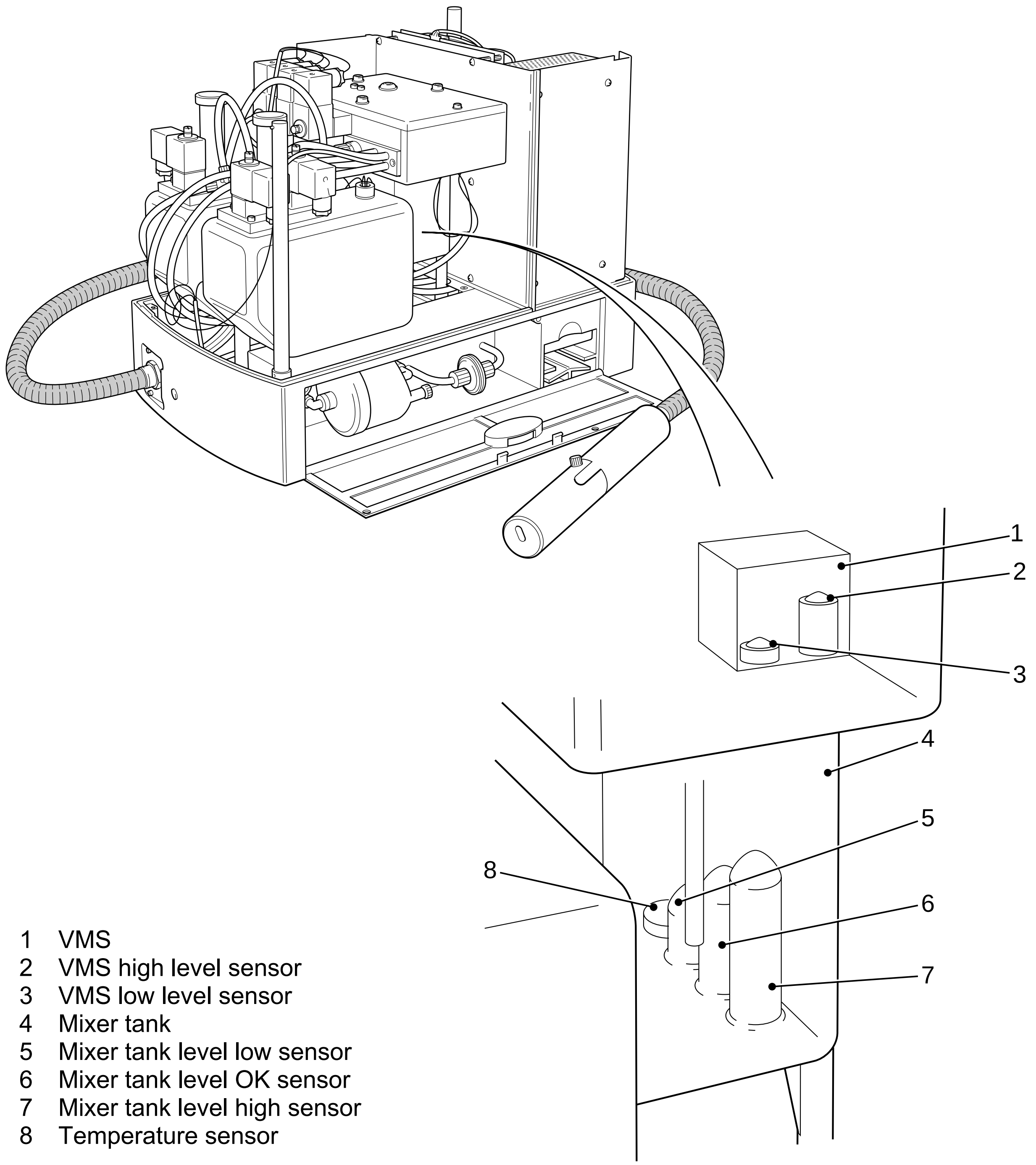
45 The ink system pump (Fig 10.21 (10)) is a rotary gear pump, driven by a brushless motor (brushed motor fitted to white pigmented 460 Pi), which provides ink system pressure.

Venturi

46 A venturi, located in the top of the FMS, generates a vacuum at the printhead nozzle or gutter as required by the ink system.

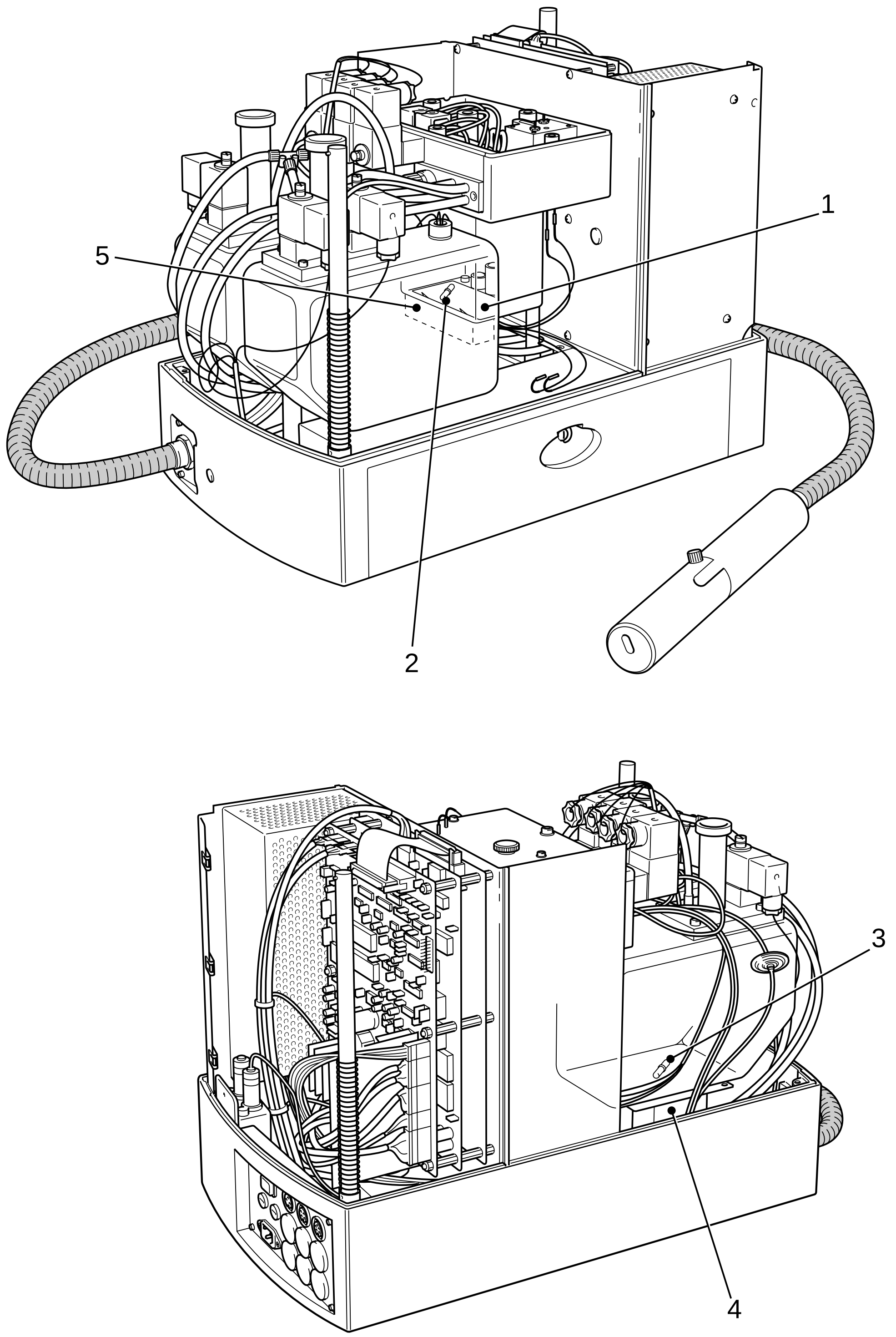
Pressure transducer

47 A pressure transducer (Fig 10.21 (8)) monitors the ink system pressure. The pressure reading is fed to the CPU via the I/O board.



1 VMS
2 VMS high level sensor
3 VMS low level sensor
4 Mixer tank
5 Mixer tank level low sensor
6 Mixer tank level OK sensor
7 Mixer tank level high sensor
8 Temperature sensor

Fig 10.23 FMS components (Si and Mi)



1 Mixer tank wear plate
2 Mixer tank stirrer bar
3 Ink reservoir stirrer bar
4 Ink reservoir stirrer motor
5 Mixer tank stirrer motor

Fig 10.24 Pi stirrer components

Stirrer motors (Pi)

48 Magnetic stirrer bars are fitted to the mixer tank (Fig 10.24 (2)) and ink reservoir (3) to agitate the contents of the receptacles so that the particles of ink do not settle. The mixer tank is fitted with a wear plate (1) to minimise the effects of the stirrer bar rotating at the base of the tank.

49 The stirrer bars are rotated by the magnetic fields from the ink reservoir stirrer motor (4) and the mixer tank stirrer motor located under the tank. The stirrer motors are supplied from the levels interface board (Para 25 to 28) connector JP3, pins 2 (red cable (+ve)) and 3 (white cable (-ve)) supply the mixer tank stirrer motor, pins 4 (blue cable (+ve)) and 5 (black cable (-ve)) supply the ink reservoir stirrer motor.

PRINTER OPERATION

50 Printer operation is described in two parts:

50.1 Printhead.

50.2 Ink system.

Printhead

General

51 Three types of printhead are fitted to the 400 series of printers. The Si models use the standard printhead, the Mi model uses a micro printhead and the Pi model uses a larger nozzle to accommodate the particle size of pigmented ink. The principle of operation is the same for all types but there are minor differences in the construction and operating parameters. These will be pointed out in the functional description that follows.

Ink jet information

52 An electrically conductive ink is supplied under pressure by the ink system to the nozzle assembly (Fig 10.25 (2)) via the ink feed pipe (3). An ink stream is formed as the ink is forced out of the nozzle jet orifice (1). A modulation signal is applied to a ceramic transducer (4) which is bonded to the nozzle assembly. The transducer causes the nozzle assembly to vibrate longitudinally, breaking up the ink stream into droplets, a small distance away (the break up point) from the nozzle jet orifice. The frequency of modulation on a standard Si and Pi printhead is 76.8 kHz or 120 kHz for a micro printhead. A micro printhead has a damping mass attached to the rear of the transducer to mechanically 'tune' the nozzle assembly to the higher modulation frequency.

53 The ink droplets are produced at the same rate as the modulation frequency, are uniform in size and separated by equal distances. The droplets produced by a micro head are smaller than those produced by a standard head. This is because the nozzle orifice diameter is 35 microns compared with 60 microns on a standard head or 70 microns on a Pi printhead.

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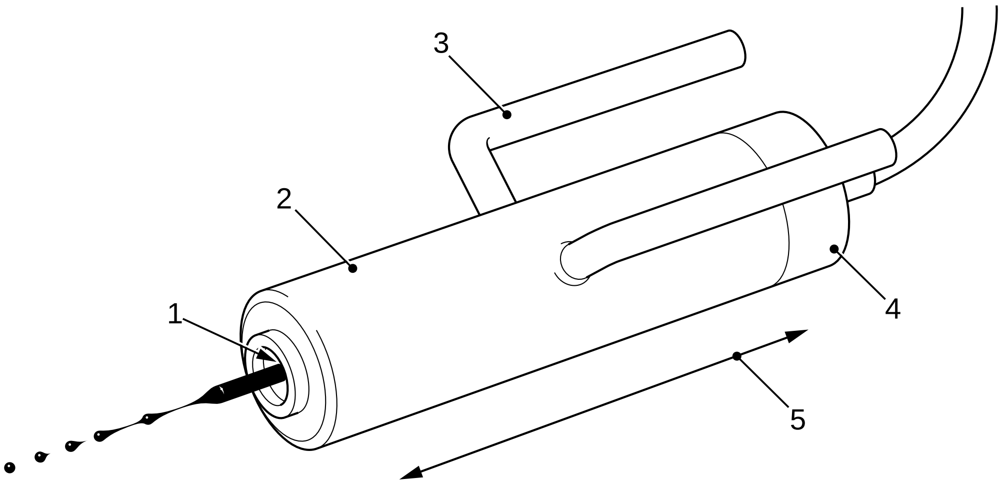
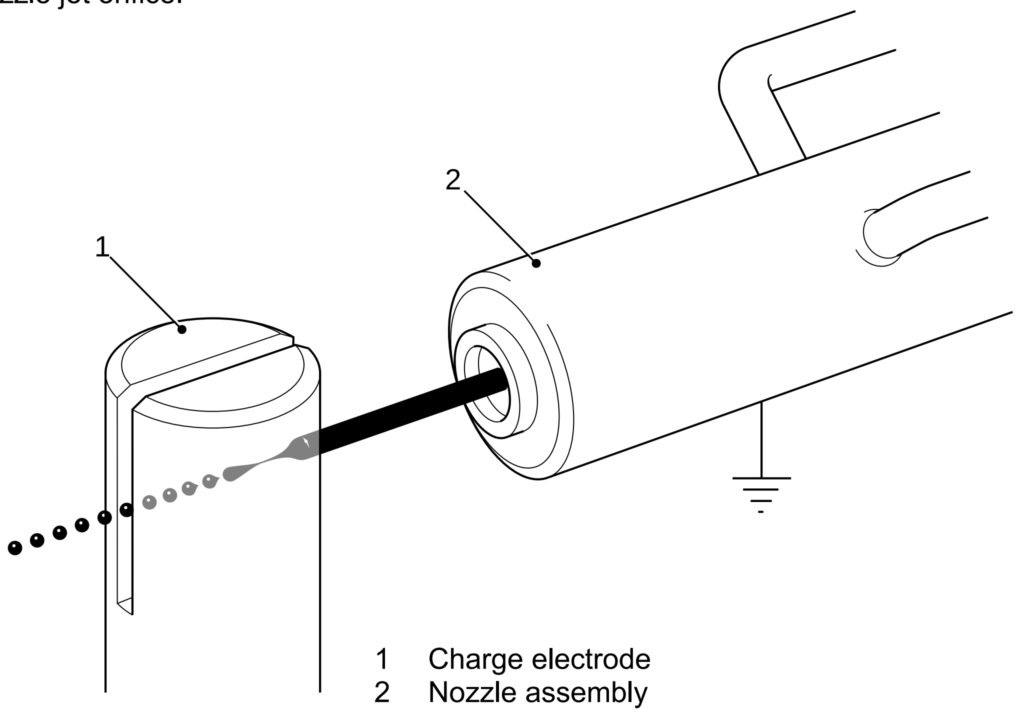


1 Nozzle jet orifice
2 Nozzle assembly
3 Ink feed pipe
4 Ceramic transducer
5 Vibration direction

Fig 10.25 Ink jet formation

Droplet charging

54 The charge electrode (Fig 10.26 (1)) is positioned at the break up point of the ink stream and extends for several drops either side of it. This allows a tolerance for break up position and shields the ink stream from the influence of the other electrostatic fields. The distance between the nozzle assembly (2) and the charge electrode on a micro head is much shorter (0.5 mm) than on a standard head (2 mm). This is because the break up point of the ink stream is much nearer to the nozzle due to the higher modulation frequency and smaller nozzle jet orifice.



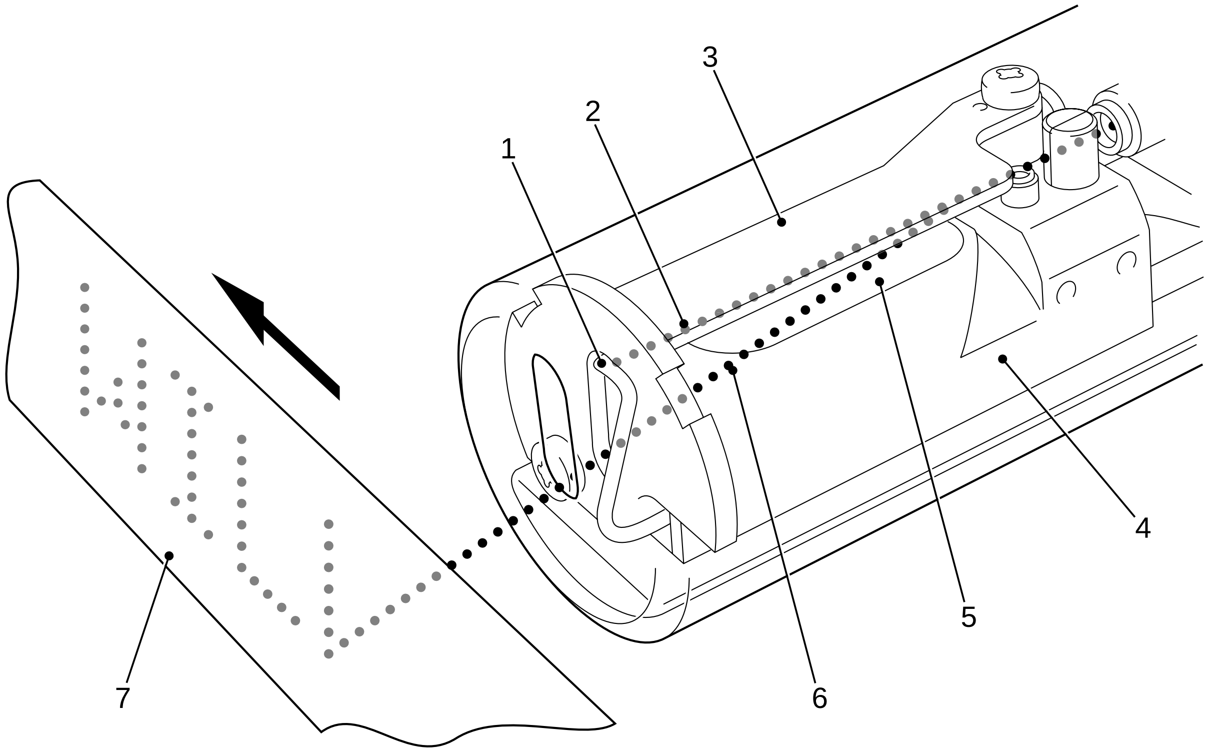
1 Charge electrode
2 Nozzle assembly

Fig 10.26 Charge electrode

55 The ink stream and the charge electrode can be considered as the two electrodes of a capacitor. By raising the charge electrode to a specific positive voltage (with a charge pulse) the section of the ink system within the charge electrode will have a negative charge induced on it. When a drop of ink then breaks from the jet it will have trapped on it a charge directly proportional to that on the charge electrode. If the positive voltage is then removed from the charge electrode, the negative charge on the jet will discharge through the ink jet and nozzle assembly to ground. However, the drop of ink which has become detached from the jet cannot discharge as it no longer has a conductive path to ground.

Droplet deflection

56 After passing through the charge electrode the droplet stream passes through an electrostatic field maintained by the deflector electrodes which are connected to a high tension supply (typically 6 kV). The negatively charged droplets are deflected by the field towards the high voltage deflector electrode (Fig 10.27 (5)). The distance a drop is deflected is proportional to the charge carried, which is in turn proportional to the voltage applied to the charge electrode when the drop became detached from the ink jet.



1 Gutter
2 Droplet path to gutter
3 Ground potential deflector electrode
4 EHT block
5 High voltage deflector electrode
6 Deflected droplet path
7 Substrate

Fig 10.27 Droplet deflection

57 The charged droplets once deflected (6) leave the printhead to form characters in a dot matrix format on the substrate (7). Droplets which are not required for printing are not charged and are therefore not deflected (2). They continue into the gutter (1) where they are returned to the ink reservoir.

58 In the micro printhead the EHT block (4) is shorter than the one in a standard head. Overall, the micro printhead is shorter by 20 mm. There is also a smaller throw distance between the printhead and the substrate. The lower mass of the droplets, shorter head and throw distance, mean that the inkjet is deflected less and that smaller, higher definition characters are produced.

Ink system

General

59 The functions of the ink system are as follows:

59.1 Deliver ink to the nozzle at a constant pressure and temperature.

59.2 Ensure sufficient ink and solvent are available.

59.3 Ensure that the ink is kept at a viscosity value corresponding to the ink temperature and the type of ink in use.

59.4 Generate a vacuum for gutter suction.

Operation

60 The pump draws ink from the mixer tank and circulates it round a system divided into several paths. After circulation the unused ink is returned to the mixer tank.

Circulation ensures that the ink remains thoroughly mixed and any addition of ink or solvent will be rapidly mixed in.

61 Filtered ink is fed from the pump to three sub-systems.

61.1 The VMS.

61.2 The printhead nozzle.

61.3 The venturi, which applies a vacuum to the nozzle or the gutter to perform the following operations.

61.3.1 To remove debris from the nozzle during flushing.

61.3.2 To draw solvent through the umbilical tubes (thus cleaning them) during shut down.

61.3.3 To collect non-deflected ink droplets, via the gutter, when printing.

62 The returned ink or solvent is fed back to the mixer tank via a baffle to reduce frothing.

In the following diagrams (Fig 10.28 to Fig 10.34) ink and solvent flow are represented as follows:

= Ink flow

= Solvent flow

Viscosity Monitoring System (VMS) sequence

63 Whenever the jet is running and F1 displays STOP JET, the viscosity of the ink is checked by the VMS. This procedure is as follows:

63.1 Solenoid valve V3 opens directing ink into the VMS chamber, which is an integral part of the FMS (Fig 10.28 sheet 1).

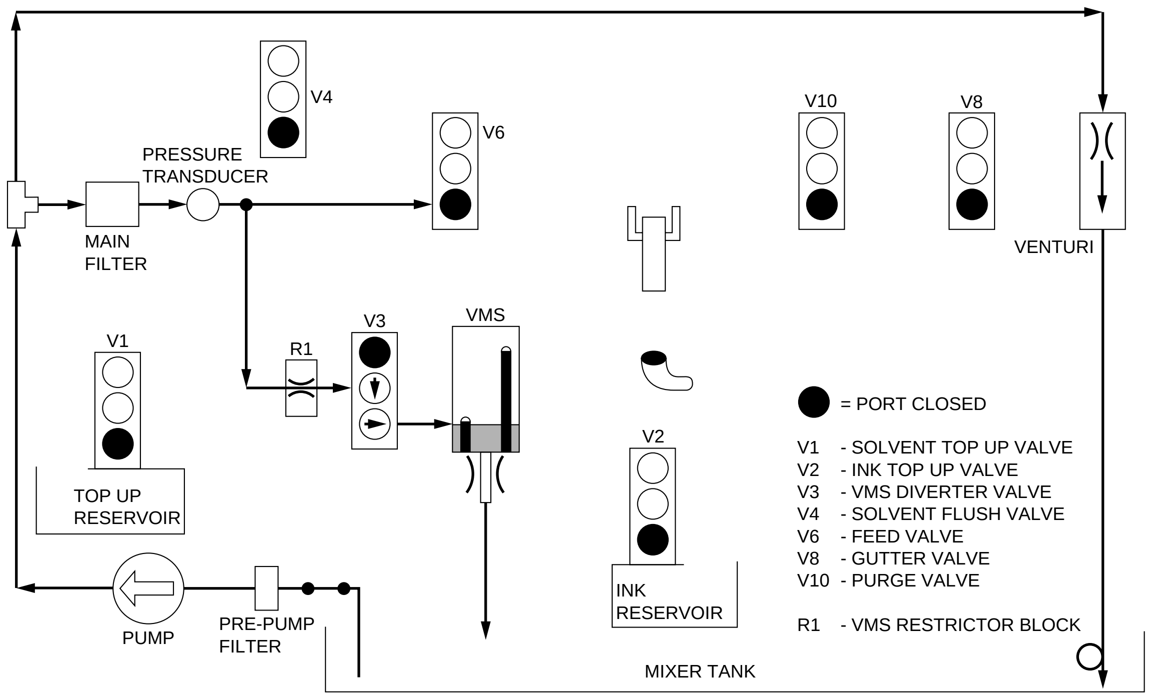


Fig 10.28 VMS sequence sheet 1

63.2 Ink flows into the VMS chamber via V3 and restrictor R1 until the high level sensor is covered. At this point V3 closes, stopping the flow of ink into the chamber (Fig 10.28 sheet 2).

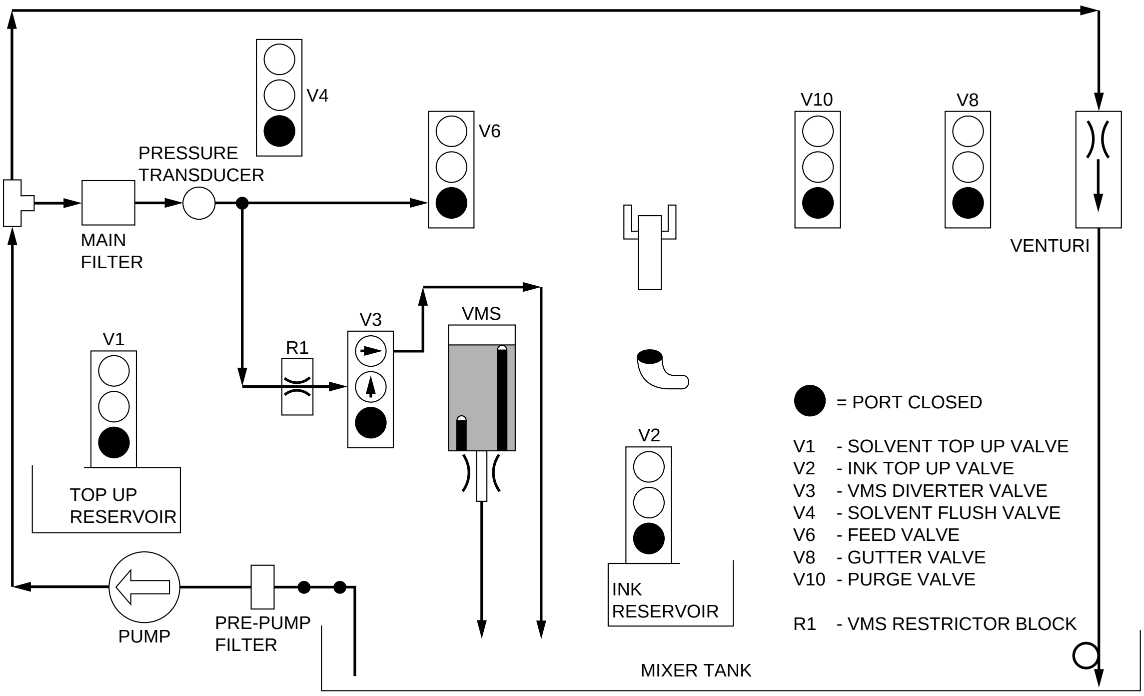


Fig 10.28 VMS sequence sheet 2

63.3 The ink flows out of the chamber through a large restrictor into the mixer tank until the low level sensor is uncovered. The CPU in the electronics system measures the time that this takes. V3 energises and the chamber starts to fill again (Fig 10.28 sheet 3).

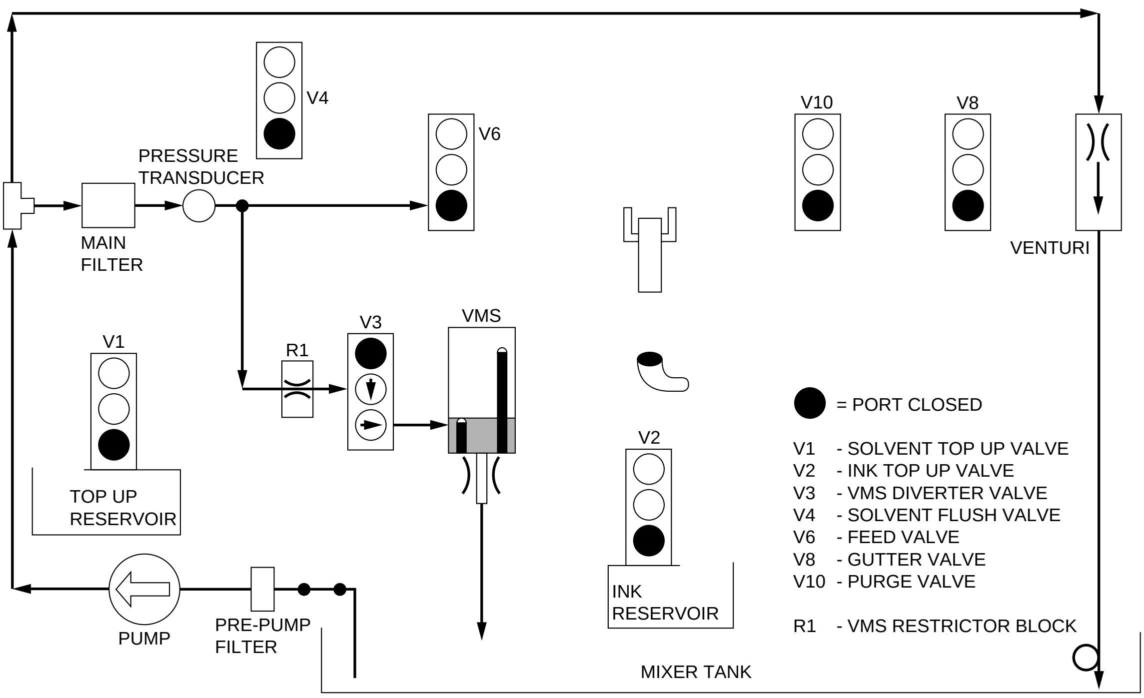


Fig 10.28 VMS sequence sheet 3

63.4 The time taken for the ink to run out of the chamber is dependent on its viscosity; the thicker the ink, the longer it will take to drain. The viscosity of the ink is affected by solvent loss during normal machine operation as well as by its temperature which is monitored by a sensor in the mixer tank.

63.5 The CPU compares the time taken for the ink to drain against a value calculated by the software. The software takes into account the type of ink (entered during system calibration) and its temperature.

63.6 If the ink is too thick (ie the time to drain is longer than the calculated value) solenoid valve V1 opens. The pump draws solvent from the top up reservoir, adding it in small doses to the mixer tank every 2nd VMS cycle until the viscosity is correct (see Para 63).

63.7 The viscosity monitoring sequence is repeated each time that the low level sensor in the VMS chamber is uncovered.

Ink is only added to the mixer tank when the tank level is below the OK level sensor.

Clean start jet sequence

64 When the start jet sequence is initiated the following automatically takes place:

64.1 Ink system pressure set to 4 bar (Fig 10.29 sheet 1).

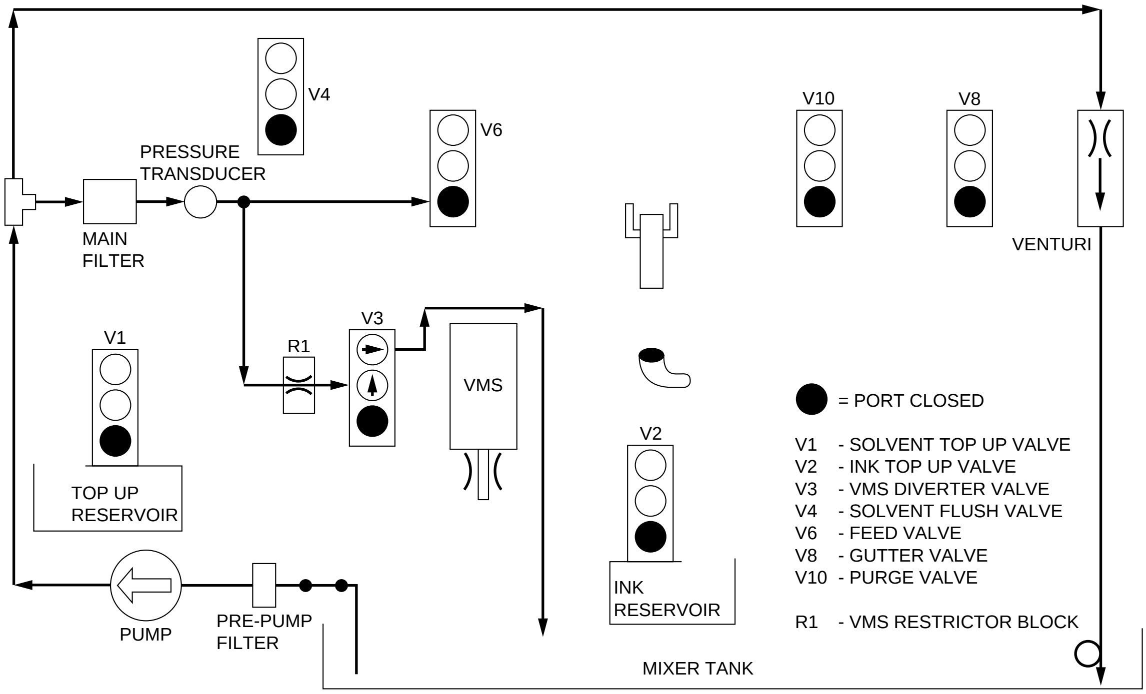


Fig 10.29 Clean start jet sequence sheet 1

64.2 After 15 seconds gutter valve V8 energises (Fig 10.29 sheet 2).

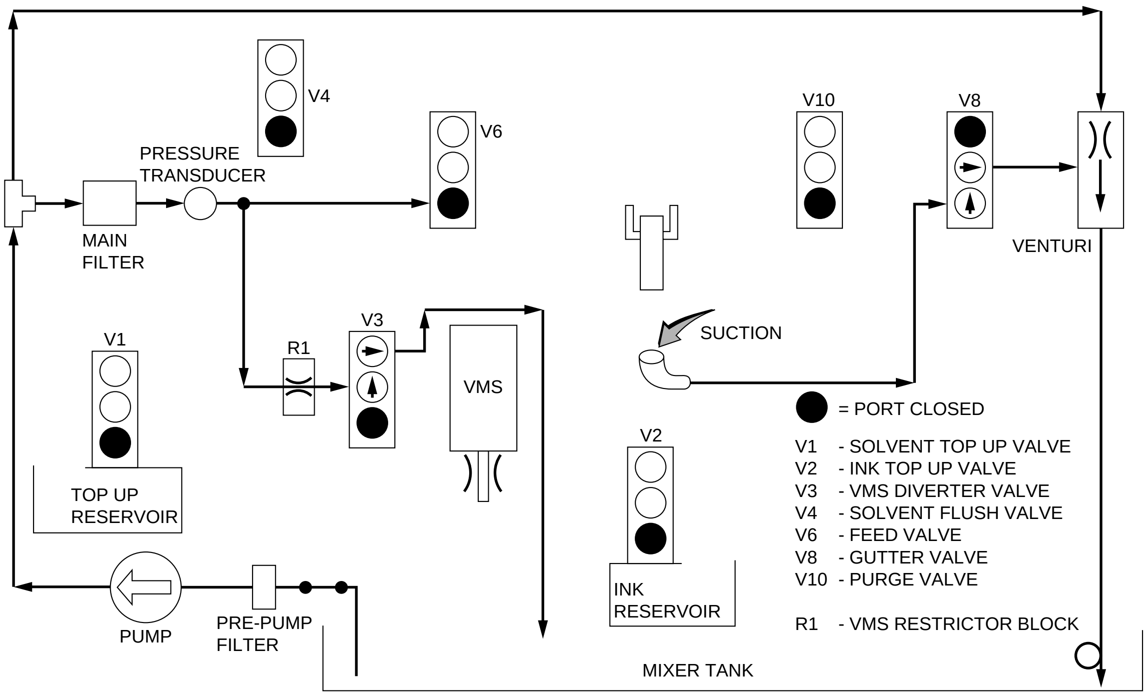


Fig 10.29 Clean start jet sequence sheet 2

64.3 After 1 second feed valve V6 energises, 250ms later the modulation signal turns on (Fig 10.29 sheet 3).

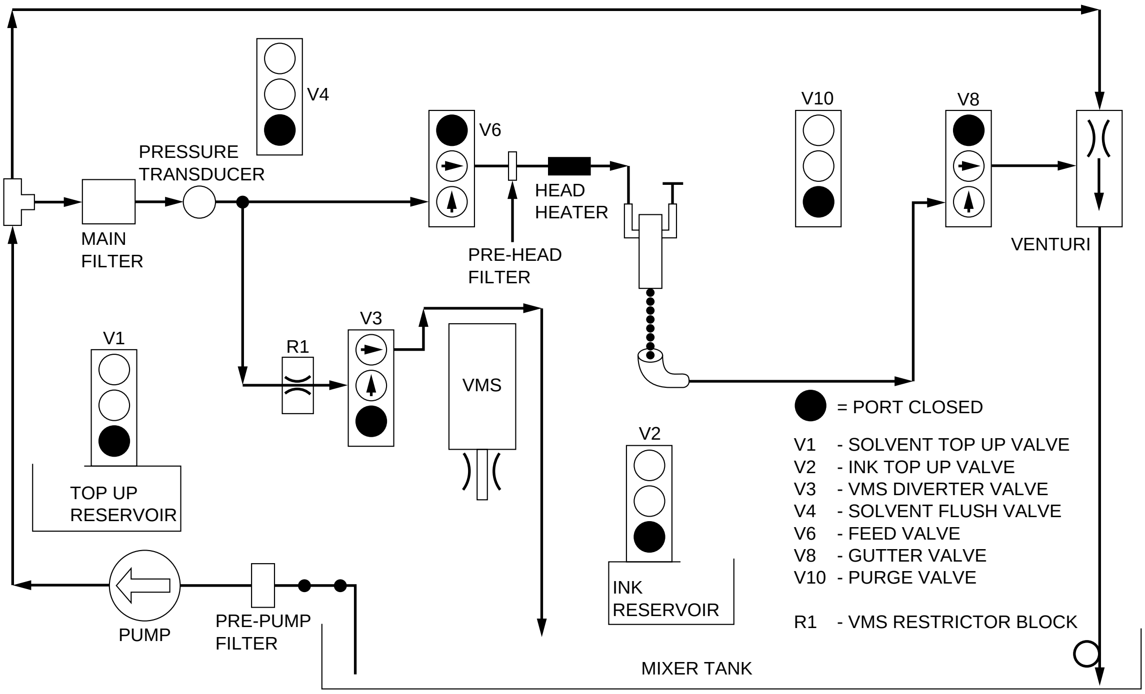


Fig 10.29 Clean start jet sequence sheet 3

64.4 After 10 seconds purge valve V10 energises (Fig 10.29 sheet 4)

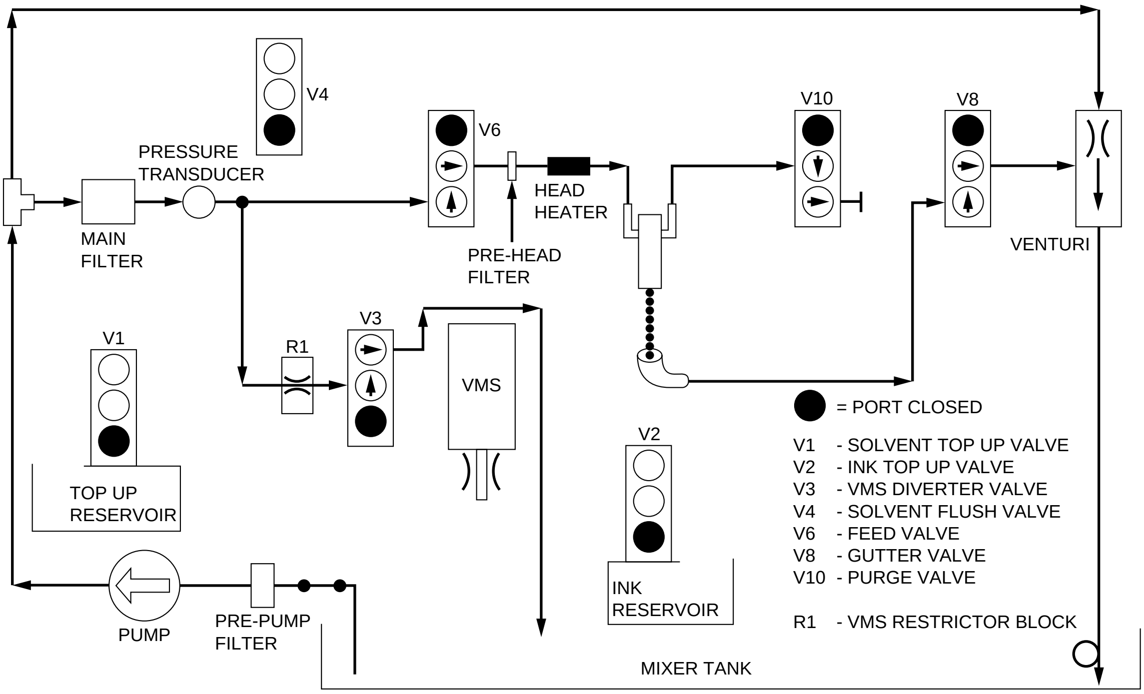


Fig 10.29 Clean start jet sequence sheet 4

64.5 After 1 second gutter valve V8 de-energises (Fig 10.29 sheet 5).

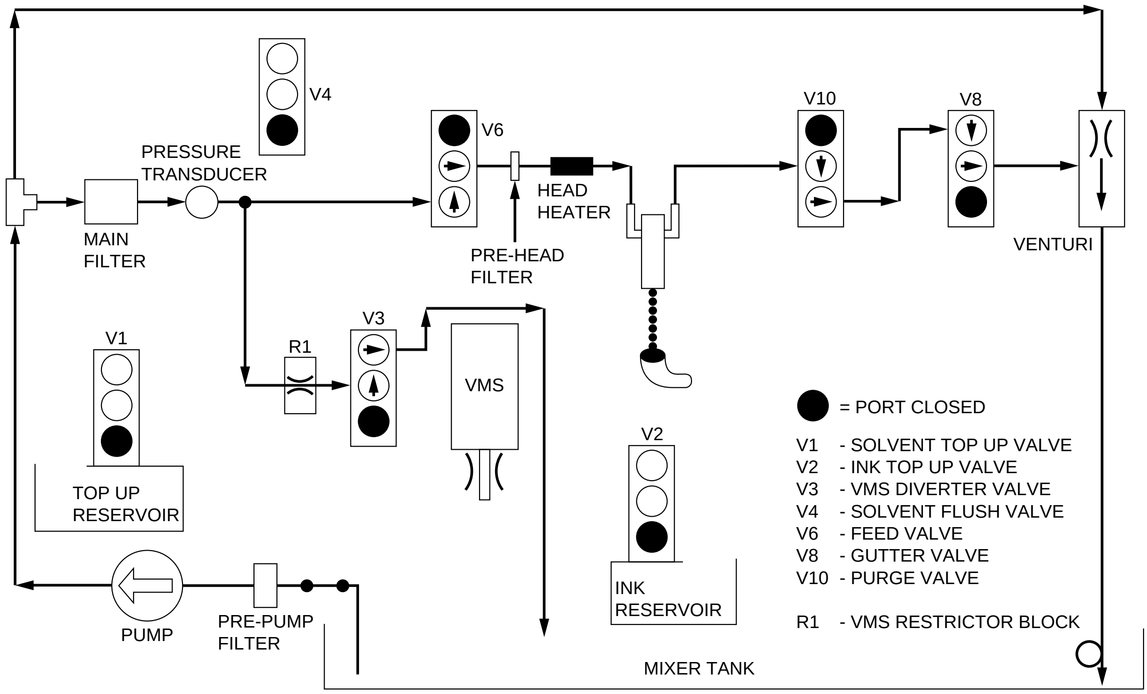


Fig 10.29 Clean start jet sequence sheet 5

64.6 After a further 50ms gutter valve V8 energises (Fig 10.29 sheet 6).

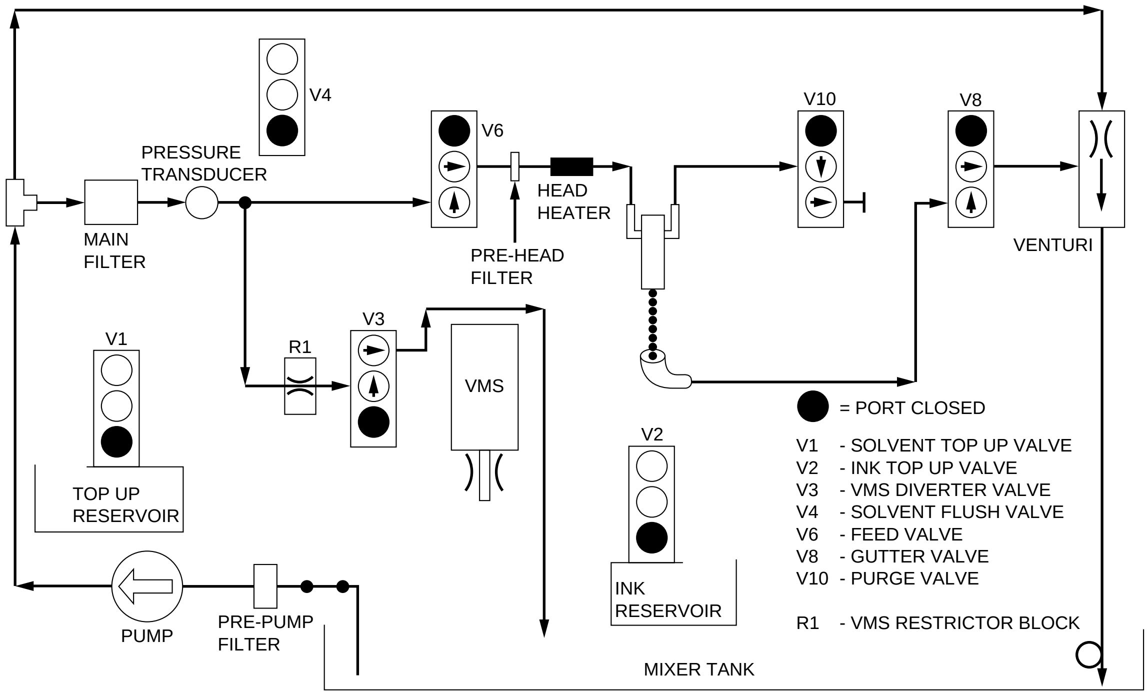


Fig 10.29 Clean start jet sequence sheet 6

64.7 After 950ms gutter valve V8 de-energises (Fig 10.29 sheet 7).

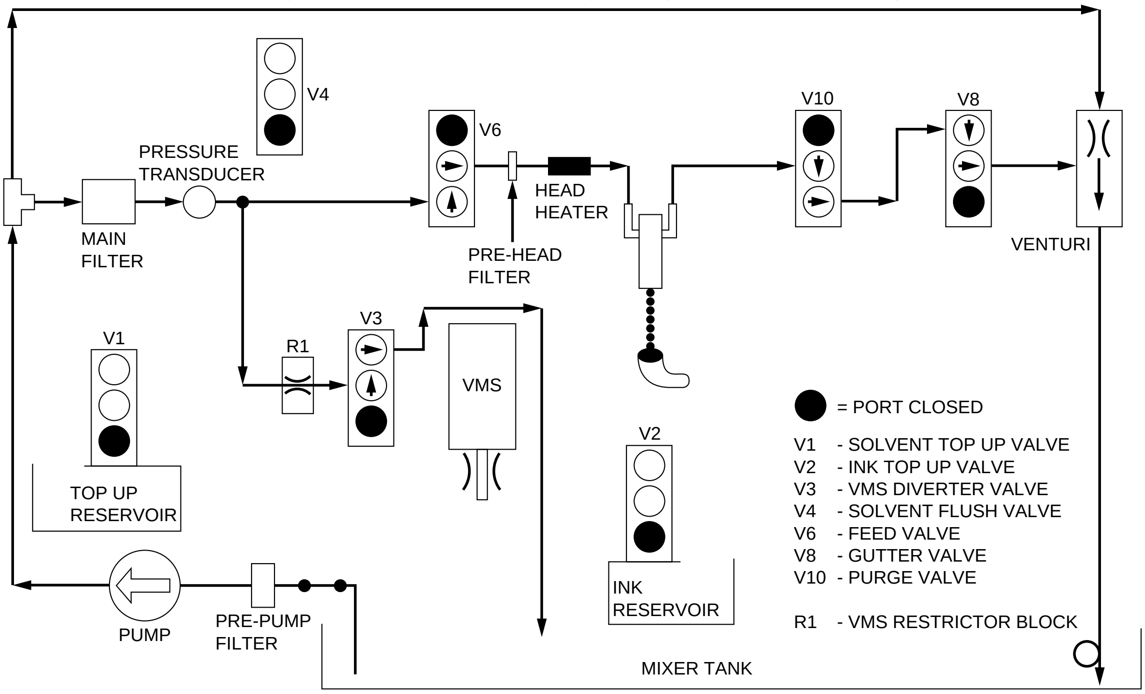


Fig 10.29 Clean start jet sequence sheet 7

64.8 Paras 64.6 and 64.7 are repeated 6 times, then after 1 second purge valve V10 de-energises. The ink system then sets to the running pressure for the ink type to be used (Fig 10.29 sheet 8).

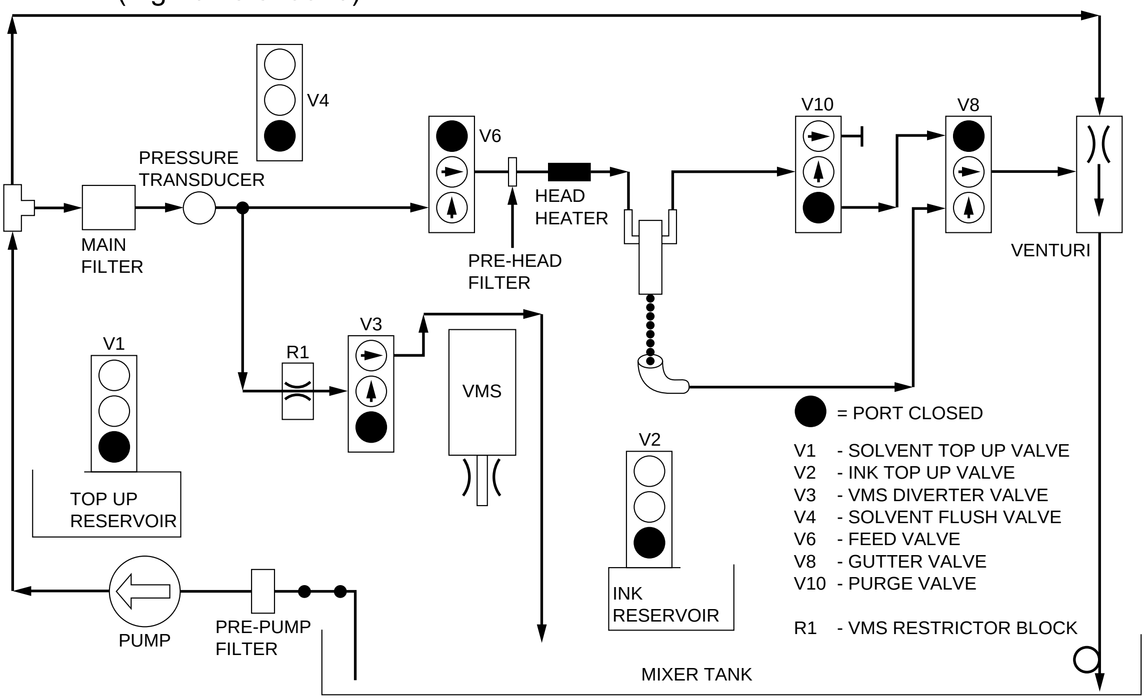


Fig 10.29 Clean start jet sequence sheet 8

64.9 The head heater starts to warm up the head to a preset temperature, typically 35°C. The CPU monitors the temperature, and when it is within 5° C of the set point there is a further pause of 2 seconds before the pre-run checks take place. As soon as the checks have ensured the droplets are charged correctly, the machine is ready to print.

Clean stop jet sequence

65 When the clean stop jet sequence is initiated the following automatically takes place.

65.1 Ink system pressure is set to 3.5 bar (Fig 10.30 sheet 1).

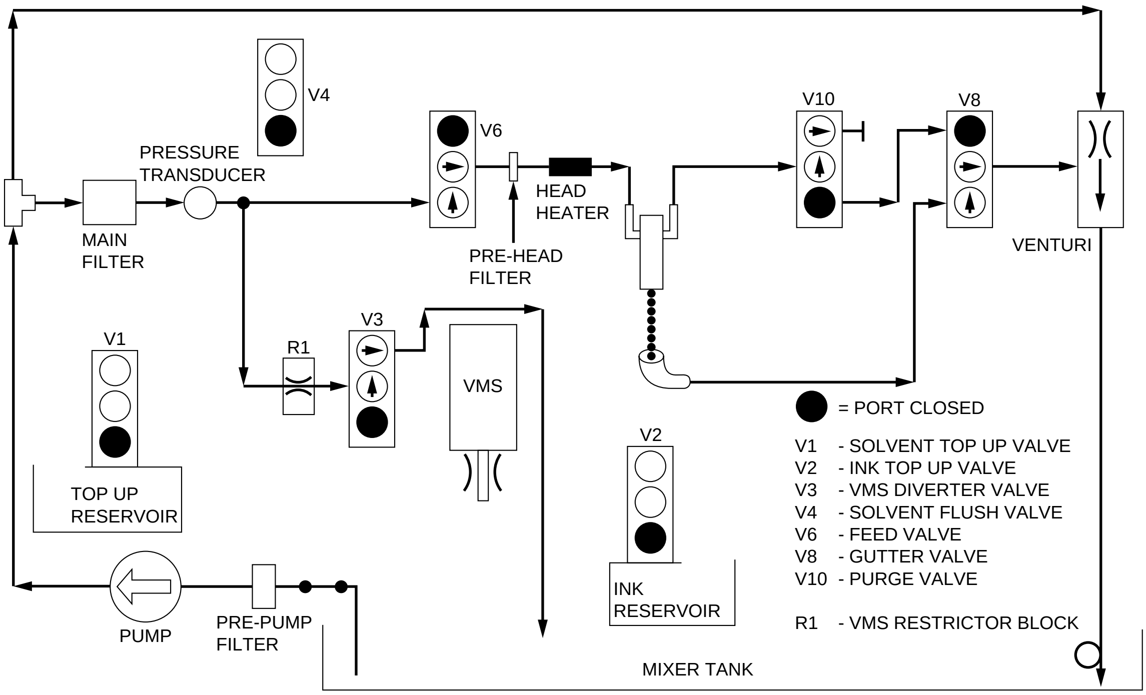


Fig 10.30 Clean stop jet sequence sheet 1

65.2 After 10 seconds feed valve V6 de-energises, gutter valve V8 de-energises and purge valve V10 energises (Fig 10.30 sheet 2).

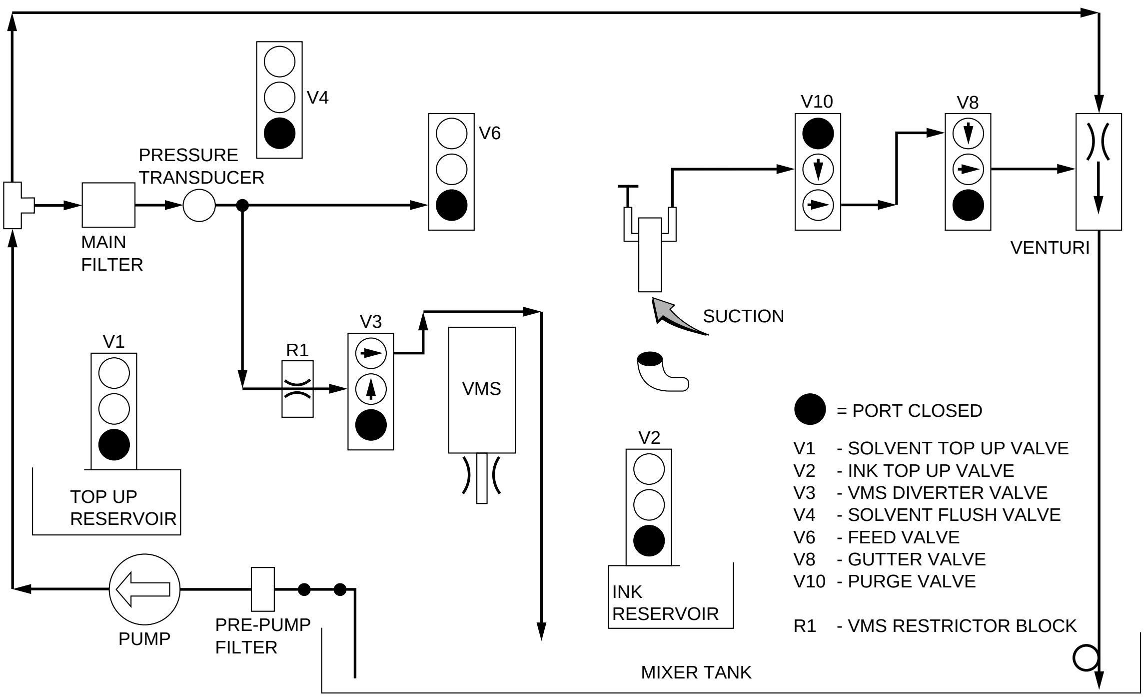


Fig 10.30 Clean stop jet sequence sheet 2

65.3 After 5 seconds gutter valve V8 energises (Fig 10.30 sheet 3).

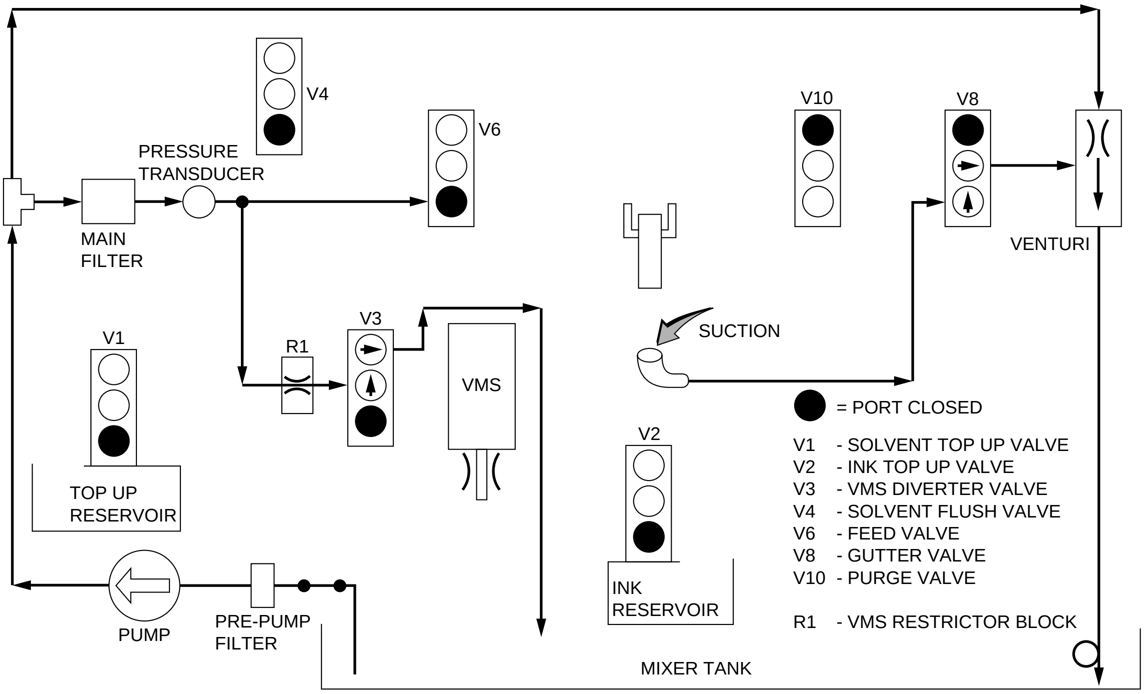


Fig 10.30 Clean stop jet sequence sheet 3

65.4 After 30 seconds gutter valve V8 de-energises (Fig 10.30 sheet 4)

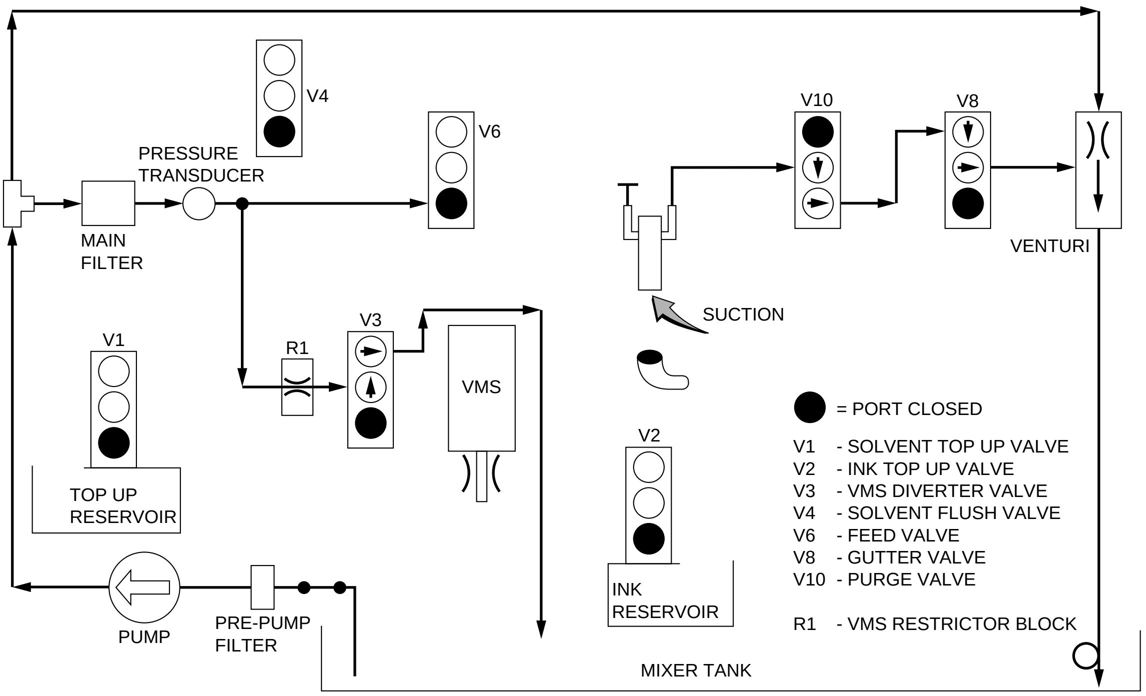


Fig 10.30 Clean stop jet sequence sheet 4

65.5 After 30 seconds flush valve V4 energises (Fig 10.30 sheet 5).

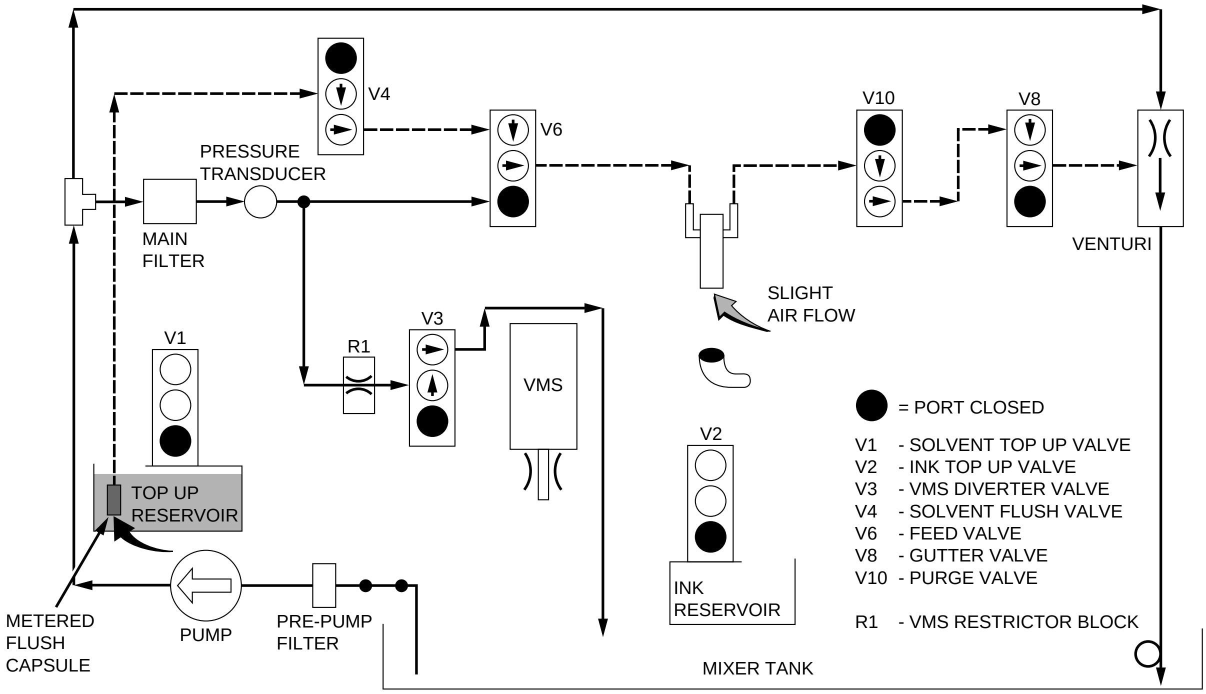


Fig 10.30 Clean stop jet sequence sheet 5

65.6 After 30 seconds flush valve V4 de-energises (Fig 10.30 sheet 6).

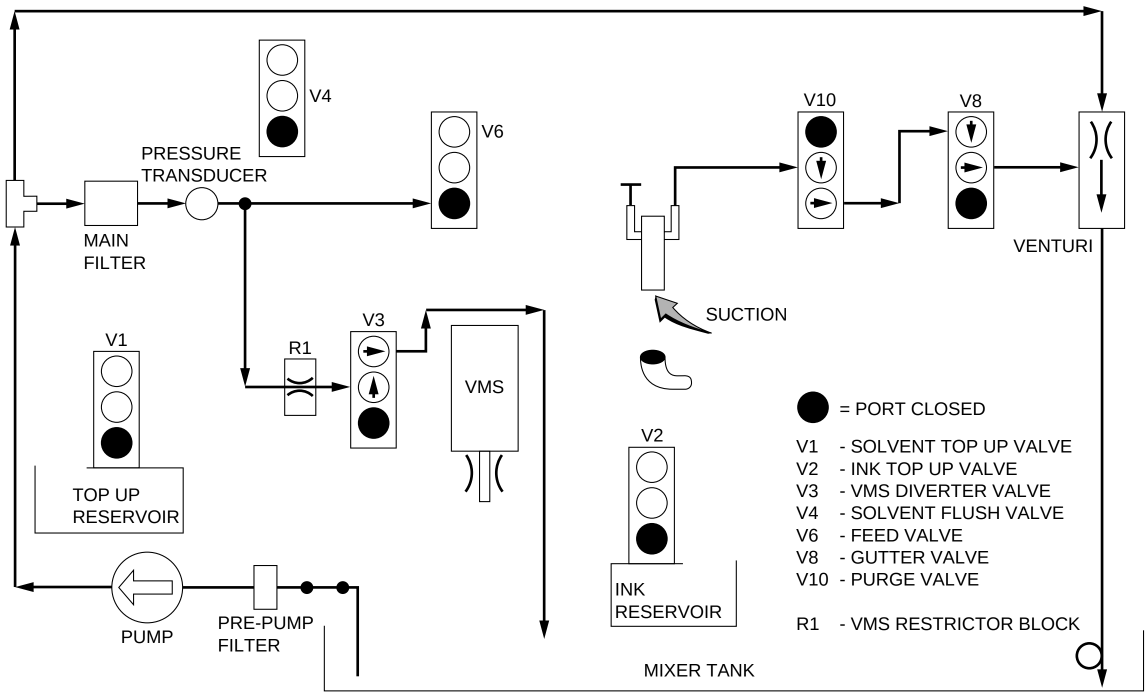


Fig 10.30 Clean stop jet sequence sheet 6

65.7 After 15 seconds flush valve V4 energises (Fig 10.30 sheet 7).

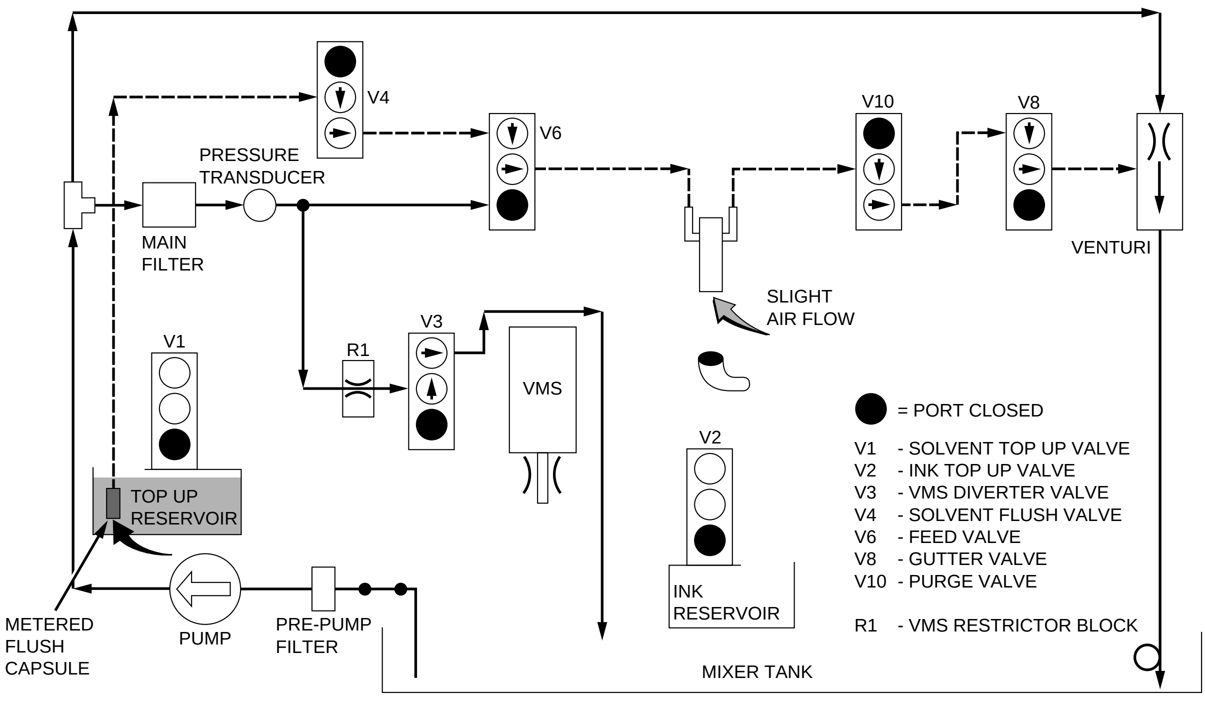


Fig 10.30 Clean stop jet sequence sheet 7

65.8 After 15 seconds flush valve V4 de-energises (Fig 10.30 sheet 8).

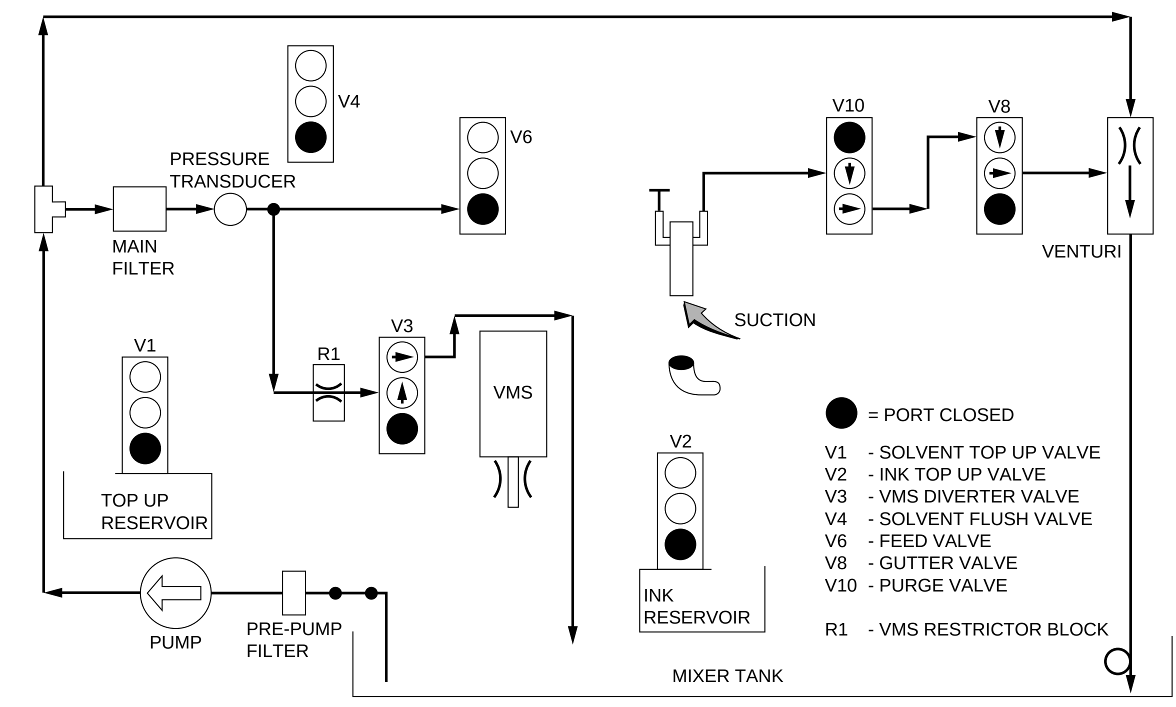


Fig 10.30 Clean stop jet sequence sheet 8

65.9 After 30 seconds gutter valve V8 energises and the modulation signal turns off (Fig 10.30 sheet 9).

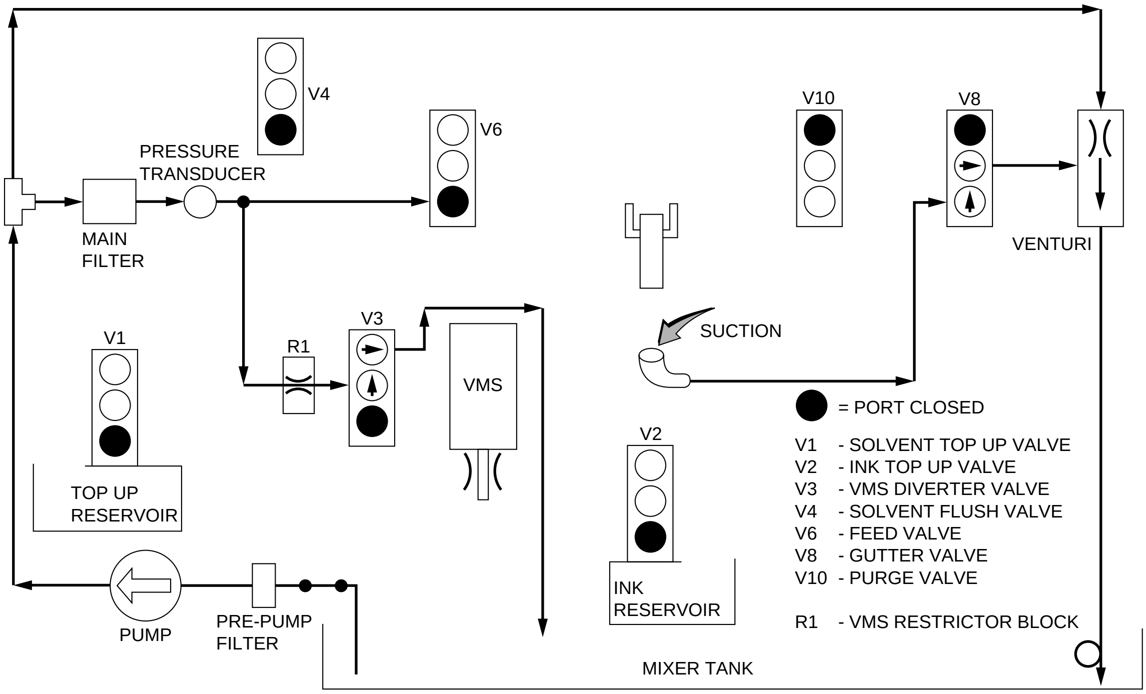


Fig 10.30 Clean stop jet sequence sheet 9

65.10 After 150 seconds gutter valve V8 de-energises, purge valve V10 de-energises and the ink system pump turns off (Fig 10.30 sheet 10).

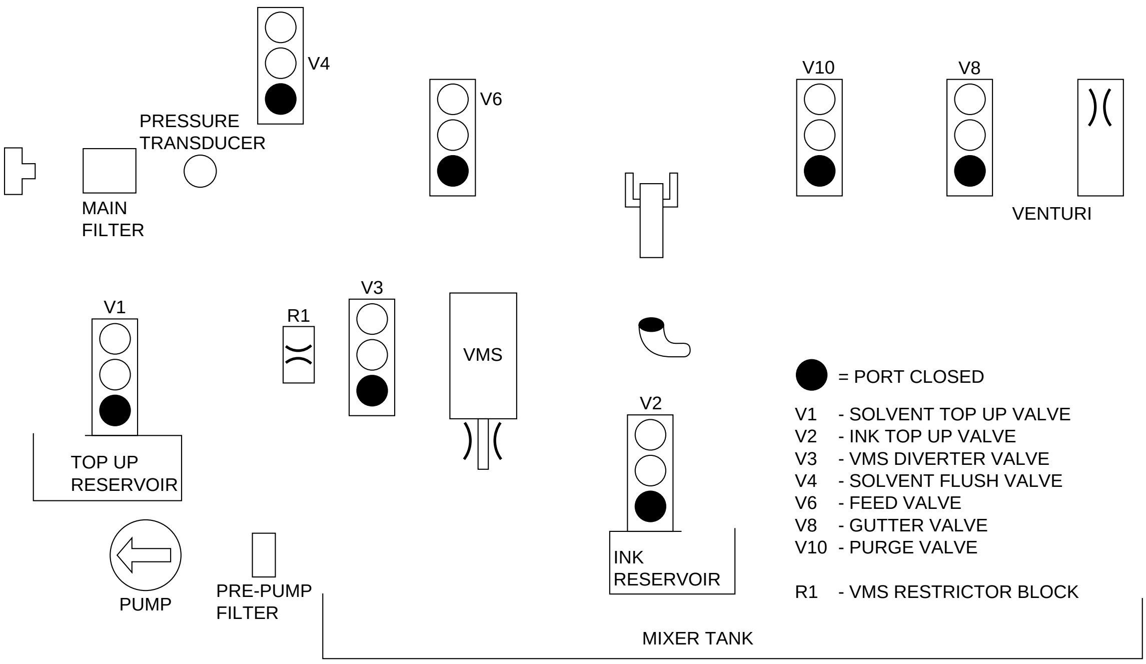


Fig 10.30 Clean stop jet sequence sheet 10

Stop jet sequence

66 When the stop jet sequence is initiated the following automatically takes place.

66.1 Ink system pressure set to 3.5 bar (Fig 10.31 sheet 1).

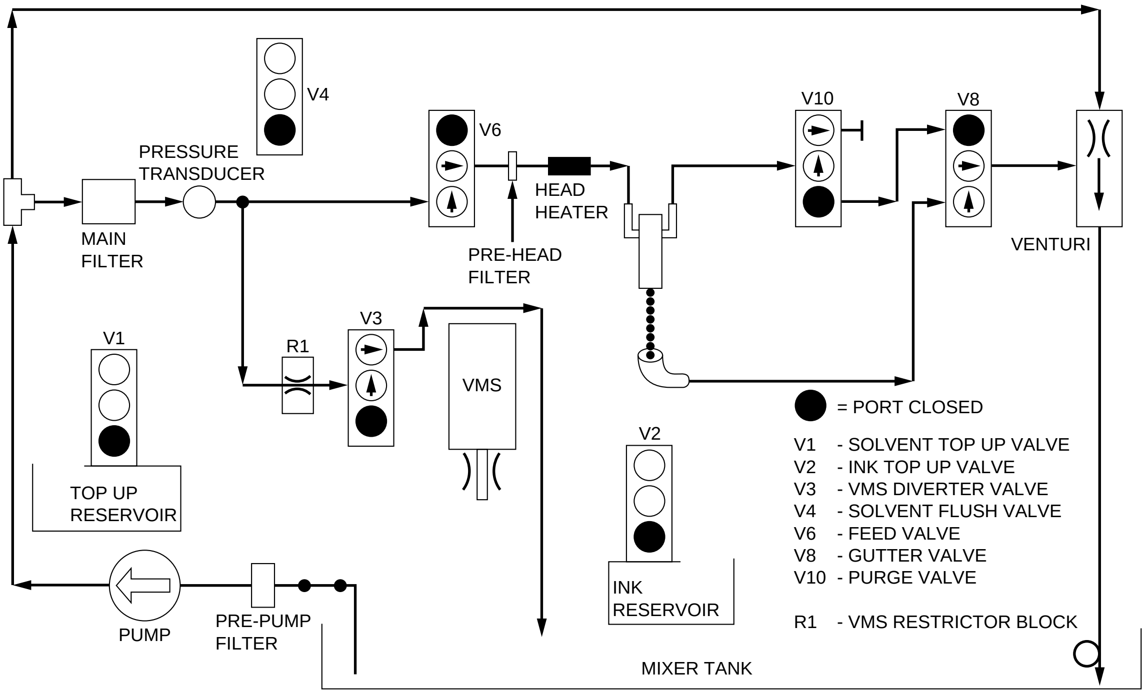


Fig 10.31 Quick stop jet sequence sheet 1

66.2 After 2 seconds feed valve V6 de-energises, gutter valve V8 de-energises and purge valve V10 energises (Fig 10.31 sheet 2).

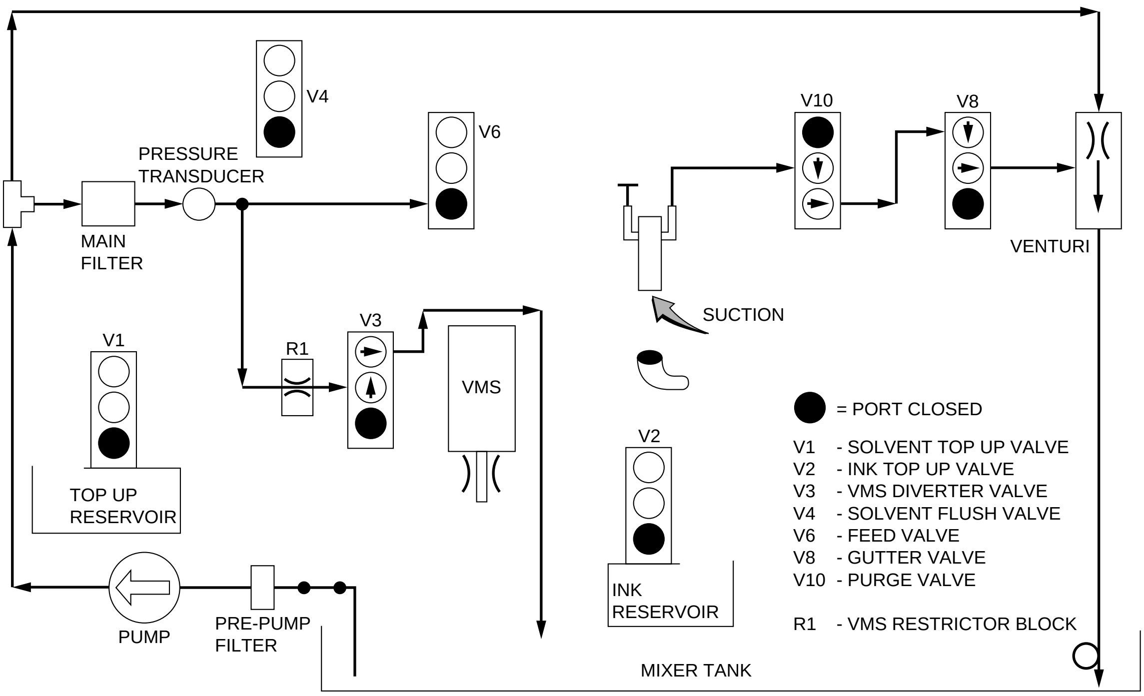


Fig 10.31 Quick stop jet sequence sheet 2

66.3 After 2 seconds purge valve V10 de-energises, gutter valve energises and modulation signal turns off (Fig 10.31 sheet 3).

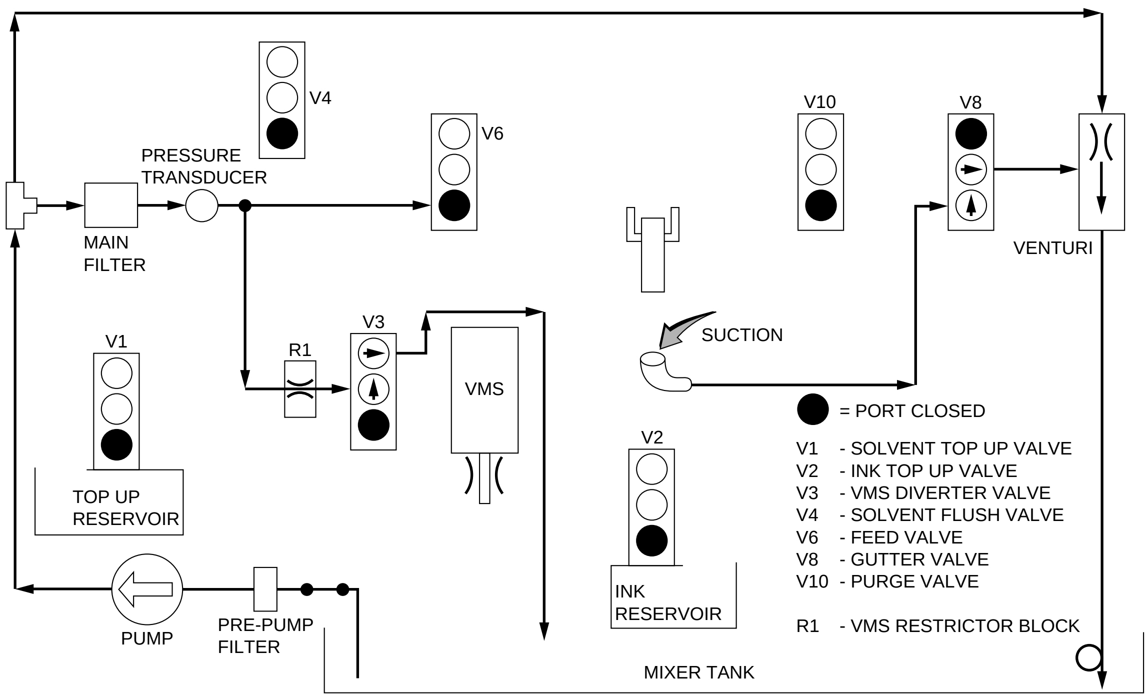


Fig 10.31 Quick stop jet sequence sheet 3

66.4 After 30 seconds gutter valve (V8) de-energises and the ink system pump turns off (Fig 10.31 sheet 4).

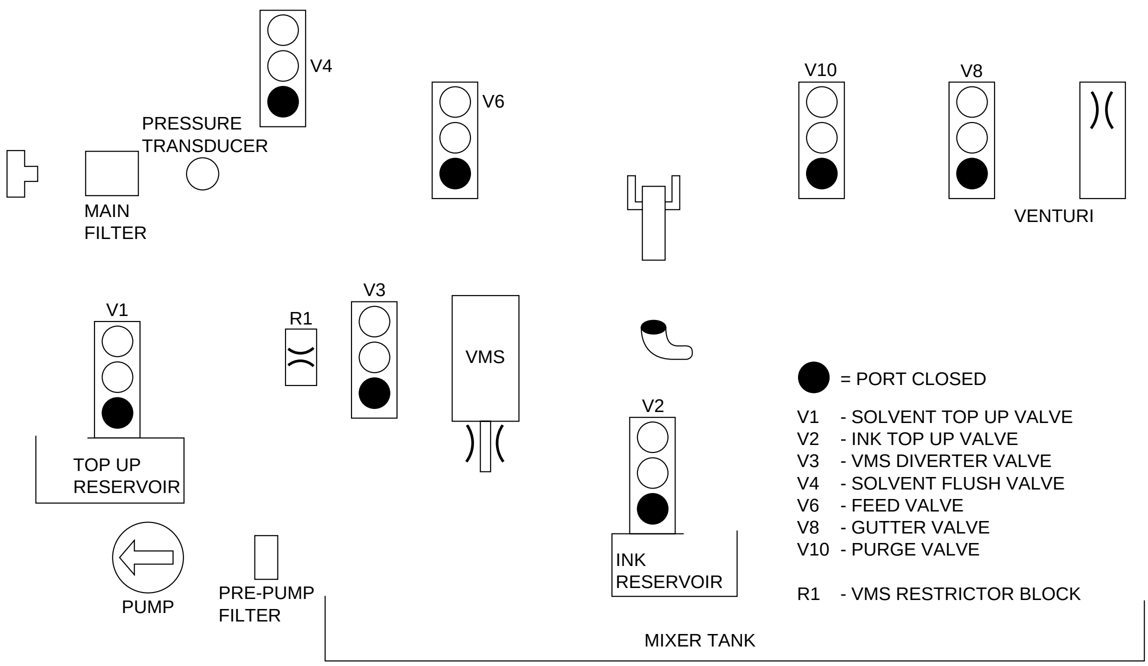


Fig 10.31 Quick stop jet sequence sheet 4

Nozzle flush

67 When 'Nozzle flush' is selected, V10 is energised. The vacuum from the Venturi is applied to the return side of the nozzle, creating suction at the nozzle orifice. Solvent is applied to the nozzle orifice to clear any blockage (Fig 10.32).

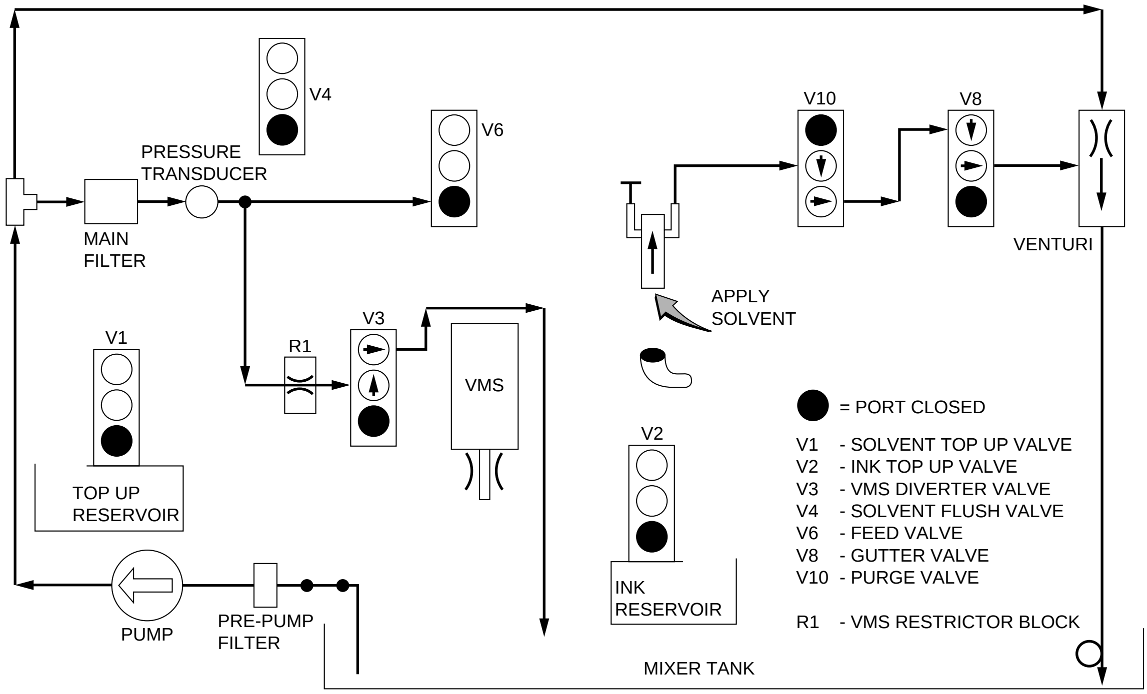


Fig 10.32 Nozzle flush

68 'Nozzle flush' will automatically time out after 2 minutes but can be stopped at any time before that by pressing F1 'Abort Flush' on the keypad.

69 A nozzle flush can be started with the jet running or stopped. If the jet is running, selecting 'Nozzle flush' will first of all de-energise Valve V6 to stop the flow of ink to the nozzle.

Ink addition to mixer tank

70 When the level of fluid in the mixer tank falls below the level OK sensor, the ink top up valve V2 is energised. Ink from the reservoir flows round the system into the mixer tank until the level OK sensor is covered. V2 is then de-energised (Fig 10.33).

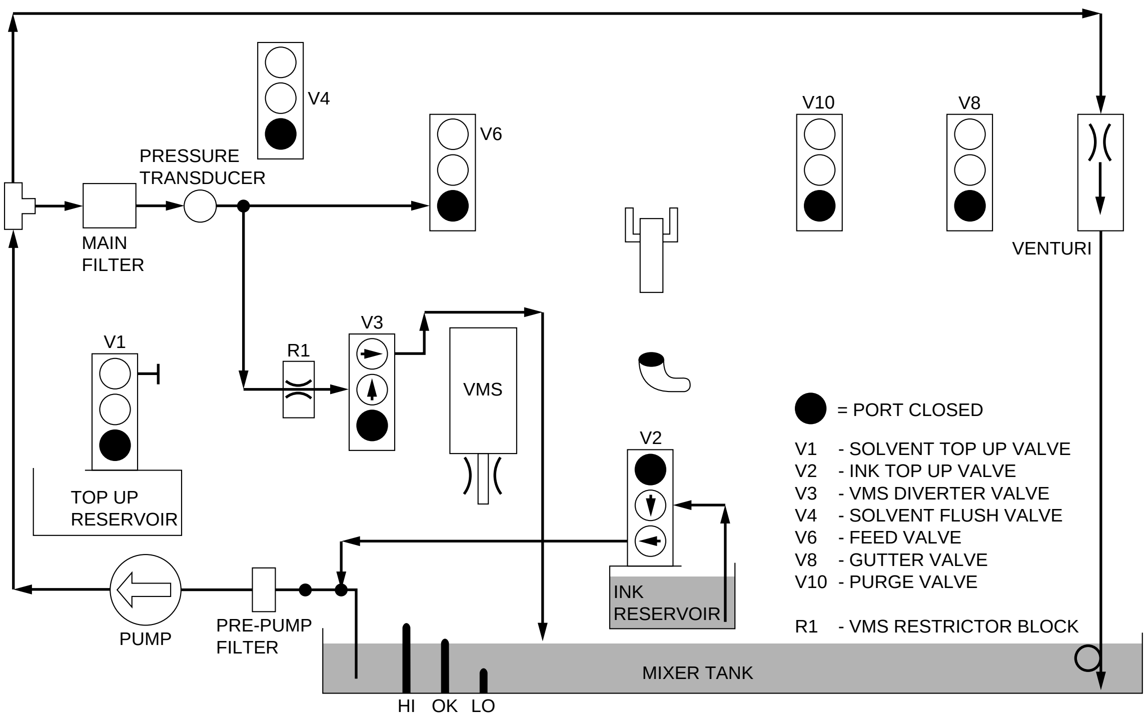


Fig 10.33 Ink addition to mixer tank

Top up addition to mixer tank

71 The time taken for the VMS chamber to empty is checked by the software against a reference value. The reference value is derived from a 'time to empty algorithm' stored in the CPU memory. It takes into account the type of ink in the machine (entered by the operator during calibration) and the ink temperature as measured by the sensor in the mixer tank. If the actual time to empty is greater than the reference value, the viscosity of the ink is too high. Solvent top up valve V1 is energised for up to 5 seconds every 2nd VMS sequence until the viscosity is corrected (Fig 10.34).

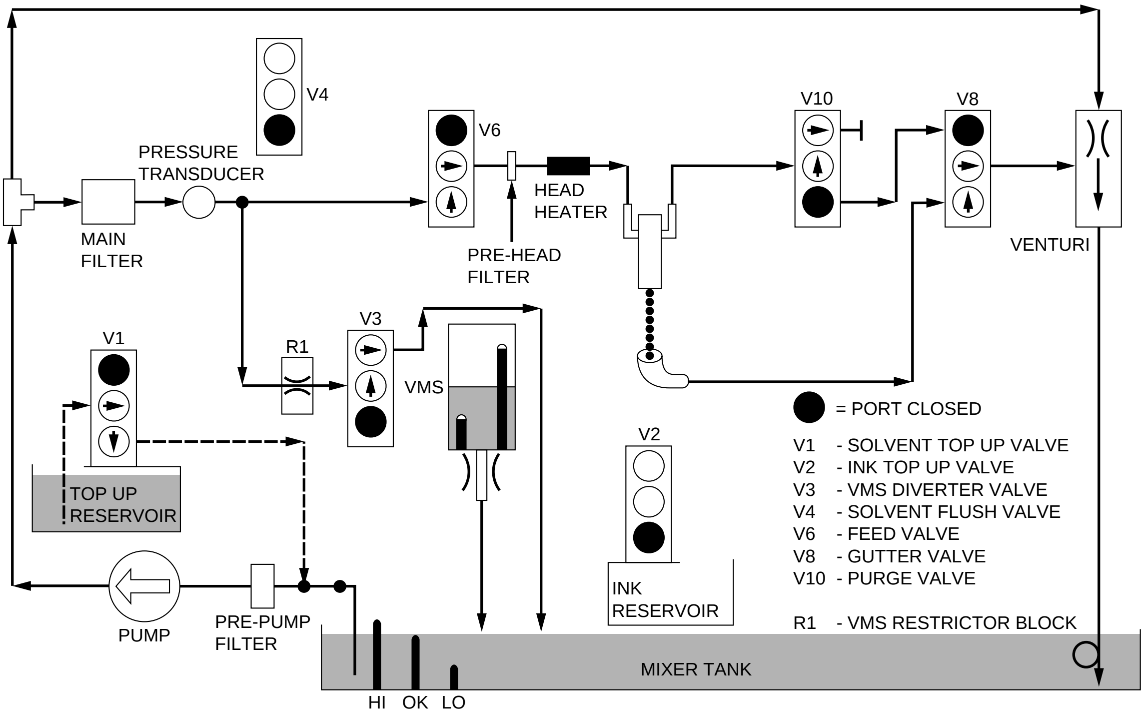


Fig 10.34 Top up addition to mixer tank

I/O BOARD CROSS REFERENCE

72 Table 10.50 lists the component cross references between the Issue 1 and Issue 2 I/O board.

TABLE 10.50 I/O BOARD CROSS REFERENCE

Serial (1)	Issue 1 (2)	Issue 2 (3)	Value (4)	Remarks (5)
1	R1	R15	220k	
2	R2	R17	4k7	
3	R3	R16	360k	
4	R4	R1	68R	
5	R5	R2	1k	
6	R6	R3	6R8	
7	R7	R4	150k	
8	R8	R5	1k	
9	R9	R6	470R	
10	R10	R18	2k7	
11	R11	R10	2k7/680	See Note 7
12	R12	R13	10k	
13	R13	R14	100R	
14	R14	R7	100R	
15	R15	R19	150R	
16	R16	R20	3k9	
17	R17	R23	2k7	
18	R18	R8	10k	
19	R19	R9	2k7	
20	R20	R21	10k	
21	R21	R37	220k	
22	R22	R38	1k	
23	R23	R39	6k2	
24	R24	R40	100R	
25	R25	R41	1k	
26	R26	R42	6k8	
27	R27	R43	4k3	
28	R28	R44	1k	
29	R29	R45	1k	
30	R30	R31	100k	
31	R31	R32	22k	
32	R32	R33	100k	
33	R33			See Note 1

(Continued)

TABLE 10.50 I/O BOARD CROSS REFERENCE (Continued)

Serial (1)	Issue 1 (2)	Issue 2 (3)	Value (4)	Remarks (5)
34	R34	R34	100k	
35	R35	R35	22k	
36	R36	R36	100k	
37	R37			See Note 1
38	R38			See Note 1
39	R39			See Note 1
40	R40	R52	100k	See Note 2
41	R41	R53	10k	
42	R42	R54	39k	
43	R43			See Note 1
44	R44			See Note 1
45	R45	R56	11k	
46	R46	R77	11k	
47	R47			See Note 1
48	R48	R66	100k	
49	R49	R59	100k	
50	R50			See Note 1
51	R51	R60	22k	
52	R52			See Note 1
53	R53	R61	1k	
54	R54			See Note 1
55	R55			See Note 1
56	R56			See Note 1
57	R57			See Note 1
58	R58			See Note 1
59	R59			See Note 1
60	R60	R67	100k	
61	R61	R68	562R	
62	R62			See Note 1
63	R63			See Note 1
64	R64			See Note 1
65	R65			See Note 1
66	R66			See Note 1

(Continued)

TABLE 10.50 I/O BOARD CROSS REFERENCE (Continued)

Serial (1)	Issue 1 (2)	Issue 2 (3)	Value (4)	Remarks (5)
67	R67			See Note 1
68	R68			See Note 1
69	R69			See Note 1
70	R70	R71	10R	
71	R71	R72	1k	
72	R72	R73	22k	
73	R73	R76	10k	
74	R74	R94	27k	
75	R75	R78	27k	
76	R76			See Note 1
77	R77			See Note 1
78	R78	R79	33k	
79	R79	R80	10k	
80	R80	R64	1k	
81	R81	R65	47k	
82	R82			See Note 1
83	R83			See Note 1
84	R84	R86	10k	
85	R85	R87	100k	
86	R86			
87	R87			See Note 1
88	R88			See Note 1
89	R89	R93	100k	
90	R90			See Note 1
91	R91			See Note 1
92	R92	R69	56k	
93	R93	R70	30k	
94	R94	R84	24k	
95	R95	R85	22k	
96	R96	R82	24k	
97	R97	R83	30k	
98	R98	R81	56k	
99	R99	R97	6k2	

(Continued)

TABLE 10.50 I/O BOARD CROSS REFERENCE (Continued)

Serial (1)	Issue 1 (2)	Issue 2 (3)	Value (4)	Remarks (5)
100	R100	R90	18k	
101	R101	R106	1k	
102	R102	R102	4k7	
103	R103	R103	1k	
104	R104	R104	68k	
105	R105	R105	68k	
106	R106			See Note 1
107	R107			See Note 1
108	R108			See Note 1
109	R109	R95	10R	
110	R110			See Note 1
111	R111			See Note 1
112	R112			See Note 1
113	R113			See Note 1
114	R114			See Note 1
115	R115	R25	4k7/10k	See Note 7
116	R116			See Note 1
117	R117	R62	10k	
118	R118	R63	47k	
119	R119	R11	6k8/470R	See Note 7
120	R120			See Note 1
121	R121			See Note 1
122	R122			See Note 1
123	R123			See Note 1
124	R124			See Note 1
125	R125			See Note 1
126	R126			See Note 1
127	R127	R101	100k	
128	R128	R91	10M	
129	R129	R22	10k	
130	R130	R47	4k7	
131	R131	R45	47k	
132	R132	R24	75k	

(Continued)

TABLE 10.50 I/O BOARD CROSS REFERENCE (Continued)

Serial (1)	Issue 1 (2)	Issue 2 (3)	Value (4)	Remarks (5)
133	R133	R12	3M3	
134	R134	R48	100k	
135	R135	R49	22k	
136	R136	R50	100k	
137	R137			See Note 1
138	R138		200R	See Note 3
139	R139		24k	See Note 3
140	R140	R57	100R	
141	R141	R92	47k	
142	R142	R96	47k	
143	R143	R74	10k	
144	R144			See Note 1
145	R145			See Note 1
146	R146		0R27	See Note 2
147	R147		1k	See Note 3
148	R148		20k	See Note 3
149	R149		47k	See Note 3
150	R150		5R6	See Note 3
151	R151	R27	3R3/2R7	See Note 7
152	R152		2k7	See Note 3
153	R153		10k	See Note 3
154	R154		10k	See Note 3
155	R155		10k	See Note 3
156	R156		10k	See Note 3
157	R157		270R	See Note 3
158	R158		2k7	See Note 3
159	R159			See Note 1
160	R160			See Note 1
161	R161			See Note 1
162	R162	R88	47k	
163	R163	R89	47k	
164	R164	R75	10k	
165	R165			See Note 1
166	R166			See Note 1

(Continued)

TABLE 10.50 I/O BOARD CROSS REFERENCE (Continued)

Serial (1)	Issue 1 (2)	Issue 2 (3)	Value (4)	Remarks (5)
167	R167	R28	2k2	
168	R168	R26	4k7	
169	R169	R55	47k	
170	R170			See Note 1
171	R171	R30	10k	
172	VR1	VR1	50k	
173	SIL1	SIL3		
174	SIL2	SIL2		
175	SIL3	SIL7	47k	
176	SIL4	SIL4	47k	
177	SIL5	SIL5		
178	SIL6	SIL6		
179	C1	C1	1u	
180	C2	C2	10u	
181	C3	C3	10u	
182	C4	C4	10u	
183	C5	C5	10u	
184	C6	C9	10n	
185	C7	C10	47n	
186	C8	C13	47n	
187	C9	C7	47u	
188	C10	C6	47n	
189	C11	C11	47n	
190	C12	C82	47n	
191	C13	C23	47n	
192	C14	C15	47n	
193	C15	C16	47u	
194	C16	C18	100n	
195	C17	C17	100n	
196	C18	C19	100n	
197	C19			See Note 1
198	C20			See Note 1
199	C21	C21	10u	
200	C22	C22	10u	

(Continued)

TABLE 10.50 I/O BOARD CROSS REFERENCE (Continued)

Serial (1)	Issue 1 (2)	Issue 2 (3)	Value (4)	Remarks (5)
201	C23	C65	47n	
202	C24	C30	4u7	
203	C25	C26	100n	
204	C26	C31	33p	
205	C27	C25	10p	
206	C28	C34	100n	
207	C29	C28	47n	
208	C30	C8	47n	
209	C31	C36	470n	
210	C32	C32	470nF	
211	C33	C42	47n	
212	C34			See Note 1
213	C35	C40	47n	
214	C36	C88	100n	
215	C37	C44	10u	
216	C38	C45	10u	
217	C39	C46	10u	
218	C40	C47	10u	
219	C41	C38	10u	
220	C42	C48	10u	
221	C43	C49	47n	
222	C44	C39	47n	
223	C45			See Note 1
224	C46	C54	100n	
225	C47	C51	10u	
226	C48	C95	100n	
227	C49	C59	470u	
228	C50	C64	100n	
229	C51	C66	10u	
230	C52	C67	10u	
231	C53	C85	47n	
232	C54	C92	10u	
233	C55	C61	10u	
234	C56			See Note 1

(Continued)

TABLE 10.50 I/O BOARD CROSS REFERENCE (Continued)

Serial (1)	Issue 1 (2)	Issue 2 (3)	Value (4)	Remarks (5)
235	C57	C58	47n	
236	C58	C70	100n	
237	C59	C71	100n	
238	C60	C72	100n	
239	C61	C78	10u	
240	C62	C63	47n	
241	C63	C96	100n	
242	C64	C91	10n	
243	C65			See Note 1
244	C66			See Note 1
245	C67	C53	100n	
246	C68	C56	47n	
247	C69	C69	10u	
248	C70	C57	47n	
249	C71	C14	10u	
250	C72	C99	100n	
251	C73	C89		
252	C74	C90		
253	C75			See Note 1
254	C76	C68	470p	
255	C77	C94	2n	
256	C78			See Note 1
257	C79	C87	47n	
258	C80	C73	100n	
259	C81	C77	100n	
260	C82	C97		
261	C83	C100		
262	C84			See Note 1
263	C85	C79	47u	
264	C86	C80	47u	
265	C87	C81	47u	
266	C88	C75	47/1u	
267	C89	C43		
268	C90	C41		

(Continued)

TABLE 10.50 I/O BOARD CROSS REFERENCE (Continued)

Serial (1)	Issue 1 (2)	Issue 2 (3)	Value (4)	Remarks (5)
269	C91	C52	10p	
270	C92	C50	47u	
271	C93			See Note 1
272	C94	C84	100n	
273	C95	C93	100n	
274	C96			See Note 1
275	C97	C86	100n	
276	C98	C98	100n	
277	C99	C76	100n	
278	C100	C33	100n	
279	C101	C37	2200u	
280	C102	C27	47u	
281	C103	C60	47u	
282	C104	C24	47u	
283	C105		100n	See Note 3
284	C106		1n	See Note 3
285	C107		2n	See Note 3
286	C108		100n	See Note 3
287	C109		0u22	See Note 3
288	C110		100n	See Note 3
289	C111		0u22	See Note 3
290	C112		47u	See Note 3
291	C113	C29	100n	
292	C114	C35	100n	
293	C115	C83	10u	
294	C116	C12	10u	
295	C117	C20	10u	
296	C118		470u	See Note 3
297	C119	C74	100n	
298	NC1	NC1		
299	NC2	NC6		
300	NC3	NC5		
301	NC4	NC3		
302	NC5	NC2		

(Continued)

TABLE 10.50 I/O BOARD CROSS REFERENCE (Continued)

Serial (1)	Issue 1 (2)	Issue 2 (3)	Value (4)	Remarks (5)
303	NC6	NC4		
304	NC7	NC7		
305	NC8	NC8		
306	NC9	NC9		
307	NC10	NC12		
308	NC11	NC10		
309	NC12	NC11		
310	EC1	EC1	47n	
311	EC2	EC2	47n	
312	EC3	EC4	47n	
313	EC4	EC5	47n	
314	EC5	EC6	47n	
315	EC6	EC8	47n	
316	EC7	EC7	47n	
317	EC8	EC3	47n	
318	D1	D4	UF4007/6	
319	D2	D2	UF4007	
320	D3	D3	2v7	
321	D4	D9	5v6	
322	D5	D13	UF4007	
323	D6	D14	UF4007	
324	D7	D15	UF4007	
325	D8	D16	UF4007	
326	D9	D18	1N4148	
327	D10	D17	1N4148	
328	D11	D10	1N4148	
329	D12	D19	1N4002	
330	D13	D21	1N4148	
331	D14		UF4007	See Note 3
332	D15		36v	See Note 3
333	D16			See Note 1
334	D17			See Note 1
335	D18	D11	3v3/2v7	See Note 7
336	D19	D23	5v1	

(Continued)

TABLE 10.50 I/O BOARD CROSS REFERENCE (Continued)

Serial (1)	Issue 1 (2)	Issue 2 (3)	Value (4)	Remarks (5)
337	D20	D6	15v	
338	D21	D22	1N4148	
339	D22	D5	5v1	
340	D23	D12	1N4148	
341	D24	D20	1N4002/7	See Note 7
342	D25	D8	5v1	
343	D26		1N4002	See Note 3
344	D27	D1	1N4002/7	See Note 7
345	D28	D7	1N4002/7	See Note 7
346	LED1	LED2	Red	
347	LED2	LED4	Red	
348	LED3	LED3	Yellow	
349	LED4	LED1	Green	
350	LED5	LED5	Green	
351	Q1	Q1	BC213/556	See Note 7
352	Q2	Q2	BC183/546	See Note 7
353	Q3	Q3	MJE350	
354	Q4	Q4	MJE340	
355	Q5	Q5	MJE340	
356	Q6	Q6	BC213/556	See Note 7
357	Q7	Q8	MJE350	
358	Q8	Q9	MJE340	
359	Q9	Q10	VN10LM	
360	Q10	Q12	BC183/546	See Note 7
361	Q11	Q14	BC183/546	See Note 7
362	Q12	Q13	RFD3055/	
363	Q13		RFD3055	See Note 3
364	Q14	Q15	BC183/546	See Note 7
365	Q15	Q11	MPSA42	
366	Q16	Q7	BC546	
367	U1	U2	DG411	
368	U2	U3	DAC08A	
369	U3	U6	DC-DC1	See Notes 5 and 6
370	U4	U5	H11L1	

(Continued)

TABLE 10.50 I/O BOARD CROSS REFERENCE (Continued)

Serial (1)	Issue 1 (2)	Issue 2 (3)	Value (4)	Remarks (5)
371	U5	U19	2803A	
372	U6			See Note 1
373	U7	U10	H11L1	
374	U8	U4	H11L1	
375	U9	U15	82C55	
376	U10	U16	ADC0808	
377	U11	U17	2272	
378	U12	U26	NE531	
379	U13	U13	NE531	
380	U14	U18	2272	
381	U15			See Note 1
382	U16	U22	74HC32	
383	U17	U23	74HC02	
384	U18	U24	LM675	
385	U19	U25	LM675	
386	U20	U21	LM35	
387	U21			See Note 1
388	U22	U28	2272	
389	U23	U29	1NA114	
390	U24	U30	74HC373	
391	U25	U41	74HCT14	
392	U26	U31	LM675	
393	U27			See Note 1
394	U28	U33	REF01	
395	U29			See Note 1
396	U30	U34	74HC164	
397	U31	U39	2803A	
398	U32	U40	74HCT14	
399	U33	U36	TL084	
400	U34	U14	2272	
401	U35	U32	74HC32	
402	U36	U8	74HC373	
403	U37	U7	74HC74	
404	U38	U37	78L12	

(Continued)

TABLE 10.50 I/O BOARD CROSS REFERENCE (Continued)

Serial (1)	Issue 1 (2)	Issue 2 (3)	Value (4)	Remarks (5)
405	U39	U38	79L12	
406	U40	U27	X9C102/3	
407	U41	U20	AD7226	
408	U42	U1	NMXD1205U	
409	U43		UC3623	See Note 3
410	U44		LM2917	See Note 3
411	U45		LM317T	See Note 3
412	U46	U12	LM317T	
413	U47	U11	1NA114	
414	U48			See Note 1
415	U49			See Note 1
416	U50	U35	78L05	
417	U51		LM2991	See Note 3
418	RL1	RL1	BT53	
419	FUSE		1A	See Note 3
420	TF1	TF1		
421	TF2	TF2		
422	TP1	TP2		
423	TP2	TP1		
424	TP3	TP4		
425	TP4	TP6		
426	TP5	TP3		
427	TP6	TP5		
428	TP7	TP7		
429	TP8	TP8		
430	TP9	TP9		
431	JB1	JB1		
432	JB2	JB2		
433	HS1	HS1		
434	HS2	HS2		
435	HS3			See Note 3
436	HS4			See Note 3
437	CH4			See Note 3
438		R29	1k	See Note 4

(Continued)

TABLE 10.50 I/O BOARD CROSS REFERENCE (Continued)

Serial (1)	Issue 1 (2)	Issue 2 (3)	Value (4)	Remarks (5)
439		R51	1k	See Note 4
440		R58	1k	See Note 4
441		R98	10k	See Note 4
442		R99	10k	See Note 4
443		R100	470k	See Note 4
444		R107	220R	See Note 4
445		SIL1A	1k	See Note 4
446		C55	100n	See Note 4
447		C62	220u	See Note 4
448		DC1	47u	See Note 4
449		DC2	47u	See Note 4
450		RC1	10u	See Note 4
451		L1	330u	See Note 4
452		L2	330u	See Note 4
453		U9	7915	See Note 4
454		FUSE1	250mA	See Note 4
455		FUSE2	1A	See Note 4
456		CC1	470p	See Note 4
457	HEAD1	HEAD1	HE14 10S	
458	HEAD2	HEAD2	HE14 12D	
459	P/TRANS	P/TRANS	HE14 8S	
460	LEVELS	LEVELS	34w IDC	
461	VALVES	VALVES	H14 16D	
462	SENC	SENC	H14 4S	
463	PEC1	PEC1	HE14 3S	
464	PEC2	PEC2	HE14 3S	
465	POWER	POWER	MOLEX 8	
466	PIGS	PIGS	HE14 6S	
467	FAN_FAIL	FAN_FAIL	HE14 6D	
468	T/LIGHT	T/LIGHT	HE14 6D	
469	B/LIGHT	B/LIGHT	HE14 3S	
470	CON_B1	CON_B1	34D HEAD	
471	CON_EX	CON_EX	20w IDC	
472	CON_DA	CON_DA	20D HEAD	

(Continued)

TABLE 10.50 I/O BOARD CROSS REFERENCE (Continued)

Serial (1)	Issue 1 (2)	Issue 2 (3)	Value (4)	Remarks (5)
473	CH/MOD	CH/MOD	MOLEX 4	
474	EHT/FAN	EHT/FAN	HE14 10D	
475	CON PO	CON_P0	14D HEAD	
476	PUMP	PUMP	HE14 8D	
477		LEDS	HE14 8D	See Note 4
478		CON_BM1	8w	See Note 4
479		CON_BM2	8w	See Note 4

(1) Component not used on Issue 1 I/O board.

(2) Component has different function on Issue 2 I/O board.

(3) Component deleted on Issue 2 I/O board.

(4) New component on Issue 2 I/O board.

(5) DC-DC1 is NMH1205S on Issue 1 I/O board.

(6) DC-DC1 is NMXS0512 on Issue 2 I/O board.

(7) Component values different between Issue 1 and Issue 2 I/O boards.

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(1) LETHAL HAZARD. DISCONNECT THE PRINTER FROM THE ELECTRICAL SUPPLY PRIOR TO ANY FAULT FINDING, REPAIR OR ADJUSTMENTS UNLESS IT IS ABSOLUTELY NECESSARY FOR THE POWER TO BE LEFT SWITCHED ON.

(2) LETHAL HAZARD/SERIOUS EQUIPMENT DAMAGE. ONLY PERSONNEL TRAINED BY WILLETT SYSTEMS LIMITED SHOULD ATTEMPT THE FAULT FINDING AND/OR REPAIRS DESCRIBED IN THIS SECTION.

EQUIPMENT DAMAGE. An antistatic wrist strap must be worn when working on printed circuit boards.

This issue of the manual refers to the Issue 2 Input/Output (I/O) board, refer to Section 10 for component cross reference details of the Issue 1 I/O board.

GENERAL

1 Before carrying out the fault finding and repairs described in this section it is advisable to move the printer from the production line to a clean environment.

2 When a fault condition occurs, the first step in diagnosing the fault should be to check the following:

2.1 The fault and status icons displayed on the display.

2.2 The status LEDs on the I/O board.

3 Tables 11.1 to 11.13 list the possible faults. The tables contain either remedial action or a reference out to more detailed fault finding information.

4 By using the schematics and the associated tables to check signal voltages and waveforms, the faulty component or sub-assembly can be pinpointed.

FAULT FINDING

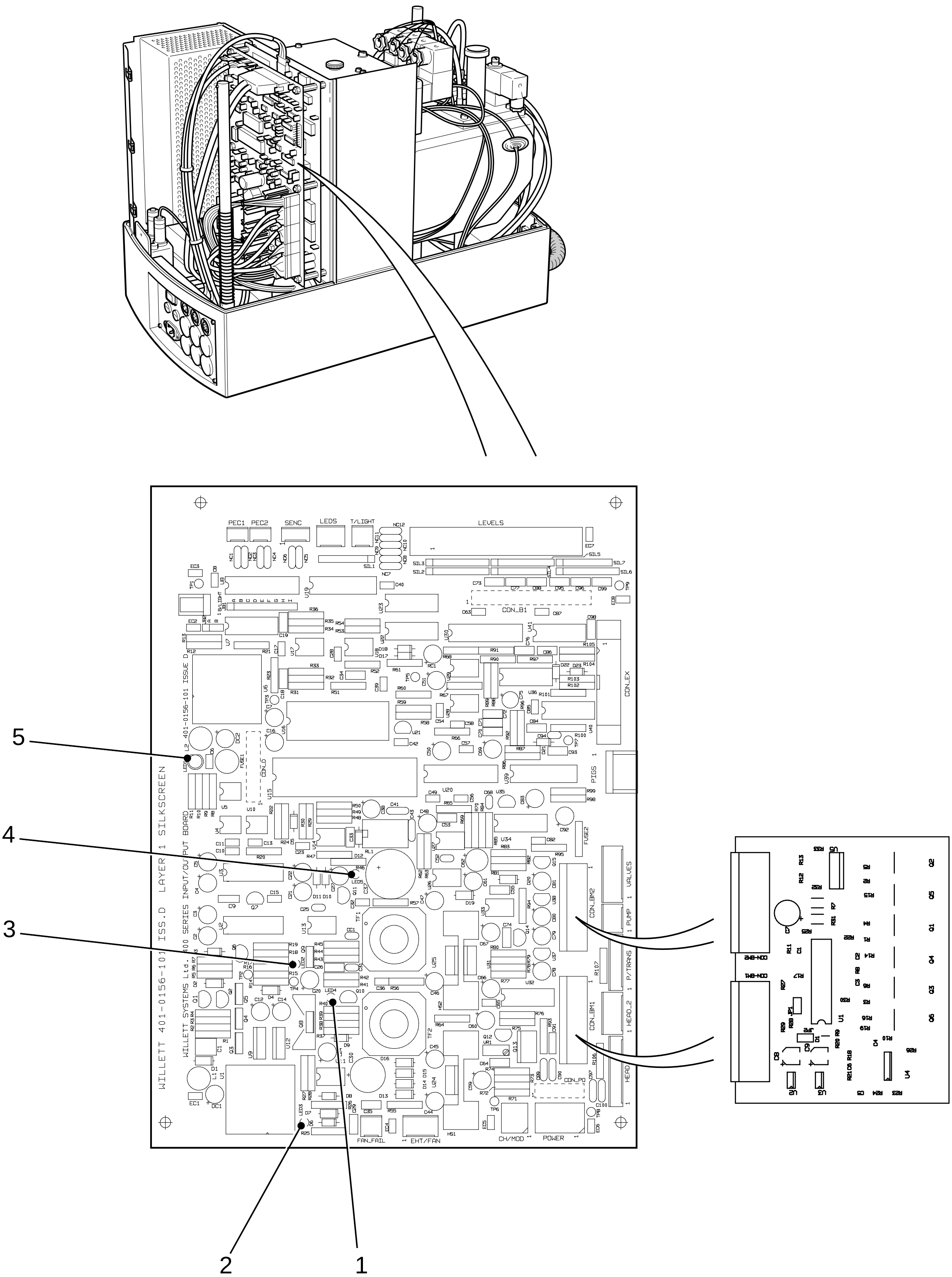
Printer fails to initialise

5 If the printer fails to initialise when switched on, refer to Table 11.1 for possible causes and remedial action.

TABLE 11.1 PRINTER FAILS TO INITIALISE

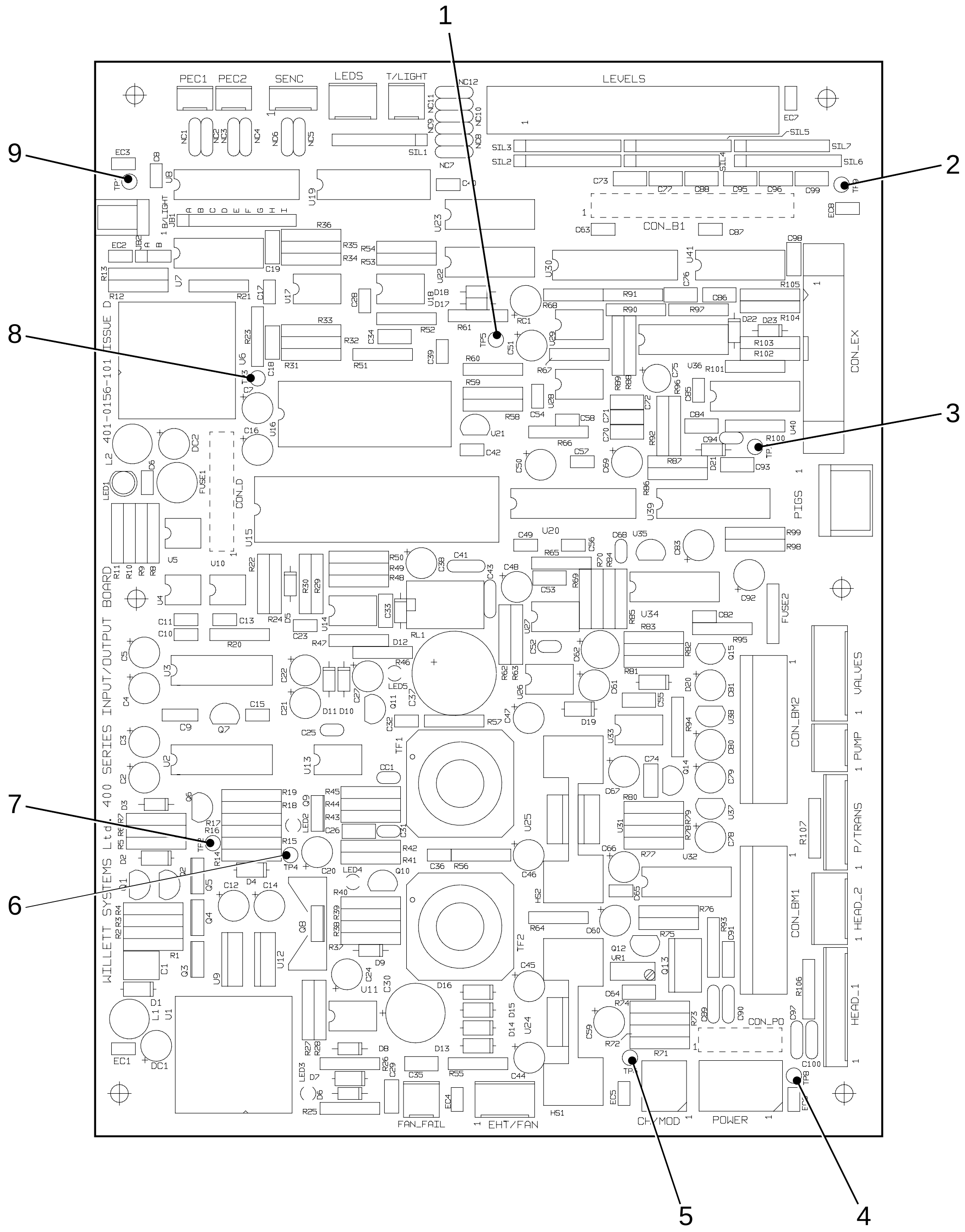
Serial (1)	Possible Cause (2)	Remedial Action (3)
1	No mains supply	Check that mains supply is available and switched on
2	Mains input cable disconnected or faulty	1 Check that mains input cable is connected 2 Check continuity of cable. Repair or replace if faulty
3	Printer mains fuse(s) failed	Check the fuses (Section 4). Replace if necessary
4	Mains inlet connector faulty	Check the mains inlet connector for continuity. Replace if faulty (Para 39)
5	Cable between inlet connector and mains switch is disconnected or faulty	1 Check cable connections, reconnect if necessary 2 Check cable for continuity. Replace if faulty
6	Faulty mains switch	Check mains switch for continuity. Replace if faulty (Para 41)
7	Cable between mains switch and PSU is disconnected or faulty	1 Check cable connections. Reconnect if necessary 2 Check cable for continuity. Replace if faulty
8	PSU faulty or PSU output not reaching the I/O board	Check LED's 1, 2 (dim or bright), 3, 4 and 5 on I/O board (See Fig 11.1). If any LED is extinguished go through steps 9 to 11 in that order
9	Cable between PSU and I/O board is faulty or disconnected	1 Check that cable is connected, reconnect if necessary 2 Check cable for continuity, replace if faulty
10	PSU fuse failed	Check fuse, replace if necessary (Para 31)
11	PSU faulty	Replace PSU (Para 29 and 30)
12	I/O or CPU board failed	1 Check that LED's 1, 2 (dim or bright), 3, 4 or 5 on I/O board are illuminated (Fig 11.1) 2 Change I/O board (Para 24). If fault remains then change CPU board (Para 27)

LED2 on the I/O board has a clear lens that glows red when illuminated.



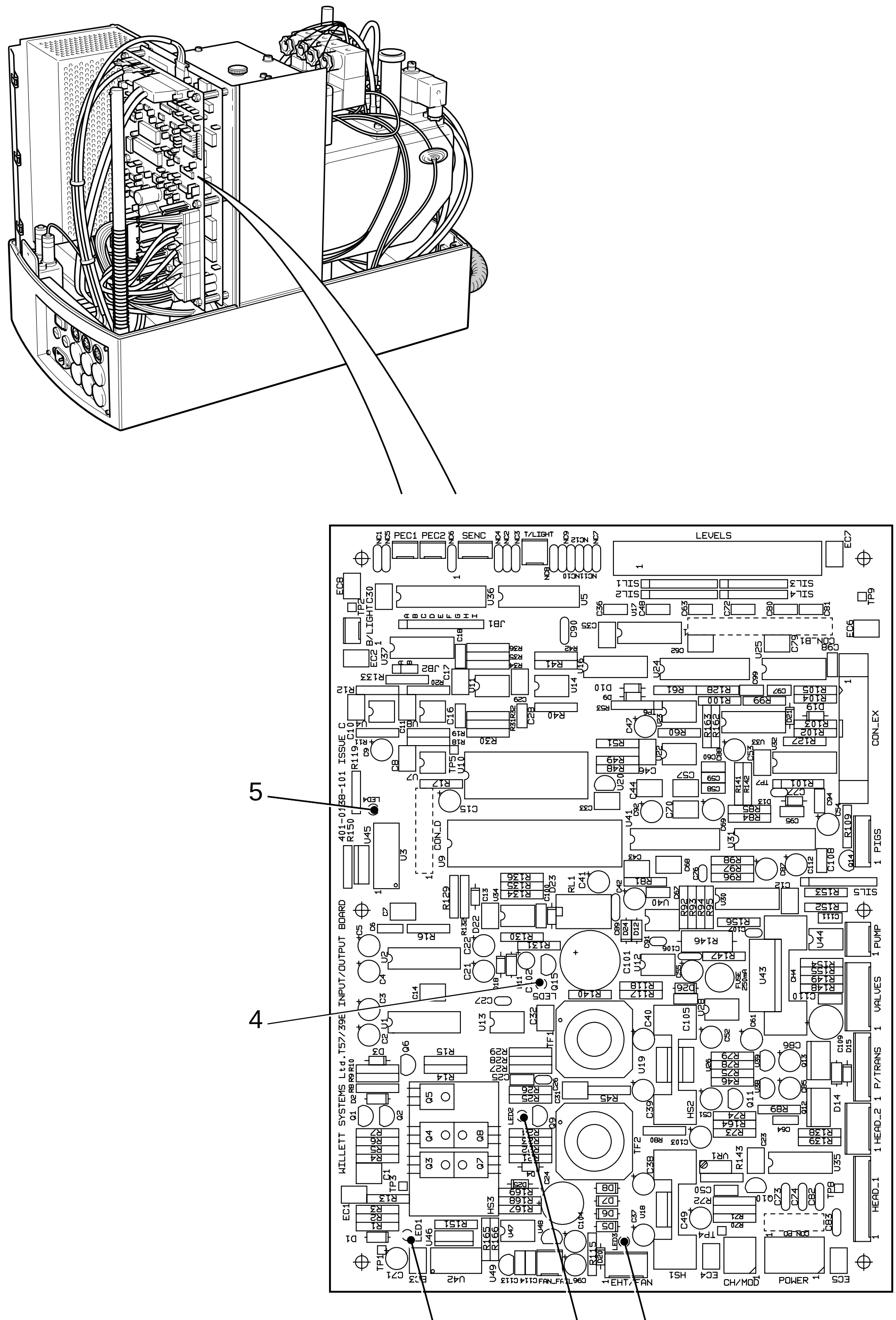
1 LED 4 (red); -15 V
2 LED 3 (yellow); -24 V
3 LED 2 (red); 285 V (bright) charge amplifier supply (+15 V (dim); no printhead cover fitted)
4 LED 5 (green); +24 V valve/pump/heater supply
5 LED 1 (green); +12 V isolated supply

Fig 11.1 I/O board status LED location; Mk 2 (sheet 1 of 4)



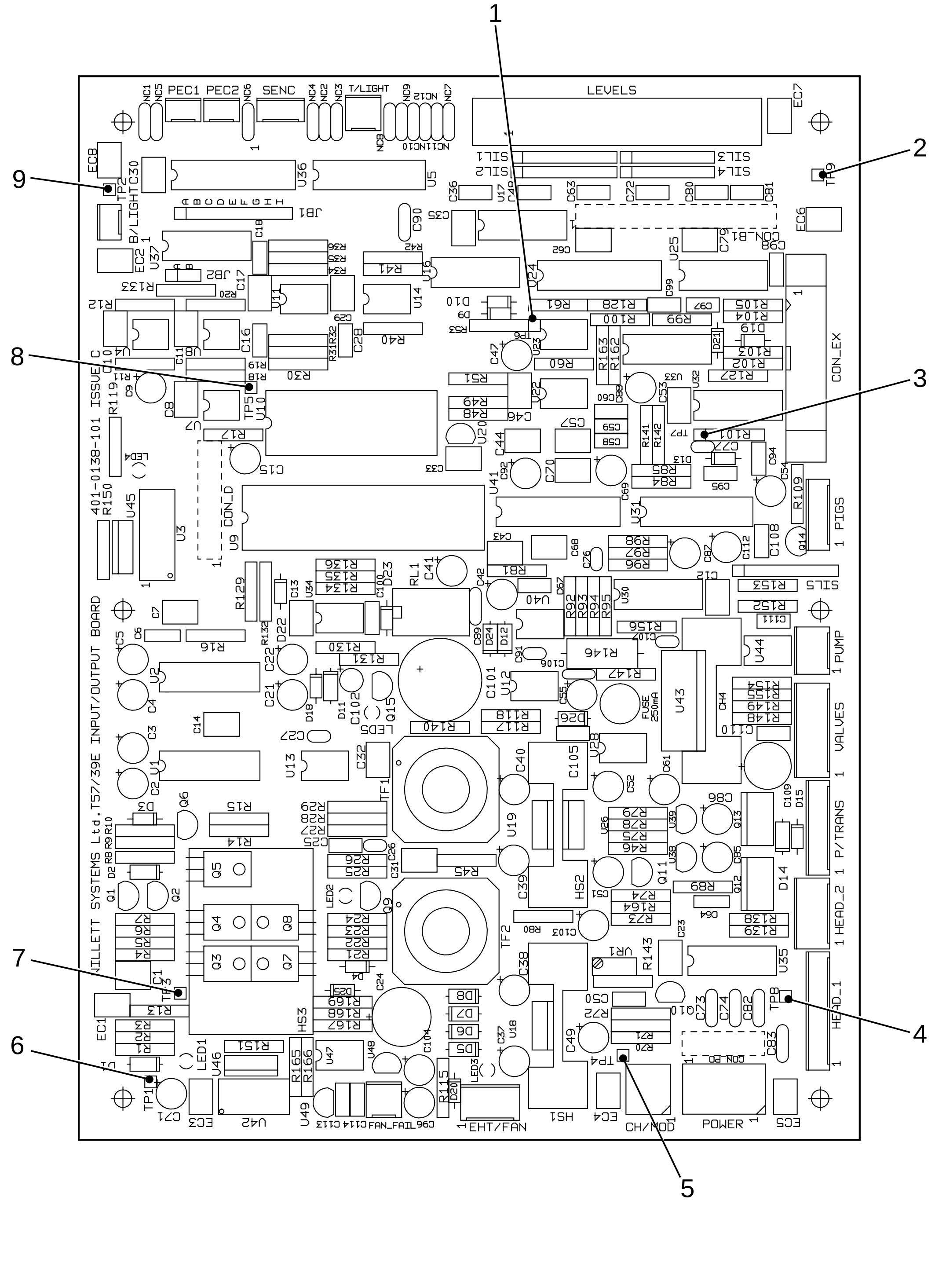
1	TP5	6	TP4
2	TP9	7	TP2
3	TP7	8	TP3
4	TP8	9	TP1
5	TP6		

Fig 11.1 I/O board TP location; Mk 2 (sheet 2 of 4)



1 LED 3 (yellow); -24 V
2 LED 2 (red); -15 V
3 LED 1 (red); 285 V (bright); charge amplifier supply: +15 V (dim); no printhead cover fitted
4 LED 5 (green); +24 V valve/pump/heater supply
5 LED 4 (green); 10 V isolated supply

Fig 11.1 I/O board status LED location; Mk1 (sheet 3 of 4)



1	TP6	6	TP1
2	TP9	7	TP3
3	TP7	8	TP5
4	TP8	9	TP2
5	TP4		

Fig 11.1 I/O board TP location; Mk 1 (sheet 4 of 4)

LCD faults

<u>Backlight</u>

6 If the LCD backlight is not functioning, refer to Table 11.2 for possible causes and remedial action.

TABLE 11.2 LCD BACKLIGHT FAILURE

Serial (1)	**Possible Cause (2)**	**Remedial Action (3)**
1	Backlight shut down by screensaver facility	Press any key on the keypad to re-start the backlight
2	Backlight inverter faulty	1 Check for 24 V DC at 3 way input connector on backlight converter (Pins 1 and 2 on I/O board B/LIGHT connector) **HIGH VOLTAGE. A HIGH AC VOLTAGE IS PRESENT AT THE INVERTER AND BACKLIGHT. EXTREME CAUTION IS REQUIRED WHEN DIAGNOSING FAILURE IN THESE AREAS.** Some DVMs may not show the 1000 V AC correctly, use a scope fitted with a high voltage probe to measure the voltage. 2 Check for 1000 V AC at output leads from backlight inverter (Pins 3 and 5) 3 If 24 V DC present but 1000 V AC missing, change the LCD/backlight assembly (Para 33)
3	Cable from I/O board to backlight is disconnected or faulty	1 If 24 V DC is not present at backlight inverter but is present at Pins 1 and 3 of B/LIGHT connector on I/O board, check that the cable is connected between the two 2 Check cable for continuity, replace if faulty

(Continued)

TABLE 11.2 LCD BACKLIGHT FAILURE (Continued)

Serial (1)	Possible Cause (2)	Remedial Action (3)
4	Backlight faulty	If 1000 V AC is present at output of backlight inverter but backlight not illuminated, change the LCD/Backlight assembly (Para 33)
5	I/O or CPU board faulty	1 Check for 24 V DC on pins 1 and 3 of B/LIGHT connector on I/O board. If voltage not present, change I/O board (Para 24) 2 If changing the I/O board does not clear the fault, change the CPU board (Para 27)

LCD

7 If the LCD is not functioning correctly, refer to Table 11.3 for possible causes and remedial action.

TABLE 11.3 LCD FAILURE

Serial (1)	Possible Cause (2)	Remedial Action (3)
1	LCD contrast not set correctly	Press Ctrl + L. When the LCD is readable, press any key to set contrast
2	Ribbon cable between CPU board and LCD is faulty	Check cable for continuity. Replace if faulty
3	I/O board or CPU board faulty	1 Use schematic (Fig 11.16) and Table 11.16 to determine where fault lies 2 Change I/O board (Para 24) or CPU board (Para 27)
4	LCD faulty	Change LCD assembly (Para 33)

Keypad faults

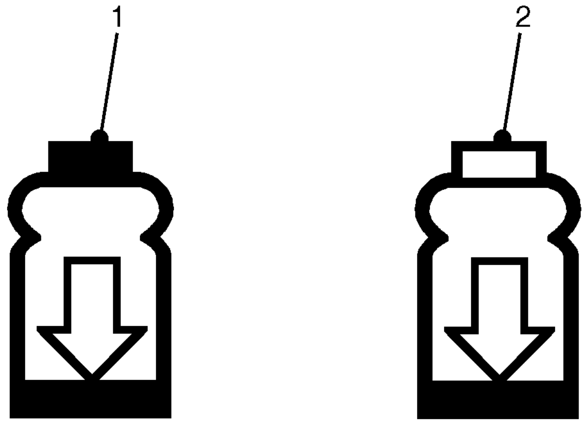
8 If the keypad is not functioning correctly, refer to Table 11.4 for possible causes and remedial action.

TABLE 11.4 KEYPAD FAILURE

Serial (1)	Possible Cause (2)	Remedial Action (3)
1	Ribbon cable between CPU board and keypad is disconnected or faulty	1 Check that cable is connected 2 Check cable for continuity, replace if faulty
2	CPU board faulty	Change CPU board (Para 27)
3	Keypad faulty	Change keypad (Para 35)

Ink or top up level low

9 If the ink or solvent top up level low icons (Fig 11.2) appear on the display, refer to Table 11.5 for possible causes and remedial action.



1 Ink reservoir level low
2 Top up reservoir level low

Fig 11.2 Ink and top up level low icons

TABLE 11.5 INK AND TOP UP LEVEL LOW ICON DISPLAYED

Serial (1)	Possible Cause (2)	Remedial Action (3)
1	Ink top up or solvent top up reservoir empty	Top up the empty reservoir with ink or solvent as necessary (Section 3). Check that the icon is no longer displayed. If it is still displayed, proceed to Step 2
2	Remove sides and ensure reservoirs have not been over filled with fluid	Remove ink or top up from reservoirs as required
3	Cable between sensor and I/O board (or LEVELS board (Pi)) is faulty or disconnected	Check that cable is connected to CONN LEVELS on the I/O board (Si and Mi) (Refer to Section 10 for connector location) or LEVELS board (Pi)
4	Sensor faulty	Use schematic diagram (Fig 11.25) and Table 11.25 to check operation of sensor. Replace sensor if faulty (Para 37) (Refer to Section 10 for CONN LEVELS location)
5	I/O, LEVELS (Pi) or CPU board faulty	1 Use schematic (Fig 11.25) and Table 11.25 to determine where fault lies 2 Replace I/O board (Para 24) or CPU board (Para 27) 3 Replace LEVELS board (Pi) (Para 76)

Mixer tank ink level high

CAUTION. Read Para 10 and 11 prior to attempting a repair.

10 If the mixer tank level high icon is displayed there are two possible reasons:

10.1 The mixer tank level is genuinely too high (ie the level high sensor is covered with ink). In this case the list of possible causes for the fault are given in Table 11.6.

10.2 There is a fault in the level high sensor circuit and a fault is being indicated even through the sensor is not covered, refer to Table 11.7.

To determine which fault condition exists, refer to Para 11.

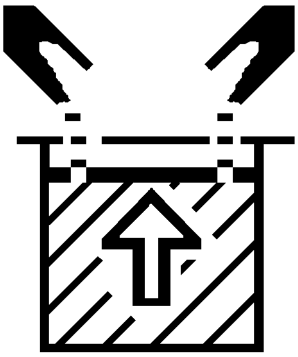


Fig 11.3 Mixer tank level high icon

PERSONAL INJURY. WHEN HANDLING INKS ALWAYS WEAR PROTECTIVE GLOVES AND GOGGLES. ENSURE THAT YOU HAVE READ AND UNDERSTOOD THE RELEVANT WARNINGS IN THE PRELIMINARY INFORMATION PAGES OF THIS MANUAL.

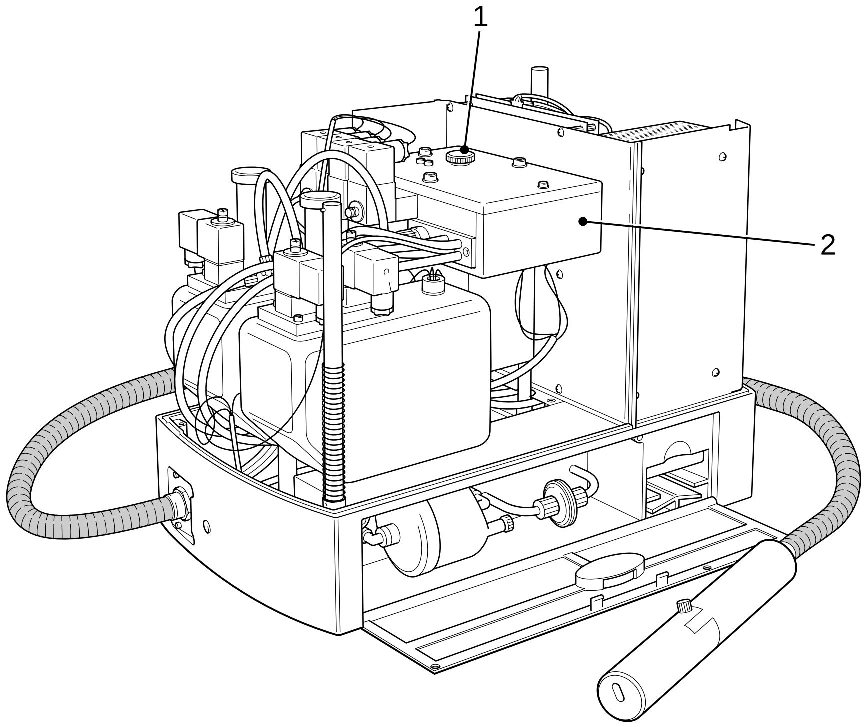
11 To determine which situation exists, proceed as follows:

11.1 Remove the filler plug (Fig 11.4 (1)) from the FMS (2).

11.2 Use a syringe and plastic tube, remove 100 ml of ink from the FMS to uncover the level high sensor.

11.3 If the icon is no longer displayed, the level high sensor is working (Table 11.6).

11.4 If the icon remains on the display, the level high sensor circuit is faulty (Table 11.7).



1 Filler plug 2 FMS

Fig 11.4 Location of FMS filler plug

Before carrying out the checks listed in Table 11.6, Step 2, add 100 ml of ink to the FMS to ensure that the mixer tank level OK sensor is covered.

TABLE 11.6 MIXER TANK LEVEL HIGH-SENSOR COVERED

Serial (1)	Possible Cause (2)	Remedial Action (3)
1	VMS incorrectly calibrated	Check ink viscosity (Para 210). If incorrect, drain the mixer tank and refill with new ink (Para 107). Recalibrate the VMS (Para 114)
2	Mixer OK sensor or cable faulty	1 Go to the Diagnostic screen of the Calibrate menu. If Mixer OK is OFF then the sensor circuit is faulty 2 Check that the sensor cable is connected. 3 Use Fig 11.25 and Table 11.25 to locate faulty sensor or board. Replace FMS (Para 45) if level sensor is faulty 4 Replace I/O board (Para 23), CPU board (Para 27) or LEVELS board (Para 76)

(Continued)

TABLE 11.6 MIXER TANK LEVEL HIGH-SENSOR COVERED (Continued)

Serial (1)	Possible Cause (2)	Remedial Action (3)
3	Faulty valve on ink or top up reservoir	Use Fig 11.14 and Table 11.14 to check electrical operation of valves V2 (ink) and V1 (top up). Replace valve if faulty (Para 49)
4	Valve stuck internally	Clean valve V2 (ink) and V1 (top up) (Para 86). Replace valve if fault remains (Para 49)

TABLE 11.7 MIXER TANK LEVEL HIGH-SENSOR UNCOVERED

Serial (1)	Possible Cause (2)	Remedial Action (3)
1	Cable between Mixer level high sensor and I/O board (Si and Mi) or LEVELS board (Pi) is faulty or disconnected	Check that cable is connected
2	Mixer level high sensor circuit faulty	1 Use Fig 11.25 and Table 11.25 to locate faulty sensor or sub-assembly 2 If sensor faulty, replace FMS (Para 45) 3 Replace I/O board (Para 24) or CPU board (Para 27) or LEVELS board (Para 76) if faulty

Viscosity error

12 If the VMS detects a viscosity error, the icon shown at Fig 11.5 will be displayed. Table 11.8 gives possible causes of the fault, together with remedial action.

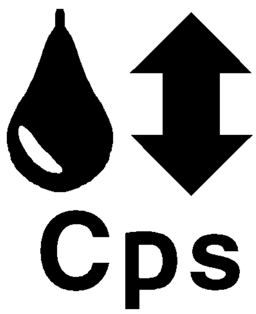


Fig 11.5 Viscosity error icon

TABLE 11.8 VISCOSITY ERROR FAULTS

Serial (1)	Possible Cause (2)	Remedial Action (3)
1	Top up reservoir empty	Fill the top up reservoir with solvent and run the machine to correct the viscosity
2	Top up reservoir valve (V1) not functioning correctly	1 Use Fig 11.4 and Table 11.14 to isolate faulty valve, I/O board or CPU board 2 Change valve (Para 49), I/O board (Para 24) or CPU board (Para 27)
3	Valve V1 stuck internally	Clean valve V1 (Para 86). Replace valve (Para 49) if fault remains
4	VMS inlet restrictor blocked	Clean inlet restrictor (Para 87)
5	VMS outlet blocked	Clean outlet restrictor (Para 88)
6	VMS level sensor or cable faulty	1 Check that cable is connected 2 Use Fig 11.25 and Table 11.25 to isolate faulty component or sub-assembly 3 Replace FMS if sensor faulty (Para 45), I/O board (Para 24) or CPU board (Para 27)
7	I/O board faulty	Replace I/O board (Para 24)
8	CPU board faulty	Replace CPU board (Para 27)

Maintenance due

13 If the maintenance due icon (Fig 11.6) appears on the display, ensure that the filters are changed (Section 2) then reset the pump run hours (Para 102).

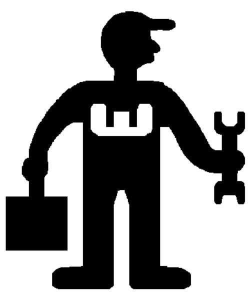


Fig 11.6 Maintenance due icon

Printhead cover

14 If the printhead cover icon (Fig 11.7) is displayed, ensure that the cover is fitted correctly. If the cover is fitted, but the icon remains on the display, use Fig 11.17 and Table 11.17 to determine where the fault lies.

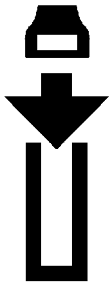


Fig 11.7 Printhead cover open icon

Gutter detect

15 If the gutter fault icon (Fig 11.8) appears on the display, refer to Table 11.9 for possible causes of the fault and remedial action.

11.8 Gutter fault icon

TABLE 11.9 GUTTER FAULTS

Serial (1)	Possible Cause (2)	Remedial Action (3)
1	Nozzle blocked	1 Perform nozzle flush (Para 115) 2 Check that the jet is going into the gutter. Repeat nozzle flush 3 or 4 times if required
2	Nozzle misaligned	Re-align printhead (Para 90)
3	Faulty gutter detect circuit	1 Use Fig 11.20 and Table 11.20 to locate faulty component or sub-assembly 2 Replace gutter detect module (Para 58), I/O board (Para 24) or CPU board (Para 27)

EHT trip

16 If the EHT trip icon (Fig 11.9) appears on the display, refer to Table 11.10 for possible causes and remedial action.

Fig 11.9 EHT trip icon

TABLE 11.10 EHT TRIP

Serial (1)	Possible Cause (2)	Remedial Action (3)
1	Dirty printhead	Clean printhead (See Section 2)
2	EHT trip out of calibration	Re-calibrate EHT trip (Para 147)
3	Faulty EHT circuit	1 Use Fig 11.17 and Table 11.17 to locate the faulty component or sub-assembly 2 Replace faulty component/EHT Module (Para 56), I/O board (Para 24) or CPU board (Para 27)

Ink out

17 If the ink out icon (Fig 11.10) appears on the display, refer to Table 11.11 for possible causes of the fault and remedial action.

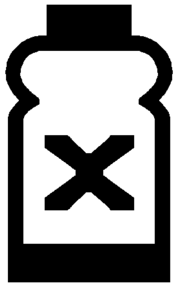


Fig 11.10 Ink out icon

TABLE 11.11 INK OUT

Serial (1)	Possible Cause (2)	Remedial Action (3)
1	Ink reservoir empty	Refill reservoir and prime mixer bowl (Section 9). If ink out icon is still displayed, proceed to Step 3
2	Valve V2 on ink reservoir faulty	1 Use Fig 11.14 and Table 11.14 to locate faulty component or sub-assembly 2 Change valve (Para 49), I/O board (Para 24), or CPU board (Para 27)
3	Valve V2 stuck internally	Clean valve V2 (Para 86). Replace valve (Para 49) if fault remains
4	Mixer level low sensor or cable faulty	1 Check that cable is connected 2 Check continuity of cable and replace if faulty 3 Use Fig 11.25 and Table 11.25 to locate faulty component or sub-assembly 4 Replace FMS (Para 45) if sensor faulty, I/O board (Para 24), CPU board (Para 27) or LEVELS board (Pi) (Para 76)

Cabinet overtemp

18 If the cabinet overtemp icon (Fig 11.11) is displayed, refer to Table 11.12 for possible causes of the fault and remedial action.

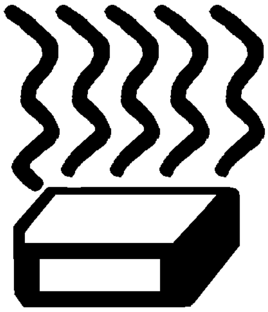
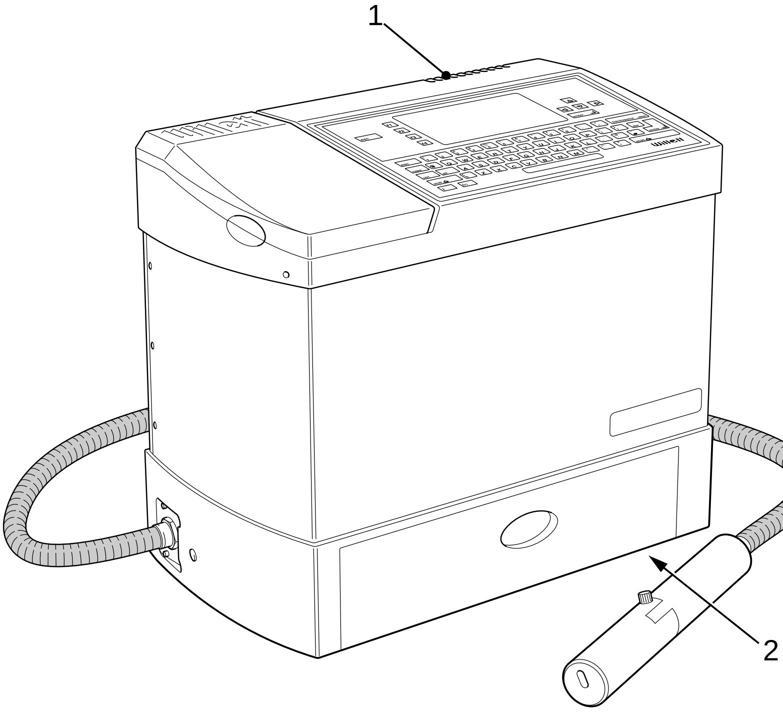


Fig 11.11 Cabinet overtemp icon

TABLE 11.12 CABINET OVERTEMPERATURE

Serial (1)	Possible Cause (2)	Remedial Action (3)
1	Environment too hot for printer	Measure ambient temperature. If it is greater than 40°C, move the printer to a cooler position or reduce ambient temperature by improving ventilation etc
2	Printer air inlet or outlet blocked	Check that the printer is standing on a flat surface and that the inlet and outlet are clear (Fig 11.12)
3	Fan failed (Fan failed icon is displayed)	Check for 24 V DC across pins 4 and 5 on the EHT/FAN connector on the I/O board. If the voltage is present, replace the fan (Para 51)
4	Fan failure card faulty	Replace fan failure card (Para 53)
5	I/O board faulty	Replace I/O board (Para 24)
6	CPU board faulty	Replace CPU board (Para 27)



1 Air outlet
2 Air inlet

Fig 11.12 Printer air inlet and outlet

Charge error

19 If the charge error icon (Fig 11.13) is displayed, refer to Table 11.13 for possible causes of the fault and remedial action.

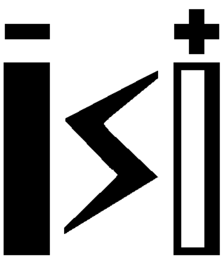


Fig 11.13 Charge Error icon

TABLE 11.13 CHARGE ERROR

Serial (1)	Possible Cause (2)	Remedial Action (3)
1	Dirty printhead	Clean printhead (Section 2)
2	Viscosity incorrect	See Table 11.8
3	Modulation incorrect	Adjust as required (Para 121)
4	Head heater circuitry faulty	1 Use Fig 11.21 and Table 11.21 to locate faulty component or sub-assembly 2 Replace head heater (Para 60), I/O board (Para 24) or CPU board (Para 27)
5	Faulty nozzle assembly or modulation circuitry	1 Use Fig 11.23 and Table 11.23 to locate faulty component or sub-assembly 2 Replace nozzle (Para 66), I/O board (Para 24) or CPU board (Para 27)
6	Charge electrode or circuitry faulty	1 Use Fig 11.24 and Table 11.24 to locate faulty component or sub-assembly 2 Replace EHT Block (Para 64), cabling, I/O board (Para 24) or CPU board (Para 27)
7	Phase detector or circuitry faulty	1 Use Fig 11.24 and Table 11.24 to locate faulty component or sub-assembly 2 Replace phase detector (Para 62), cabling, I/O board (Para 24) or CPU board (Para 27)

SCHEMATIC DIAGRAMS AND SIGNAL TRACING INFORMATION

20 Figures 11.14 to 11.25 are simplified schematic diagrams of the circuits listed below. Each one has an associated table (Table 11.14 to 11.25) giving signal tracing information. The diagrams should be used in conjunction with the fault finding tables (Table 11.1 to 11.13) to locate faulty components and sub-assemblies.

20.1 Fig 11.14 - Valve circuits.

20.2 Fig 11.15 - Cabinet temperature controls.

20.3 Fig 11.16 - LCD contrast control.

20.4 Fig 11.17 - EHT control.

20.5 Fig 11.18 - Pump motor control and pressure transducer.

20.6 Fig 11.19 - Mixer tank ink temperature control.

20.7 Fig 11.20 - Gutter detect circuit.

20.8 Fig 11.21 - Head heater and temperature sensor circuit.

20.9 Fig 11.22 - 285 volt generator circuit on I/O board.

20.10 Fig 11.23 - Modulation control circuit.

20.11 Fig 11.24 - Charging and phasing circuits.

20.12 Fig 11.25 - Level sensor circuits.

21 The voltages and waveforms are typical of a fully serviceable printer. Any major deviation from the values given in the tables indicate a fault condition.

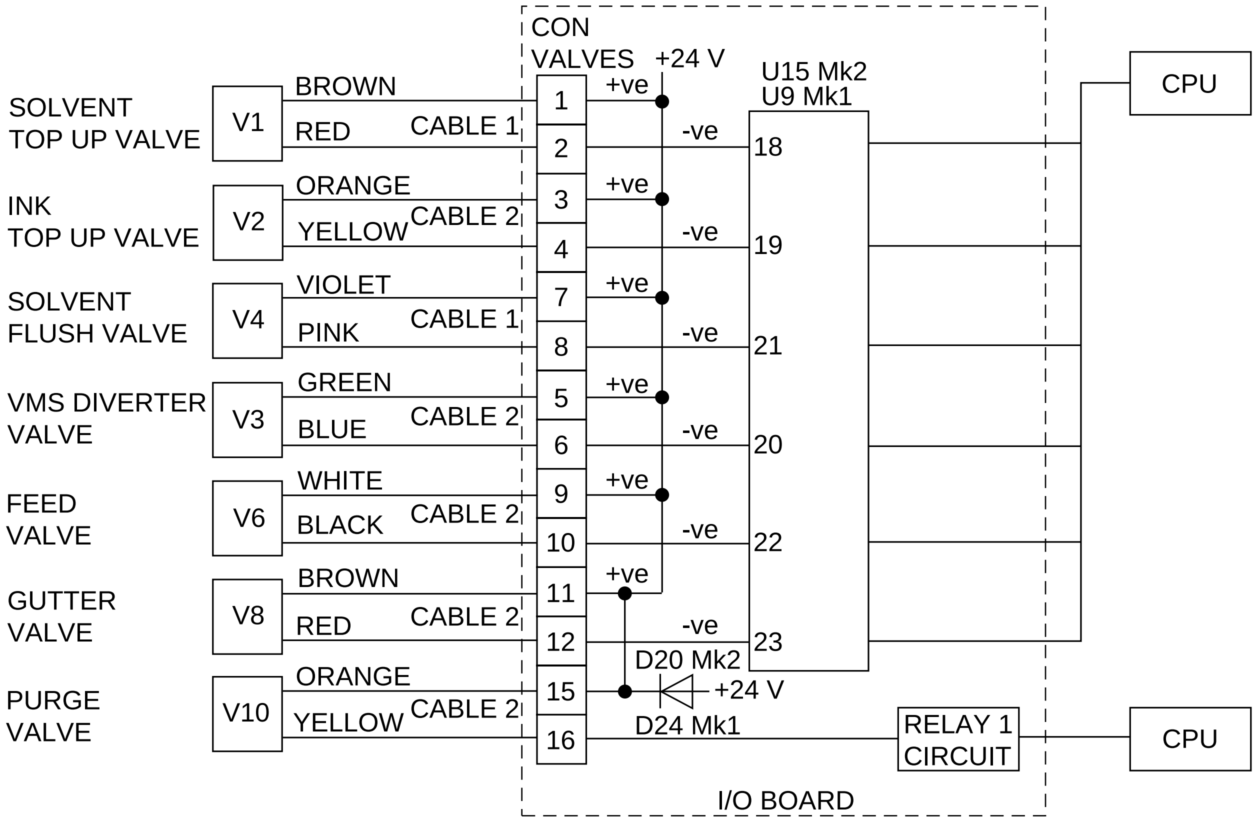


Fig 11.14 Valve circuits

TABLE 11.14 VALVE CIRCUIT SIGNAL TRACING

Serial (1)	Component (2)	Pin No. (3)	Meter type (4)	Status (5)	Signal (6)
1	CON VALVES	2, 4, 6, 8, 10, 12 (Chassis 0 V ref)	DVM	Valve de-energised	+24 V
2	CON VALVES	2, 4, 6, 8, 10, 12 (Chassis 0 V ref)	DVM	Valve energised	0 V
3	CON VALVES	Measure across pins 15 (+ve) and 16	DVM	Mains supply power down	Approx 10 V (Capacitor discharge)
4	CON VALVES	16 (Chassis 0 V ref)	DVM	Valve de-energised	+24 V
5	CON VALVES	16 (Chassis 0 V ref)	DVM	Valve energised	0 V
6	U15/9	18, 19, 20, 21, 22, 23	DVM	Valve de-energised	0 V
7	U15/9	18, 19, 20, 21, 22, 23	DVM	Valve energised	+5 V

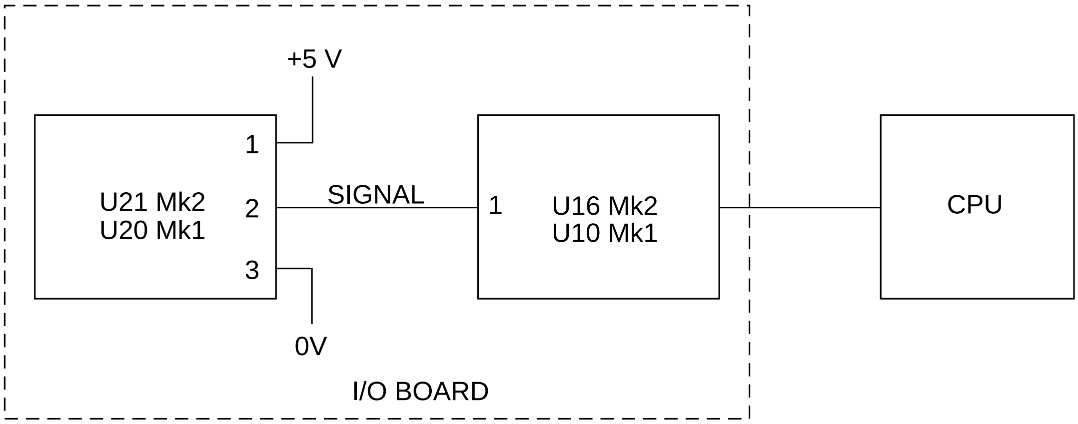


Fig 11.15 Cabinet temperature controls

TABLE 11.15 CABINET TEMPERATURE CONTROL SIGNAL TRACING

Serial (1)	Component (2)	Pin No. (3)	Meter type (4)	Temperature (5)	Signal (6)
1	U21/20	2 (Chassis 0 V ref)	DVM	20ºC	200 mV
2	U21/20	2 (Chassis 0 V ref)	DVM	30ºC	300 mV
3	U16/10	1 (Chassis 0 V ref)	DVM	20ºC	1.8 V
4	U16/10	1 (Chassis 0 V ref)	DVM	30ºC	1.8 V

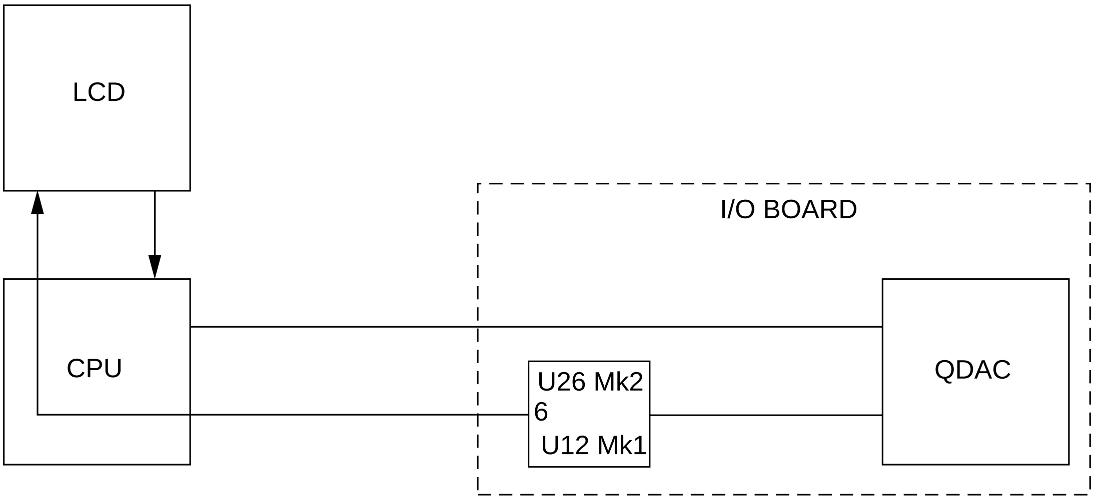


Fig 11.16 LCD Contrast control

TABLE 11.16 LCD CONTRAST CONTROL SIGNAL

Serial (1)	Component (2)	Pin No. (3)	Meter type (4)	Contrast value (5)	Signal (6)
1	U26/12	6 (Chassis 0 V ref)	DVM	0	-100 mV
2	U26/12	6 (Chassis 0 V ref)	DVM	50	-3.7 V
3	U26/12	6 (Chassis 0 V ref)	DVM	100	-8.4 V
4	U26/12	6 (Chassis 0 V ref)	DVM	150	-14 V
5	U26/12	6 (Chassis 0 V ref)	DVM	200	-18 V
6	U26/12	6 (Chassis 0 V ref)	DVM	255	-23 V

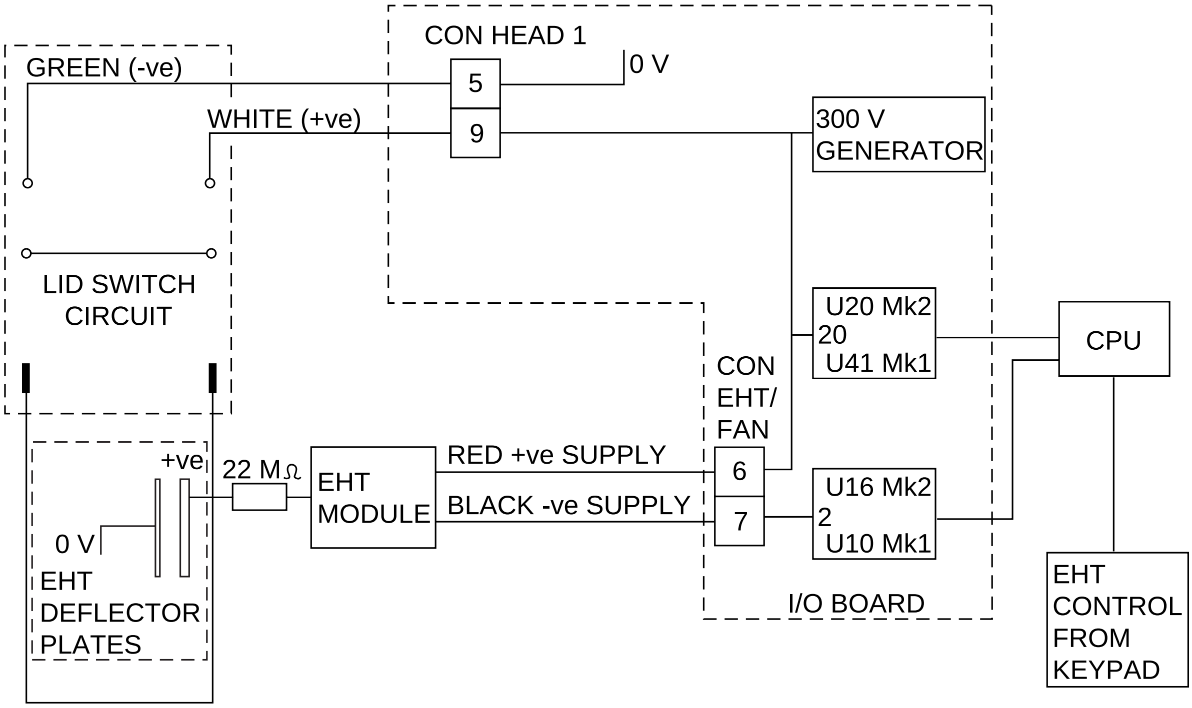


Fig 11.17 EHT control and lid switch circuit

TABLE 11.17 EHT CONTROL AND LID SWITCH SIGNAL TRACING

Serial (1)	Component (2)	Pin No. (3)	Meter type (4)	EHT value (5)	Signal (6)
1	CON EHT/FAN	6 (Chassis 0 V ref)	DVM	Lid off (No EHT)	0 V
2	CON EHT/FAN	7 (Chassis 0 V ref)	DVM	Lid off (No EHT)	0 V
3	U20/41	20 (Chassis 0 V ref)	DVM	Lid off (No EHT)	0 V
4	U16/10	2 (Chassis 0 V ref)	DVM	Lid off (No EHT)	0 V
5	CON HEAD 1	9 (Chassis 0 V ref)	DVM	Lid off (No EHT)	3.5 V
6	CON EHT/FAN	6 (Chassis 0 V ref)	DVM	Lid on (EHT 50)	4.2 V

(Continued)

TABLE 11.17 EHT CONTROL AND LID SWITCH SIGNAL TRACING (Continued)

Serial (1)	Component (2)	Pin No. (3)	Meter type (4)	EHT Value (5)	Signal (6)
7	CON EHT/FAN	7 (Chassis 0 V ref)	DVM	Lid on (EHT 50)	70 mV
8	U20/41	20 (Chassis 0 V ref)	DVM	Lid on (EHT 50)	1 V
9	U16/10	2 (Chassis 0 V ref)	DVM	Lid on (EHT 50)	300 mV
10	CON HEAD 1	9 (Chassis 0 V ref)	DVM	Lid on (EHT 50)	500 mV
11	CON EHT/FAN	6 (Chassis 0 V ref)	DVM	Lid on (EHT 100)	9 V
12	CON EHT/FAN	7 (Chassis 0 V ref)	DVM	Lid on (EHT 100)	150 mV
13	U20/41	20 (Chassis 0 V ref)	DVM	Lid on (EHT 100)	2 V
14	U16/10	2 (Chassis 0 V ref)	DVM	Lid on (EHT 100)	600 mV
15	CON HEAD 1	9 (Chassis 0 V ref)	DVM	Lid on (EHT 100)	500 mV
16	CON EHT/FAN	6 (Chassis 0 V ref)	DVM	Lid on (EHT 150)	13 V
17	CON EHT/FAN	7 (Chassis 0 V ref)	DVM	Lid on (EHT 150)	200 mV
18	U20/41	20 (Chassis 0 V ref)	DVM	Lid on (EHT 150)	3 V
19	U16/10	2 (Chassis 0 V ref)	DVM	Lid on (EHT 150)	1 V
20	CON HEAD 1	9 (Chassis 0 V ref)	DVM	Lid on (EHT 150)	500 mV
21	CON EHT/FAN	6 (Chassis 0 V ref)	DVM	Lid on (EHT 200)	17 V

(Continued)

TABLE 11.17 EHT CONTROL AND LID SWITCH SIGNAL TRACING (Continued)

Serial (1)	Component (2)	Pin No. (3)	Meter type (4)	EHT Value (5)	Signal (6)
22	CON EHT/FAN	7 (Chassis 0 V ref)	DVM	Lid on (EHT 200)	200 mV
23	U20/41	20 (Chassis 0 V ref)	DVM	Lid on (EHT 200)	4 V
24	U16/10	2 (Chassis 0 V ref)	DVM	Lid on (EHT 200)	1.3 V
25	CON HEAD 1	9 (Chassis 0 V ref)	DVM	Lid on (EHT 200)	500 mV
26	CON EHT/FAN	6 (Chassis 0 V ref)	DVM	Lid on (EHT 255)	22 V
27	CON EHT/FAN	7 (Chassis 0 V ref)	DVM	Lid on (EHT 255)	370 mV
28	U20/41	20 (chassis 0 V ref)	DVM	Lid on (EHT 255)	5 V
29	U16/10	2 (Chassis 0 V ref)	DVM	(Lid on (EHT 255)	1.7 V
30	CON HEAD 1	9 (Chassis 0 V ref)	DVM	(Lid on (EHT 255)	0 V

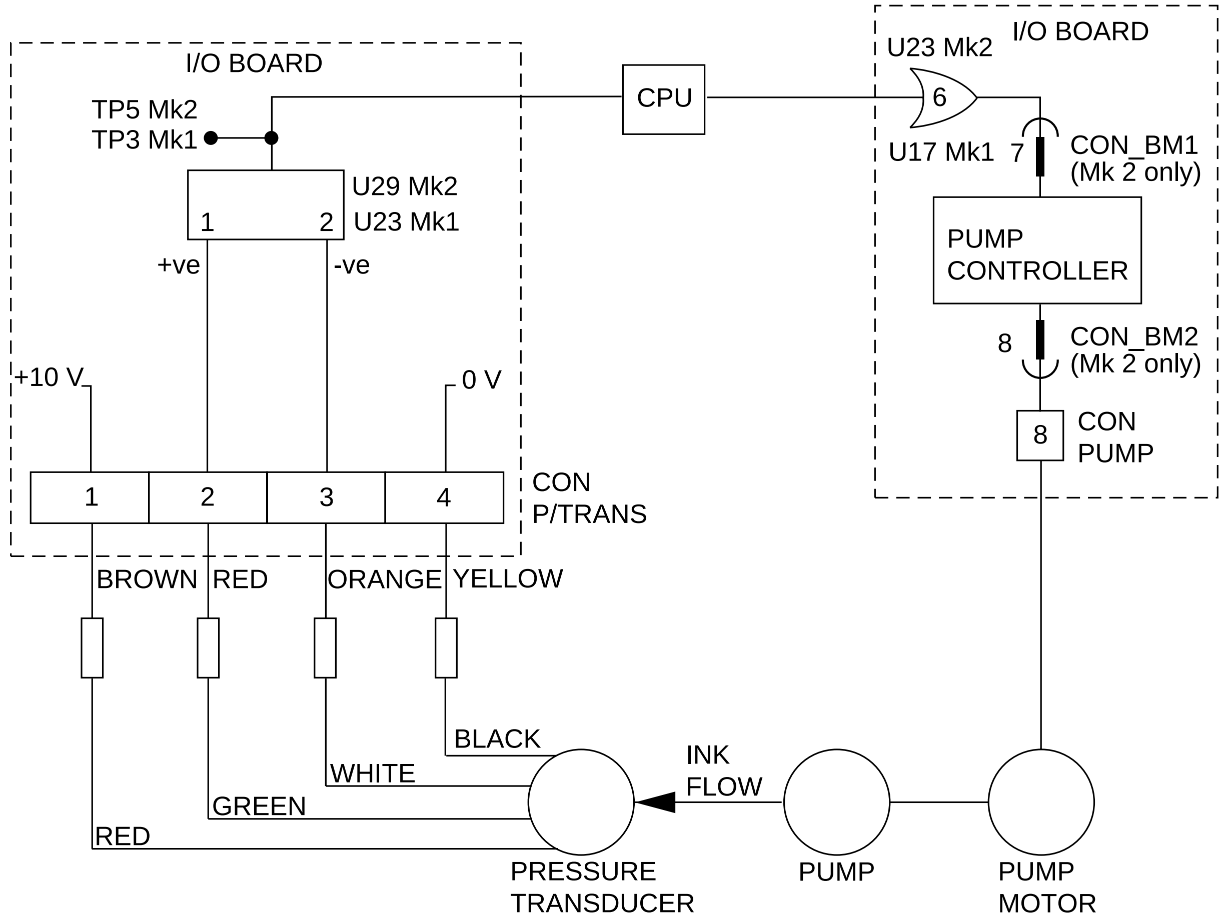
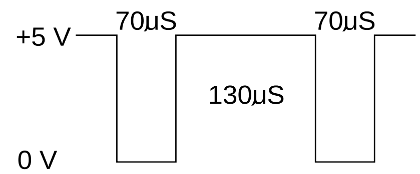


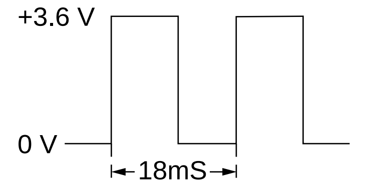
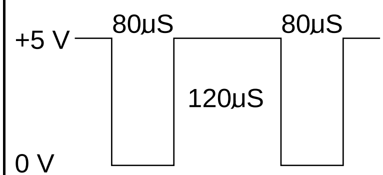
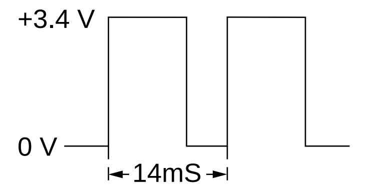
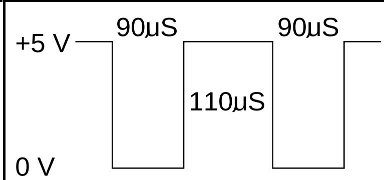
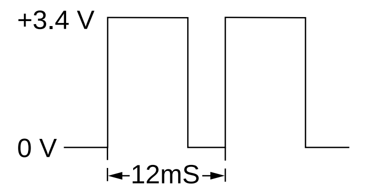
Fig 11.18 Pump motor control and pressure transducer

TABLE 11.18 PUMP MOTOR CONTROL AND PRESSURE TRANSDUCER SIGNAL TRACING

Serial (1)	Component (2)	Pin No. (3)	Meter type (4)	Pressure Digital (6)	Pressure Actual (7)	Signal (8)
1	CON P/TRANS	1 (Pin 4 0 V ref)	DVM	20	2 Bar	+10 V
2	CON P/TRANS	Measure across Pin 2 (+ve) and Pin 3 (-ve)	DVM	20	2 Bar	25 mV
3	TP5/3	TP5 (Chassis 0 V ref)	DVM	20	2 Bar	2.3 V
4	U23/17	6 (Chassis 0 V ref)	Scope	20	2 Bar	

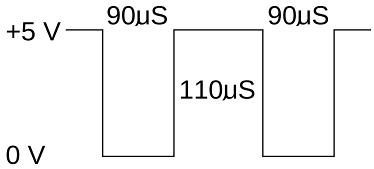
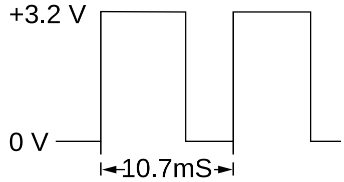
(Continued)

TABLE 11.18 PUMP MOTOR CONTROL AND PRESSURE TRANSDUCER SIGNAL TRACING (Continued)

Serial (1)	Component (2)	Pin No. (3)	Meter type (4)	Pressure Digital (5)	 Actual (6)	Signal (7)
5	CON PUMP	8 (Chassis 0 V ref)	Scope	20	2 Bar	
6	CON P/TRANS	1 Pin 4 (0 V ref)	DVM	30	3 Bar	+10 V
7	CON P/TRANS	Measure across Pin 2 (+ve) and Pin 3 (-ve)	DVM	30	3 Bar	35 mV
8	TP5/3	TP5/3 (+ve) (Chassis 0 V ref)	DVM	30	3 Bar	3.4 V
9	U23/17	6 (Chassis 0 V ref)	Scope	30	3 Bar	
10	CON PUMP	8 (Chassis 0 V ref)	Scope	30	3 Bar	
11	CON P/TRANS	1 (Pin 4 0 V ref)	DVM	40	4 Bar	+10 V
12	CON P/TRANS	Measure across Pin 2 (+ve) and Pin 3 (-ve)	DVM	40	4 Bar	46 mV
13	TP5/3	TP5/3 (+ve) (Chassis 0 V ref)	DVM	40	4 Bar	+4.1 V
14	U23/17	6 (Chassis 0 V ref)	Scope	40	4 Bar	
15	CON PUMP	8 (Chassis 0 V ref)	Scope	40	4 Bar	

(Continued)

TABLE 11.18 PUMP MOTOR CONTROL AND PRESSURE TRANSDUCER SIGNAL TRACING (Continued)

Serial (1)	Component (2)	Pin No. (3)	Meter type (4)	Pressure Digital (5)	Pressure Actual (6)	Signal (7)
16	CON P/TRANS	1 (Pin 4 0 V ref)	DVM	50	5 Bar	+10 V
17	CON P/TRANS	Measure across Pin 2 (+ve) and Pin 3 (-ve)	DVM	50	5 Bar	55 mV
18	TP5/3	TP5/3 (+ve) (Chassis 0 V ref)	DVM	50	5 Bar	+5 V
19	U23/17	6 (Chassis 0 V ref)	Scope	50	5 Bar	
20	U23/17	8 (Chassis 0 V ref)	Scope	50	5 Bar	

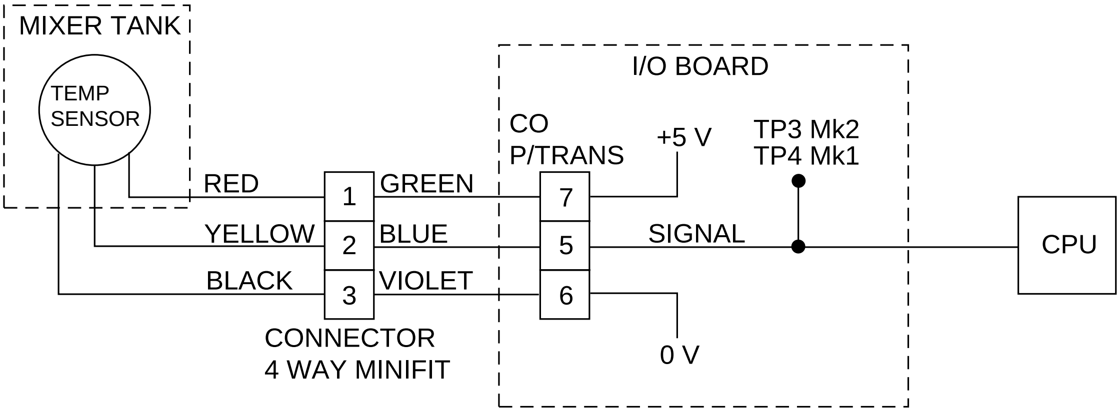


Fig 11.19 Mixer tank ink temperature control

TABLE 11.19 MIXER TANK INK TEMPERATURE CONTROL SIGNAL TRACING

Serial (1)	Component (2)	Pin No. (3)	Meter type (4)	Temperature (5)	Signal (6)
1	CONNECTOR 4 WAY MINIFIT	1 (Pin 3 0 V ref)	DVM	20°C	+5 V
2	CONNECTOR 4 WAY MINIFIT	2 (Pin 3 0 V ref)	DVM	20°C	200 mV
3	CON P/TRANS	7 (Pin 6 0 V ref)	DVM	20°C	+5 V
4	CON P/TRANS	5 (Pin 6 0 V ref)	DVM	20°C	200 mV
5	TP3/4	TP3/4 (+ve) (Chassis 0 V ref)	DVM	20°C	1.2 V
6	CONNECTOR 4 WAY MINIFIT	1 (Pin 3 0 V ref)	DVM	25°C	+5 V
7	CONNECTOR 4 WAY MINIFIT	2 (Pin 3 0 V ref)	DVM	25°C	250 mV
8	CON P/TRANS	7 (Pin 6 0 V ref)	DVM	25°C	+5 V
9	CON P/TRANS	5 (Pin 6 0 V ref)	DVM	25°C	250 mV
10	TP3/4	TP3/4 (+ve) (Chassis 0 V ref)	DVM	25°C	1.5 V

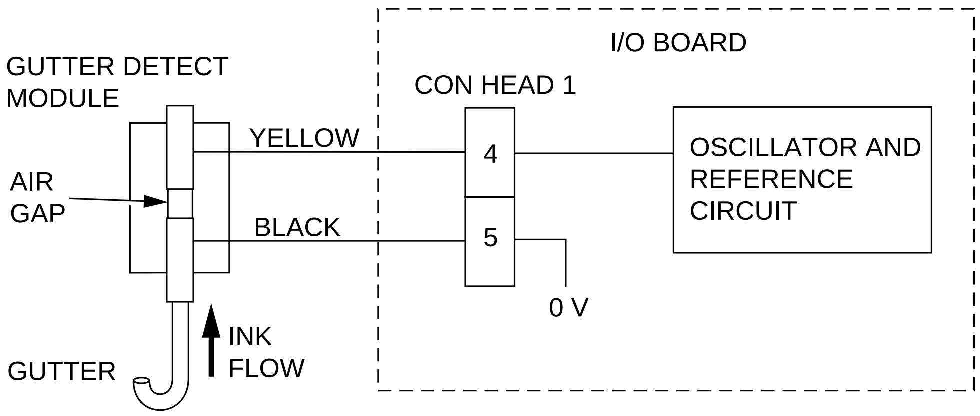
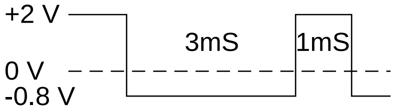
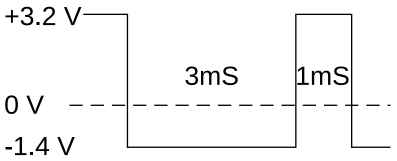


Fig 11.20 Gutter detect circuit

TABLE 11.20 GUTTER DETECT CIRCUIT SIGNAL TRACING

Serial (1)	Component (2)	Pin No. (3)	Meter type (4)	Ink flow (5)	Signal (6)
1	CON HEAD 1	4	Scope	Ink flow through module	
2	CON HEAD 1	4	Scope	No ink flow	

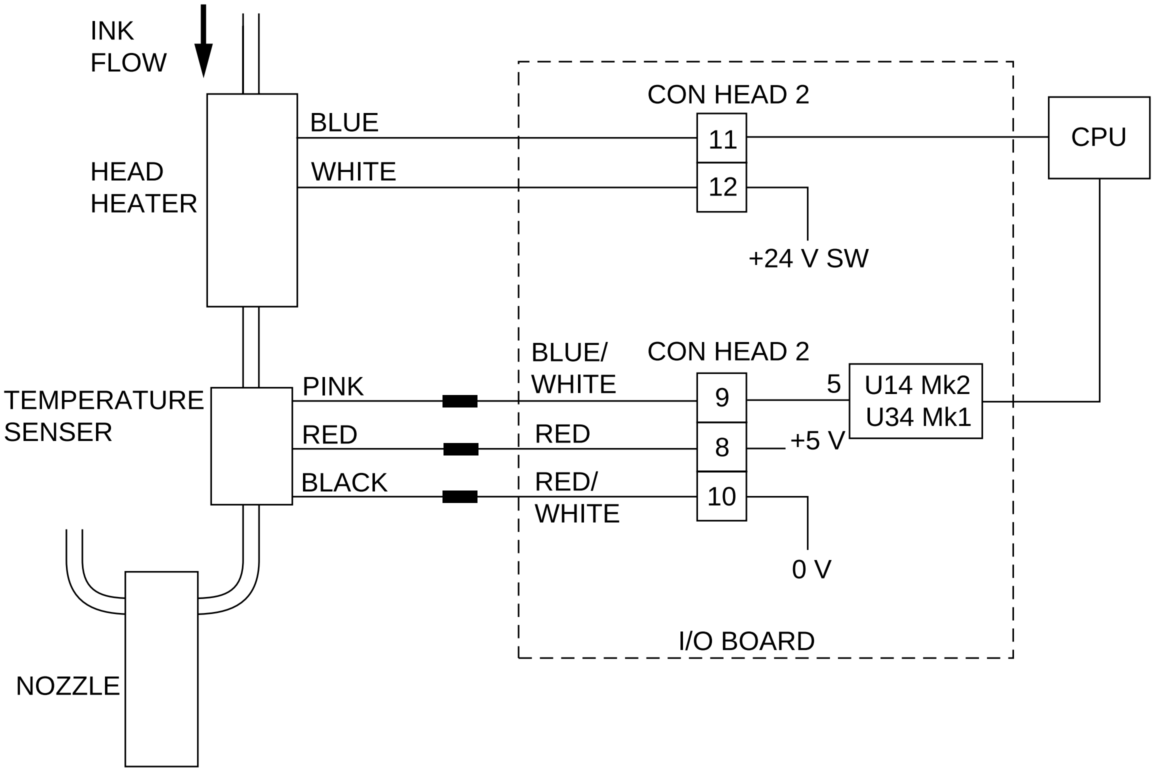


Fig 11.21 Head heater and temperature sensor circuit

(1) When the required temperature is reached, CON HEAD 2 pins 11 and 12 are both at +24 V. When the actual temperature is below the set temperature, pin 11 remains at +24 V while pin 12 is supplied with +24 V switched pulses.

(2) If the temperature exceeds 55°C, the thermal cutout shuts down the head heater.

TABLE 11.21 HEAD HEATER AND TEMPERATURE SENSOR SIGNAL TRACING

Serial (1)	Component (2)	Pin No. (3)	Meter type (4)	Temperature (5)	Signal (6)
1	CON HEAD 2	11 (Chassis 0 V ref)	Scope	25°C	See Note 1
2	CON HEAD 2	12 (Chassis 0 V ref)	Scope	25°C	See Note 1
3	CON HEAD 2	9 (Pin 10 0 V ref)	DVM	25°C	250 mV
4	CON HEAD 2	11 (Chassis 0 V ref)	Scope	35°C	See Note 1
5	CON HEAD 2	12 (Chassis 0 V ref)	Scope	35°C	See Note 1
6	CON HEAD 2	9 (Pin 10 0 V ref)	DVM	35°C	350 mV
7	CON HEAD 2	11 (Chassis 0 V ref)	Scope	45°C	See Note 1
8	CON HEAD 2	12 (Chassis 0 V ref)	Scope	45°C	See Note 1
9	CON HEAD 2	9 (Pin 10 0 V ref)	DVM	45°C	450 mV
10	CON HEAD 2	11 (Chassis 0 V ref)	Scope	55°C	See Note 1
11	CON HEAD 2	12 (Chassis 0 V ref)	Scope	55°C	See Note 1
12	CON HEAD 2	9 (Pin 10 0 V ref)	DVM	55°C	550 mV
13	U14/34	5	DVM	25°C	1.5 V
14	U14/34	5	DVM	35°C	2 V
15	U14/34	5	DVM	45°C	2.5 V
16	U14/34	5	DVM	55°C	3 V

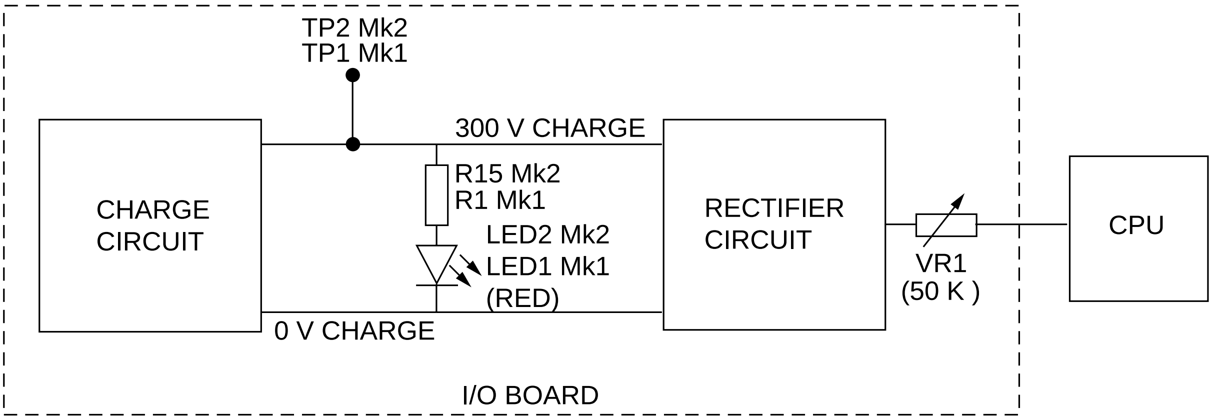


Fig 11.22 300 volt generator circuit

TABLE 11.22 300 VOLT GENERATOR CIRCUIT SIGNALS

Serial (1)	Component (2)	Pin No. (3)	Meter type (4)	Status (5)	Signal (6)
1	TP2/1	TP2 (+ve) (Chassis 0 V ref)	DVM	Printhead cover off	+15 V
2	TP2/1	TP2 (+ve) (Chassis 0 V ref)	DVM	Printhead cover on	Max = +330 V Calibrated to 285 V with VR1
3	LED2/1		Visual inspection	Printhead cover off	Dimly lit
4	LED2/1		Visual inspection	Printhead cover on	Brightly lit

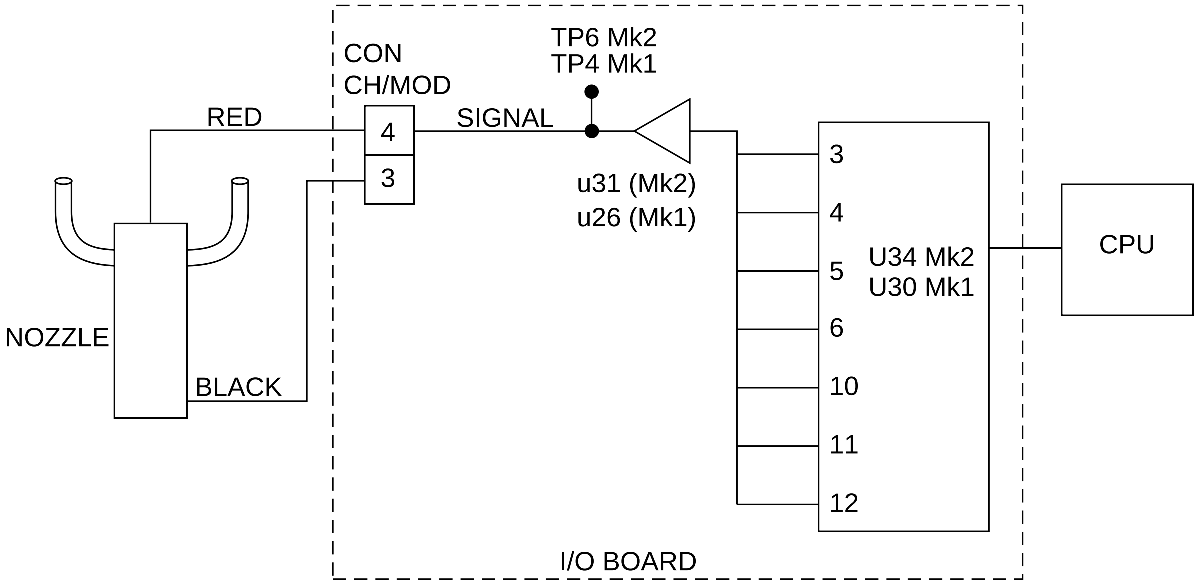
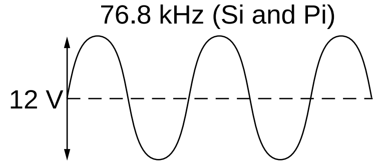
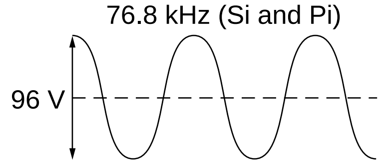


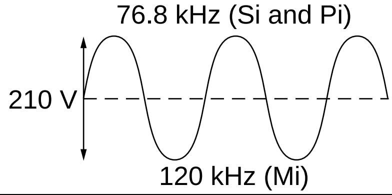
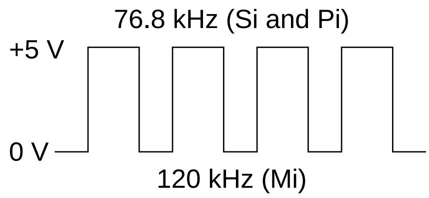
Fig 11.23 Modulation control circuit

TABLE 11.23 MODULATION CONTROL CIRCUIT SIGNAL TRACING

Serial (1)	Component (2)	Pin No. (3)	Meter type (4)	MOD value (5)	Signal (6)
1	TP6/4	TP6/4 (Chassis 0 V ref)	Scope	0	76.8 kHz (Si and Pi)  120 kHz (Mi)
2	CON CH/MOD	4 (Chassis 0 V ref)	Scope	0	Same waveform as Serial 1
3	CON CH/MOD	3 (Chassis 0 V ref)	Scope	0	0 V
4	TP6/4	TP6/4 (Chassis 0 V ref)	Scope	45	76.8 kHz (Si and Pi)  120 kHz (Mi)
5	CON CH/MOD	4 (Chassis 0 V ref)	Scope	45	Same waveform as Serial 4
6	CON CH/MOD	3 (Chassis 0 V ref)	Scope	45	0 V

(Continued)

TABLE 11.23 MODULATION CONTROL CIRCUIT SIGNAL TRACING (Continued)

Serial (1)	Component (2)	Pin No. (3)	Meter type (4)	MOD value (5)	Signal (6)
7	TP6	TP6 (Chassis 0 V ref)	Scope	99	
8	CON CH/MOD	4 (Chassis 0 V ref)	Scope	99	Same waveform as Serial 7
9	CON CH/MOD	3 (Chassis 0 V ref)	Scope	99	0 V
10	U34/30	3, 4, 5, 6, 10, 11, 12	Scope	0	
11	U34/30	3, 4, 5, 6, 10, 11, 12	Scope	45	Same waveform as Serial 10
12	U34/30	3, 4, 5, 6, 10, 11, 12	Scope	99	Same waveform as Serial 10

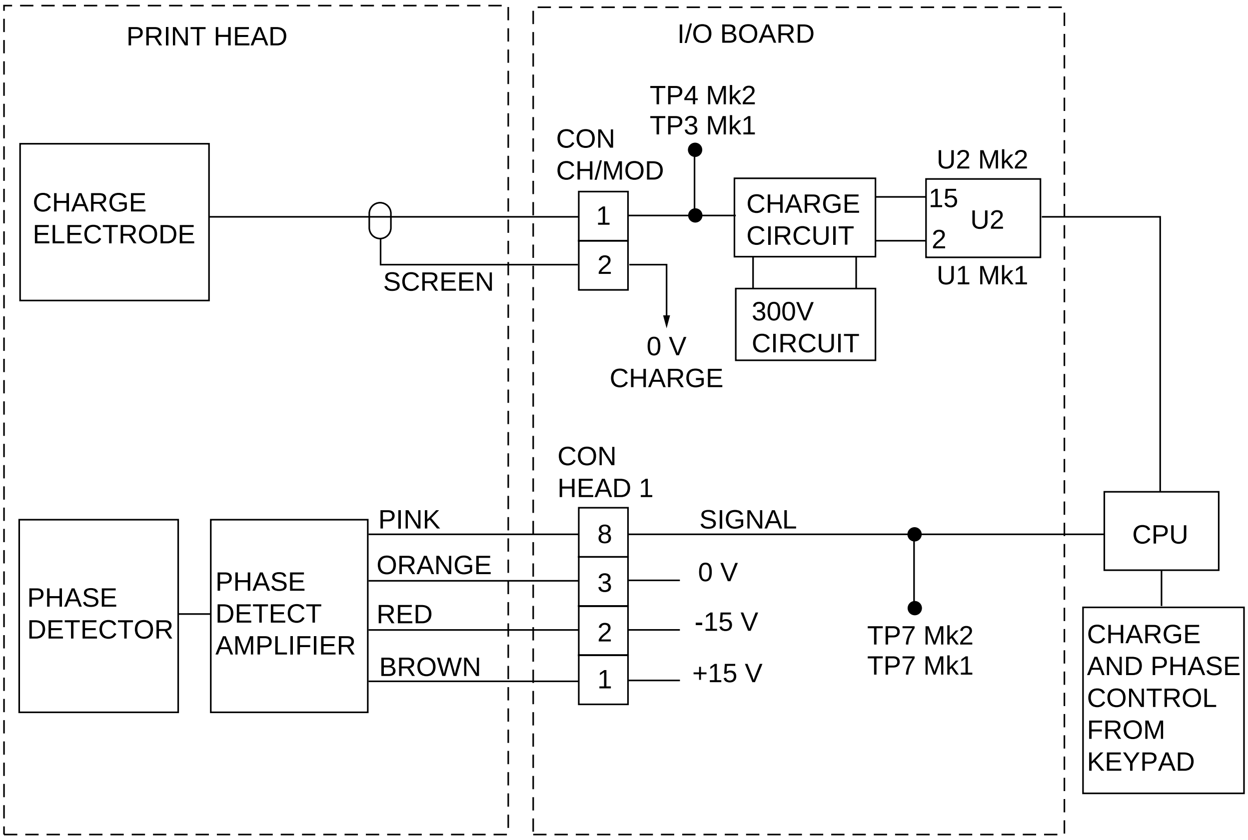
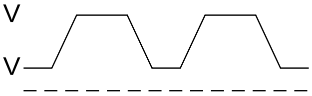


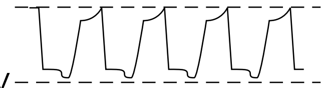
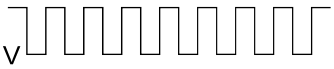
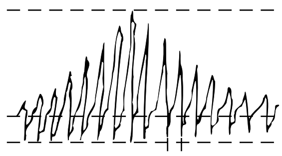
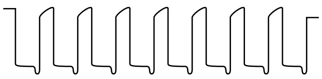
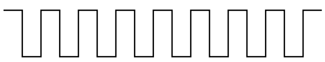
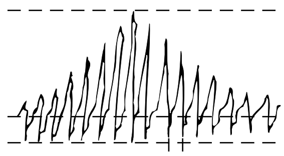
Fig 11.24 Charging and phasing circuits (printing and phasing)

TABLE 11.24 CHARGING AND PHASING CIRCUITS SIGNAL TRACING

Serial (1)	Component (2)	Pin No. (3)	Meter type (4)	Status (5)	Signal (6)
1	CON CH/MOD	1 (or TP4/3) (Chassis 0 V ref)	Scope	Jet running phasing/lid on Phase charge 0 Phase profile 15 x 0	
2	U2/1	15 (Chassis 0 V ref)	DVM	Jet running Phasing/lid on Phase charge 0 Phase profile 15 x 0	0 V
3	CON HEAD 1	8 (or TP7) (Chassis 0 V ref)	DVM	Jet running Phasing/lid on Phase charge 0 Phase profile 15 x 0	100 mV

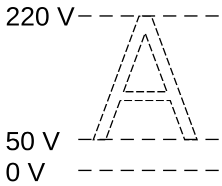
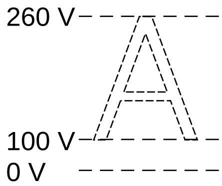
(Continued)

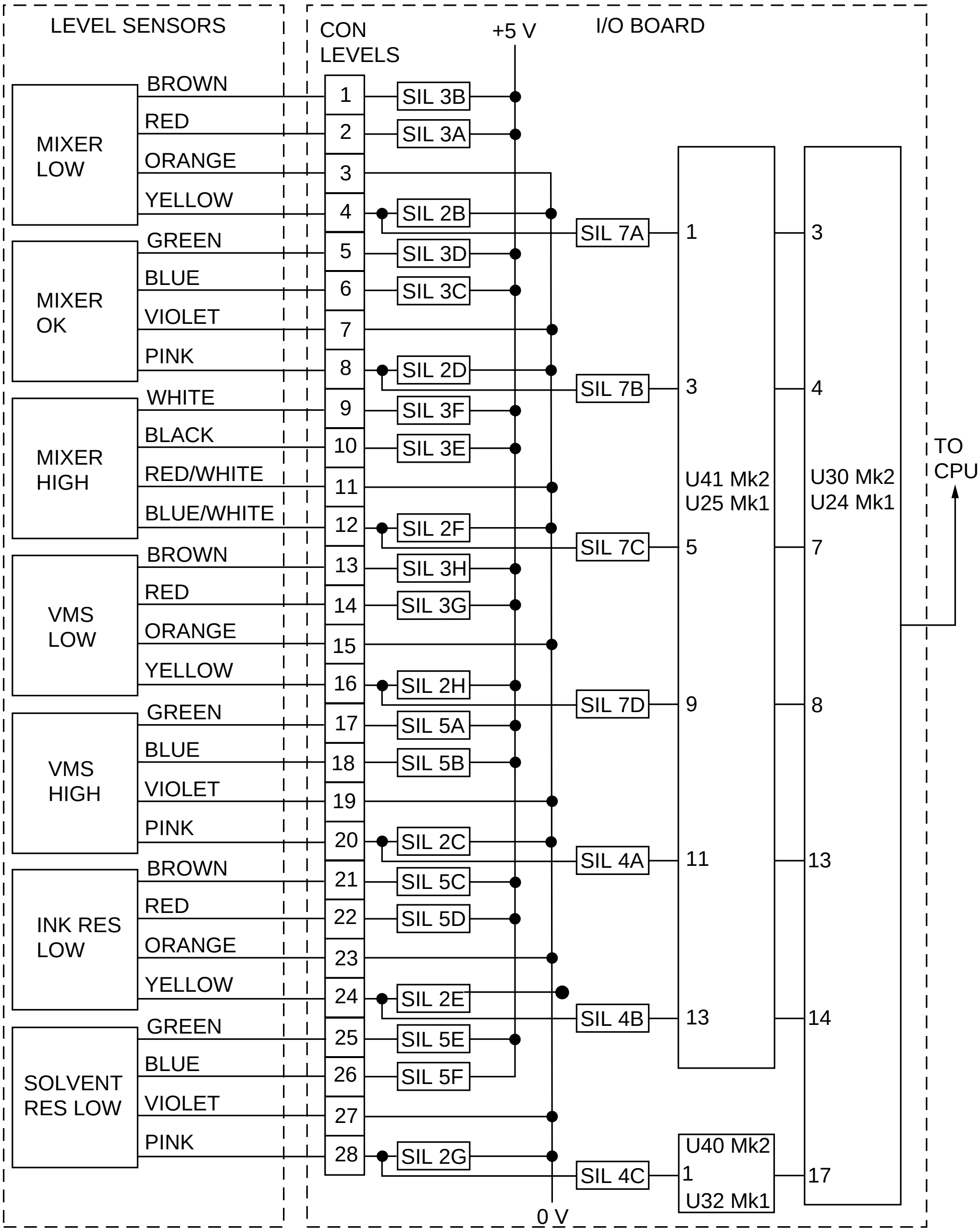
TABLE 11.24 CHARGING AND PHASING CIRCUITS SIGNAL TRACING (Continued)

Serial (1)	Component (2)	Pin No. (3)	Meter type (4)	Status (5)	Signal (6)
4	CON CH/MOD	1 (or TP4/3) (Chassis 0 V ref)	Scope	Jet running Phasing/lid on Phase charge 122 Phase profile 8 x 1	76.8 kHz (Si and Pi) 0 V  -12 V 120 kHz (Mi)
5	U2/1	15 (Chassis 0 V ref)	Scope	Jet running Phasing/lid on Phase charge 122 Phase profile 8 x 1	76.8 kHz (Si and Pi) 0 V  -1.7 V Burst of 8 pulses 120 kHz (Mi)
6	CON HEAD 1	8 (or TP7) (Chassis 0 V ref)	Scope	Jet running Phasing/lid on Phase charge 122 Phase profile 8 x 1	+2 V  0 V -0.5 V 16 pulses (0-15)
7	CON CH/MOD	1 (or TP4/3) (Chassis 0 V ref)	Scope	Jet running Phasing/lid on Phase charge 255 Phase profile 13 x 1	76.8 kHz (Si and Pi) 0 V  -14 V Burst of 8 pulses 120 kHz (Mi)
8	U2/1	15 (Chassis 0 V ref)	Scope	Jet running Phasing/lid on Phase charge 255 Phase profile 13 x 1	76.8 kHz (Si and Pi) 0 V  -3 V 120 kHz (Mi)
9	CON HEAD 1	8 (or TP4/3) (Chassis 0 V ref)	Scope	Jet running Phasing/lid on Phase charge 255 Phase profile 13 x 1	+2.1 V  0 V -0.5 V 16 pulses (0-15)

(Continued)

TABLE 11.24 CHARGING AND PHASING CIRCUITS SIGNAL TRACING (Continued)

Serial (1)	Component (2)	Pin No. (3)	Meter type (4)	Status (5)	Signal (6)
10	CON CH/MOD	1 (or TP4/3) (Chassis 0 V ref)	DVM	Printing Jet on/ lid on Charge value 0 Phase profile 0 Phase charge 130	+1.2 V
11	U2/1	2 (Chassis 0 V ref)	DVM	Printing Jet on/lid on Charge value 0 Phase profile 0 Phase charge 130	0 V
12	CON CH/MOD	1 (or TP4/3) (chassis 0 V ref)	Scope	Printing Jet on/lid on Charge value 160 Phase profile 8 x 1 Phase charge 130	 24 dot high character
13	U2/1	2 (chassis 0 V ref)	DVM	Printing Jet on/lid on Charge value 160 Phase profile 8 x 1 Phase charge 130	-1.1 V to +1.1 V
14	CON CH/MOD	1 (or TP4/3) (Chassis 0 V ref)	Scope	Printing Jet on/lid on Charge value 255 Phase profile 10 x 1 Phase charge 130	 24 dot high character
15	U2/1	2 (Chassis 0 V ref)	DVM	Printing Jet on/lid on Charge value 255 Phase profile 10 x 1 Phase charge 130	-2.1 V to +1.5 V



(1) SIL3 on Mk2 is SIL1 on Mk1.

(2) SIL7 on Mk2 is SIL3 on Mk1.

(3) SIL2 on Mk2 is SIL2 on Mk1.

Fig 11.25 Level sensor circuits; Si and Mi (Sheet 1 of 2)

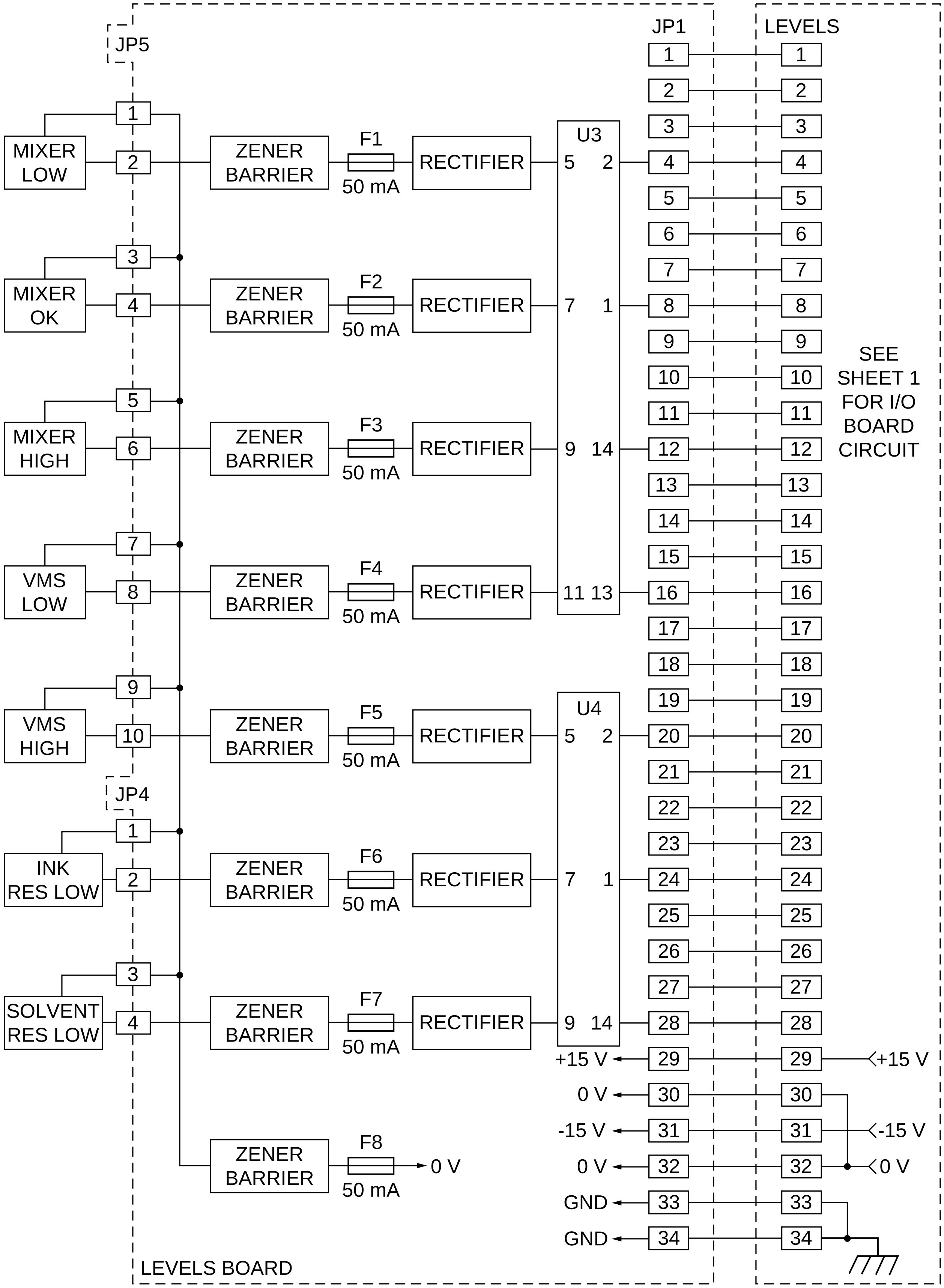


Fig 11.25 Level sensor circuits; Pi (Sheet 2 of 2)

TABLE 11.25 LEVEL SENSOR CIRCUITS SIGNAL TRACING

Serial (1)	Component (2)	Pin No. (3)	Meter type (4)	Signal: Sensor covered (5)	Signal: Sensor uncovered (6)
1	U41/25	1, 3, 5, 9, 11, 13 (Chassis 0 V ref)	Scope	0 V	+4.7 V DC
2	U40/32	1 (Chassis 0 V ref)	Scope	0 V	+4.7 V DC
3	U30/24	3, 4, 7, 8, 13, 14, 17 (Chassis 0 V ref)	Scope	+5 V DC	0 V
4	Levels interface board U3 (Pi)	5, 7, 9, 11	Scope	3 V	<2.5 V
5	Levels interface board U4 (Pi)	5, 7, 9	Scope	3 V	<2.5 V

Levels interface board fuses (Pi)

22 The levels interface board (Pi) is fitted with one 250 mA and eight 50 mA fast blow fuses. The fuse functions are listed in Table 11.26.

TABLE 11.26 LEVELS INTERFACE BOARD FUSES (PI)

Serial (1)	Fuse (2)	Function (3)
1	1	Mixer tank low level detector (50 mA)
2	2	Mixer tank OK level detector (50 mA)
3	3	Mixer tank high level detector (50 mA)
4	4	VMS low level detector (50 mA)
5	5	VMS high level detector (50 mA)
6	6	Ink low level detector (50 mA)
7	7	Solvent low level detector (50 mA)
8	8	Negative return line for level detectors (50 mA)
9	9	Ink reservoir and FMS stirrer motors (250 mA)

REMOVAL AND REFITTING PROCEDURES

23 The following paragraphs give removal and refitting procedures for the components and sub-assemblies listed below:

23.1 I/O board (Para 24).

23.2 CPU board (Para 27).

23.3 PSU (Para 29).

23.4 PSU fuses (Para 31).

23.5 LCD/backlight assembly (Para 33).

23.6 Keypad (Para 35).

23.7 Ink or top up reservoir sensor (Para 37).

23.8 Mains inlet connector (Para 39).

23.9 Mains switch (Para 41).

23.10 Fluid management system (Para 45).

23.11 Ink system pump (Para 47).

23.12 Valves (Para 49).

23.13 Fan (Para 51).

23.14 Fan failure card (Para 53).

23.15 EHT Module (Para 56).

23.16 Gutter detect module (Para 58).

23.17 Head heater (Para 60).

23.18 Phase detector (Para 62).

23.19 EHT block (Para 64).

23.20 Nozzle assembly (Para 66).

23.21 Ink reservoir stirrer motor, Pi only (Para 68).

23.22 Ink reservoir stirrer bar; Pi only (Para 70).

23.23 FMS stirrer bar; Pi only (Para 72).

23.24 FMS stirrer motor; Pi only (Para 74).

23.25 Levels interface board; Pi only (Para 76).

LETHAL HAZARD. DISCONNECT THE PRINTER FROM THE ELECTRICAL SUPPLY BEFORE REMOVING AND REFITTING COMPONENTS.

EQUIPMENT DAMAGE. An antistatic wrist strap must be worn when working on printed circuit boards.

I/O board

The Pi machine is fitted with an extra circuit board behind the CPU board. The procedure for removal and refitting the I/O board is identical to that described below.

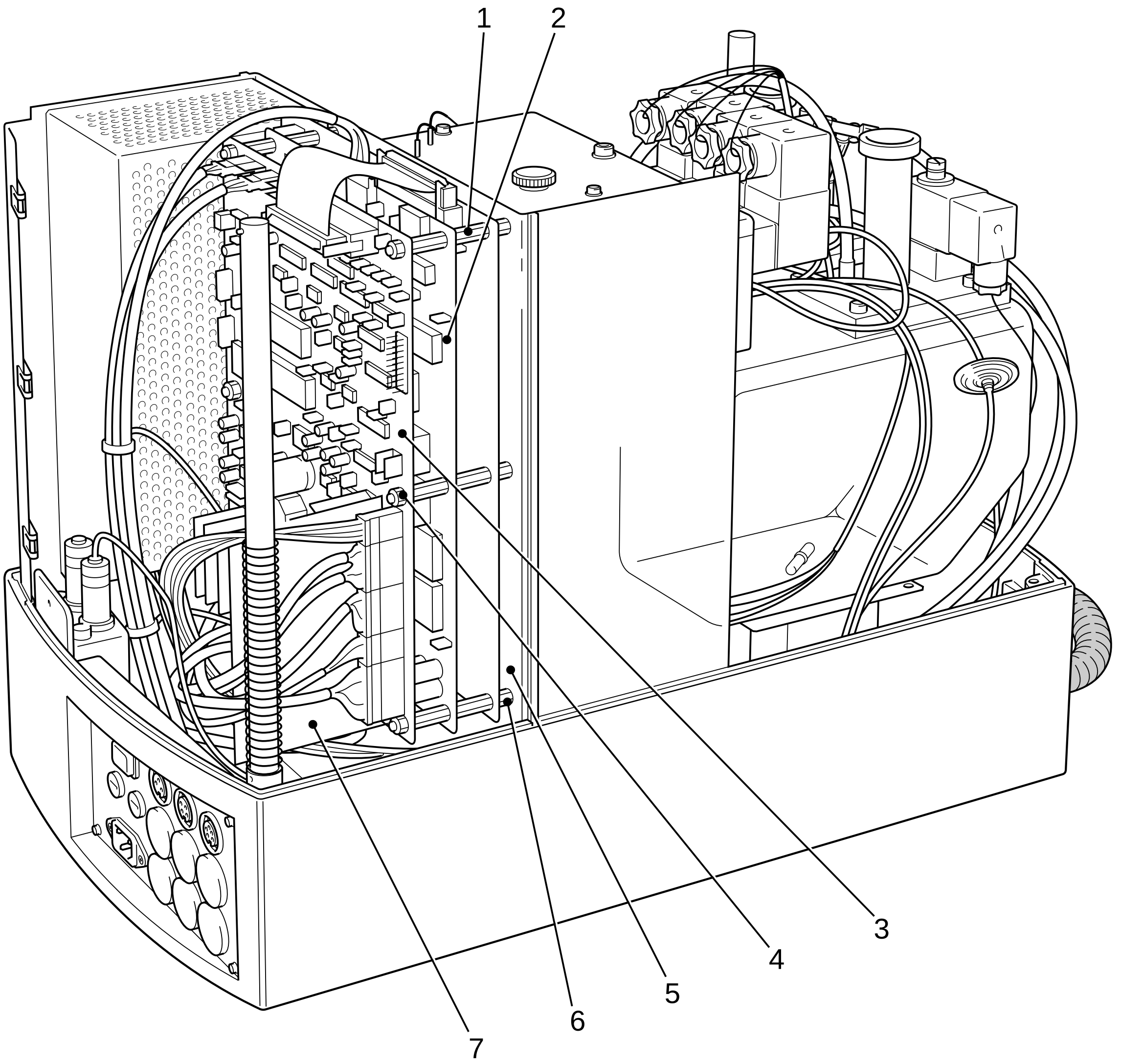
Removal

24 To remove the I/O board, proceed as follows:

24.1 Remove the ink pump motor driver board (Fig 11.26 (7)) from the I/O board. Note the orientation for refitting.

24.2 Remove all connectors from the I/O board noting their position and orientation for refitting.

24.3 Remove and retain the six securing nuts and washers (4). Pull the I/O board away from the CPU board (2) taking care not to damage the interboard connectors.



1	18 mm stand offs	5	Levels interface board (Pi)
2	CPU	6	10 mm stand offs
3	I/O board	7	Ink pump motor driver board
4	Securing nuts and washers		

Fig 11.26 CPU and I/O boards - removal and refitting

<u>Refitting</u>

25 To refit the I/O board, proceed as follows:

25.1 Position the I/O board (Fig 11.26 (3)) on the 18 mm stand offs (1) with the component side facing out and the LEVELS connector at the top right-hand corner.

25.2 Push the I/O board on to the CPU board (2), ensuring that the interboard connectors mate correctly.

25.3 Secure the I/O board using the six nuts and washers removed at Para 24.2. Refit the connectors.

25.4 Refit the ink pump motor driver board as noted at Para 24.1.

<u>Calibration</u>

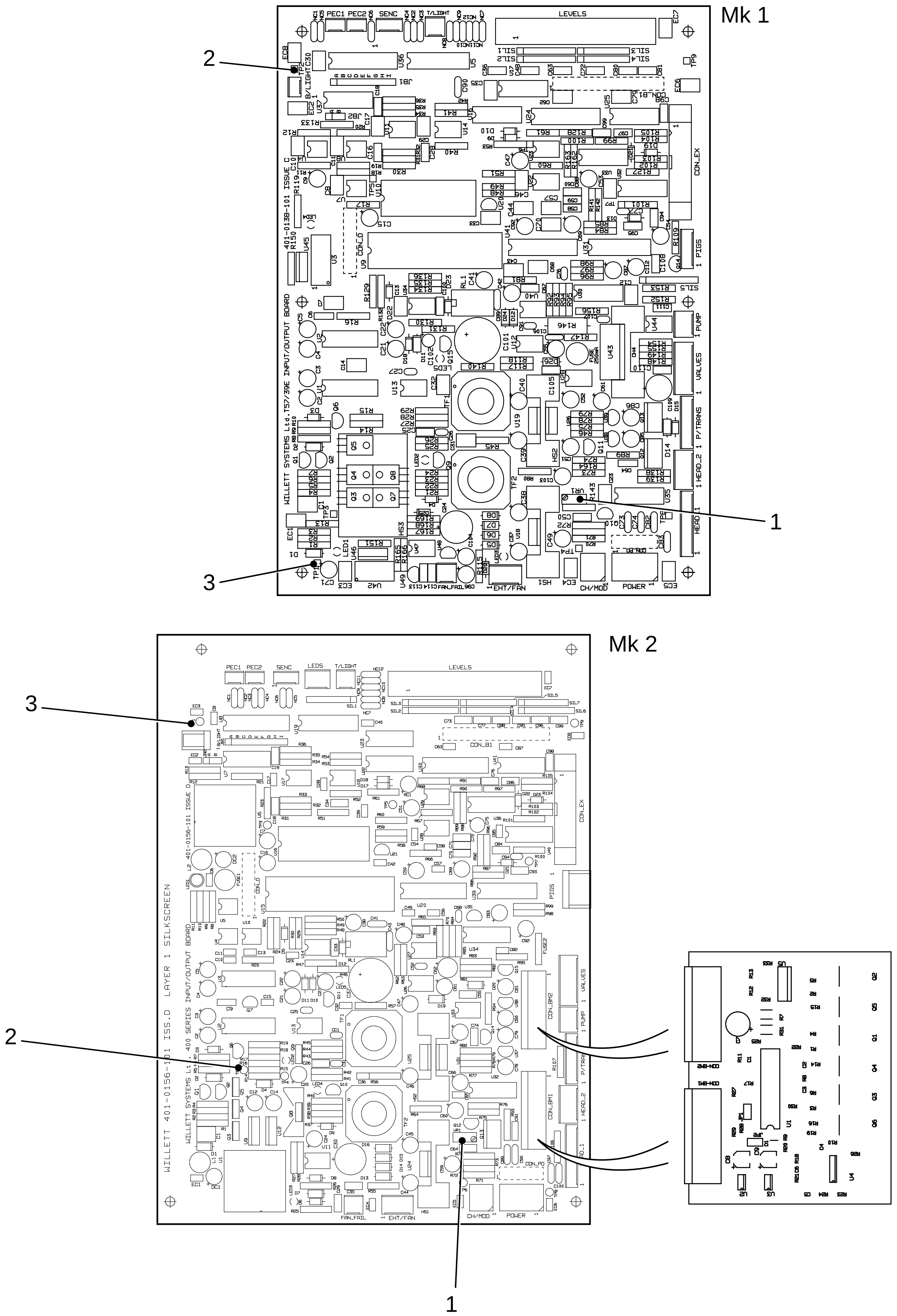
26 When a new I/O board is fitted, calibrate the 285 V rail limit as described below:

26.1 Reconnect power to the printer and switch on.

26.2 Set a digital volt meter to a range suitable for measuring 285 V DC. Connect the positive probe to TP2 (TP1; Mk1) (Fig 11.27 (2)) and the negative probe to TP1 (TP2; Mk1) (3).

26.3 Adjust VR1 (1) to give a reading of 285 V ± 1 V. When the adjustment has been made, seal VR1 with a suitable sealing compound.

26.4 Recalibrate the system (Para 91) and calibrate the modulation value (Para 121).



1 VR1 2 TP2 3 TP1

Fig 11.27 I/O board calibration

CPU board

The Pi machine is fitted with an extra circuit board behind the CPU board. The procedure for removal and refitting the CPU board is identical to that described below.

Removal

27 To remove the CPU board (Fig 11.26 (2)), proceed as follows:

27.1 Remove the I/O board (Para 24).

27.2 Remove all connectors from the CPU board, noting their position and orientation for refitting.

27.3 Remove and retain the six 18 mm stand offs (1) and remove the CPU board.

27.4 Note the position of all links on the old CPU board.

Refitting

28 To refit the CPU board, proceed as follows:

28.1 Set the links on the new CPU board as noted at Para 27.4.

28.2 Position the CPU board (Fig 11.26 (2)) on the six 10 mm stand offs (6) with the component side facing outwards and CON_K at the top left-hand corner.

28.3 Secure the CPU board with the six 18 mm stand offs (1) removed at Para 27.3.

28.4 Refit the connectors.

28.5 Refit the I/O board (Para 25) and download the correct software for the machine type (Section 9).

28.6 Calibrate the system (Para 91).

PSU

Removal

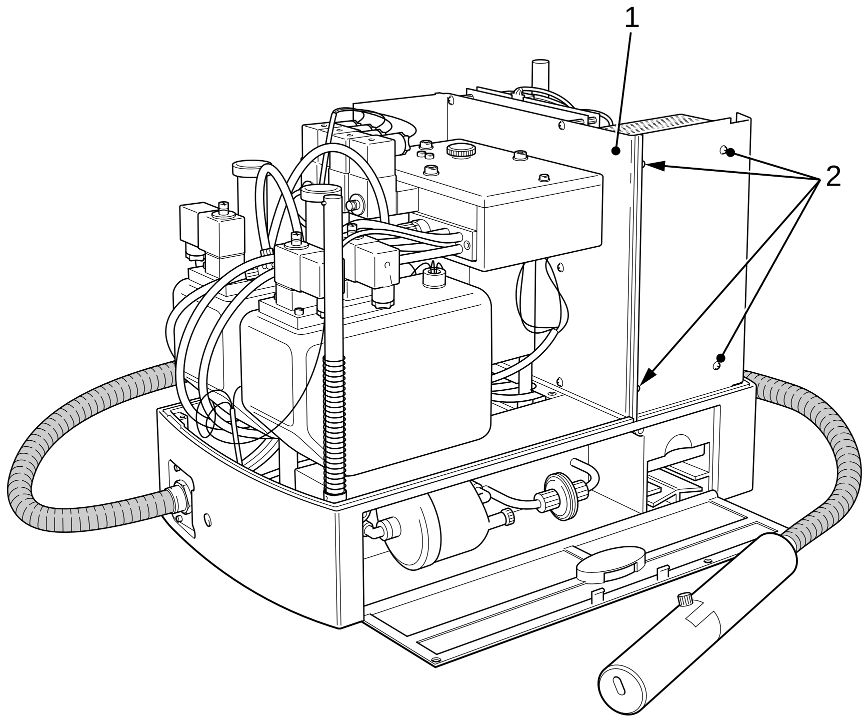
29 To remove the PSU module proceed as follows:

29.1 Disconnect the DC power cable from the POWER connector on the I/O board.

29.2 Remove and retain the screws and washers (Fig 11.28 (2)) that secure the PSU module to the baffle plate (1). Support the PSU to prevent damage to other components.

29.3 Lift up the PSU module sufficiently to gain access to the mains connector on the base. Disconnect the mains connector and earth leads.

29.4 The PSU module can now be removed, taking care that the DC power lead does not catch on any other components.



1 Baffle plate 2 PSU module securing screws and washers

Fig 11.28 PSU module

Refitting

30 To refit the PSU module, proceed as follows:

30.1 Hold the PSU above the cooling fan in the electronics compartment. Connect the mains input lead to the connector on the base of the CPU, reconnect the earth leads.

30.2 Align the fixing holes on the rear of the PSU with the corresponding holes in the baffle plate. Secure the PSU to the baffle plate using the screws and washers removed at Para 29.2.

30.3 Connect the DC power cable to the POWER connector on the I/O board.

PSU module fuse replacement

31 To replace the fuse in the PSU module, proceed as follows:

31.1 Remove the PSU module as described in Para 29.

31.2 Remove and retain the cover retaining screws at the base of the PSU and lift off the cover.

31.3 Remove the fuse F1 from its holder (at the bottom left-hand corner of the PCB) and fit a serviceable replacement (3A fast acting glass tube fuse, 5.5 mm dia, 21 mm long).

31.4 Refit the PSU cover and secure it with the screws removed at Para 31.2.

32 Refit the PSU as described at Para 30.

LCD and backlight

Removal

33 To remove the LCD and backlight panel assembly, proceed as follows:

33.1 Disconnect all cables, earth strap and the vent tube from the printer top moulding, noting their position and orientation for refitting.

33.2 Remove the top moulding from the printer (Section 9).

33.3 Place the top moulding (Fig 11.29 (7)) face down on a clean level surface. Protect the keypad membrane (1) from damage and contamination.

33.4 Remove and retain the securing nuts and washers (4) and the screw (5) which holds the keypad plate (3) in position. Remove the keypad plate from the top moulding, complete with the LCD panel assembly (2) and backlight inverter (6).

33.5 Remove and retain the four nuts securing the LCD panel assembly to the keypad plate. Remove the LCD panel and backlight inverter (These two items are supplied as one complete assembly). Note the orientation of the backlight inverter in its housing for refitting.

Refitting

34 To refit the LCD and backlight panel assembly, proceed as follows:

34.1 Fit the LCD panel (Fig 11.29 (2)) to the keypad plate (3) and secure it using the four nuts removed at Para 33.5.

34.2 Fit the keypad plate (3) in position on the top moulding (7) ensuring that the backlight inverter is placed correctly in its housing and the seal (8) is seated correctly.

34.3 Secure the keypad plate to the top moulding using the screw (5) and nuts and washers (4) removed at Para 33.4.

34.4 Fit the top moulding to the printer and reconnect the vent tube and cables and earth strap which were disconnected at Para 33.1.

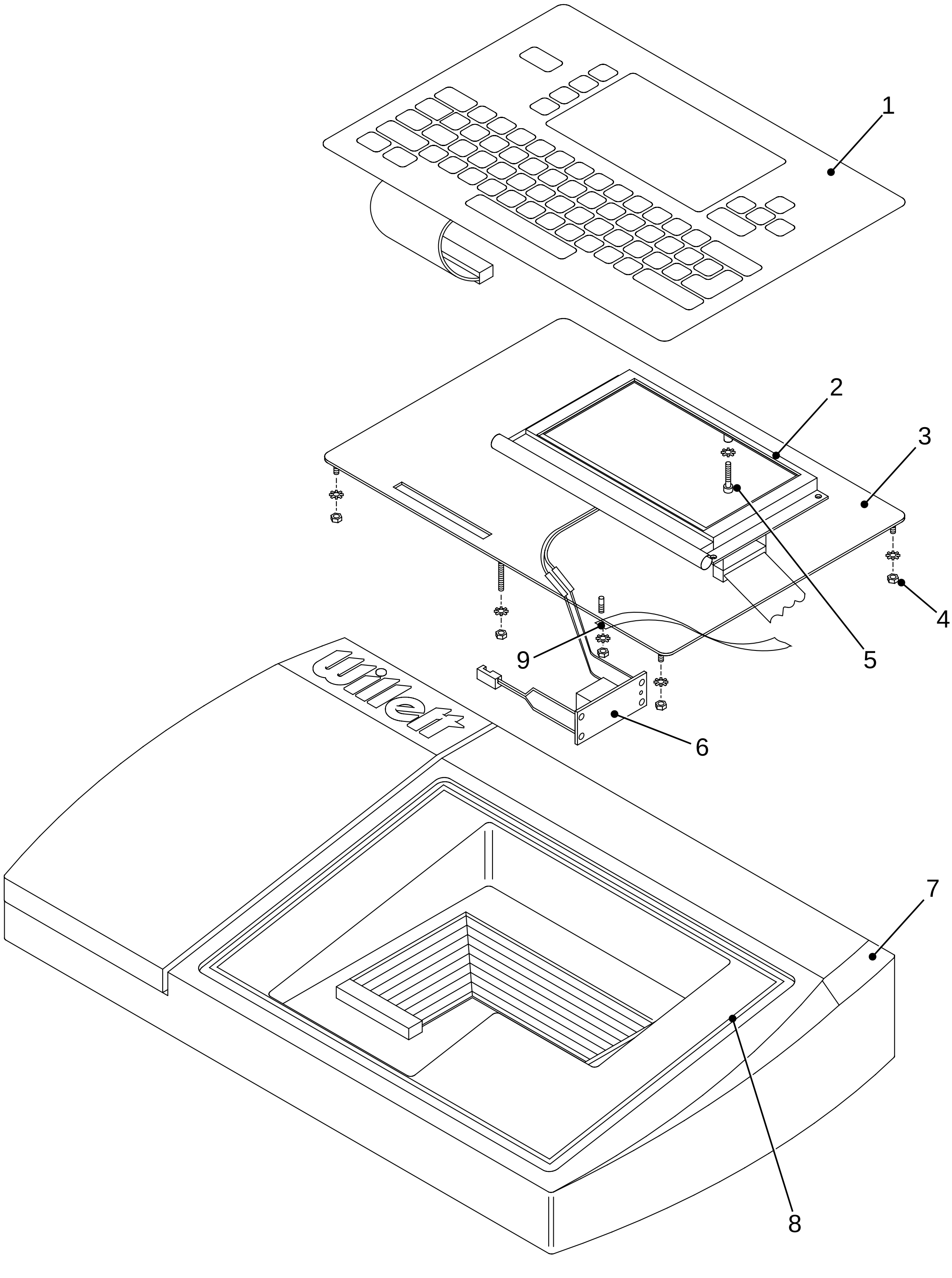
Keypad

Removal

35 To remove the keypad, proceed as follows:

35.1 Remove the keypad plate from the printer as described in Para 33.1 to 33.4.

35.2 Peel the keypad (Fig 11.29 (1)) from the keypad plate (3).



1	Keypad	6	Backlight inverter
2	LCD panel assembly	7	Top moulding
3	Keypad plate	8	Seal
4	Securing nuts and washers	9	Earth strap
5	Securing screw		

Fig 11.29 Top moulding, keypad and LCD panel

<u>Refitting</u>

36 To fit a new keypad, proceed as follows:

36.1 Clean the keypad plate (Fig 11.29 (3)) to remove any old adhesive left by the old keypad.

36.2 Remove the backing from the new keypad and fix it in position on the keypad plate.

36.3 Refit the keypad plate as described in Para 34.2 to 34.4.

Ink or top up reservoir sensor

<u>Removal</u>

37 AWAITING INFORMATION

<u>Refitting</u>

38 AWAITING INFORMATION

Mains inlet connector

<u>Removal</u>

39 To remove the mains inlet connector (Fig 11.30 (1)), proceed as follows:

39.1 Remove and retain the two screws (Fig 11.31 (5)), nuts and washers (6) which secure the inlet connector (4) to the connector panel (1).

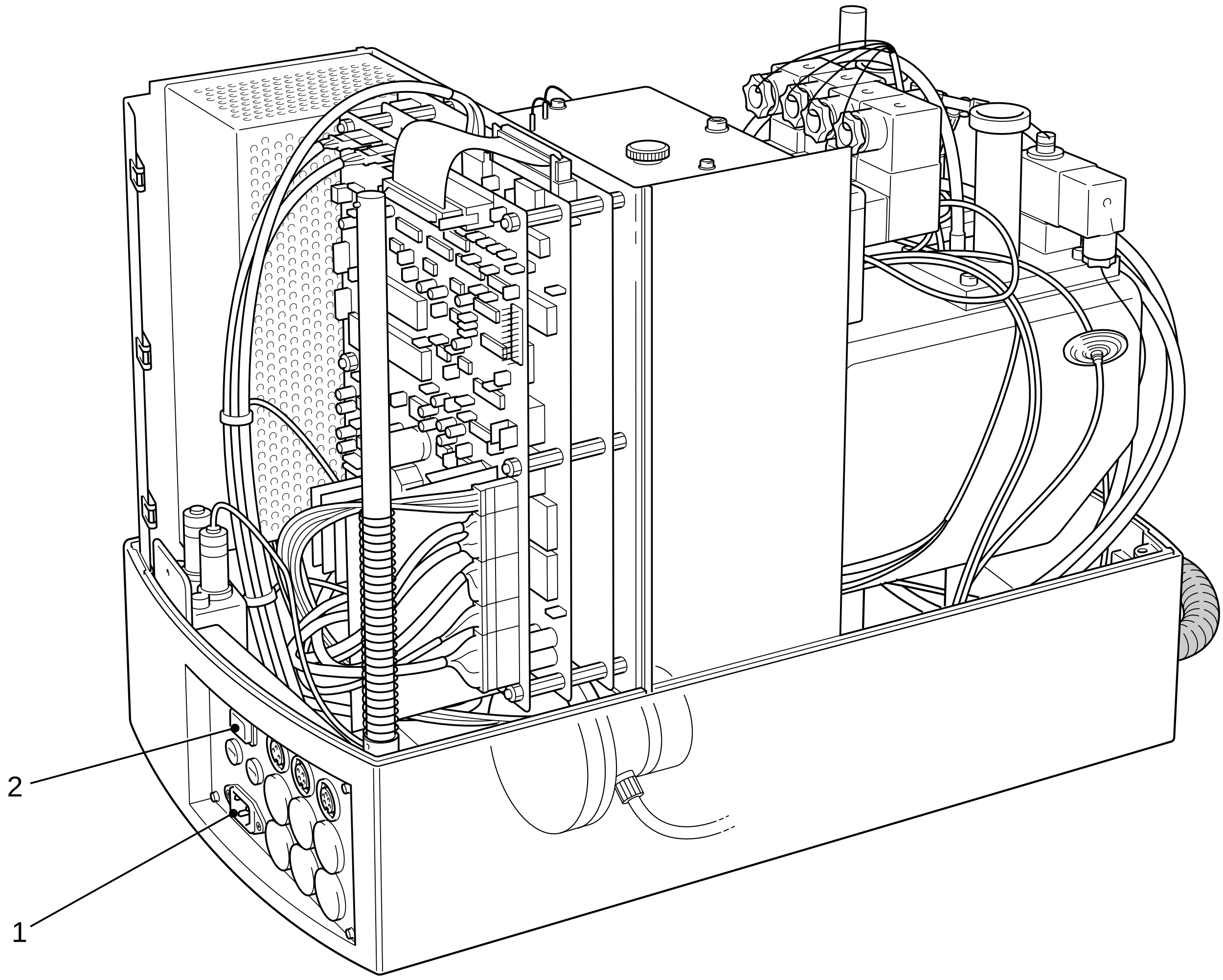
39.2 Withdraw the inlet connector from the printer and disconnect the cables from the terminals at the rear. Note the orientation of the cables for refitting.

<u>Refitting</u>

40 To refit the mains inlet connector, proceed as follows:

40.1 Refit the cables, removed at Para 39.2, to the terminals on the rear of the inlet connector (Fig 11.31 (4)).

40.2 Fit the inlet connector to the connector panel (1) and secure it with the screws (5), nuts and washers (6) removed at Para 39.1.



1 Mains inlet connector 2 Mains switch

Fig 11.30 Mains inlet connector and mains switch

Mains switch

Removal

41 To remove the mains switch (Fig 11.30 (2)), proceed as follows:

41.1 Remove the cables from the terminals at the rear of the mains switch (Fig 11.31 (2)) noting their position for refitting.

41.2 Remove the cover (3) from the mains switch.

41.3 Push the switch out of its mounting hole, noting the orientation for refitting.

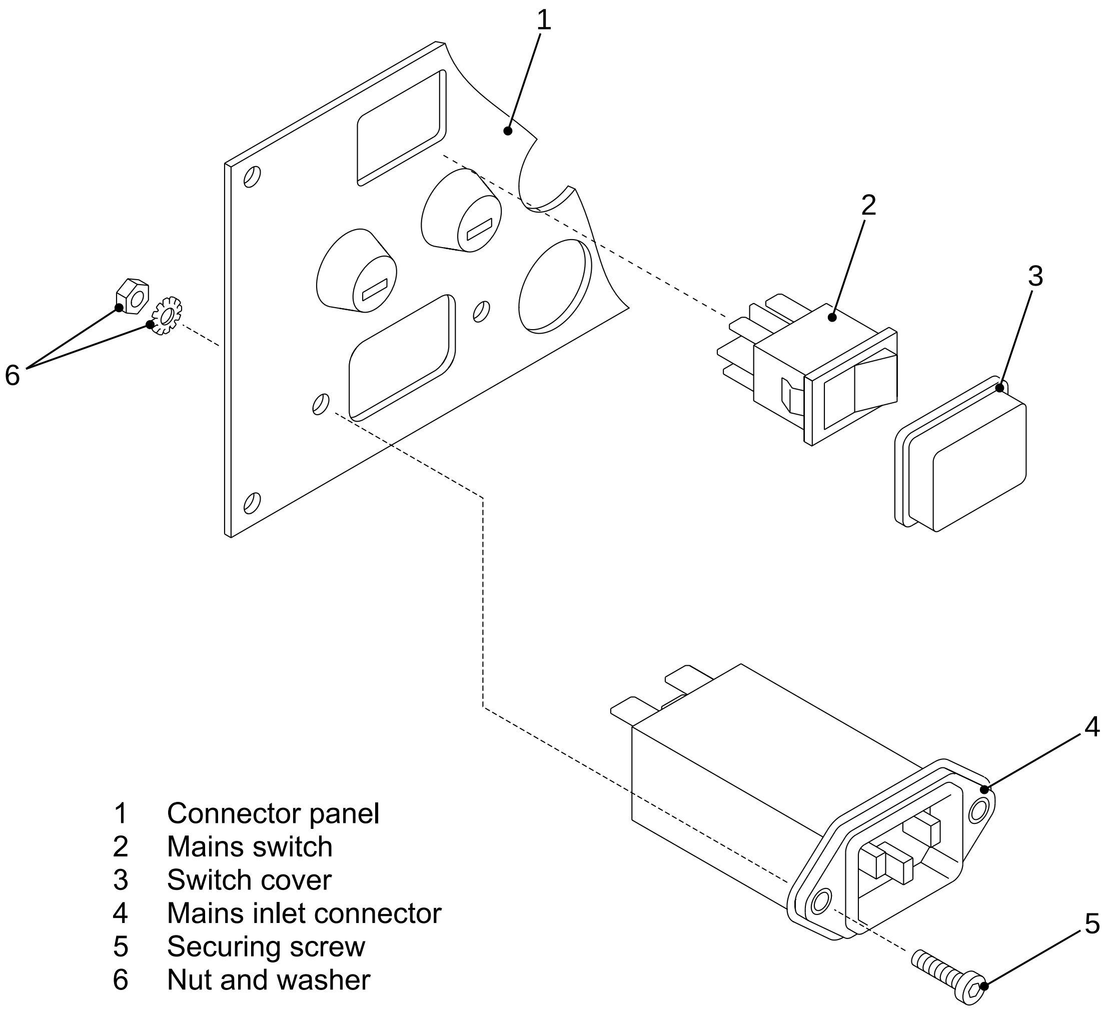


Fig 11.31 Inlet connector and mains switch - removal and refitting

<u>Refitting</u>

42 Push the mains switch (Fig 11.31 (2)) into its mounting hole after first checking that the orientation is correct.

43 Fit the cover (3) to the switch.

44 Reconnect the cables, removed at Para 41.1, to the terminals at the rear of the switch.

(1) PERSONAL INJURY. SAFETY GLASSES (WITH SIDE SHIELDS) ARE TO BE WORN AT ALL TIMES WHEN HANDLING INKS AND TOP UPS. ALSO IT IS ADVISABLE TO WEAR SAFETY GLASSES WHEN CARRYING OUT MAINTENANCE.

(2) PERSONAL INJURY. IT IS RECOMMENDED THAT PROTECTIVE GLOVES AND CLOTHING BE WORN.

(3) PERSONAL INJURY. USE HAND BARRIER CREAM WHEN HANDLING INK.

(4) PERSONAL INJURY. IF SKIN IS CONTAMINATED BY INK OR TOP UP, WASH WITH SOAPY WATER. DO NOT USE SOLVENT TO CLEAN INK STAINS FROM THE SKIN.

(5) FIRE HAZARD. IMMEDIATELY AFTER USE REMOVE ANY TISSUE OR CLOTHS THAT BECOME SATURATED WITH INK OR TOP UP. DISPOSAL OF SUCH ITEMS SHOULD BE SUCH THAT THERE IS NO DANGER OF A FIRE RISK OR HEALTH HAZARD.

(6) FIRE HAZARD. IN THE EVENT THAT A CONTAINER IS LEFT CONTAINING INK OR SOLVENT, IT SHOULD BE RESEALED. HOWEVER, SINCE ONLY FULL BOTTLES ARE RECOMMENDED TO BE USED WHEN REPLENISHING INK OR TOP UP, IT IS RECOMMENDED THAT PARTIALLY FILLED BOTTLES BE DISCARDED IN A WAY THAT WILL NOT POSE A FIRE OR HEALTH HAZARD.

(7) FIRE HAZARD. THE INK AND TOP UP IS VOLATILE AND FLAMMABLE, EXTREME CARE MUST BE USED WHEN HANDLING AND STORING THEM.

Fluid management system (FMS)

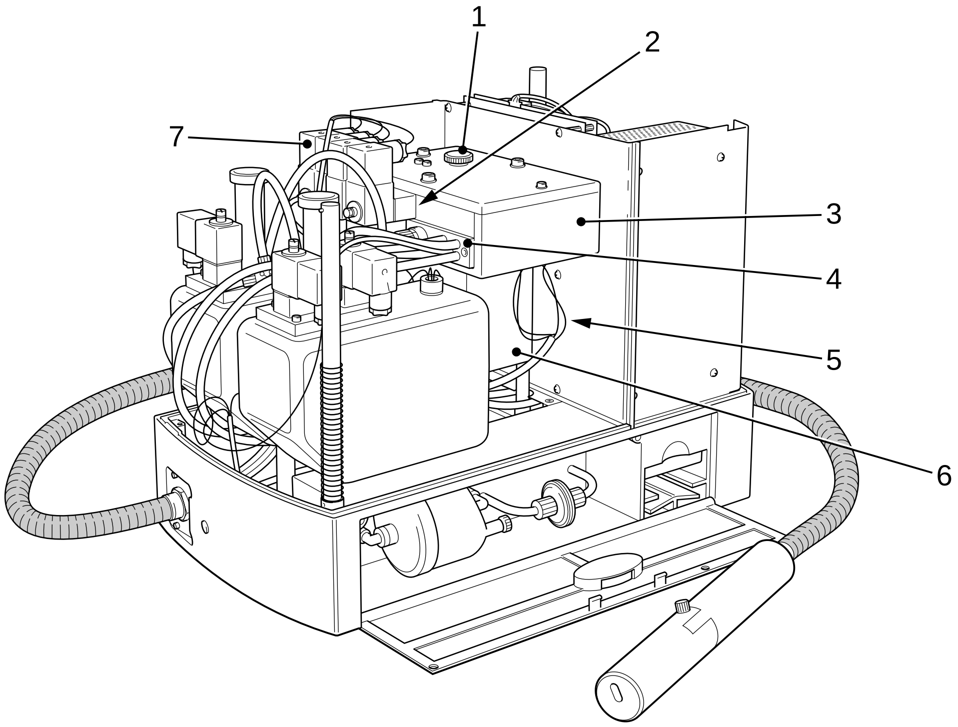
Removal

45 To remove the FMS (Fig 11.32 (3)), proceed as follows:

45.1 Remove the filler plug (1) and drain the ink system using a syringe and a length of plastic tubing.

45.2 Unsolder the connections to the VMS level sensors (5) and the mixer tank sensors (located in the base of the mixer tank (6)), (Slide the heatshrink on each lead back on to the cable looms to reveal the soldered connections). Note the colour and destination of each sensor lead.

45.3 Unplug the in-line temperature sensor connector. The temperature sensor is located next to the level sensors in the base of the mixer tank.



1	Filler plug	5	VMS sensor connections
2	Printhead manifold	6	Mixer tank
3	FMS	7	Valves
4	Main manifold		

Fig 11.32 Ink system removal

45.4 Remove and retain the two screws securing the printhead manifold (situated underneath the valves). Pull the manifold clear of the ink system (take care to retain the manifold O-rings).

45.5 Remove the electrical connectors from the valves (7) V3, V6, V8 and V10.

45.6 Remove and retain the three screws securing the main manifold (4). Pull the manifold clear of the ink system (take care to retain the manifold O-rings).

45.7 Tilt the printer, or place in a suitable position across a bench corner, to gain access to the underneath of the machine.

45.8 Locate the three screws that secure the FMS mounting pillars to the base moulding. Remove and retain the screws. The FMS can now be removed from the printer.

On a Pi machine check that the stirrer bar is correctly positioned at the bottom of the mixer tank prior to refitting the FMS.

Refitting

46 To refit the FMS (Fig 11.32 (3)), proceed as follows:

46.1 Tilt the printer, or place in a suitable position across a bench corner, to gain access to the underneath of the machine.

46.2 Place the FMS in position and secure it to the base moulding using the screws removed at Para 45.8.

46.3 Fit the main manifold (4) to the FMS and secure it to the ink system with the three screws removed at Para 45.6 (ensure all the O-rings are refitted in their correct positions).

46.4 Refit the electrical connectors to the valves (7) V3, V6, V8 and V10.

46.5 Fit the printhead manifold in position beneath the valves and secure it using the two screws removed at Para 45.4 (ensure all the O-rings are refitted in their correct positions).

46.6 Reconnect the inline connector to the temperature sensor lead.

46.7 Resolder the connections to the VMS level sensors (5) and the mixer tank sensors. Fit protective heatshrink over each soldered joint.

46.8 Commission the ink system as described in Para 107, 108, and 112.

46.9 Recalibrate the VMS as described in Para 114.

Ink system pump

Removal

47 To remove the ink system pump (Fig 11.33 (5)), proceed as follows:

47.1 Disconnect the top of the pump feed pipe (4) from the T connector (1) located closest to Valve V1 (Top up valve). This will prevent ink being siphoned from the ink system when the pump is disconnected.

47.2 Disconnect the PUMP connector (3) from the I/O board.

47.3 Remove and retain the two screws (2) securing the baffle plate to the base moulding.

47.4 Move the baffle plate assembly to one side to allow access to the pump (see Para 47.5 for white Pi machine).

47.5 White Pi only; remove the connector panel to allow access to the pump.

47.6 Place a wad of tissue or absorbent cloth underneath the pump to catch any ink spillage.

47.7 Disconnect the inkfeed (4) and outlet pipes from the pump.

47.8 Use the arrow on the pump head to note orientation.

47.9 Remove and retain the two screws securing the pump. Withdraw the pump and its sealing gasket. Discard the gasket.

Refitting

48 To refit the ink system pump (Fig 11.33 (5)) proceed as follows:

48.1 Ensure that the pump is the correct type for the machine.

48.2 Place the pump in position, with a new sealing gasket fitted between the pump and the bulkhead (see Para 48.3 for white Pi machine), ensure that the pump orientation is correct.

48.3 White Pi only; place the pump in position through the connector panel cavity, with a new sealing gasket fitted between the pump and the bulkhead, ensure that the pump orientation is correct.

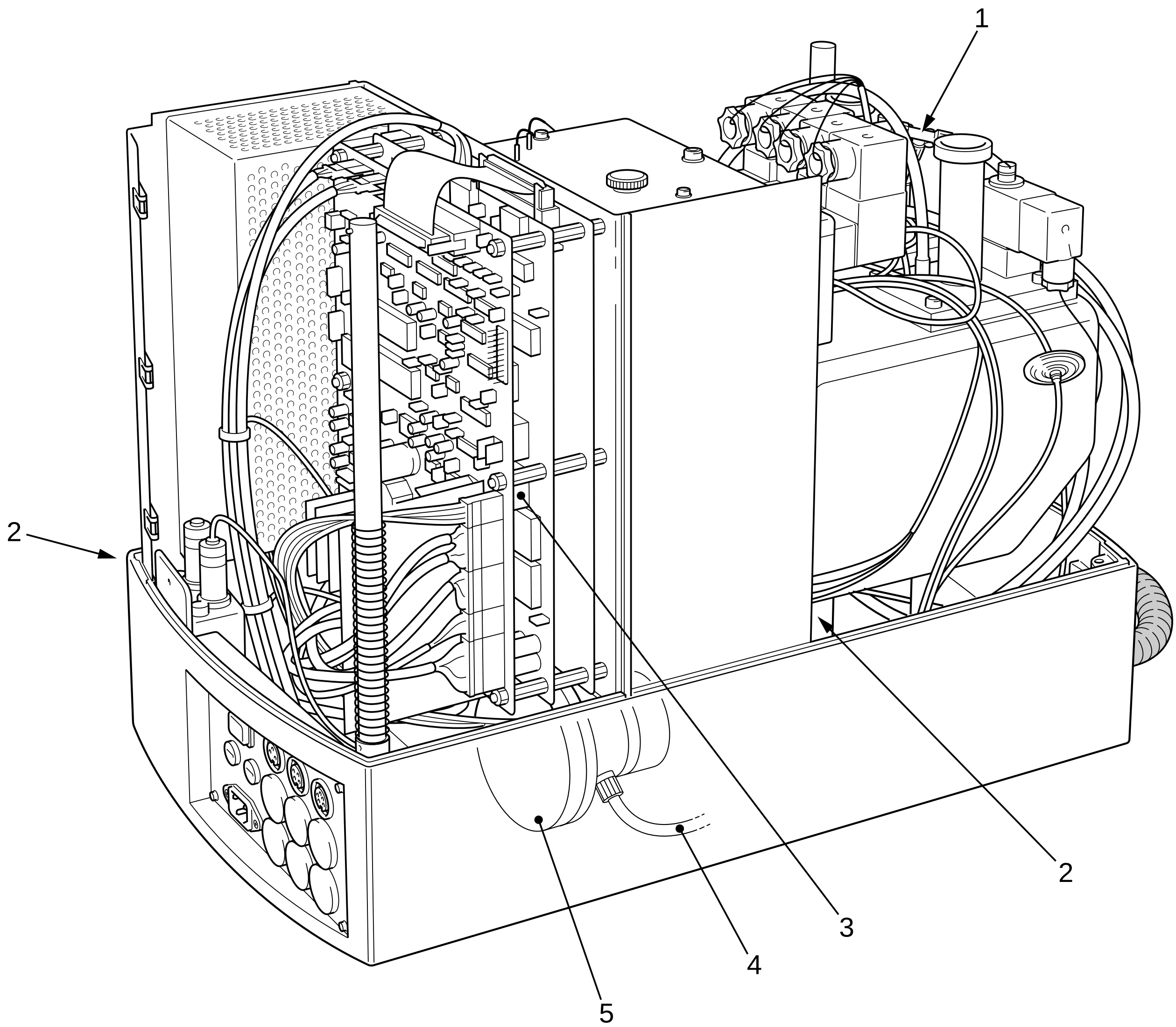
48.4 Secure the pump to the bulkhead, using the two screws removed at Para 47.9.

48.5 Connect the ink feed (4) and outlet pipes to the pump.

48.6 Connect the top of the inkfeed pipe to the T connector (1) next to V1 (Top up valve). Remove the tissue or cloth (placed to catch ink spillage) from beneath the pump.

48.7 Put the baffle plate in position and secure it with the two screws (2) removed at Para 47.3.

48.8 Connect the PUMP connector (3) to the I/O board.



1 T connector
2 Baffle plate fixing screw
3 PUMP connector
4 Pump feed pipe
5 Ink system pump

Fig 11.33 Ink system pump removal

Valves

Removal

49 To remove a valve, proceed as follows:

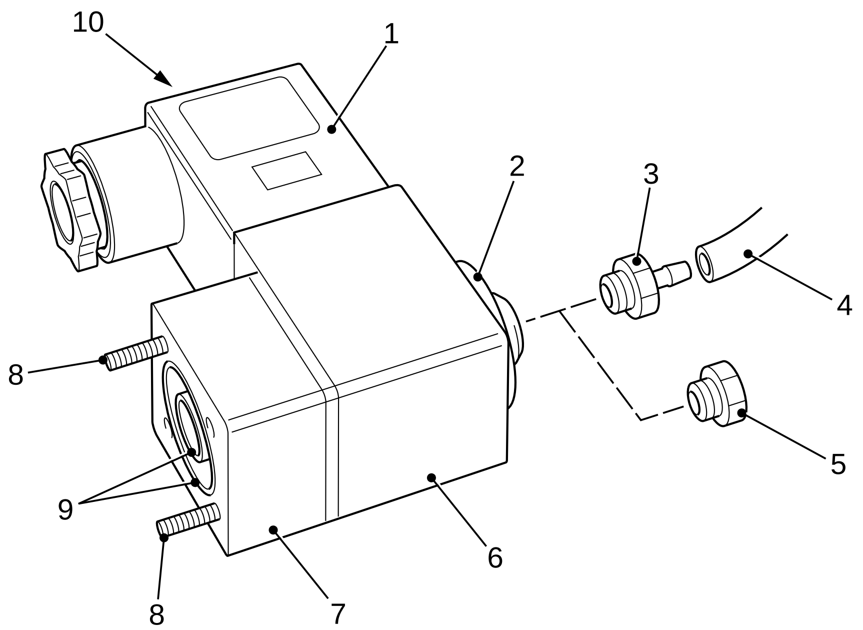
49.1 Remove the electrical connector (Fig 11.34 (1)) from the body of the valve after slackening the captive retaining screw (10).

49.2 Remove the tube (4) from the barb (3) on valves V3, V8 or V6 (note the colour of the stripe on the tube).

49.3 Remove the plug (5) from valves V1, V2, V4 and V10.

49.4 Remove the circlip (2) and slide the solenoid windings (6) off the valve block (7) (note the orientation of the solenoid).

49.5 Remove and retain the two screws (8) securing the valve block to the manifold. Remove the valve block, complete with O-rings. Retain the O-rings (9).



1	Electrical connector	6	Solenoid windings
2	Circlip	7	Valve block
3	Barb	8	Retaining screws
4	Tube	9	O-ring seals
5	Plug	10	Captive retaining screw

Fig 11.34 Valve components

Refitting

50 To refit a valve, proceed as follows:

50.1 Fit the O-rings (Fig 11.34 (9)), removed at Para 49.5, to the valve block (7).

50.2 Fit the valve block to the manifold and secure it with the two screws (8) removed at Para 49.5.

50.3 Slide the solenoid windings (6) on to the valve block and secure with the circlip.

50.4 Refit the electrical connector (1) and secure it with the captive screw.

50.5 Refit the tube (4) on to the barb (3) on valves V3, V8 or V6 (ensure the tube with the correct colour stripe is fitted).

50.6 Refit the plug (5) on to the valves V1, V2, V4 or V10.

Fan

Removal

51 To remove the electronics compartment cooling fan proceed as follows:

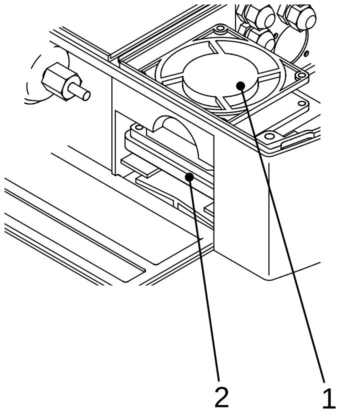
51.1 Disconnect the FAN/EHT plug from the I/O board. Identify the two leads that go to the fan (pins 4 and 5) and remove them from the plug by pressing the crimp release lugs on the side. Make a note of the colour and destination of each lead.

51.2 Remove and retain the two screws that secure the baffle plate to the base moulding. Move the baffle plate assembly to one side to reveal the fan (Fig 11.35 (1)).

EQUIPMENT DAMAGE. Ensure that the fan fail sensor is not damaged when removing or refitting the filter housing.

51.3 Support the filter housing (2) and remove the two screws securing the fan. These screws fasten into holes in the filter housing, which will drop if not supported. Remove the filter housing (see Caution) and put to one side.

51.4 Remove the fan from the electronics compartment.



1 Fan
2 Filter housing

Fig 11.35 Fan removal

Refitting

52 To refit the electronics compartment cooling fan, proceed as follows:

EQUIPMENT DAMAGE. Ensure that the fan fail sensor is not damaged when removing or refitting the filter housing.

52.1 Place the fan (Fig 11.35 (1)) in position in the electronics compartment. Hold the fan filter housing (2) in position in the filter compartment and align the fixing holes with the holes in the fan casing. Secure the fan to the filter housing using the screws removed at Para 51.3.

52.2 Insert the crimped ends of the fan power lead into the FAN/EHT plug in the positions noted in Para 51.1. It may be necessary to open the crimp release lugs to enable the crimp to lock back into position inside the connector.

52.3 Put the baffle plate assembly back into its correct position and secure it to the base moulding using the screws removed at Para 51.2.

52.4 Connect the FAN/EHT plug to the I/O board.

Fan failure card

Removal

53 The fan failure card is located in the electronics compartment, with two temperature sensors protruding into the filter compartment, just below the fan filter.

54 To remove the fan failure card, proceed as follows:

54.1 Disconnect the FAN FAIL connector from its location at bottom centre of the I/O board.

54.2 Remove and retain the nylon screw securing the fan failure card. The screw is located in the filter compartment, below the fan filter.

54.3 The fan failure card can now be removed from the electronics compartment.

Refitting

55 To refit the fan failure card, proceed as follows:

55.1 Place the card in position with the temperature sensors protruding in to the filter compartment.

55.2 Secure the card with the nylon screw removed at Para 54.2.

55.3 Connect the FAN FAIL connector to the I/O board.

EHT module

Removal

56 To remove the EHT module (Fig 11.36 (3)), proceed as follows:

56.1 Remove the two screws (1) securing the baffle plate to the base moulding. Move the baffle plate assembly (2) so that it is clear of the EHT module.

56.2 Remove the EHT connector (4) from the EHT module.

56.3 Lift the EHT module clear of its housing and disconnect the low voltage connector from its base.

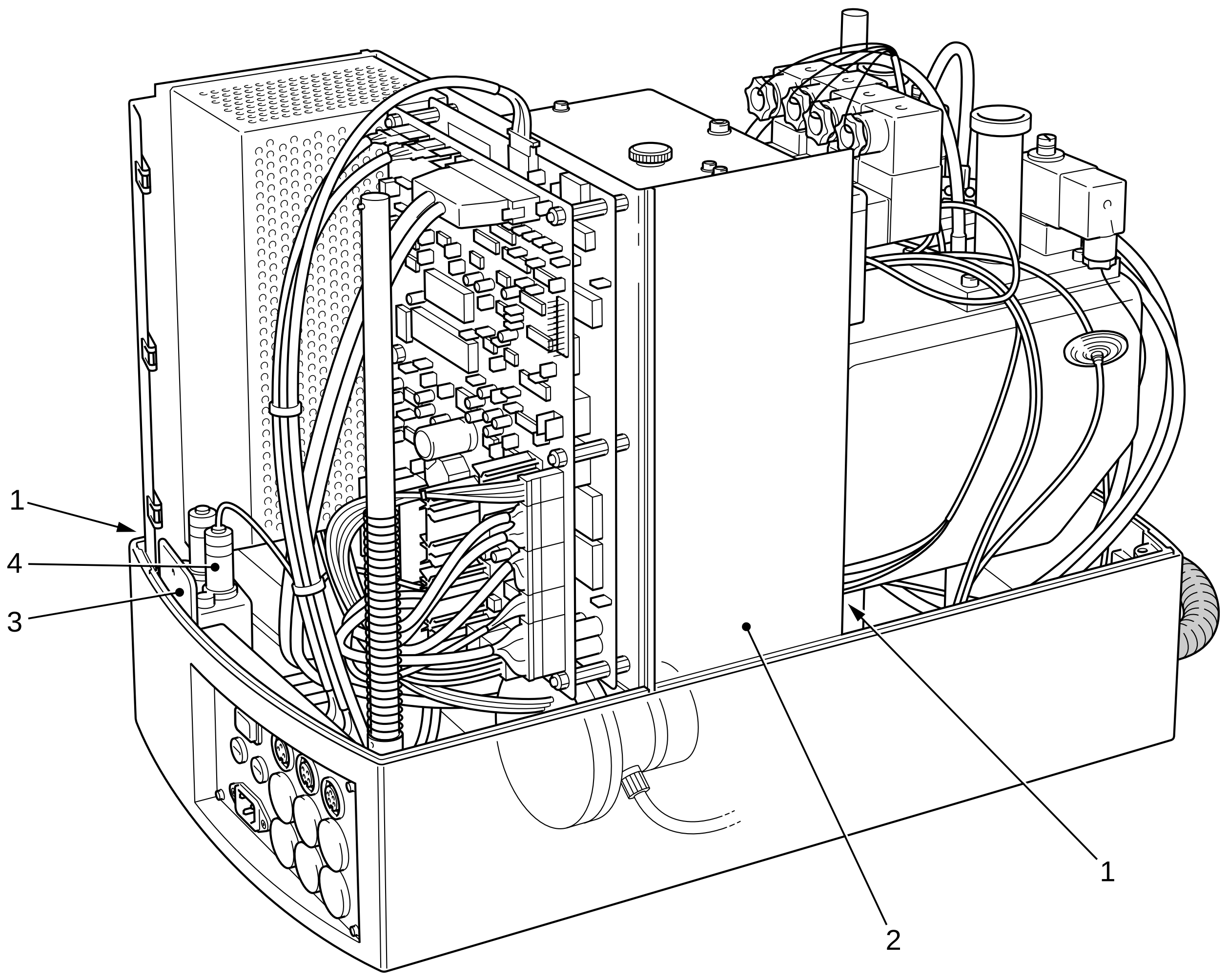
Refitting

57 To refit the EHT module (Fig 11.36 (3)) proceed as follows:

57.1 Fit the low voltage connector to the base of the module and place the module in its housing.

57.2 Fit the EHT connector (4) to the top of the module.

57.3 Replace the baffle plate assembly (2) in its correct position and secure it with the two screws (1) removed at Para 56.1.



1	Baffle plate securing screw	3	EHT module
2	Baffle plate assembly	4	EHT connector

Fig 11.36 EHT module removal

Gutter detect module

Removal

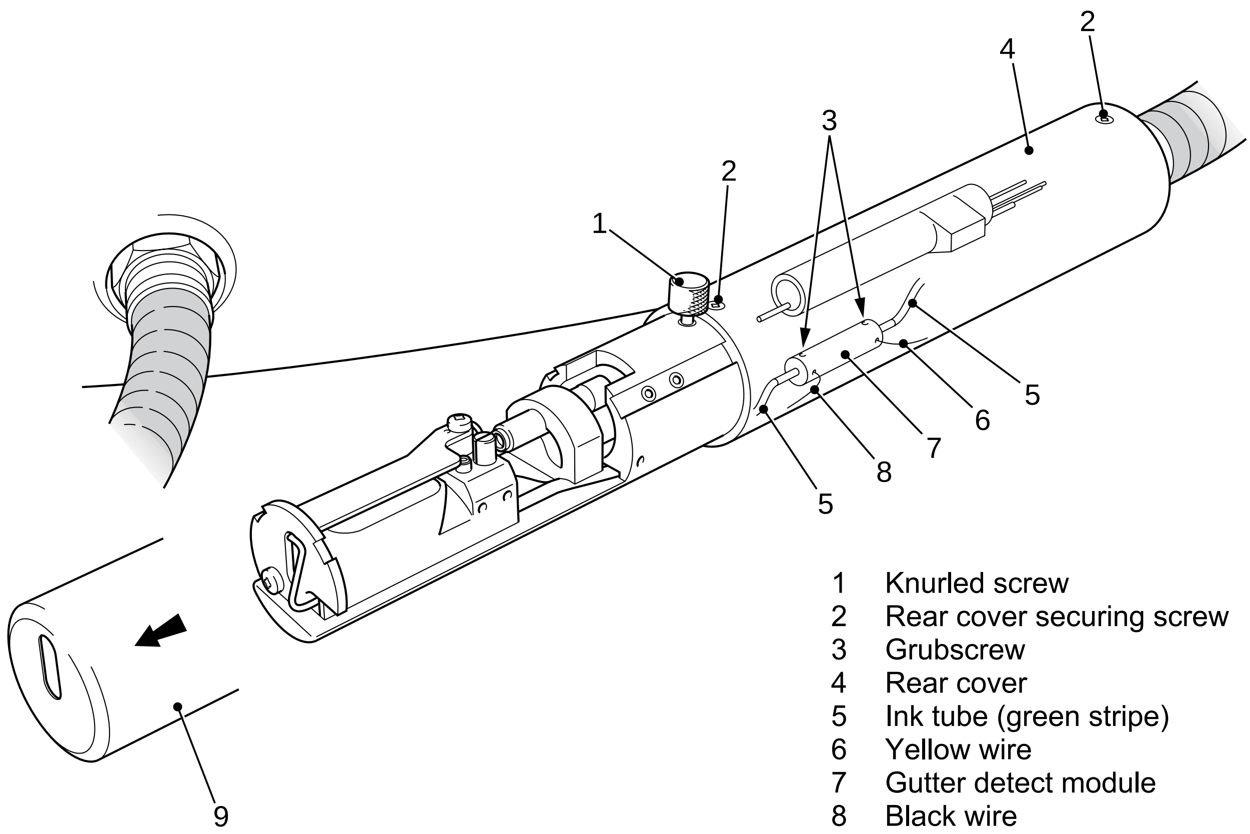
58 To remove the gutter detect module (Fig 11.37 (7)), proceed as follows:

58.1 Slacken the knurled screw (1) and slide the front cover (9) off the printhead.

58.2 Remove and retain the rear cover securing screws (2). Slide the rear cover (4) back over the umbilical until it is clear of the printhead.

58.3 On the gutter detect module (7), slacken the grubscrews (3) and pull the yellow wire (6) and black wire (8) out of the module.

58.4 Pull the ink tubes (green stripe) (5) off each end of the gutter detect module. The module can now be removed from the printhead.



1 Knurled screw
2 Rear cover securing screw
3 Grubscrew
4 Rear cover
5 Ink tube (green stripe)
6 Yellow wire
7 Gutter detect module
8 Black wire
9 Front cover

Fig 11.37 Gutter detect module removal

Refitting

59 To refit the gutter detect module (Fig 11.37 (7)), proceed as follows:

59.1 Place the gutter detect module in position and attach the ink tubes (green stripe) (5) to each end of the module.

59.2 Place the ends of the yellow wire (6) and the black wire (8) in the holes at the positions shown at Fig 11.37. Secure the wires by tightening the grubscrews (3).

59.3 Slide the rear cover (4) into position and secure it with the securing screws (2) which were removed at Para 58.2.

59.4 Slide the front cover on to the printhead and secure it with the knurled screw (1).

Head heater

Removal

60 To remove the head heater (Fig 11.38 (4)), proceed as follows:

60.1 Slacken the knurled screw (1) and slide the front cover (7) off the printhead.

60.2 Remove and retain the two rear cover securing screws (2). Slide the rear cover (6) back over the umbilical until it is clear of the printhead.

60.3 Remove the heatshrink from the five electrical connections (5) at the rear of the head heater. Make a note of how the wires are connected and then unsolder the connections.

60.4 Remove the ink tubes (3) from the front and rear of the head heater.

60.5 The head heater can now be removed from the printhead.

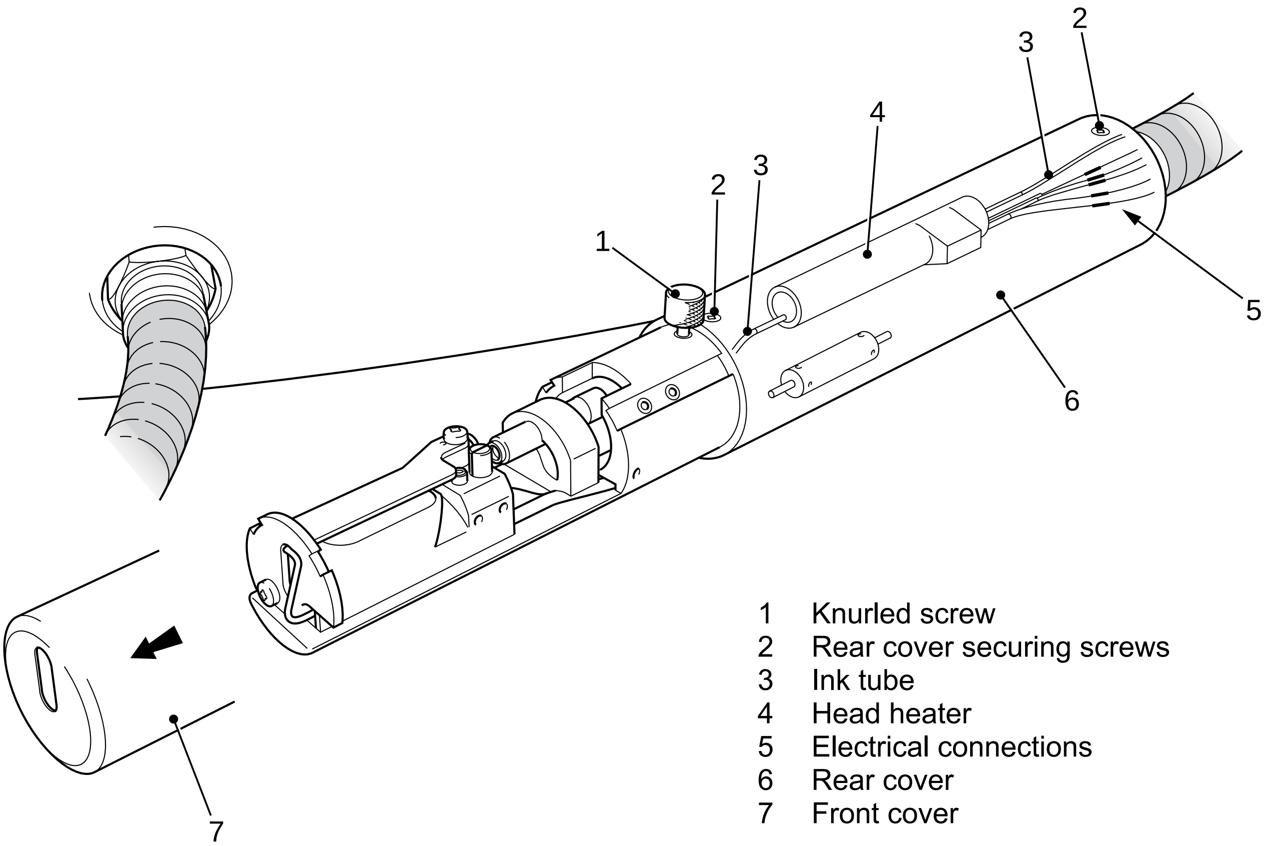


Fig 11.38 Head heater removal

Refitting

61 To refit the head heater (Fig 11.38 (4)) to the printhead, proceed as follows:

61.1 Place the head heater in position on the printhead, with the electrical connections to the rear.

61.2 Slide a new length of heat shrink on to one side of each of the electrical connections. Resolder the connections (as noted in Para 60.3) and slide the heatshrink over each soldered joint.

61.3 Push the ink tubes (3) on to the connectors at each end of the head heater.

61.4 Slide the rear cover (6) into position on the printhead and secure it with the two screws (2) removed at Para 60.2.

61.5 Slide the front cover on to the printhead and secure it with the knurled screw (1).

Phase detector

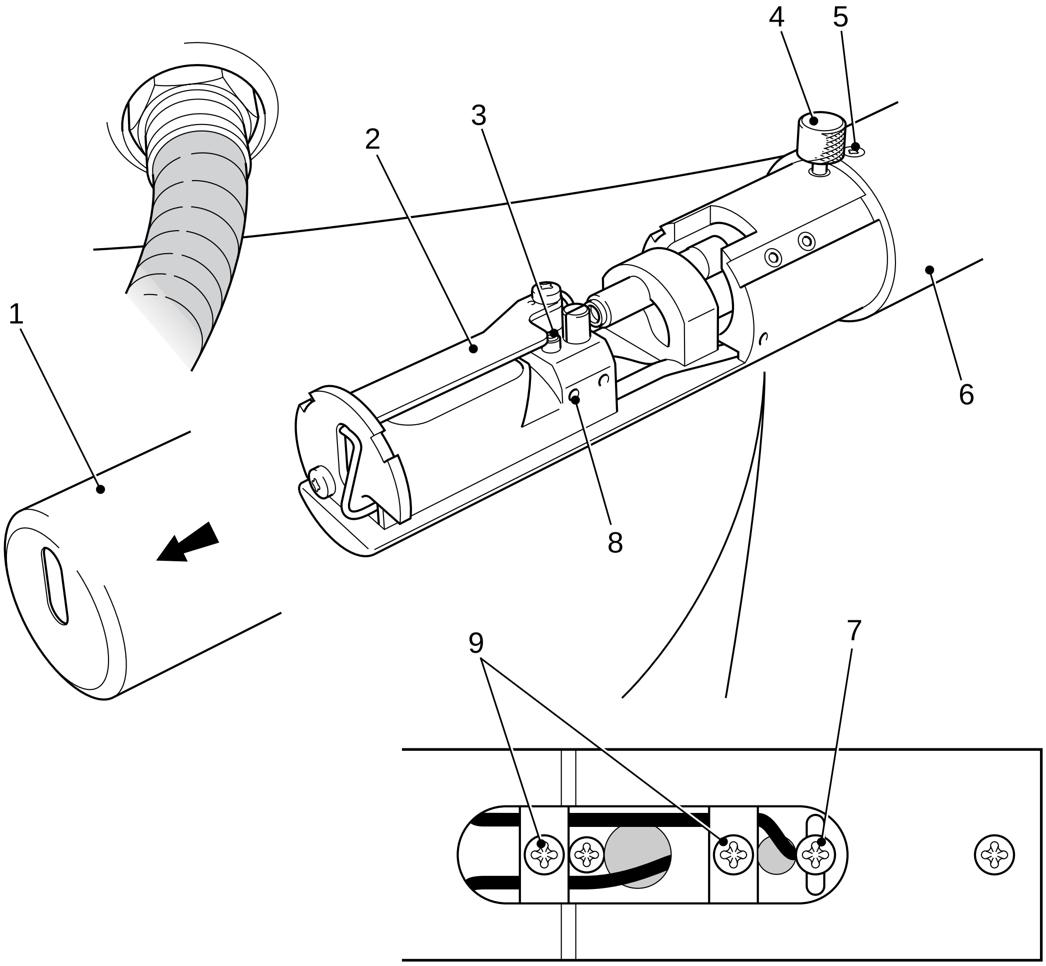
Removal

62 To remove the phase detector (Fig 11.39 (3)) from the printhead, proceed as follows:

62.1 Slacken the knurled screw (4) and slide the front cover off the printhead.

62.2 Remove and retain the two rear cover securing screws (5) and slide the rear cover (6) back until it is clear of the printhead.

62.3 Remove the heatshrink from the connections between the phase detector and the cable loom. Make a note of how the wires are connected and desolder the connections.



1	Printhead front cover	6	Rear cover
2	Top deflector plate	7	Phase detector cable
3	Phase detector	8	Phase detector clamping screw
4	Knurled screw	9	Cable clamp screw (x2)
5	Rear cover securing screw		

Fig 11.39 Phase detector removal and refitting

62.4 Slacken the phase detector clamping screw (8) and slide out the detector. If necessary, move the top deflector plate (2) to gain access to the clamping screw.

62.5 Slacken the rear cable clamp screws (9) to release the phase detector cable.

62.6 Remove the phase detector from the printhead.

Refitting

63 To refit the phase detector (Fig 11.39 (3)) to the printhead, proceed as follows:

63.1 Route the phase detector cable (7), through the cable clamps (9) to the rear of the printhead. Tighten the rear cable clamp screws (9), making sure that the cables are not crushed by the clamp.

63.2 Slide the phase detector into its mounting hole and position it so that the top of the detector is 1mm below the printhead nozzle orifice. Tighten the clamping screw (8) to hold the detector in position.

63.3 Slide lengths of heatshrink on to one side of each of the phase detector connections. Resolder the connections (As noted in Para 62.3) and slide the heatshrink over each soldered joint.

63.4 Start the jet and ensure that the phase profile is correct (Para 127).

63.5 Slide the rear cover (6) back into position and secure it with the two screws (5) removed at Para 62.2.

63.6 Slide the front cover (1) into position and secure it using the knurled screw (4).

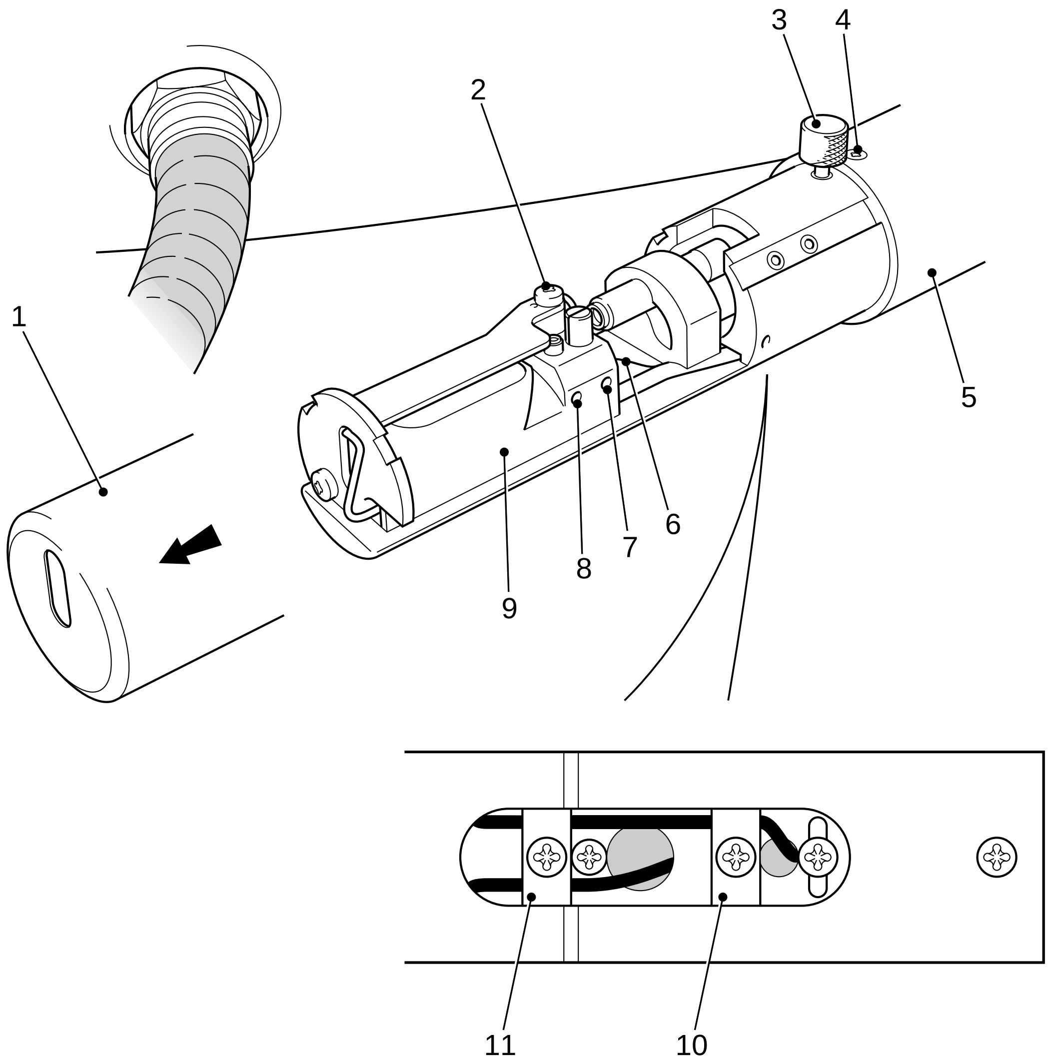
EHT block

Removal

64 To remove the EHT block (Fig 11.40 (9)) from the printhead, proceed as follows:

64.1 Slacken the knurled screw (3) and slide the front cover (1) from the printhead.

64.2 Remove and retain the two rear cover securing screws (4). Slide the rear cover back until it is clear of the printhead.



1	Printhead front cover	7	Charge electrode clamping screw
2	0 V deflector plate fixing screw	8	Phase detector clamping screw
3	Knurled screw	9	EHT block
4	Rear cover securing screw	10	Rear cable clamp
5	Printhead rear cover	11	Front cable clamp
6	Charge electrode cable		

Fig 11.40 EHT block removal and refitting

64.3 Desolder the EHT cable from the front of the 22 MΩ resistor.

64.4 Remove the two cable clamps (10 and 11).

64.5 Loosen the phase detector clamping screw (8). Slide the phase detector out of the EHT block, through the bottom of the printhead.

64.6 Loosen the charge electrode clamping screw (7) and pull the charge electrode cable (6) from the EHT block.

64.7 Remove and retain the 0 V detector plate fixing screw (2) and deflector plate. Pull the 0 V connecting cable away from the EHT block.

64.8 Remove and retain the two EHT block securing screws which are situated below the block.

64.9 Remove the EHT block, disconnecting the gutter return pipe as the block is removed.

Refitting

65 To refit the EHT block (Fig 11.40 (9)) to the printhead, proceed as follows:

65.1 Place the EHT block in position, connecting the gutter return pipe at the same time. Secure the block with the two screws removed at Para 64.8.

65.2 Refit the 0 V deflector plate and 0 V connecting cable removed at Para 64.7. Secure them with the fixing screw (2).

65.3 Fit the charge electrode cable (6) to the EHT block and tighten the clamping screw (7).

65.4 Slide the phase detector back into the EHT block from the bottom of the printhead. Position the top of the phase detector 1mm below the nozzle orifice. Tighten the clamping screw (8).

65.5 Refit the front and rear cable clamps (10 and 11) taking care that the cables are routed correctly through the channels in the clamps and not crushed when the clamps are tightened.

65.6 Resolder the EHT connector to the front of the 22 MΩ resistor. Take care that the soldered joint does not have any spikes which may cause arcing during operation. The soldered joint must be sleeved with the correct grade of heatshrink.

65.7 Carry out a full alignment procedure on the printhead (Para 90).

65.8 Slide the rear printhead cover (5) into position and secure it using the two screws (4) removed at Para 64.2.

65.9 Slide the front cover (1) into position and secure it using the knurled screw.

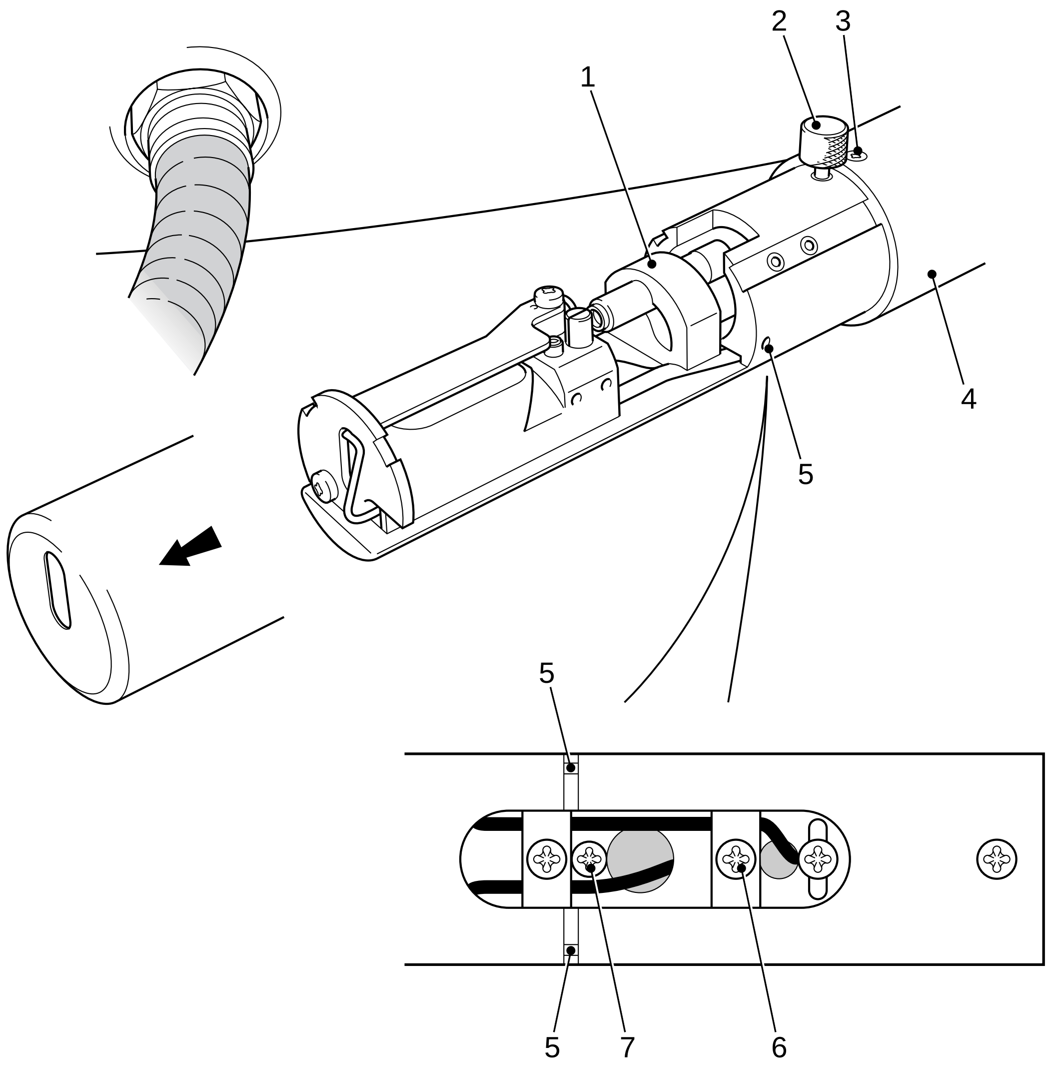
Nozzle assembly

Removal

66 To remove the printhead nozzle assembly (Fig 11.41 (1)), proceed as follows:

66.1 Slacken the knurled screw (2) and slide the front cover off the printhead.

66.2 Remove and retain the two rear cover securing screws (3) and slide the rear cover (4) off the printhead.



1	Nozzle assembly	5	Lateral clamping screw
2	Knurled screw	6	Cable/nozzle clamp screw
3	Rear cover securing screw	7	Nozzle height adjusting screw
4	Rear cover		

Fig 11.41 Printhead nozzle removal and replacement

66.3 Identify the red and black leads from the nozzle to the wiring loom. Remove the heatshrink and desolder the connections.

66.4 Disconnect the umbilical ink feed and return tubes from the nozzle assembly ink tubes. Connect the umbilical tubes together.

66.5 Remove and retain the cable/nozzle clamp screw (6) and the nozzle height adjusting screw (7). Retain the spring that is located on the height adjusting screw.

66.6 Slacken the two lateral clamping screws (5) and slide out the nozzle assembly.

Ensure that the new nozzle is the correct type prior to refitting:

460Mi: Serial number AM: yellow jewel

460Pi: Serial number PT: White jewel

460Si: Serial number T: Red jewel

Refitting

67 To refit the nozzle assembly (Fig 11.41 (1)), proceed as follows:

67.1 Slide the nozzle assembly into position and secure it using the cable/nozzle clamp screw (6) and the nozzle height adjusting screw (7). Ensure that the spring is fitted over the height adjusting screw, directly beneath the nozzle assembly.

67.2 Tighten the lateral clamping screws (5).

67.3 Reconnect the umbilical ink feed and return tubes to the nozzle assembly ink tubes.

67.4 Slide a length of heatshrink over the red and black electrical leads, resolder the connections to the wiring loom and cover the soldered joints with the heatshrink.

67.5 Slide the rear cover back into position and secure it with the two screws (3) removed at Para 66.2.

67.6 Align the printhead (Para 90).

67.7 Refit the front cover and secure it with the knurled screw (2).

67.8 Calibrate the modulation value (Para 121).

Ink reservoir stirrer motor (Pi)

Removal

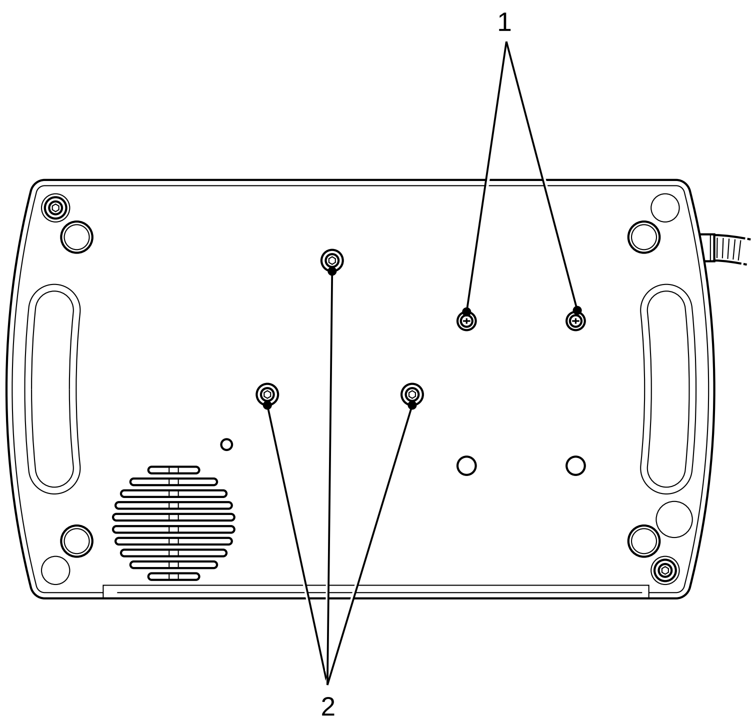
68 To remove the ink reservoir stirrer motor, proceed as follows:

68.1 Ensure that the printer is disconnected from the mains supply.

68.2 Obtain assistance to support the printer and slide the printer over the edge of a flat surface so that the ink reservoir securing screws (Fig 11.42 (1)) are accessible. Remove the securing screws and slide the printer back onto the flat surface.

68.3 Carefully move the ink reservoir so that the stirrer motor is accessible. If necessary, separate the reservoir and motor.

68.4 Identify the motor electrical cable, remove the sleeving from the blue and black leads, use a soldering iron to disconnect the leads. Remove the motor.



1 Ink reservoir securing screws
2 FMS securing screws

Fig 11.42 Ink reservoir and FMS securing screws

Refitting

69 To refit the ink reservoir stirrer motor, proceed as follows:

69.1 Fit sleeving to the motor electrical leads, use a soldering iron to connect the leads to the blue and black supply leads. Slide the sleeving over the electrical connections.

69.2 Place the motor over the ink reservoir pillars, fit the ink reservoir over the motor.

69.3 Obtain assistance to support the printer and slide the printer over the edge of a flat surface so that the ink reservoir securing screws (Fig 11.42 (1)) can be fitted. Refit the securing screws.

69.4 Connect the printer to the mains supply and test machine operation.

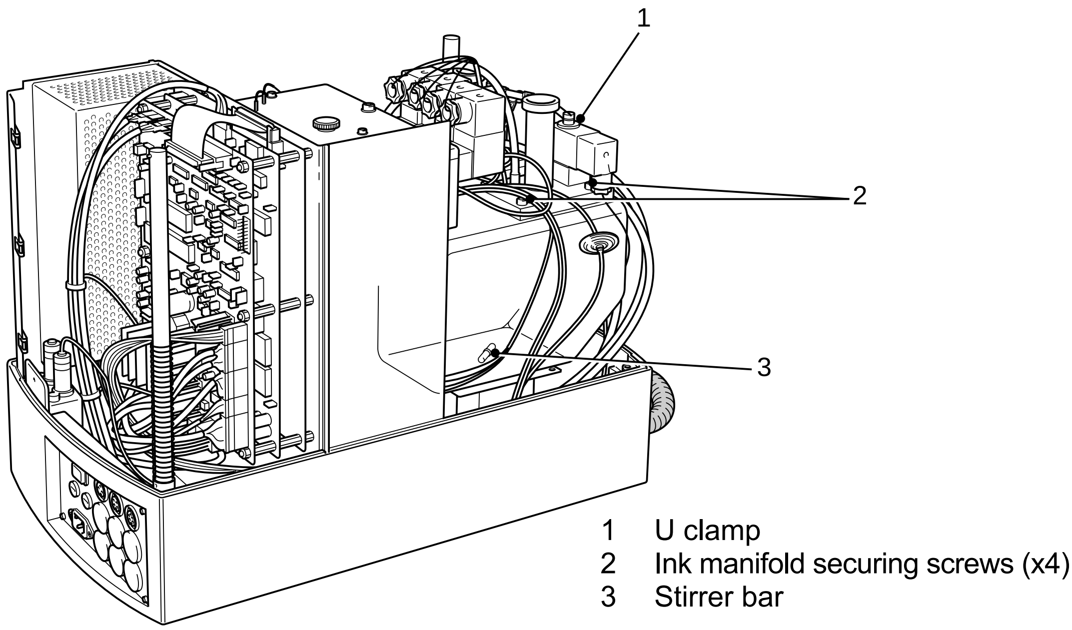


Fig 11.43 Ink reservoir stirrer bar

Ink reservoir stirrer bar (Pi)

Removal

70 To remove the ink reservoir stirrer bar, proceed as follows:

70.1 Remove the top U-clamp (Fig 11.43 (1)) from valve V2 on the ink manifold. Rotate valve V2 by 90° anticlockwise.

70.2 Remove four M4 socket headed ink manifold securing screws (2) and carefully separate the ink manifold from the reservoir.

70.3 Check the condition of the ink manifold gasket, replace if necessary.

70.4 Remove the stirrer bar (3) from the reservoir using a pair of long nosed pliers. It may be necessary to use a syringe to remove the contents of the reservoir in order to locate the stirrer bar.

<u>Refitting</u>

71 To refit the ink reservoir stirrer bar, proceed as follows:

71.1 Use a pair of long nosed pliers to locate the stirrer bar in the bottom of the ink reservoir as shown at Fig 11.43.

71.2 Fit the ink manifold gasket to the ink reservoir.

71.3 Secure the ink manifold to the ink reservoir using four M4 socket headed securing screws.

71.4 Orientate valve V2 by 90° clockwise as shown at Fig 11.43. Fit the top U clamp to valve V2.

71.5 If necessary, replenish the ink reservoir.

71.6 Test machine operation.

FMS stirrer bar (Pi)

<u>Removal</u>

72 To remove the FMS stirrer bar, proceed as follow:

72.1 Disconnect the machine from the mains supply.

72.2 Identify and note the blue lead to the VMS high probe (Fig 11.44 (1)), disconnect the lead.

72.3 Identify and note the pink lead to the VMS low probe (2), disconnect the lead.

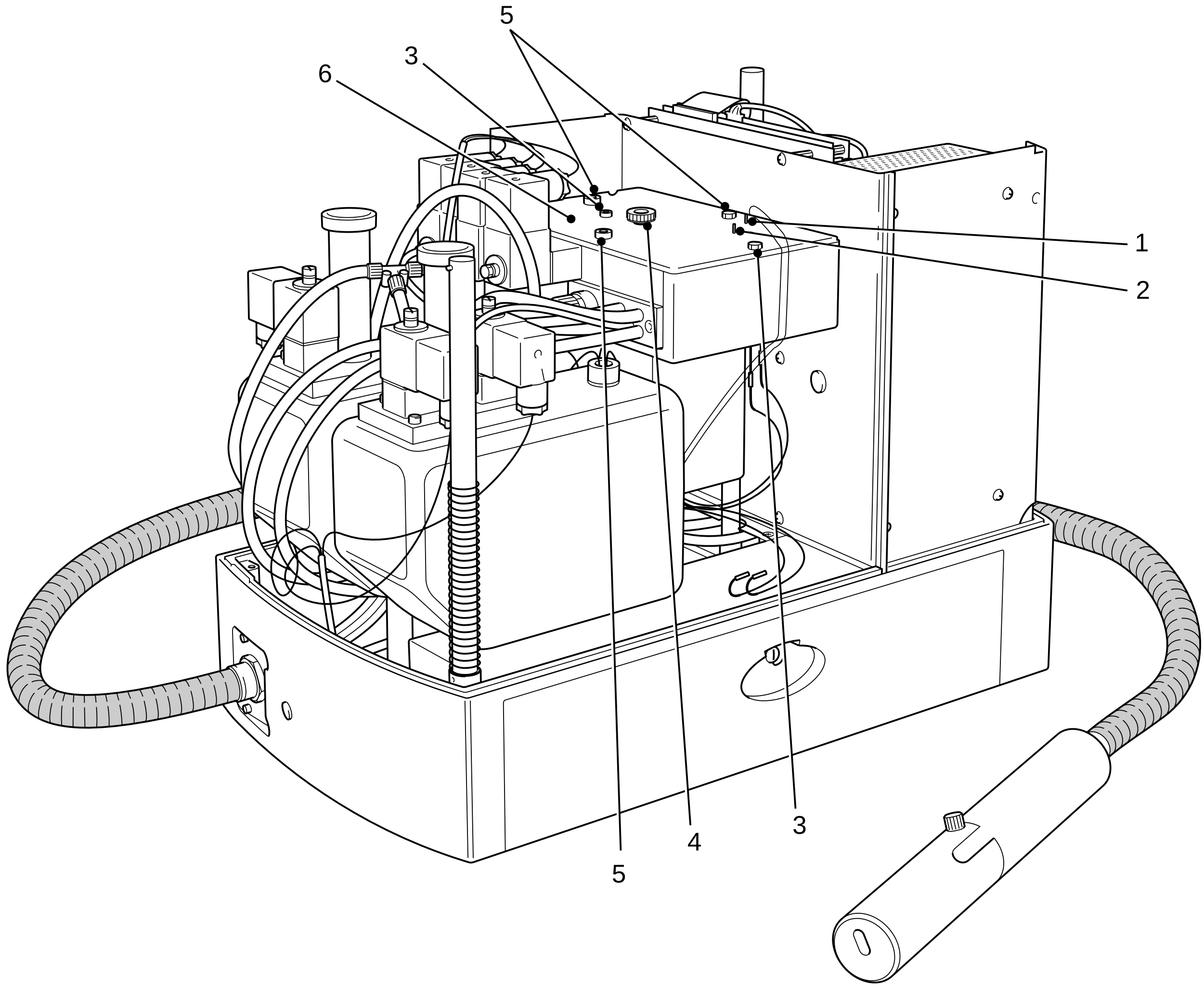
72.4 Remove two M4 socket headed top cover securing screws (3) and associated nylon washers.

72.5 Remove the filler plug (4).

72.6 Remove three M5 socket headed top cover securing screws (5).

72.7 Use a syringe to remove any fluid from the manifold housing (Fig 11.45 (1)).

Issue 2.1
Part No. 306-0400-103



1	VMS high probe (blue lead)	4	Filler plug
2	VMS low probe (pink lead)	5	FMS top cover securing screw (M5)
3	FMS top cover securing screw (M4)	6	FMS top cover

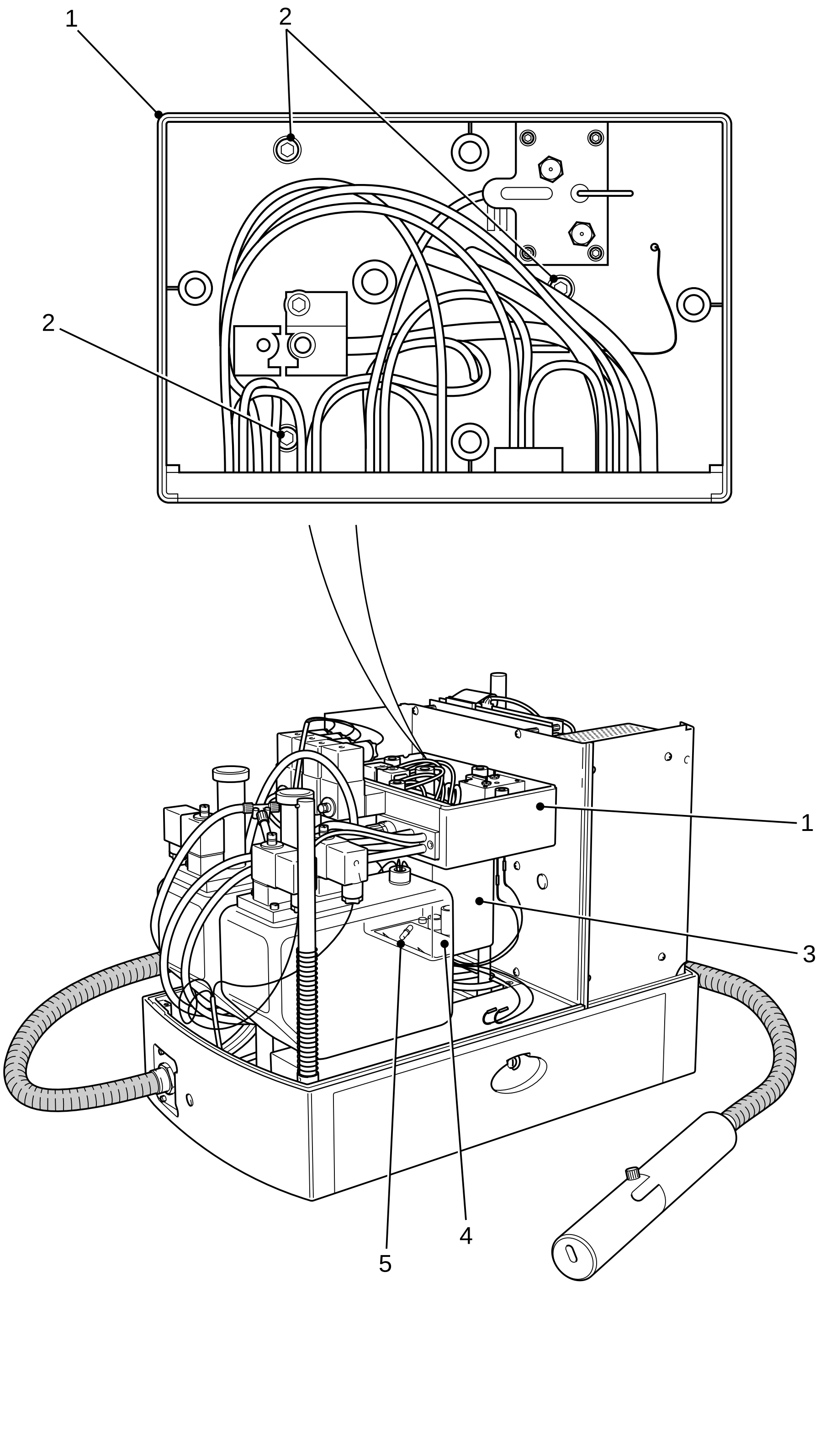
Fig 11.44 FMS top cover removal (Pi)

72.8 Carefully separate the top cover from the FMS, check the top cover gasket and replace if necessary.

72.9 Remove three M4 socket headed manifold housing securing screws (2) and carefully separate the manifold housing from the mixer tank (3). Check the manifold housing gasket and replace if necessary.

72.10 Use a syringe to remove any fluid from the mixer tank..

72.11 Use a pair of long nosed pliers to remove the stirrer bar (5) from the wear plate (4).



1	manifold housing	4	Wear plate
2	manifold housing securing screw	5	Stirrer bar
3	Mixer tank		

Fig 11.45 FMS stirrer bar

Refitting

73 To refit the FMS stirrer bar, proceed as follows:

73.1 Use a pair of long nosed pliers to place the stirrer bar onto the wear plate as shown at Fig 11.45.

73.2 Fit the manifold housing gasket to the mixer tank.

73.3 Fit the manifold housing to the mixer tank and secure using three M4 socket headed manifold housing securing screws. Tighten the screws to 0.3 Newton/meters (Nm).

73.4 Fit the top cover gasket to the manifold housing. Fit the top cover to the manifold housing.

73.5 Fit the filler plug to the top cover.

73.6 Fit the new three M5 top cover securing screws and associated nylon washers, tighten the screws to 0.3 Nm.

73.7 Fit the two M4 top cover securing screws and associated nylon washers, tighten the screw near the filler plug to 0.7 Nm, tighten the remaining screw to 0.3 Nm.

73.8 Connect the pink lead to the VMS low probe as noted at Para 72.3.

73.9 Connect the blue lead to the VMS high probe as noted at Para 72.2.

73.10 Connect the printer to the mains supply.

73.11 Commission the ink system as described at Para 107, 108 and 112.

73.12 Calibrate the VMS as described at Para 114.

FMS stirrer motor (Pi)

Removal

74 To remove the FMS stirrer motor, proceed as follows:

74.1 Disconnect the printer from the mains supply.

74.2 Obtain assistance to support the printer and slide the printer over the edge of a flat surface so that the FMS securing screws are accessible (Fig 11.42 (2)), remove three M3 socket headed securing screws and slide the printer back onto the flat surface.

EQUIPMENT DAMAGE. Be extremely careful not to strain or break any tubing or electrical wiring when moving the FMS.

74.3 Carefully move the FMS to gain access to the stirrer motor, gently pull the stirrer motor away from the FMS pillars. Locate the FMS back onto the pillars.

74.4 Identify the motor electrical cable, remove the sleeving from the red and black leads, use a soldering iron to disconnect the leads. Remove the motor.

Refitting

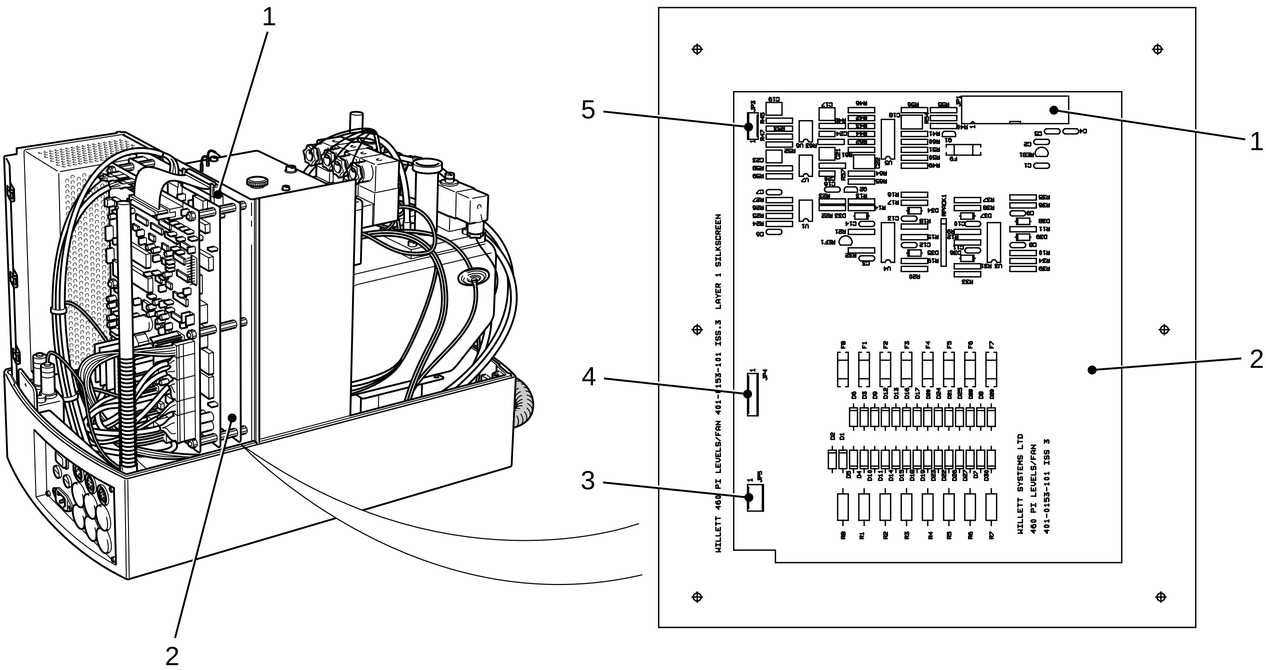
75 To refit the FMS stirrer motor, proceed as follows:

75.1 Fit sleeving to the motor electrical leads, use a soldering iron to connect the leads to the red and black supply leads. Slide the sleeving over the electrical connections.

75.2 Place the motor over the FMS pillars, place the FMS over the pillars.

75.3 Obtain assistance to support the printer and slide the printer over the edge of a flat surface so that the FMS securing screws can be fitted. Refit the securing screws.

75.4 Connect the printer to the mains supply and test machine operation.



1 Levels connector (JP1)
2 Levels interface board
3 Ink system sensor connector (JP5)
4 Reservoir sensor connector (JP4)
5 Stirrer motors connector (JP3)

Fig 11.46 Levels interface board

Levels interface board (Pi)

Removal

76 To remove the levels interface board (Fig 11.46 (2)), proceed as follows:

76.1 Disconnect the printer from the mains supply.

76.2 Remove the I/O board (Para 24) and CPU board (Para 27).

76.3 Remove connectors JP1 (1), JP3 (5), JP4 (4) and JP5 (3) from the board.

76.4 Remove and retain six M3 x 18 mm long PCB stand-offs and the earth strap from the board. Remove the levels interface board.

Refitting

77 To refit the levels interface board, proceed as follows:

77.1 Fit the board earth strap, and secure using six M3 x 18 mm long PCB standoffs retained at Para 76.4.

77.2 Connect JP1, JP3, JP4 and JP5.

77.3 Refit the CPU board (Para 28).

77.4 Refit the I/O board (Para 25).

77.5 Connect the printer to the mains supply and test machine operation.

FITTING OF SYSTEM CONNECTION OPTIONS

System connections (Option A)

78 The system connections (option A) allow additional facilities to be connected to the printer, without the requirement for an expansion board. The option A connectors are supplied as cable assemblies and require fitting as follows:

78.1 Ensure the printer is disconnected from the mains supply.

78.2 Screw in the two top cover fasteners to release the top cover catches and raise the top cover. The top cover is held in the open position by support stays.

78.3 Once the top cover is in the open position, undo the six quick release side cover fasteners and remove the side covers.

Orientation of the side covers should be noted for refitting.

EQUIPMENT DAMAGE. An antistatic wrist strap must be worn when working on printed circuit boards.

78.4 Remove the rubber grommet from the required position in the printer connector panel (Fig 11.47 (1)). Push the HE14 connector through the hole, pull the cable through and secure the DIN connector to the connector panel using the supplied lock nut.

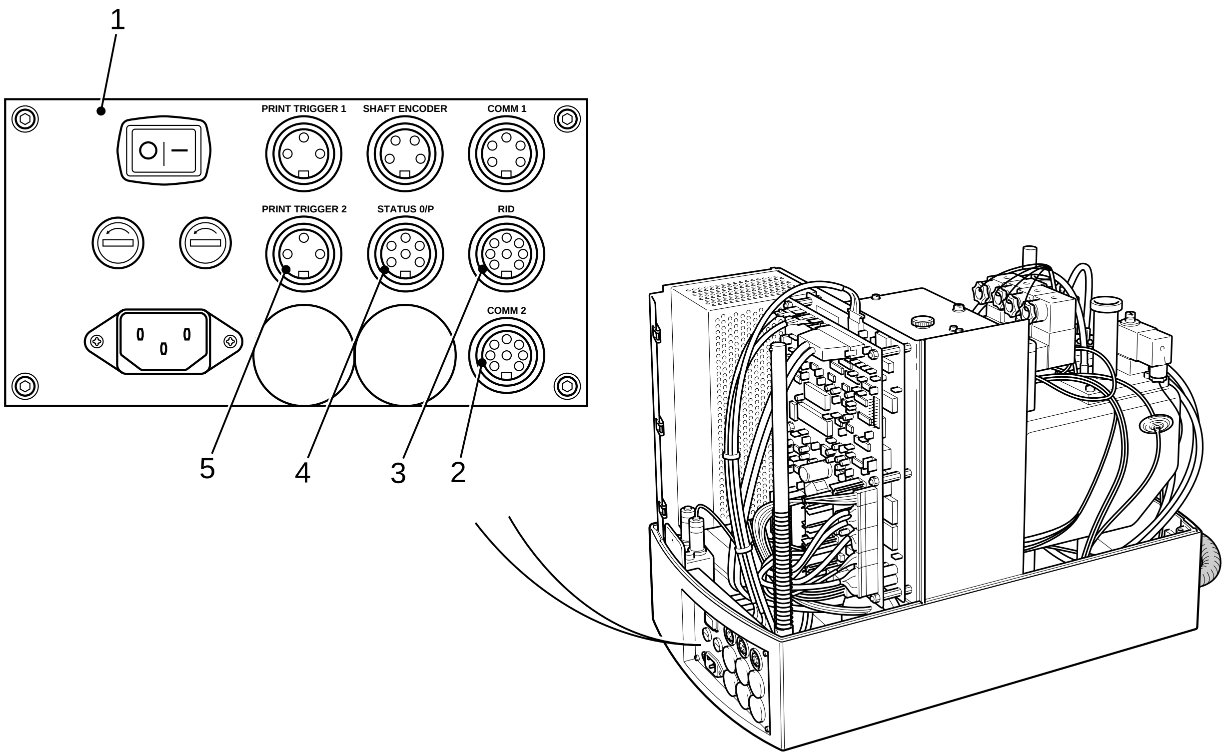
78.5 Fit the HE14 connector to the required connector on the CPU board or the Input/Output board (Fig 11.48).

78.6 When the connector has been fitted, refit the side covers and secure the six quick release fasteners. Lower the top cover and screw out the two top cover fasteners until the top cover is secure.

79 Table 11.27 lists the Option A DIN connectors (connector panel) and the corresponding connectors on the CPU and I/O board.

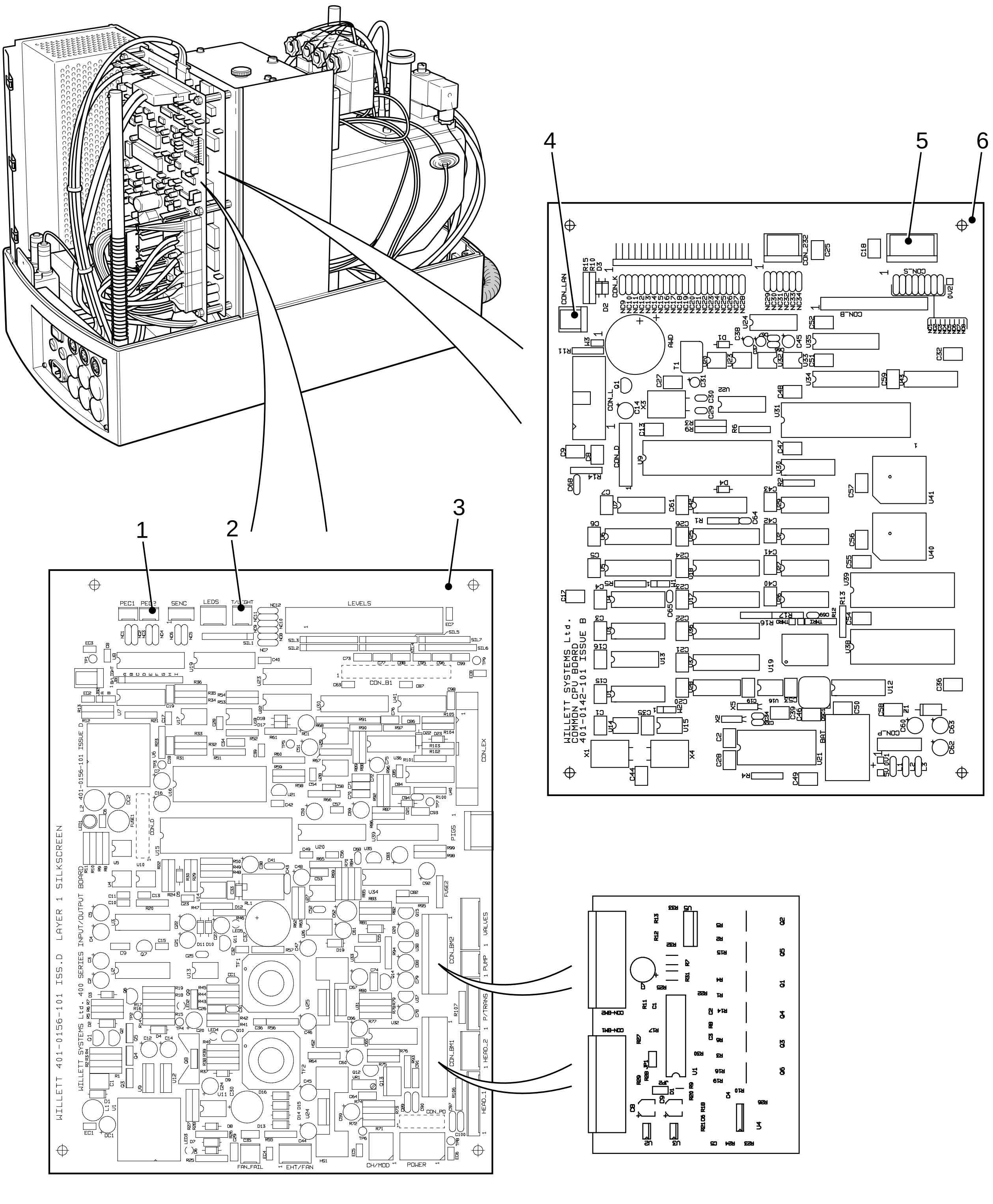
TABLE 11.27 OPTION A CONNECTIONS

Serial (1)	DIN connector (2)	I/O or CPU connector (3)
1	COMM 2	CON_LAN (CPU board)
2	RID	CON_S (CPU board)
3	STATUS O/P	T/LIGHT (I/O board)
4	PRINT TRIGGER 2	PEC2 (I/O board)



1 Printer connector panel
2 COMM 2 connector
3 RID connector
4 Status O/P connector
5 Print trigger 2 connector

Fig 11.47 Printer connector panel (Option A connections)



1 Product Sensor 2
2 Traffic light
3 I/O board (Mk2)
4 Modem/LAN (via expansion board)
5 RID
6 CPU board (Mk2)

Fig 11.48 HE14 connector location (I/O and CPU boards)

System connections (option B)

80 The system connections (option B) allow additional facilities to be connected to the printer via an expansion board. To fit the expansion board proceed as follows:

80.1 Ensure that the printer is disconnected from the mains supply.

80.2 Screw in the two top cover fasteners to release the top cover catches and raise the top cover. The top cover is held in the open position by support stays.

80.3 Once the top cover is in the open position, undo the six quick release side cover fasteners and remove the side covers.

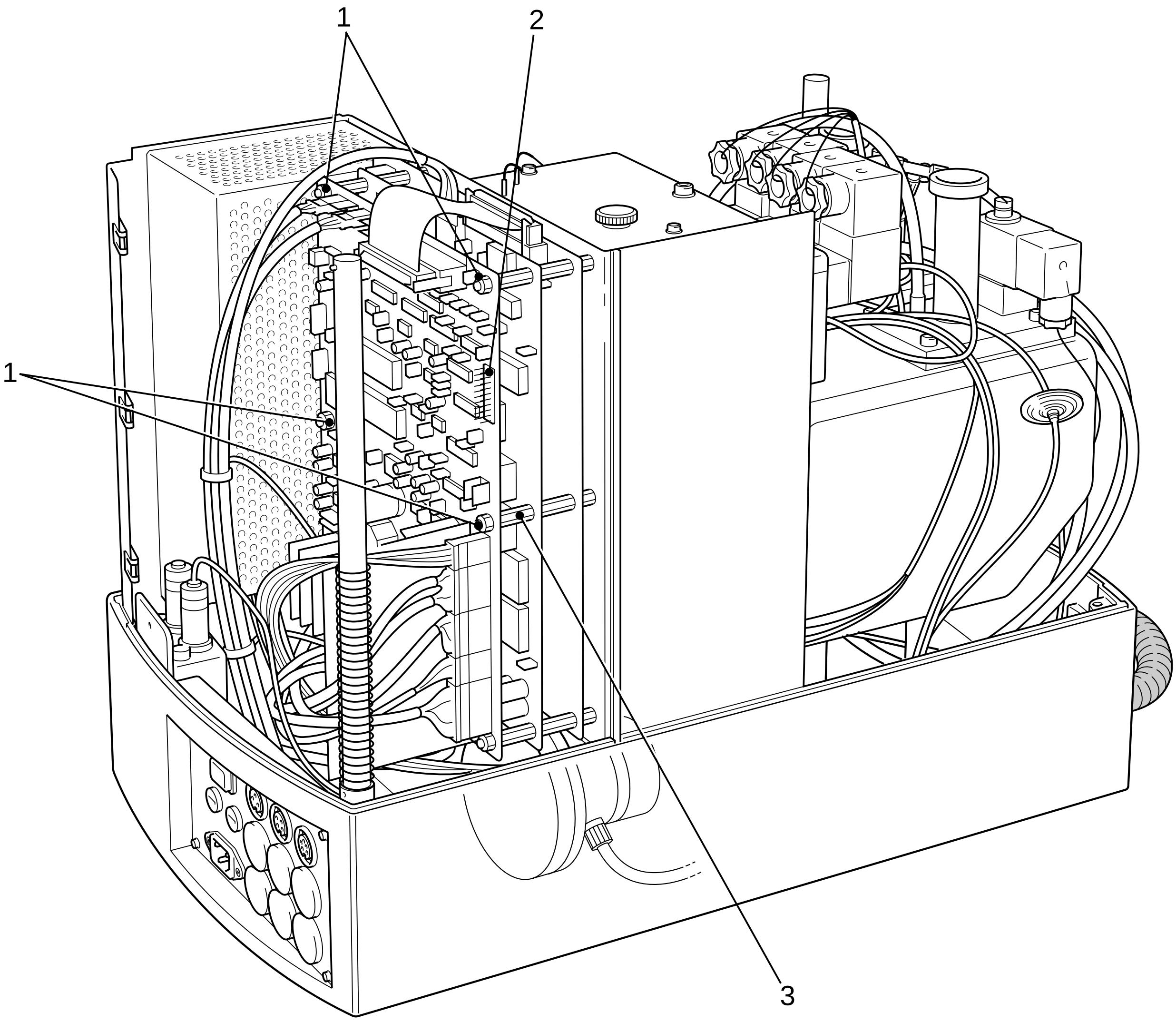
Orientation of the side covers should be noted for refitting.

EQUIPMENT DAMAGE. An antistatic wrist strap must be worn when working on printed circuit boards.

80.4 Remove the four securing nuts (11.49 (1)) and fit the four stand-offs supplied with the expansion board to the input/output board stand-offs.

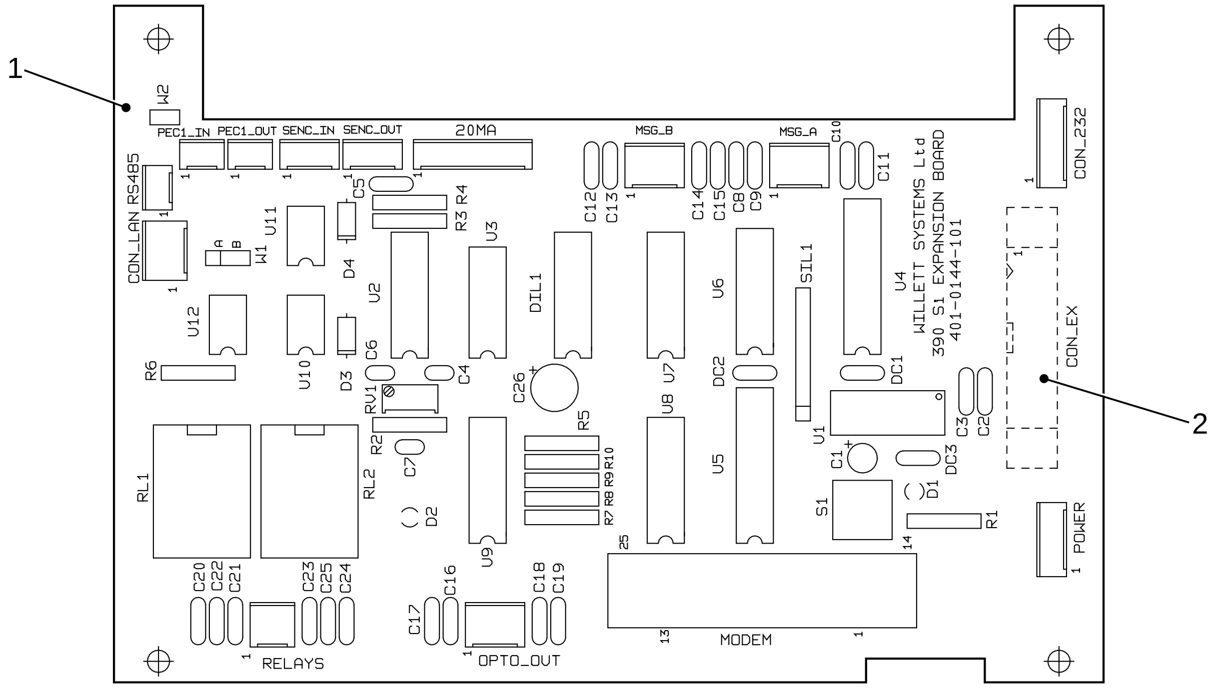
80.5 Orientate the expansion board (Fig 11.50 (1)) so that the large cut-out is upper most and the board interconnector (2) is on the right side of the board. Position it onto the stand-offs and ensure the board interconnector mates correctly.

80.6 Fit the four securing nuts supplied with the kit.



1 Securing nuts
2 Board interconnector
3 Stand-offs

Fig 11.49 Expansion board fitting



1 Expansion board
2 Board interconnector

Fig 11.50 Expansion board

81 The option B connection is supplied assembled but requires fitting as follows:

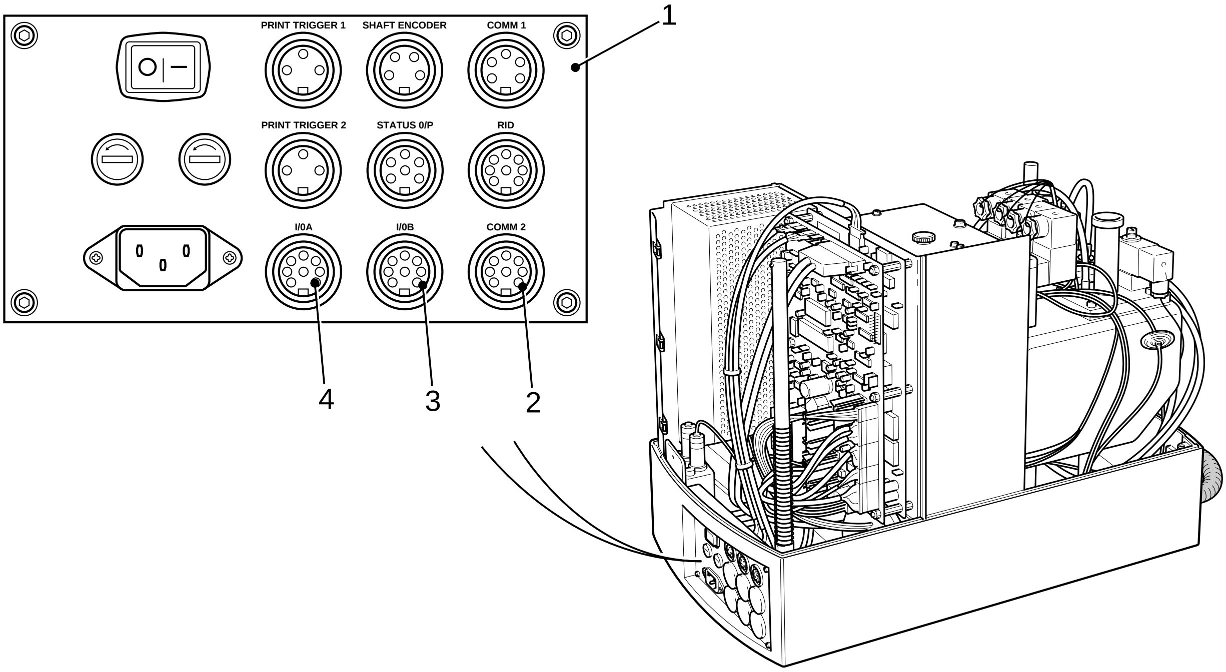
81.1 Ensure that the printer is disconnected from the mains supply.

81.2 Screw in the two top cover fasteners to release the top cover catches and raise the top cover. The top cover is held in the open position by support stays.

81.3 Once the top cover is in the open position, undo the six quick release side cover fasteners and remove the side covers.

81.4 Remove the rubber grommet from the required position in the connector panel (Fig 11.51 (1)). Push the HE14 connector through the hole, pull the cable through and secure the DIN connector to the connector panel.

81.5 Fit the HE14 connector to the required connector on the expansion board (Fig 11.52).



1 Printer connector panel
2 COMM 2 connector
3 I/OB connector
4 I/OA connector

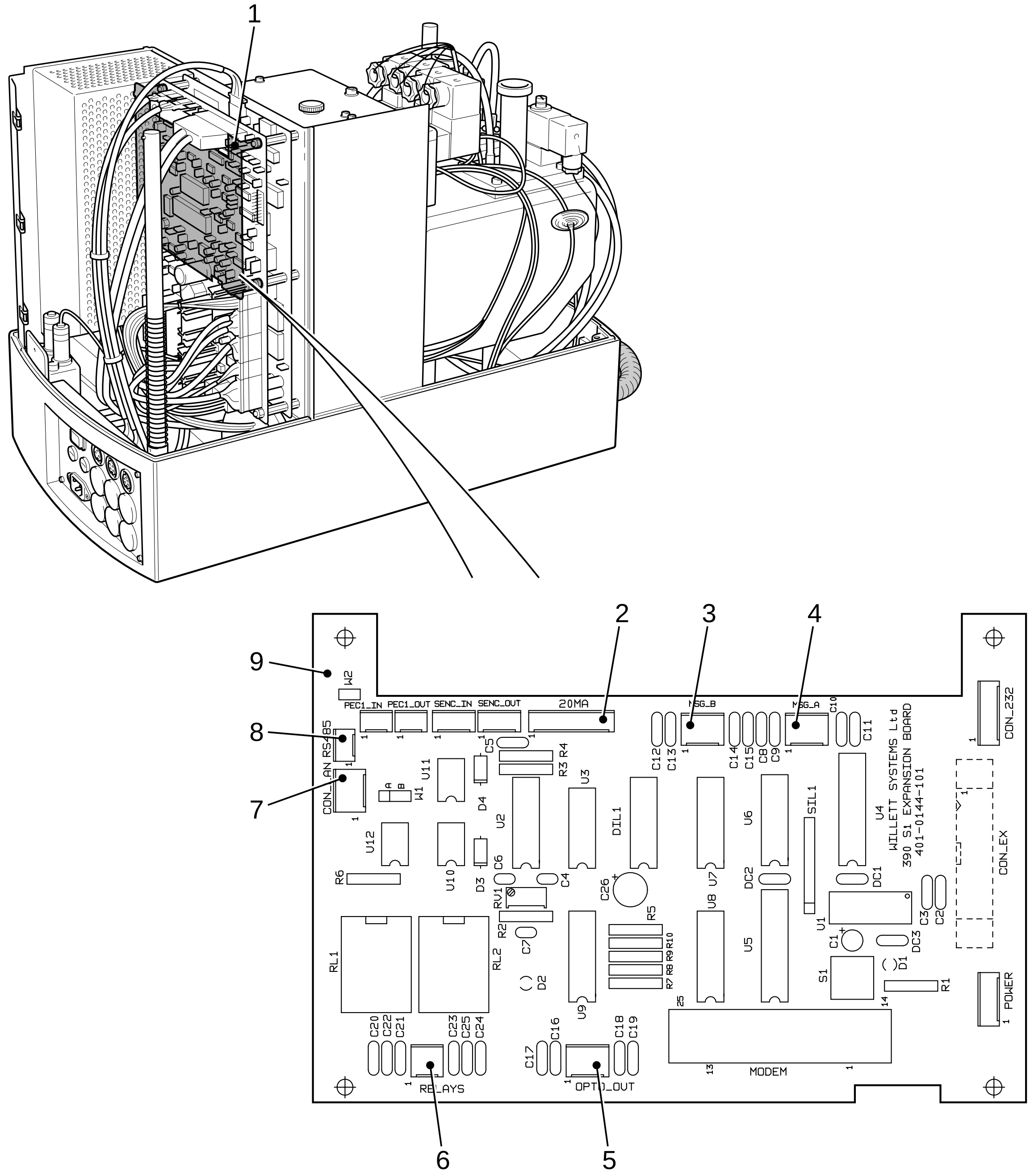
Fig 11.51 Printer connector panel (Option B connection)

81.6 When the connector has been fitted, refit the side covers and secure the six quick release fasteners. Lower the top cover and screw out the two cover fasteners until the top cover is secure.

82 Table 11.28 lists the Option B DIN connectors and the corresponding connectors on the expansion board.

TABLE 11.28 OPTION B CONNECTIONS

Serial (1)	Option B DIN connector (2)	Expansion board connector (3)
1	1 COMM 2 (8 pin (DIN))	1 20MA current loop
	2 COMM 2 (3 pin (DIN))	2 RS485
2	I/O A	MSG_A
3	I/O B	MSG_B



1 Expansion board (fitted)
2 20mA Local Area Network
3 MESSAGE_B opto coupled input
4 MESSAGE_A opto coupled input
5 OPTO_OUT output
6 RELAYS (change over relay status outputs)
7 LAN port
8 RS485
9 Expansion board

Fig 11.52 HE14 connector location (Expansion board)

RS232 jumper

83 The RS232 jumper assembly is used when downloading firmware to a 450Si printer. Because the 450SI is not fitted with an external COMM1 port, it is necessary to make a temporary connection to the CPU, via the jumper.

Fitting

84 To fit the RS232 jumper (Part No. 100-0370-158), proceed as follows:

84.1 Ensure that the printer is disconnected from the mains supply.

84.2 Screw in the two top cover fasteners to release the top cover catches and raise the top cover. The top cover is held in the open position by support stays. Unscrew (do not remove) the two top cover fasteners, leave them captive.

84.3 When the top cover is in the open position, undo the six quick release side cover fasteners and remove the side covers.

84.4 Connect one end of the jumper to the CON_232 connector on the CPU board (Fig 11.53 (2)).

84.5 Place the other end of the cable in a convenient position, making sure that there is no danger of it fouling mechanical components or short circuiting electrical components. Switch on the printer.

84.6 Download the firmware as described in Section 9.

Removal

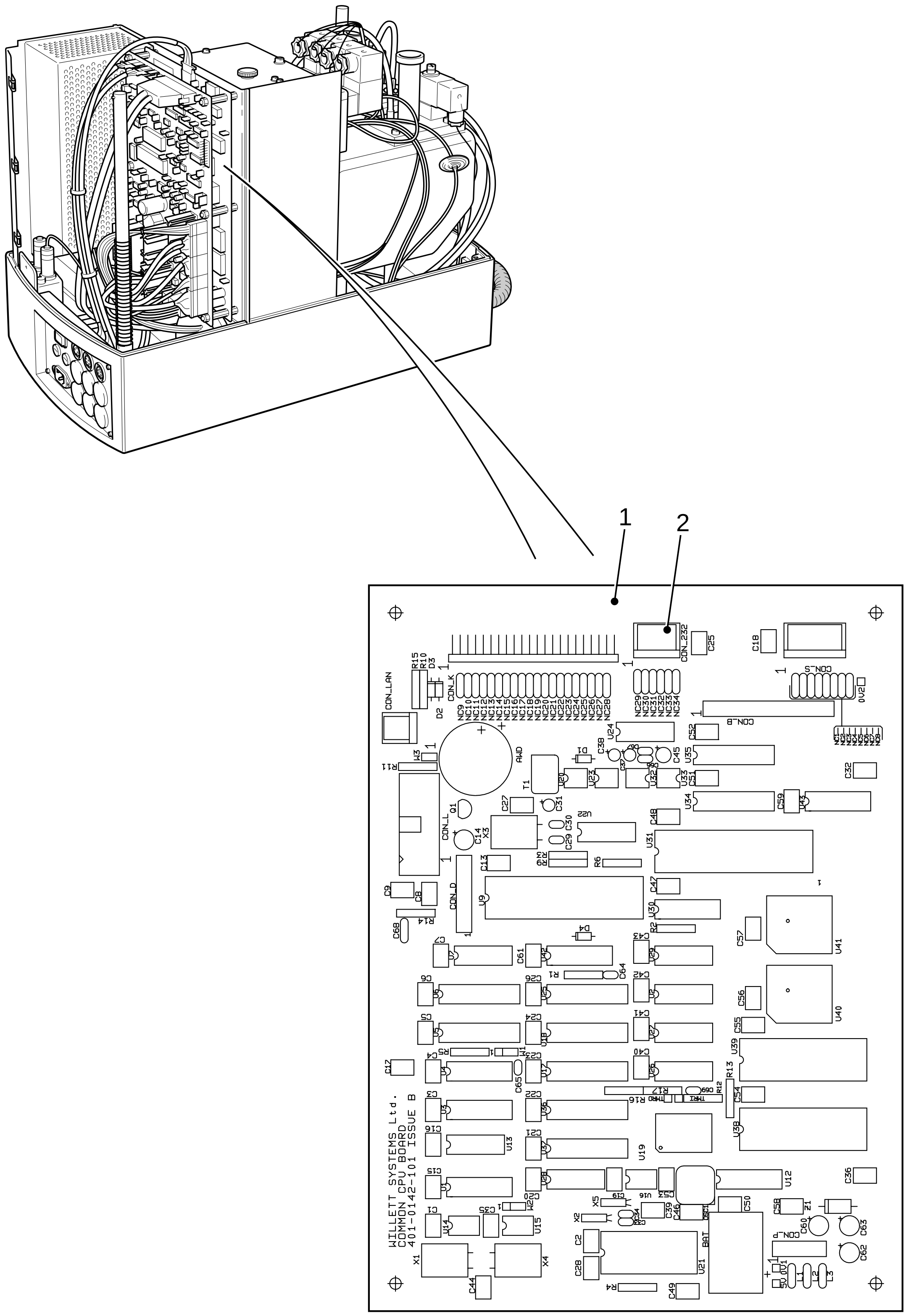
85 To remove the RS232 jumper, proceed as follows:

85.1 After downloading the firmware, switch off the mains supply to the printer and the PC. Disconnect the PC from the jumper.

85.2 Remove the jumper from the CON_232 connector (Fig 11.53 (2)) on the CPU board (1).

85.3 Refit the side covers to the printer and secure them with six quick release fasteners.

85.4 Lower the top cover.



1 CPU board 2 CON_232

Fig 11.53 CON_232 location

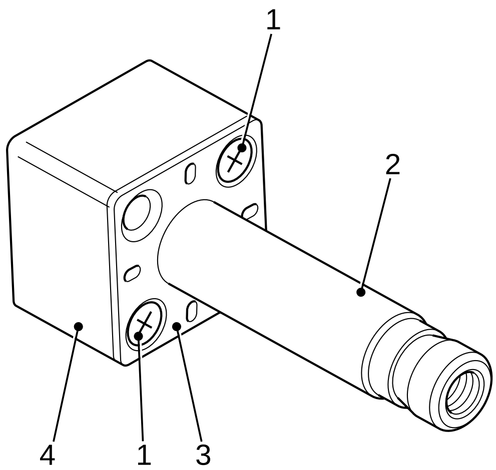
CLEANING AND ADJUSTMENT PROCEDURES

Valve cleaning

86 To clean a valve, proceed as follows:

86.1 Remove the appropriate valve as described in Para 49.

86.2 Remove the valve plate retaining screws (Fig 11.54 (1)). Retain the screws and note the orientation of the plate. Pull the valve stem (2) and the valve plate (3) away from the valve block (4).



1	Valve plate retaining screws	3	Valve plate
2	Valve stem	4	Valve block

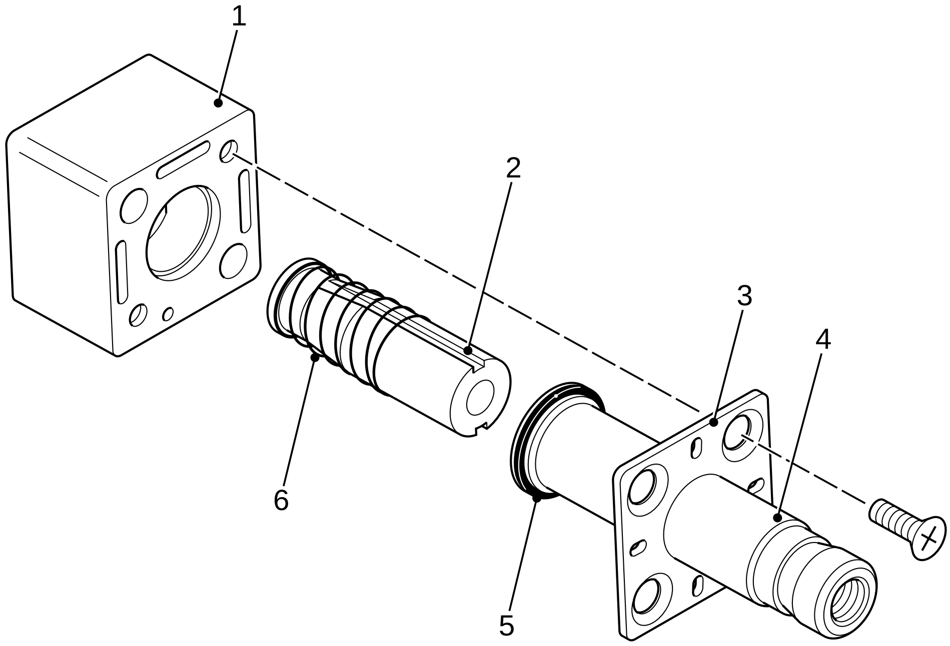
Fig 11.54 Valve components

86.3 Disassemble the internal valve components (Fig 11.55) noting the orientation of each.

86.4 Clean all the components in a suitable Willett solvent washdown.

86.5 Reassemble the internal valve components. Fit the valve plate to the valve block and secure it using the two screws removed at Para 86.2.

86.6 Refit the valve in its correct position on the manifold as described in Para 50.



1	Valve block	4	Valve stem
2	Valve plunger	5	Valve stem O-ring
3	Valve plate	6	Valve plunger spring

Fig 11.55 Valve internal components

VMS inlet restrictor cleaning

87 If it is suspected that the VMS inlet restrictor is blocked, clean it as described below:

87.1 Remove valve V3 from the FMS valve plate (Para 49).

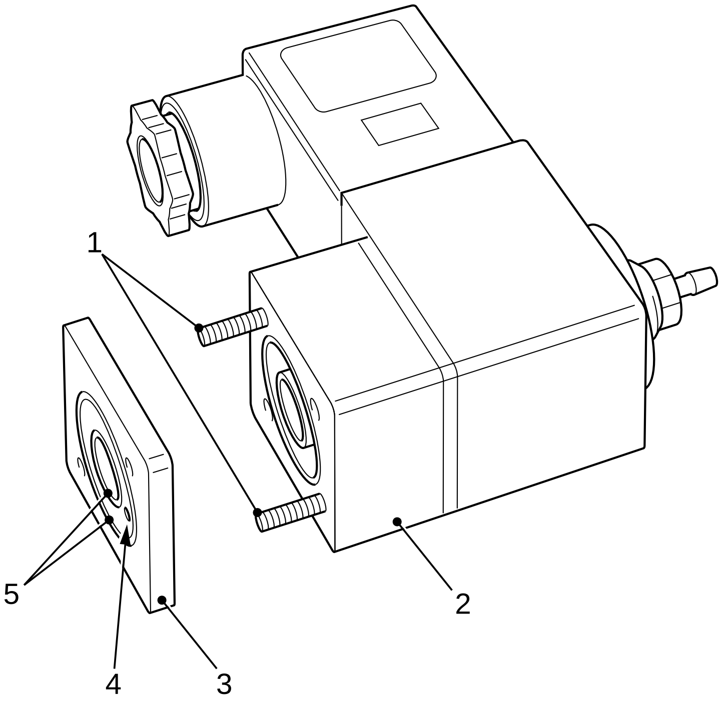
87.2 Pull the VMS restrictor block (Fig 11.56 (3)) away from the valve body (2). Retain the two O-rings from the VMS restrictor block and the two O-rings from the valve body.

87.3 Wash the restrictor block with solvent. Blow through the restrictor orifice (4) with an air line or force solvent through it.

87.4 Hold the restrictor block up to the light and check that the orifice is clear.

87.5 Refit the restrictor block over the valve retaining screws, with the O-rings (5) facing outwards.

87.6 Refit the valve as described in Para 50.



1	Valve retaining screws	4	Restrictor orifice
2	Valve body	5	O-rings
3	VMS restrictor block		

Fig 11.56 VMS restrictor cleaning

VMS outlet cleaning

88 If it is suspected that the VMS outlet is blocked, clean it as described below:

88.1 Remove all screws from the top of the FMS; retain all screws, washers and seals. Remove the top of the FMS.

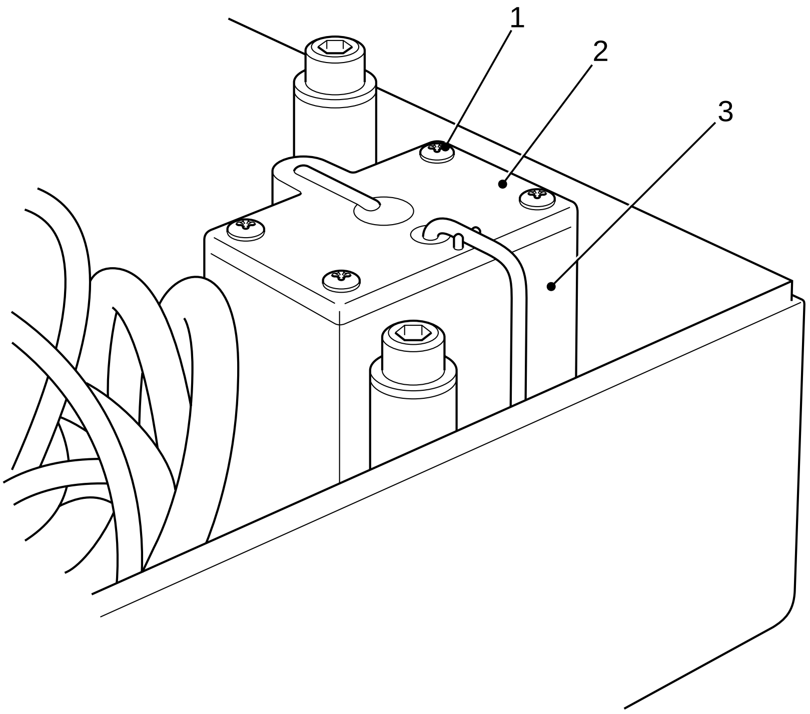
88.2 Remove the four retaining screws (Fig 11.57 (1)) from the top of the VMS chamber (3) remove the lid (2) and sealing gasket located under the lid. Note the orientation of the gasket.

88.3 Carefully run a fine wire through the outlet orifice in the bottom of the chamber.

88.4 Syringe a small amount of ink into the VMS chamber and check that it runs out into the mixer tank below.

88.5 When the outlet is clear, refit the VMS chamber lid and gasket and secure it using the four screws removed at Para 88.2.

88.6 Refit the top of the FMS using the screws removed at Para 88.1.



1 Retaining screw
2 VMS chamber lid
3 VMS chamber

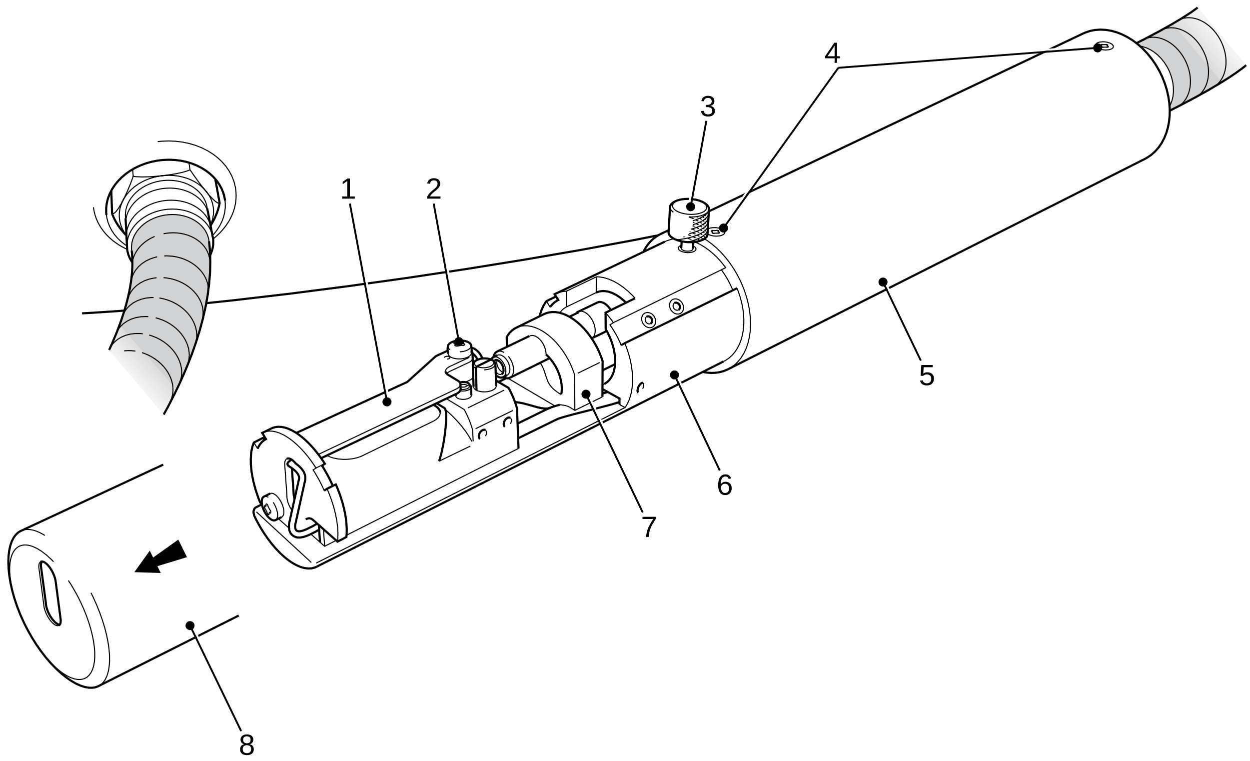
Fig 11.57 VMS chamber

Umbilical purge

89 To carry out an umbilical purge, proceed as follows:

89.1 Set the mains switch to off and disconnect the printer from the mains supply.

89.2 Loosen the knurled screw (Fig 11.58 (3)) and remove the printhead front cover (8).



1 Ground potential deflector electrode
2 Securing screw
3 Knurled screw
4 Rear cover securing screws
5 Rear cover
6 Printhead body
7 Nozzle assembly
8 Front cover

Fig 11.58 Printhead assembly

89.3 Remove the rear cover securing screws (4) and slide the rear cover (5) off the printhead body (6). Remove the umbilical feed and return pipes from the nozzle feed and return pipes and loop them together.

89.4 Connect the printer to the mains supply and set the mains supply to on.

89.5 Select the Umbilical Purge option from the System menu, the Umbilical Purge dialogue box (Fig 11.59) will be displayed. Select *Enable* using the ← or → key to start the umbilical purge, after fifteen minutes stop the umbilical purge, by selecting *Disable* from the *Umbilical Purge* option.

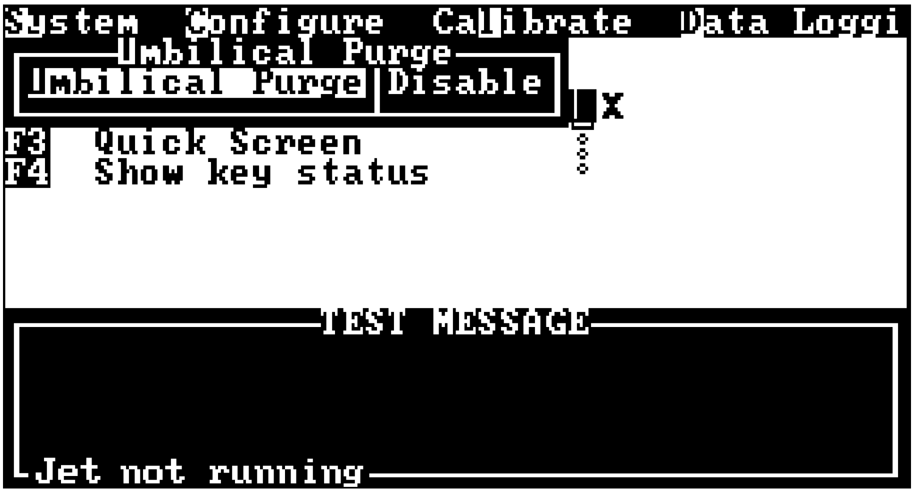


Fig 11.59 Umbilical Purge dialogue box

89.6 Disconnect the feed and return pipes and reconnect them to the nozzle feed and return pipes.

89.7 Slide the rear cover back into position on the printhead and secure it using the two screws (4) removed at Para 89.3.

89.8 Refit the front over (8) and secure it with the knurled screw (3).

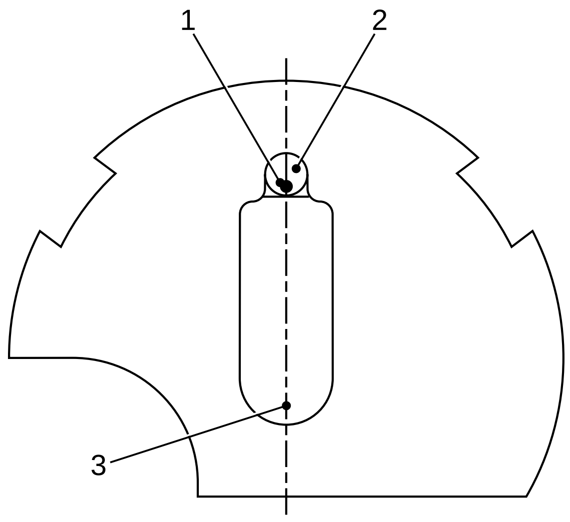
Printhead alignment

90 To carry out an alignment of the printhead, proceed as follows:

90.1 Slacken the knurled nut (Fig 11.58 (3)) and remove the front cover from the printhead.

90.2 Secure the printhead vertically in a suitable stand with the nozzle pointing downwards. Place a suitable container beneath the printhead to catch the ink.

90.3 Disable the Gutter Detect and Charge Check in the System menu.



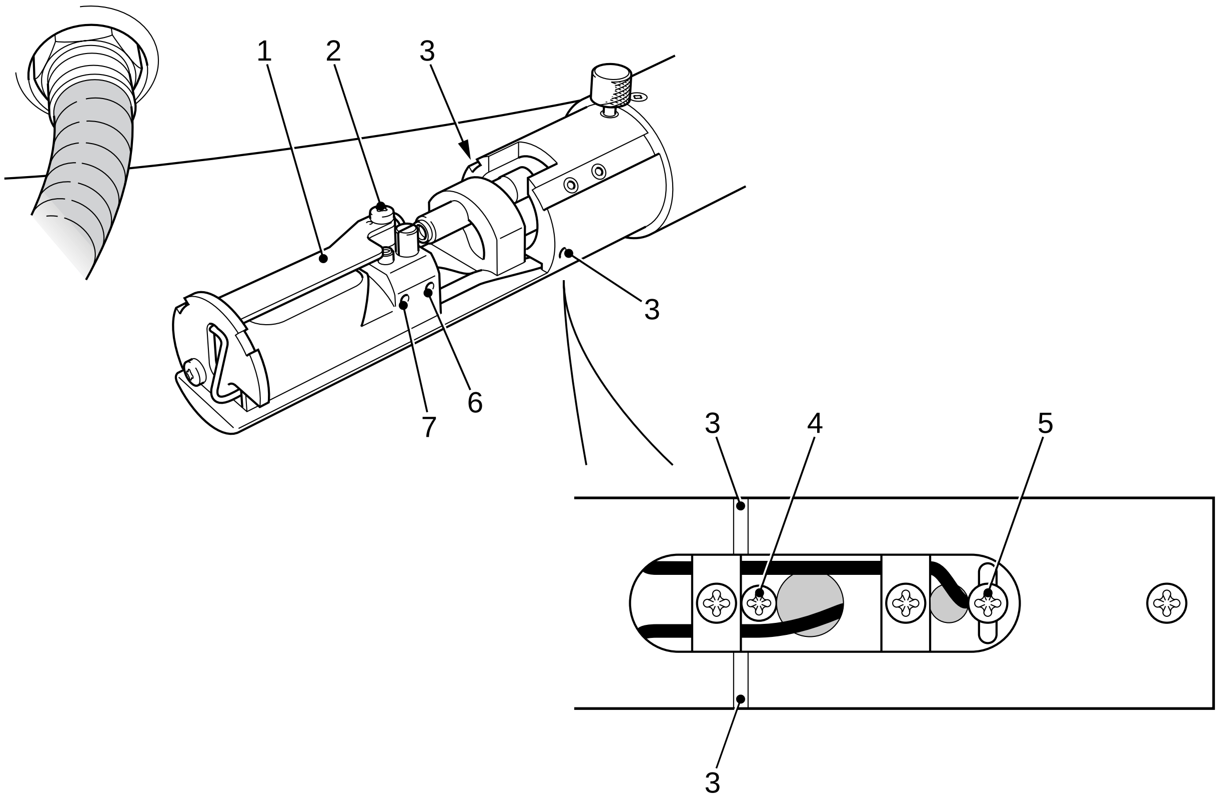
1 Ink jet position
2 Gutter
3 Centre line

Fig 11.60 Ink jet to gutter position

90.4 Press F1 to start the jet. When the ink jet has started, check that the ink jet is in the correct positioning in the gutter (See Fig 11.60).

EQUIPMENT DAMAGE. Never attempt to bend the gutter. It is in a fixed position.

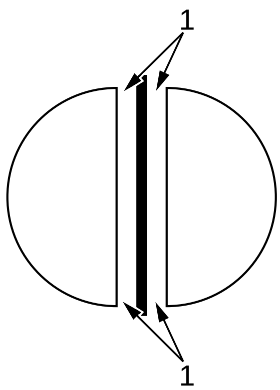
90.5 Adjust the ink jet position if necessary using the lateral adjustment screws (11.61 (3)) and height adjustment screw (4). When the adjustment has been made ensure that the lateral adjustment screws are tight and the ink jet position is correct.



1 Ground potential deflector electrode
2 Securing screw
3 Lateral adjustment screw
4 Height adjustment screw
5 Deflector block adjustment screw
6 Charge electrode clamping screw
7 Phase detector clamping screw

Fig 11.61 Printhead adjustment screw location

90.6 When ink jet position is correct in the gutter, check the ink jet is flowing through the centre of the charge electrode slot parallel to the sides of the slot (Fig 11.62).



1 Equidistant gap

Fig 11.62 Ink jet flow through charge electrode

(1) EQUIPMENT DAMAGE. When rotating the charge electrode care must be taken to avoid deforming the charge electrode slot.

(2) EQUIPMENT DAMAGE. Ensure that the charge cable is not pulled out of its position in the rear face of the deflector block assembly.

90.7 To centralise the ink jet flow through the charge electrode, release the deflector block adjustment screw (Fig 11.61 (5)) and move the block until the jet is in the correct position. Secure the adjustment screw and recheck jet position. For parallel adjustment release the charge electrode clamping screw (6). Rotate the charge electrode until the jet is parallel to, and in the centre of the slot, secure the clamping screw ensuring that the charge cable is clamped.

90.8 Check that the ink jet is approximately 1 mm away from the phase detector. To adjust, release the phase detector clamping screw (7) and move the phase detector sensor to the correct position, secure the phase detector clamping screw.

90.9 When ink jet alignment is correct, reposition the ground potential deflector electrode and secure.

90.10 Remove the printhead from the stand. Refit the front cover and secure it with the knurled screw.

SYSTEM CALIBRATION AND TEST

91 The system calibration and test procedure described below should be performed as necessary to commission the machine after repairs have been carried out. All or part of the procedure may be required, as indicated in the failure diagnosis and repair instructions at the beginning of this section. The procedures may also be used as an aid to fault finding.

In all earth continuity tests, the resistance between the mains lead earth wire and the test points should be less than 1Ω.

Earth continuity test

92 Using the multimeter, test between the green/yellow earth wire in the mains lead and the following points.

92.1 The front and rear panels.

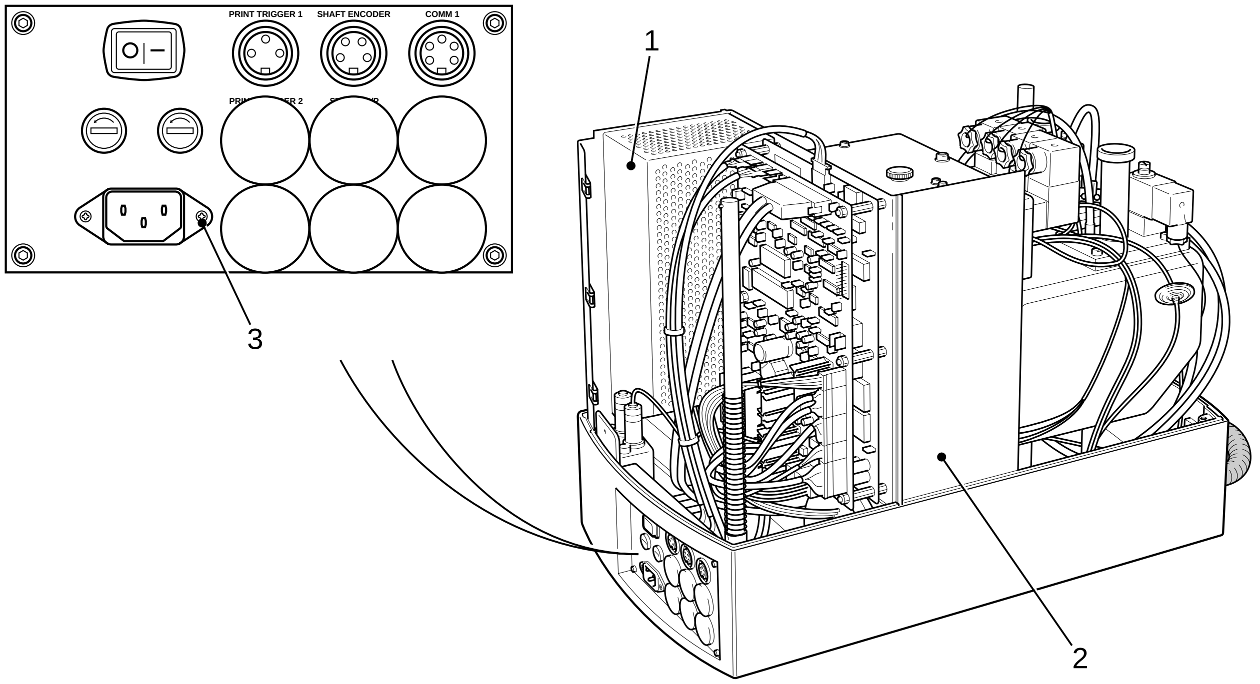
93 With the covers removed from the printer and the top moulding raised, check between the green/yellow wire in the mains lead and the following points:

93.1 Mains supply filter screw (Fig 11.63 (3)).

93.2 PSU cover (1).

93.3 Baffle plate (2).

93.4 Earth point on printhead (located under the rear cover).



1 PSU cover
2 Baffle plate
3 Mains supply filter screw

Fig 11.63 Earth continuity test points

Machine power-up

94 Ensure that the correct fuses are fitted for the local mains supply voltage. The correct values are listed below:

94.1 110V supply - 5A fuse.

94.2 240V supply - 3.15A fuse.

95 Connect the printer to the mains supply and set the mains switch on the connector panel to ON (I).

96 Ensure that the machine initialises correctly.

If the LCD is not visible, press [F3], [Ctrl] [L]. When the LCD is readable press any key to set the contrast.

97 If there is no ink in the system, ensure that the Ink Out icon (Fig 11.10) is displayed.

Pump zero offset calibration

FALSE READINGS. The pump zero offset should only be calibrated when there is no ink in the system and the pump is off.

98 Calibrate the pump zero offset as follows:

98.1 Enter the Calibrate menu and select the Pump Zero Offset option (Fig 11.64).

98.2 Press [↵].

98.3 The ink system pressure is automatically set to zero relative to local atmospheric pressure. There is no visual indication that the calibration has been performed.

Fig 11.64 Pump zero offset

Note that the cooling fan does not rotate until the machine has been switched on for 2 - 4 minutes.

Cooling fan check

99 Check that the electronic compartment cooling fan is operating correctly (ie blowing air through the electronic compartment).

I/O Board LED check

100 Remove the printhead cover and check that LEDs 1, 3, 4 and 5 on the I/O board are illuminated and that LED2 is dimly illuminated. Refer to Fig 11.65 for the location of the LEDs. The LEDs represent the following voltage rails. Refit the printhead cover when the checks are complete.

100.1 LED1 (green); +12 V customer's isolated supply for shaft encoder/photocell.

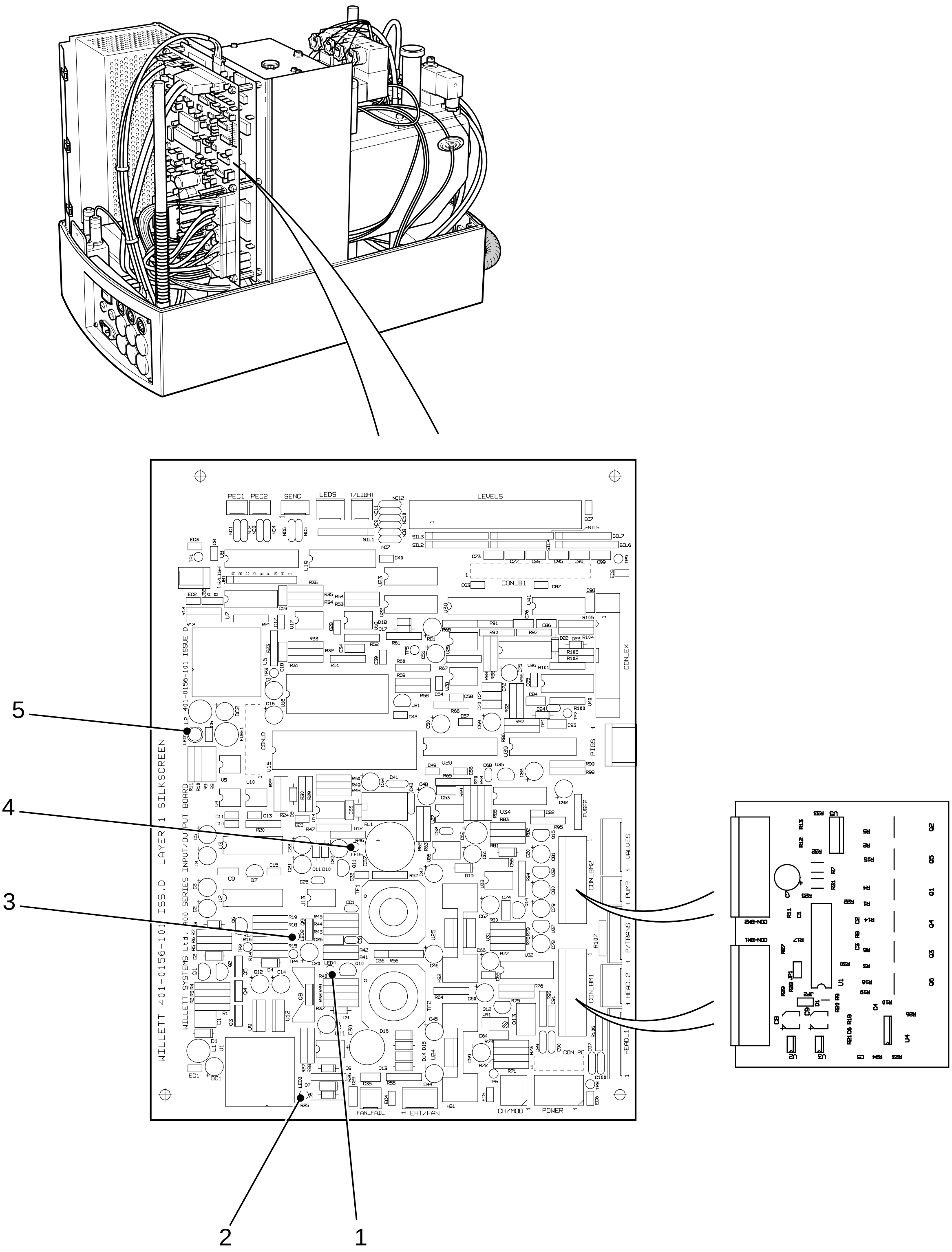
LED2 has a clear lens that glows red when illuminated.

100.2 LED2 (red); 285 V (+15 V = dim (printhead cover off), +285 V = bright (printhead cover on)).

100.3 LED3 (yellow); -24 V supply.

100.4 LED4 (red); -15 V supply.

100.5 LED5 (green); +24 V valve/pump/heater supply.



1 LED 4 (red); -15 V
2 LED 3 (yellow); -24 V
3 LED 2 (red); +285 V
4 LED 5 (green); +24 V
5 LED 1 (green); +10 V

Fig 11.65 I/O board status LED location

Voltage checks

101 Check the voltages on the POWER connector, situated at the bottom right-hand corner of the I/O board. Use Pin 2 as the 0 V reference. Fig 11.66 is a representation of the POWER connector with the voltages shown for each pin.

(1) -24 V is generated from the I/O board not the PSU.

(2) Allow ± 5% tolerance on all voltages except -24 V which is allowed ± 10%.

(3) The power connector must be connected to the I/O board to carry out this check.

PIN 8 -24 V	PIN 7 0 V	PIN 6 +24 V	PIN 5 +5 V
PIN 4 -15 V	PIN 3 +5 V	PIN 2 0 V	PIN 1 +15 V

Fig 11.66 I/O board POWER connector

Reset run hours

102 If the Maintenance Due icon (Fig 11.6) is displayed, the time until the next service is due must be entered to remove it. Proceed as follows:

102.1 Select the Data Logging menu and highlight Reset Run Hours (Fig 11.67). Press ↵. The display will change to the one shown at Fig 11.68.

102.2 Highlight *Set pump alarm hours*. Refer to Table 11.29 and enter the number of hours until the next ink system or pump service is due.

102.3 Highlight *Reset pump run hours*. Use the ← or → key to toggle to *Yes*.

102.4 Highlight *Set machine alarm hours*. Refer to Table 11.29 and enter the number of hours until the next machine service is due.

102.5 Highlight *Reset machine run hours*. Use the ← or → key to toggle to *Yes*.

102.6 Press ↵ to save the settings.

103 The following preventative maintenance schedule must be carried out by a suitably trained maintenance technician.

TABLE 11.29 PREVENTATIVE MAINTENANCE SCHECULE

Serial	Task	Hours per day running/Schedule in months					
		Pi					Si & Mi
		White			Yellow	Black	
(1)	(2)	8 hrs (3)	16 hrs (4)	24 hrs (5)	8-24 hrs (6)	8-24 hrs (7)	8-24 hrs (8)
1	Replace ink pump	6	3	2	24 *Note*	24 *Note*	24 *Note*
2	Replace main ink filter	6	6	6	6	6	6
3	Replace pre-head ink filter	6	6	6	6	6	6
4	Replace pre-head in filter	12	12	12	12	12	-
5	Replace air filter	6	6	6	6	6	6
6	Replace gutter valve	6	6	6	6	6	-
7	Replace stir bars	6	6	6	6	6	-
8	Clean ink level detect holder	6	6	6	6	6	-
9	Replace EHT block	-	-	-	-	6	-

Check and replace only if necessary.

Fig 11.67 Reset run hours

Fig 11.68 Reset run hours - options

Gutter fault and charge error disable

104 Disable the gutter fault and charge error as follows:

104.1 From the System menu select Charge Error Shutdown Disable and press ↵. The display will be as shown in Fig 11.69 (Machine Control dialogue box).

Fig 11.69 Machine control dialogue box

104.2 Use the ↑ and ↓ keys to highlight *Charge error* and use the ← or → key to toggle to *Disable*.

104.3 Use the ↑ and ↓ keys to highlight *Gutter fault* and use the ← or → key to toggle to *Disable*.

104.4 Press ↵ to disable both functions.

Set EHT range (preliminary settings for printhead and EHT table setup)

Ensure that the printhead is clean and dry before setting the EHT range and trip level. The preliminary settings will ensure that the EHT trips are prevented when setting up the printhead and finally calibrating the EHT table.

105 To set the EHT range, proceed as follows:

105.1 Fit the printhead cover and from the Calibrate menu select EHT Range Set and press ↵. The display will be as shown in Fig 11.70.

Fig 11.70 EHT range set

105.2 Use the ↑ and ↓ key to highlight *EHT Value* 1. Use the ← or → key to set the value to 255.

105.3 Use the ↑ and ↓ key to highlight *EHT Value* 10. Use the ← or → key to set the value to 255. Press ↵ to save the settings.

Set EHT trip level (for printhead setup only)

106 To set the EHT trip level, proceed as follows:

106.1 Fit the printhead cover and from the Calibrate menu, select EHT Trip Level and press ↵. The display will show *Setting EHT trip level*.

106.2 After approximately one minute the display will change to *EHT trip set successful*. Press ↵.

Filling the ink system

107 If the Ink Out icon (Fig 11.10) is displayed, remove the filler plug from the top of the FMS and prime the mixer bowl with 250ml of ink using a syringe and a length of 4 cm x 6 mm diameter plastic tube.

EQUIPMENT DAMAGE. Ensure that the ink comes from a sealed bottle and that at least one of the bottles from the same batch has been tested to ensure that the viscosity is correct.

108 The Ink Out icon (Fig 11.10) will clear from the display before all the ink is added to the mixer tank but ensure that all the ink is added.

INK/SOLVENT HAZARD. ENSURE THAT THE TOP COVER OF THE MACHINE IS LOWERED FULLY INTO THE CORRECT WORKING POSITION AND THE FILLER TUBES ARE CORRECTLY LOCATED IN THE INK/TOP UP RESERVOIR BEFORE CONTINUING.

109 If the Ink Level Low icon (Fig 11.2) is displayed, pour the remaining ink into the ink reservoir (4 slot spider).

110 If the Top Up Level Low icon (Fig 11.2) is displayed, fill the top up reservoir (3 slot spider) with one litre of the appropriate top up solvent.

Fluid Identification Number (FIN)

111 To ensure that the correct FIN for the ink in use has been entered into the machine, proceed as follows:

111.1 In the Calibrate menu select Set Ink Type. The display will be as shown in Fig 11.71.

Fig 11.71 Select ink type

111.2 If the FIN, Ink Part No. and Top up Part No. have previously been entered and are correct, press Esc.

111.3 If the numbers have been entered, but are incorrect, delete the incorrect numbers and type in the correct ones. Do not press ↵ until all three numbers have been correctly entered. When ↵ is pressed, the display will change to the one shown in Fig 11.72.

Fig 11.72 Confirm FIN

111.4 Retype the FIN to confirm that it is correct. Press ↵.

(1) A list of part numbers (For ink and top up) and FINs appears in Section 9, Table 9.10.

(2) The FIN is a 12 digit code. The following example shows the ink performance information that is contained within the 12 digits.

110/110/47/	32/	35
(VISCOSITY CURVE)	(PRESSURE)	(TEMPERATURE)

Fill mixer tank

If the ink level in the mixer tank is less than 250 ml then it will be below the ink pick up pipe. The machine will not reach operating pressure or top up ink.

112 If there is 250 ml or less ink in the mixer tank, fill it as follows:

112.1 Select the System Menu and highlight Fill Mixer Tank as shown in Fig 11.73.

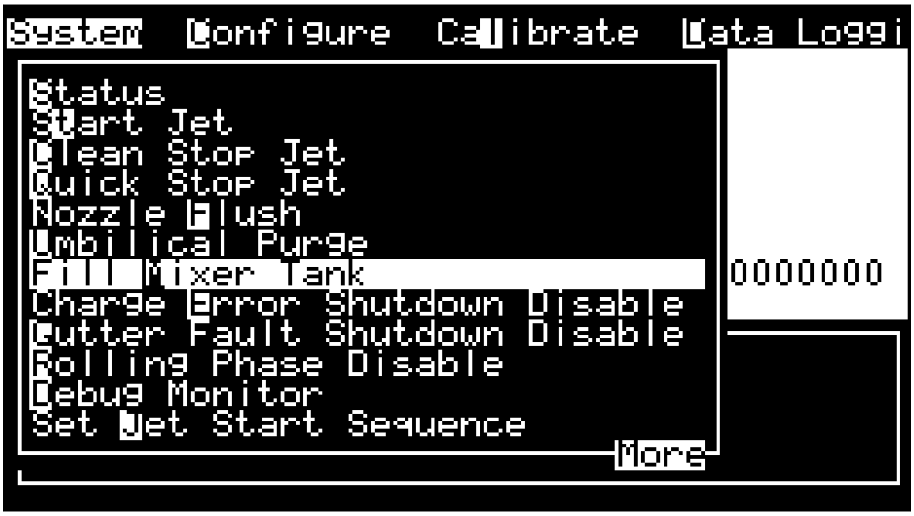


Fig 11.73 Fill mixer tank

112.2 Press ↵. The pump will start and the mixer tank will fill. When the level of ink is OK, the pump will stop (this may take several minutes).

Calibrate 285 V rail

113 To calibrate the 285 V supply, proceed as follows:

113.1 Remove the electrical connectors to the Feed Valve (V6) on the FMS and the Solvent Top up valve (V1) on the top-up reservoir.

113.2 Ensure the printhead cover is fitted and press F1 on the keypad to start the Jet.

(1) An inkjet will not be produced at the printhead as Valve V6 has been disabled.

(2) The machine will shut down if disable charge and gutter detect errors are not disabled.

113.3 On the I/O card connect a DVM, set to measure 285 V, between TP2 (+ve) and TP1 (0 V).

113.4 Set the 285 V rail to 285 V ± 1 by adjusting VR1 on the I/O board. Disconnect the multimeter.

113.5 Seal VR1 adjustment screw using a suitable sealing compound. Refit the electrical connectors to valves V6 and V1.

VMS calibration

114 To calibrate the VMS, proceed as follows:

114.1 Remove the solvent addition actuator coil.

114.2 Start the jet by pressing F1 on the keypad.

114.3 Ensure that the viscosity is correct and that the system is at normal operating temperature before proceeding.

114.4 Select the Calibrate menu and highlight VMS Chamber Calibration as shown in Fig 11.74.

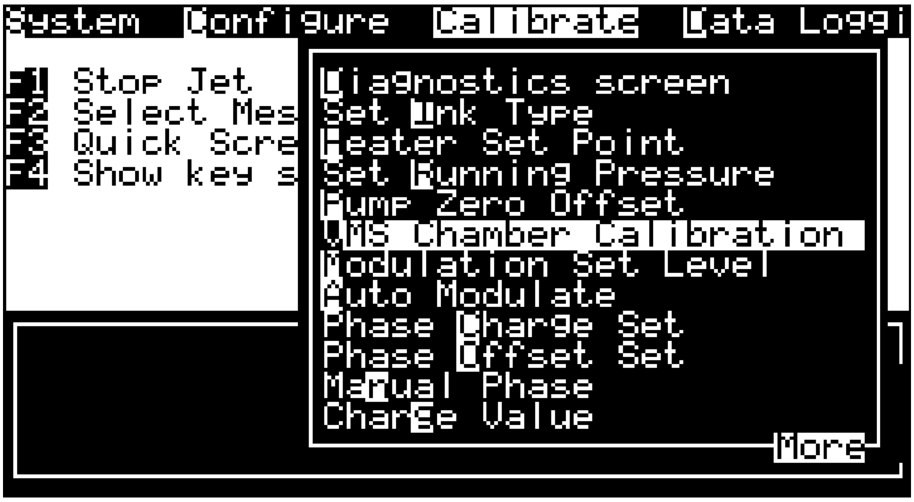


Fig 11.74 VMS calibration

114.5 Press ↵. The display will show *Calibrating VMS Chamber*. After approximately 3 minutes this will change to *VMS Chamber Calibrated*.

114.6 Refit the solvent addition valve actuator.

Nozzle flush

115 To perform a Nozzle Flush, proceed as follows:

115.1 Slacken the knurled screw on top of the printhead and remove the front cover. Support the printhead in a suitable stand and place a container underneath to catch any surplus solvent.

115.2 Select the System Menu and highlight Nozzle Flush as shown in Fig 11.75.

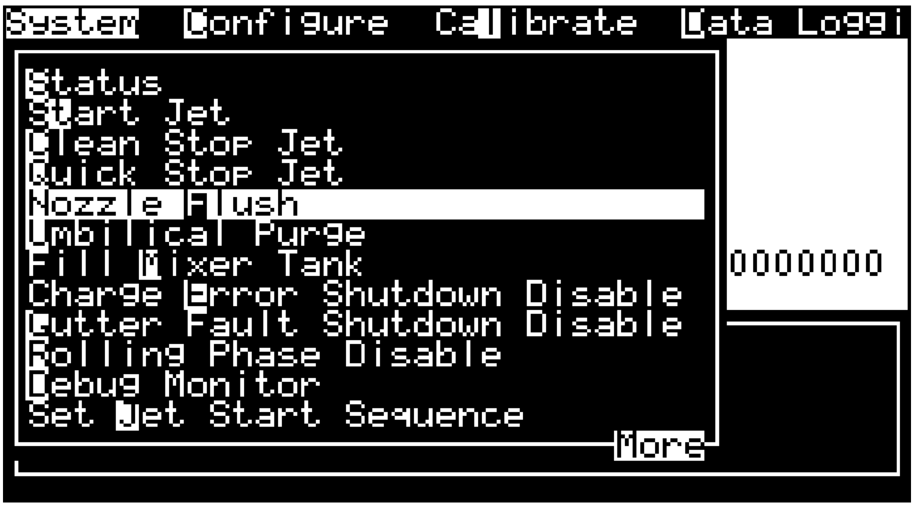


Fig 11.75 Nozzle flush

115.3 Press ↵. Irrigate the nozzle orifice with solvent to clear any blockages.

The nozzle flush will remain operational for 2 minutes but can be aborted at any time by pressing F1, Abort Flush.

Strobe LED check

116 Check that the red strobe LED (situated behind the charge electrode) is illuminated.

Ink jet alignment

117 Press F1 and start the jet. Ensure that the jet is in the correct position in the gutter (See Fig 11.62) and is passing through the centre of the charge electrode slot. Check also that the jet is parallel to the sides of the charge electrode slot.

118 If the inkjet alignment is not correct, set up the printhead alignment as described in Para 90.

Head heater temperature and ink pressure

119 Select the Calibrate menu. Highlight the Diagnostics screen option and press ↵. The display will be similar to that shown in Fig 11.76.

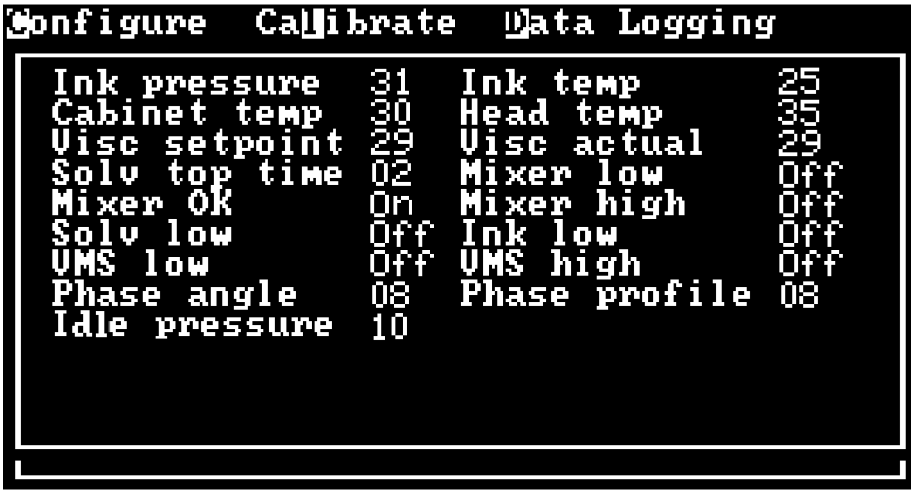


Fig 11.76 Diagnostics screen

120 Check that Ink pressure and Head temp are set to the correct values.

(1) The correct values are part of the FIN and should have been set automatically when the FIN was entered at Para 111.

(2) The Head temp is typically 35 but can vary for some inks. Ensure that the temperature set point is correct for the ink being used (refer to the last 2 digits of the FIN).

(3) Ink pressure is typically 32 but can vary for some inks. Ensure that the pressure set point is correct for the ink being used (refer to the 9th and 10th digits of the FIN).

(4) The head heater will not turn on if a gutter fault is present.

Modulation calibration (manual)

PRINT QUALITY. Ink viscosity must be checked and must be correct prior to attempting modulation calibration.

121 Before viewing the modulation it is necessary to remove the printhead cover and to disable the Rolling Phase as follows:

121.1 Select the System menu and highlight Rolling Phase Disable. Press ↵. The display will be as shown in Fig 11.77.

Fig 11.77 Rolling phase disable

121.2 Use the ← or → keys to select Disable and press ↵.

122 Select the Calibration menu and highlight Modulation Set Value. Press ↵. The display will be as shown in Fig 11.78.

Fig 11.78 Modulation set value

123 View the position of the jet break-off. Adjust the *Modulation Set Value*, using the ← or → keys until the modulation level is 5 and proceed as follows:

123.1 Observe the jet in the viewing area illuminated by the strobe LED.

123.2 While observing the jet, slowly increase the modulation level.

123.3 As the modulation level is increased the ink jet break up point should move up into the strobe LED viewing area, satellites will be observed (Fig 11.79); continue to increase the modulation until the satellites disappear.

123.4 Continue to increase the modulation level, the break up point will get closer to the nozzle until the distance between the break up point and the nozzle reaches the minimum (turning point). Record this value.

123.5 Set the modulation level to 15% below the turning point.

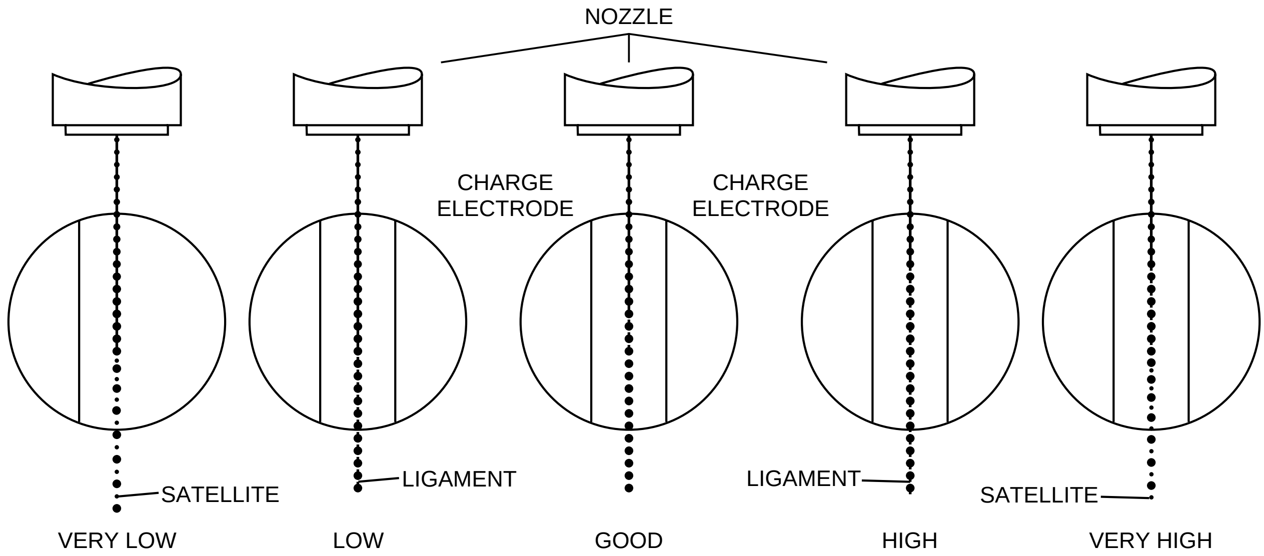


Fig 11.79 Inkjet break-off point

124 When a good break-off point is achieved, press ↵.

125 Select the System menu and highlight Rolling Phase Disable. Press ↵. The display will be as shown in Fig 11.80.

126 Use the ← or → keys to select *Enable*. Press ↵.

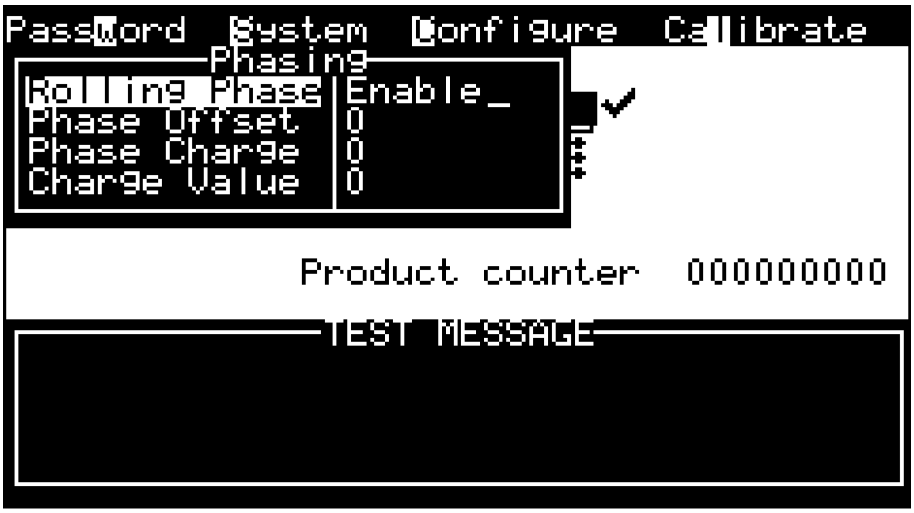


Fig 11.80 Rolling phase enable

Phase profile adjustment

127 Ensure that the phase detector is approximately 1 mm from the ink jet. If not, align the printhead as described at Para 90.

128 Select the Calibrate menu and highlight Diagnostics screen. Press ↵. Check that the Phase profile is 8 ± 1. If the Phase profile is incorrect, adjust it as follows:

128.1 Remain in the Diagnostics screen and press Alt L, C. The display will show *Phase Charge*. Use the ← or → keys to adjust the Phase Charge until the correct Phase profile is displayed, press ↵. Press Esc to exit from the Diagnostics screen.

129 Ensure that the jet is 4 mm ± 0.25 mm from the +ve EHT plate. Also ensure that the 0 V EHT plate is parallel to the jet. If any adjustments are required, refer to the printhead alignment procedure at Para 90.

Phase offset calibration

130 For 460 Si, 450 Si and 460 Mi units set the phase offset to 9.

131 For Pi machines set the phase offset to 12.

Auto Modulation calibration (automatic)

132 To ensure that the Auto Modulation routine is working correctly proceed as follows:

132.1 Select the Calibrate menu and highlight Auto Modulate as shown in Fig 11.81.

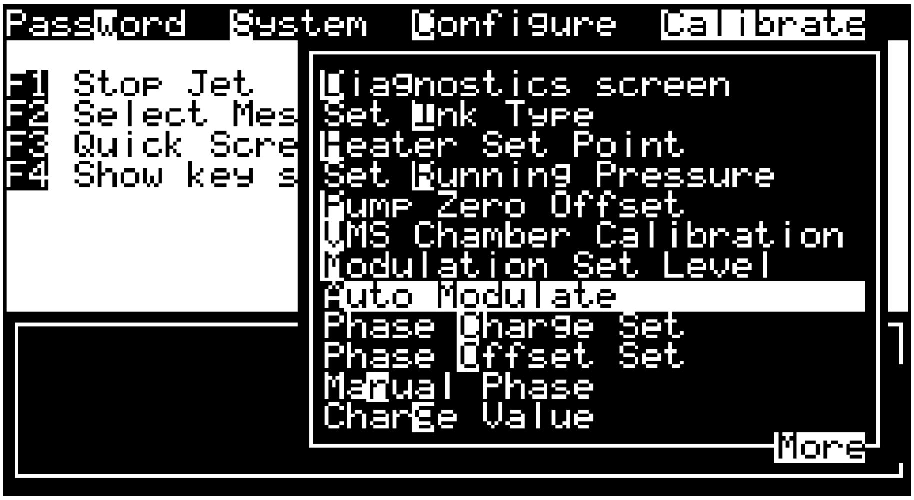


Fig 11.81 Auto Modulate

132.2 Press ↵ to turn the Automodulation to ON.

132.3 After the machine has automodulated successfully, disable the Rolling phase as described at Para 121.

132.4 View the inkjet modulation and ensure that the jet break-up is good (As shown in Fig 11.79).

132.5 Enable the Rolling phase (Para 125 and 126) and auto modulate the jet twice more. Ensure that the jet break-up is the same each time.

If there is a problem, check the ink viscosity and flush the nozzle (Para 115) 2 or 3 times to clear any blockages. If the blockage does not clear, change the nozzle (Para 66).

Print charge value calibration

133 Enter a test message that represents the specific customer rquirement.

134 Select the Calibrate menu and highlight Charge Value. Press ↵. The display will be as shown in Fig 11.82.

Fig 11.82 Charge value

135 Use the ← or → keys to select a value of 150. Do not press ↵. Take print samples, decreasing the charge value in steps of 10 until the print quality becomes poor. It may be necessary to clean the gutter when poor print quality is being produced.

136 Return to a charge value of 150 and increase it in steps of 10 until the print quality becomes poor.

137 Adjust the character height as necessary to prevent over or under deflection.

138 Select the charge value which gives the best print quality and press ↵.

Setting EHT tables for printing

139 Select Message 1 for printing. Set the Character Height for the currently selected message to 1.

140 Select the Calibrate menu and highlight EHT Range Set. Press ↵.

141 The display will be as shown in Fig 11.83.

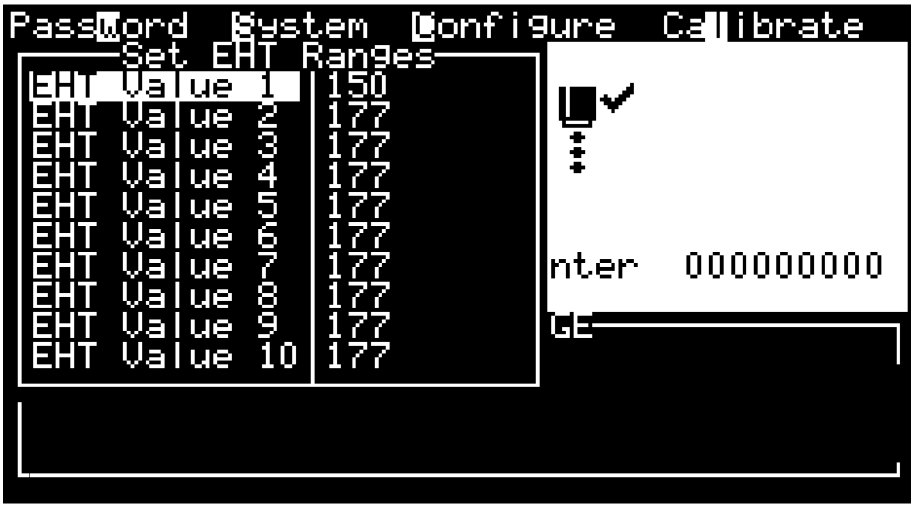


Fig 11.83 Set EHT ranges

142 Highlight *EHT Value 1* and use the ← or → keys to set the value to *150.* Press ↵.

143 Reduce the value in steps of 10 (Press ↵ after inputting each value and take print samples until the minimum readable character is achieved (gutter clipping)). Set this value.

If gutter clipping occurs, clean the gutter before proceeding.

144 Set the Character Height for the currently selected message to 10.

145 Set *EHT Value* 10 to 200. Increase the value in steps of 10 and take print samples until the maximum readable character is achieved. Note this value and decrease it by 10.

(1) It is only necessary to reduce the value by 10 if there is evidence of over deflection. If there is no evidence of over deflection at the maximum EHT setting of 255, leave the setting at 255.

(2) If over deflection occurs, clean the +ve EHT plate before continuing.

(3) After calibration of the EHT table as detailed above, the EHT trip sensitivity must be recalibrated (Para 147).

Clean shutdown check

146 Stop the jet by pressing F1. Ensure that the shutdown procedure operates correctly. i.e. the feed and return tubes are cleared of ink and solvent.

Set EHT trip level (normal operation)

147 Calibrate the EHT trip level as follows:

147.1 Ensure the printhead is clean and dry. Fit the printhead cover.

147.2 Select the Calibrate menu and highlight EHT Trip Level Set. The display will be as shown in Fig 11.84.

147.3 Press ↵. The display will show *Setting EHT trip level*. After approximately 1 minute the display will change to *EHT Trip Test successful*. Press ↵.

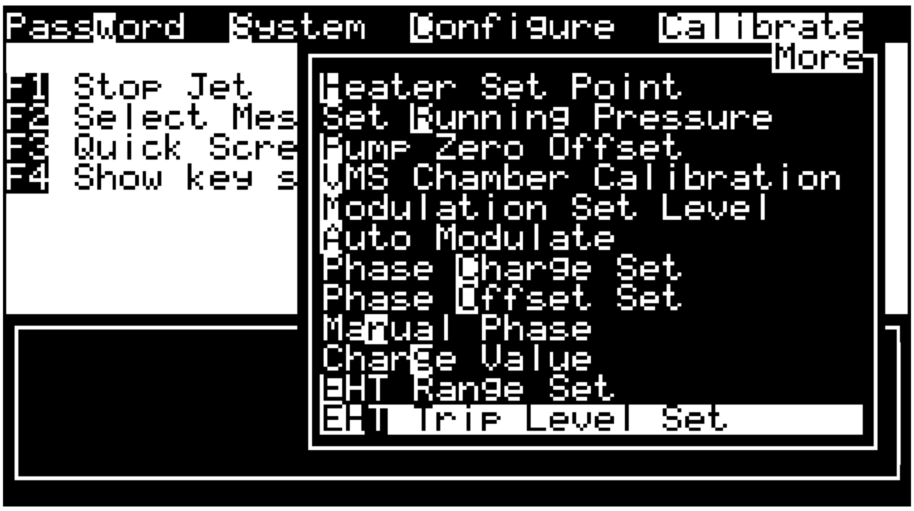


Fig 11.84 EHT Trip Level set

EHT trip test

148 Raise the top moulding and remove the side covers. Remove the electrical connector from Feed Valve V6. This will prevent an ink jet being formed at the printhead nozzle.

149 Ensure that the character height is set to 10 by entering the Messages menu. Highlight Message Parameters, press ↵ and select *Character height*. Use the ← or → keys to set the Character height to 10. Press ↵. Set the charge/gutter detect to DISABLE or the machine will shut down (Para 167 and 168).

150 Fit the modified EHT printhead cover and press F1 to start the Jet. Insert the EHT Trip Tool between the +ve deflection plate and the 0V plate. The point of the tool should be towards the +ve plate.

151 Ensure that the machine shuts down with an EHT trip indicated on the LCD.

152 Refit the electrical connector to Valve V6.

153 Refit the side panel to the printer and lower the top moulding.

Print height test

154 Take two print samples with the printhead between 8 mm and 18 mm from the substrate. Make sure that the minimum and maximum print height specifications are met as described below:

154.1 Message 2 (5 drop high) must print a message down to a minimum height of 2 mm.

154.2 Message 3 (24 drop high) must print a message up to a maximum of 10 mm (Pi; 6 mm).

Restore calibration parameters

155 To restore the previously calibrated parameters, proceed as follows:

155.1 Select the Configure menu and highlight Restore System Settings.

155.2 Press ↵ to restore the settlings.

Enable Gutter Detect and Charge Check

156 Enable the Gutter Detect and Charge Check as follows:

156.1 Enter the System menu and highlight Charge Error Shutdown Disable. Press ↵. The display will be as shown in Fig 11.85.

Fig 11.85 Charge error and gutter fault enable

156.2 Use the ↑ and ↓ keys to highlight *Charge error*. Use the ← or → keys to select *Enable* and press ↵.

156.3 Use the ↑ and ↓ keys to highlight *Gutter fault*. Use the ← or → keys to select *Enable* and press ↵.

SYSTEM, CONFIGURE AND CALIBRATE MENUS

157 The following paragraphs describe the System, Configure and Calibrate menus which are used during installation and maintenance.

System menu

158 When the System menu is selected from the menu screen, the System menu options (Fig 11.86) are displayed, a description of these options is provided in the following paragraphs.

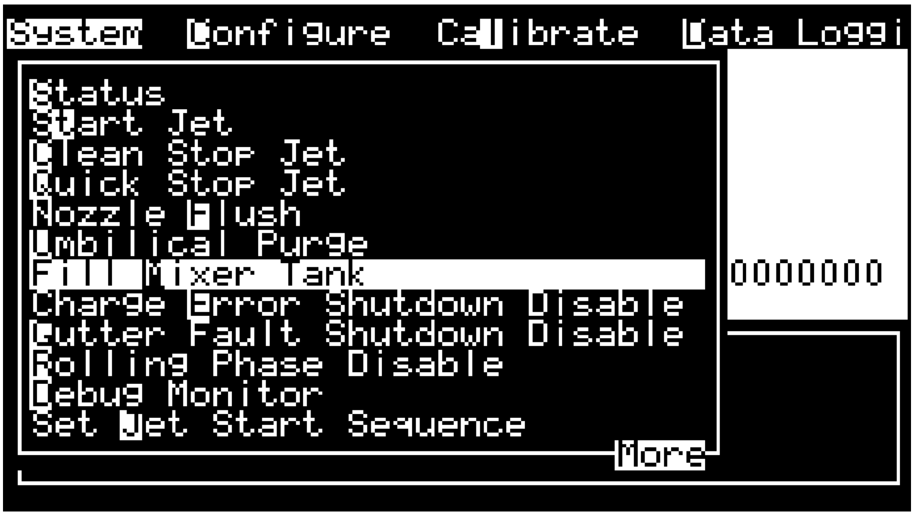


Fig 11.86 System menu options

<u>Status</u>

159 When the Status option is selected the printer status list is displayed (Fig 11.87). The list contains the possible printer faults, with current faults highlighted.

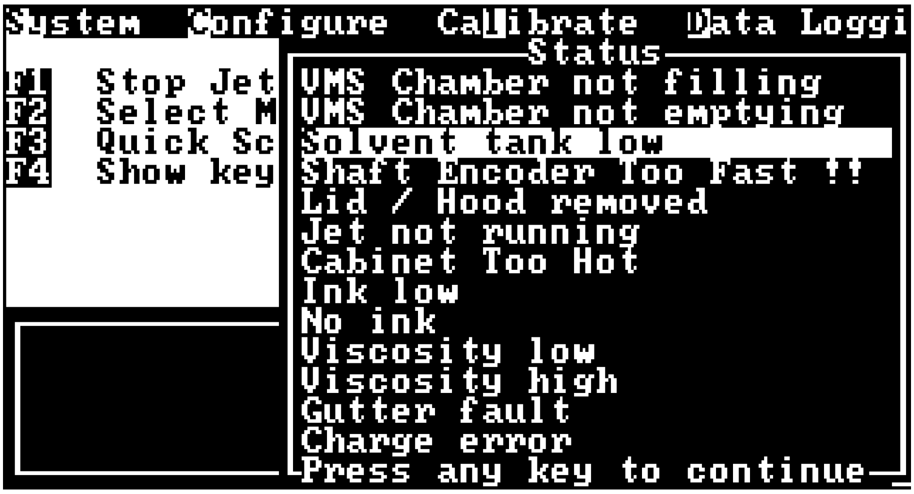


Fig 11.87 Printer faults list

Start Jet

160 When the Start Jet option is selected the ink jet is started and Jet Starting is displayed.

Clean Stop Jet

161 When the Clean Stop Jet option is selected the ink jet is stopped and the nozzle and related ink system pipe work is cleaned.

Quick Stop Jet

162 When the Quick Stop Jet option is selected the ink jet is stopped.

EQUIPMENT DAMAGE. The Quick Stop Jet option should only be used when the printer is to be shut down for short periods of time as ink system blockages will occur.

Nozzle Flush

163 When the Nozzle Flush option is selected the Nozzle Flush dialogue box is displayed. The flush continues for 2 minutes unless any key is pressed to stop it.

Umbilical Purge

164 When the Umbilical Purge option is selected the Umbilical Purge dialogue box (Fig 11.88) is displayed.

165 Select Enable to start and Disable to stop the umbilical purge using the ← or → keys.

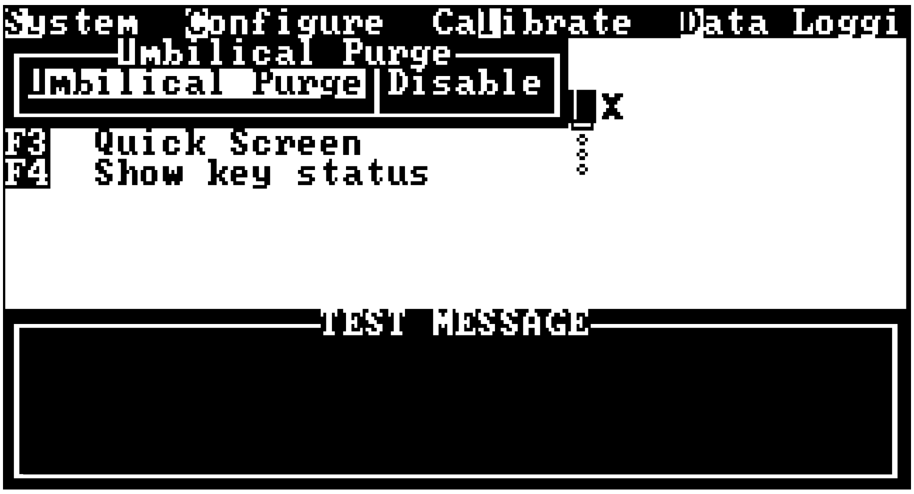


Fig 11.88 Umbilical Purge dialogue box

When using Umbilical Purge ensure that the umbilical feed and return tubes are disconnected from the nozzle feed and return tubes. Loop the umbilical feed and return tubes together and cap the nozzle feed and return tubes.

Fill Mixer Tank

166 When the Fill Mixer Tank option is selected the printer will automatically prime the mixer tank to the correct level.

Charge Error Shutdown Disable

167 When the Charge Error Shutdown/Disable option is selected the Machine Control dialogue box (Fig 11.89) is displayed, the *Charge error* shutdown can then be enabled or disabled, using ← or → keys.

Fig 11.89 Machine Control dialogue box

Gutter Fault Shutdown Disable

168 When the Gutter Fault Shutdown Disable option is selected the Machine Control dialogue box (Fig 11.95) is displayed, the *Gutter fault* shutdown can then be enabled or disabled, using the ← or → keys.

<u>Rolling Phase Disable</u>

169 When the Rolling Phase Disable option is selected, the Phasing dialogue box (Fig 11.90) is displayed, the Rolling Phase can then be disabled or enabled, using the ← or → keys.

170 Disable the Rolling Phase to view the position of the ink jet break-off.

Rolling phase must always be enabled during normal printer operation.

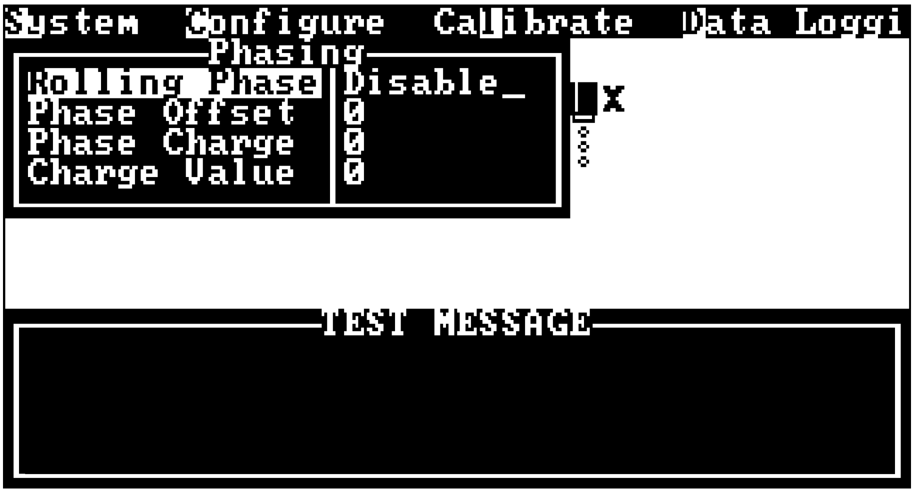


Fig 11.90 Phasing dialogue box

Always ensure that the Rolling Phase is enabled immediately after checking the ink jet break-off.

<u>Debug Monitor</u>

171 The Debug Monitor option is used to monitor the electronics system to detect possible hardware or software faults.

172 This facility should only be used by experienced Willett trained engineers.

Set Jet Start Sequence

173 The Set Jet Start Sequence option allows the setting of the timing and sequence of the valves in the ink system for the jet start procedure.

174 This facility should only be used by experienced Willett trained engineers.

Set Jet Stop Sequence

175 The Set Jet Stop Sequence option allows the setting of the timing and sequence of the valves in the ink system for the jet stop procedure.

176 This facility should only be used by experienced Willett trained engineers.

Set Jet Flush Sequence

177 The Set Jet Flush Sequence option allows the setting of the timing and sequence of the valves in the ink system for the jet flush procedure.

178 This facility should only be used by experienced Willett trained engineers.

Set Jet Clean Stop Sequence

179 The Set Jet Clean Stop Sequence option allows the setting of the timing and sequence of the valves in the ink system for the jet purge procedure.

180 This facility should only be used by experienced Willett trained engineers.

Configure menu

181 When the Configure menu is selected from the menu screen, the configure menu options (Fig 11.91) are displayed, a description of these options is below.

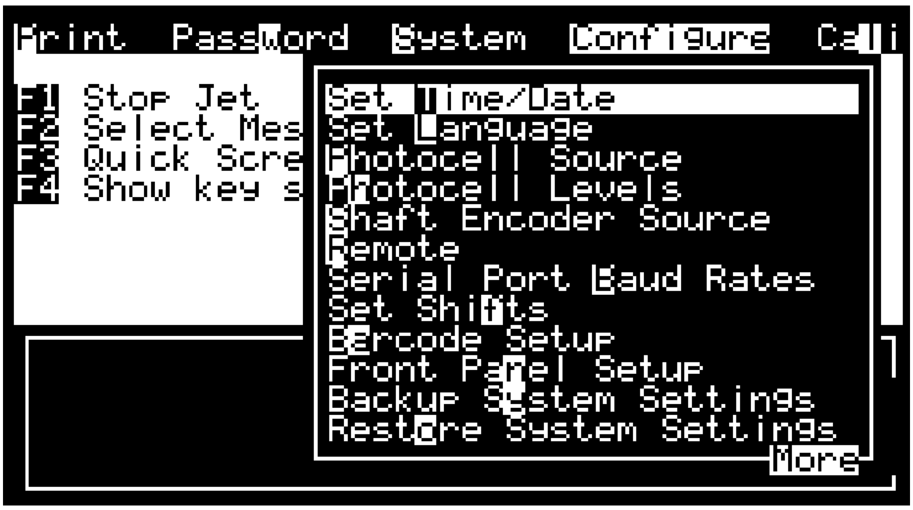


Fig 11.91 Configure menu options

Set Time/Date

182 When the Set Time/Date option is selected, the Real Time Clock (RTC) in the printer can be set to the local time and date.

Set Language

183 When the Set Language option is selected the language to be displayed can be set from the options available, a list of available languages is provided in Section 6.

Selecting a language automatically sets the appropriate keyboard type for that language.

Photocell Source

184 When Photocell Source option is selected the Print Control dialogue is displayed. The photocell source option allows external source 1 or 2 to be selected.

Photocell Levels

185 When the Photocell Levels option is selected the Photocell levels dialogue is displayed. The photocell levels option allows the levels for each photocell to be set active high or active low. Refer to Section 9 for photocell connections on the I/O board.

Shaft Encoder Source

186 When the Shaft Encoder Source option is selected the Print Control dialogue box (Fig 11.92) is displayed. From the dialogue box the shaft encoder source can be set to external or internal.

A push-pull output shaft encoder must be used.

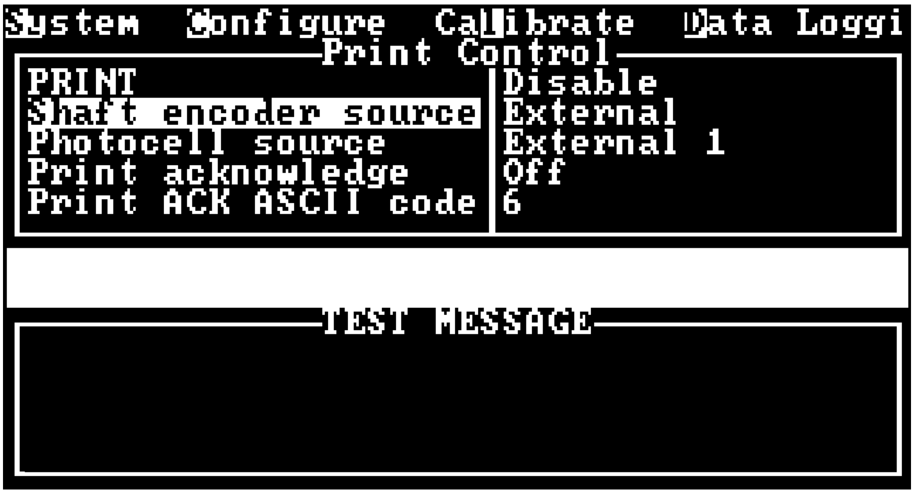


Fig 11.92 Print dialogue box

Serial Port Baud Rates

187 When the Serial Port Baud Rates option is selected, the baud rate for each serial port can be set to one of the following:

187.1 75 Baud.

187.2 110 Baud.

187.3 150 Baud.

187.4 300 Baud.

187.5 600 Baud.

187.6 1200 Baud.

187.7 2400 Baud.

187.8 4800 Baud.

187.9 9600 Baud.

187.10 19200 Baud.

Set Shifts

188 When the Set Shifts option is selected shift length and name can be set.

Barcode Setup

189 When the Barcode Setup option is selected the bar width and space width of the barcode can be set.

Front Panel setup

190 AWAITING INFORMATION.

Backup System Settings

191 The Backup System Settings option when selected, the parameters set during a calibration process will be saved to memory, overwriting any previous parameters.

Restore System Settings

192 The Restore System Settings option when selected, reads the previously saved parameters from memory.

Full System Reset

193 When the Full System Reset option is selected, the following options are available.

193.1 Initialise the printer, restoring it to the factory system settings.

193.2 Reset the printer to the backed up system settings and keep any stored message.

193.3 Reset the printer to the backed up system settings and delete any stored message.

Calibrate menu

194 When the Calibrate menu is selected from the menu screen, the calibrate menu options (Fig 11.93) are displayed, a description of these options is as follows:

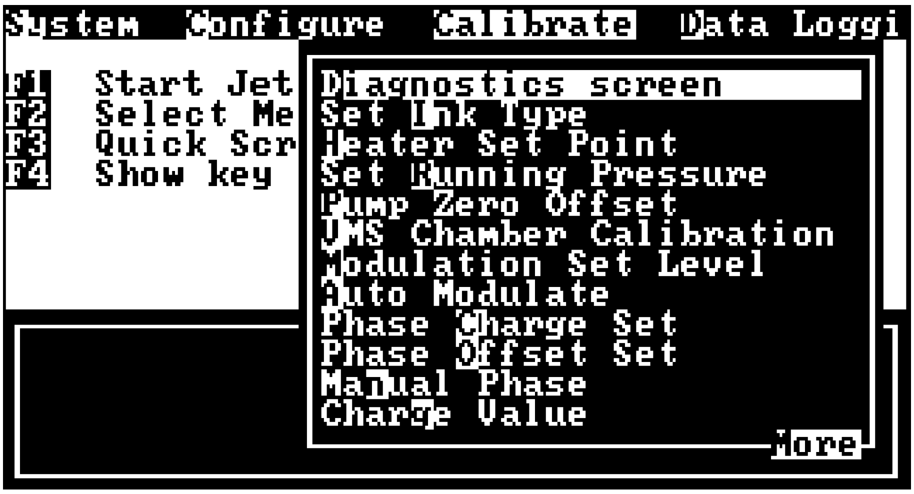


Fig 11.93 Calibrate menu options

Diagnostics screen

195 When the Diagnostics screen option is selected the diagnostics screen (Fig 11.94) is displayed. The screen displays information on ink system status, which is useful when attempting to diagnose printer faults.

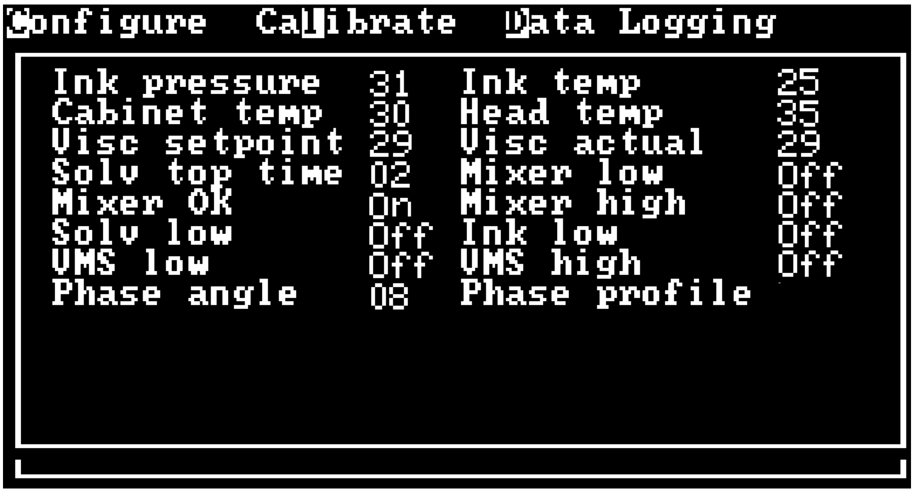


Fig 11.94 Diagnostics screen

Set Ink Type

196 When the Set Ink Type option is selected, the Select Ink Type dialogue (Fig 11.95) is displayed. The dialogue prompts the user to enter the Fluid Identification Number (FIN) and the ink and Top-up Numbers. When the ↵ key is pressed after all 3 numbers have been typed, the display will ask for the FIN number to be retyped as a double check.

Fig 11.95 Select Ink Type dialogue box

Heater Set Point

197 The Heater Set Point option is automatically set when the FIN is entered (Section 9).

Set Running Pressure

198 The Set Running Pressure option is automatically set when the FIN is entered (Section 9).

Set Idle Pressure (Pi)

199 The Set Idle Pressure option is set to 10 for white ink and is set to 0 for yellow or black ink. This allows the ink pump to continue cycling when no printing is taking place so that the ink is constantly circulating and does not settle.

Pump Zero Offset

200 The Pump Zero Offset option allows the ink system pressure to be set to zero relative to local atmosphere pressure and should be carried out with no ink in the system and the pump not running.

VMS Chamber Calibration

201 When the VMS Chamber Calibration option is selected, the VMS is automatically calibrated for the ink currently selected.

When calibrating the VMS, ensure that the ink in the mixer tank has been added from a new bottle, if not, drain the tank and replenish with fresh ink.

Modulation Set level

202 When the Modulation Set Level option is selected, the modulation voltage can be set manually to achieve optimum jet breakup. Use only ← or → keys to increase or decrease the mod value.

Ctrl + ← or → increases or decreases the value by ± 10.

Auto modulate

203 When the Auto modulate option is selected, the printer will automatically set the modulation voltage to achieve the optimum jet breakup.

Ensure that Rolling Phase is enabled when performing an Auto modulation.

Phase Charge set

204 When the Phase Charge set option is selected, the value can be adjusted using the ← or → keys. The distance the phase detector is from the jet can effect the value required for good phasing.

The phase detector should be approximately 1 mm from the ink jet.

Phase Offset Set

205 When the Phase Offset Set option is selected the Phasing dialogue box (Fig 11.96) is displayed, the Phase offset (Si & Mi = 9, Pi = 12) can then be set to a value between 0 and 15.

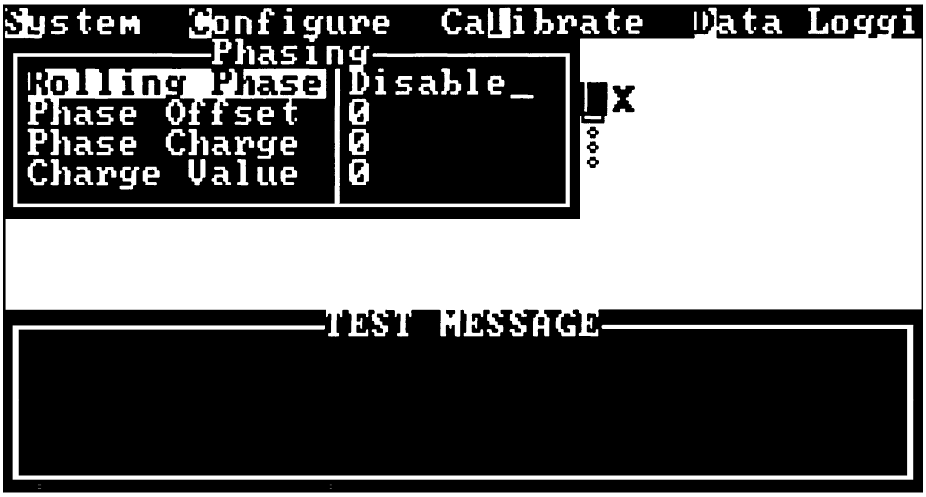


Fig 11.96 Phasing dialogue box

Manual Phase

206 Enabling this function sets the phase angle to the last one used and stops phasing. This effectively freezes the droplets when viewed against the printhead LED.

Print charge value

207 This function is used to adjust the amount of charge applied to printed drop in order to achieve optimum print quality.

EHT Range Set

208 This function sets the upper and lower limits of the EHT field so that good quality print is achieved at all character height settings. If F2 is pressed when the EHT range is displayed then the values between one and ten will be automatically calibrated.

EHT Trip level Set

209 This calibrates the trip level for the EHT circuit.

INK VISCOSITY MEASUREMENT

Before testing viscosity, ensure that the printer is at normal operating temperature.

210 To measure the viscosity of the ink, proceed as follows:

210.1 Set up the syringe viscometer over a beaker that contains a thermometer.

210.2 Using the large syringe supplied, draw out at least 60 ml of ink from the mixer reservoir.

210.3 Cover the viscometer syringe nozzle, using a gloved finger, and fill until the ink is level with the top of the syringe.

210.4 Using a stopwatch, time the flow of ink through the viscometer from the time when the finger is removed until the last drop of ink falls from the nozzle.

210.5 Make a note of the time, and also the temperature indicated on the thermometer.

210.6 Apply the temperature compensation factor (given on the graph supplied with the viscometer) to the time recorded and trace a reading on the main Time versus Viscosity graph (supplied with the viscometer).

If the temperature compensation factor is not used, the end result could be incorrect by as much as 40%.

210.7 Refer to the temperature versus viscosity graph that relates to the ink being used. The graphs are listed at Para 211.

210.8 Relate the temperature noted at Para 210.5 to the horizontal axis of the graph. Use the graph to calculate the optimum viscosity (vertical axis) for the ink.

210.9 Compare the measured viscosity to the optimum viscosity to determine whether the viscosity is high or low.

Temperature/viscosity graphs

211 The following pages contain the temperature versus viscosity graphs. For the range of inks used in the 400 Series printers. The graph titles are listed below:

211.1 Graph 11.1 - CIJ ET 3913G blue.

211.2 Graph 11.2 - CIJ ET 3924J blue.

211.3 Graph 11.3 - CIJ ET 3942J black.

211.4 Graph 11.4 - CIJ EA 3953A black.

211.5 Graph 11.5 - CIJ MK 3938D clear.

211.6 Graph 11.6 - CIJ MK 3906J green.

211.7 Graph 11.7 - CIJ MK 390ID black.

211.8 Graph 11.8 - CIJ MA 3956D violet.

211.9 Graph 11.9 - CIJ ET 3907A black.

211.10 Graph 11.10 - CIJ 3958F eggshell red.

211.11 Graph 11.11 - CIJ MK 3926A black.

211.12 Graph 11.12 - CIJ MK 3911E black.

211.13 Graph 11.13 - CIJ MK 3944A black.

211.14 Graph 11.14 - CIJ MK 3903F red.

211.15 Graph 11.15 - CIJ MK 3904G blue.

211.16 Graph 11.16 - CIJ MK 3914H thermo.

211.17 Graph 11.17 - CIJ MK 3915J black.

211.18 Graph 11.18 - CIJ MK 3919C black.

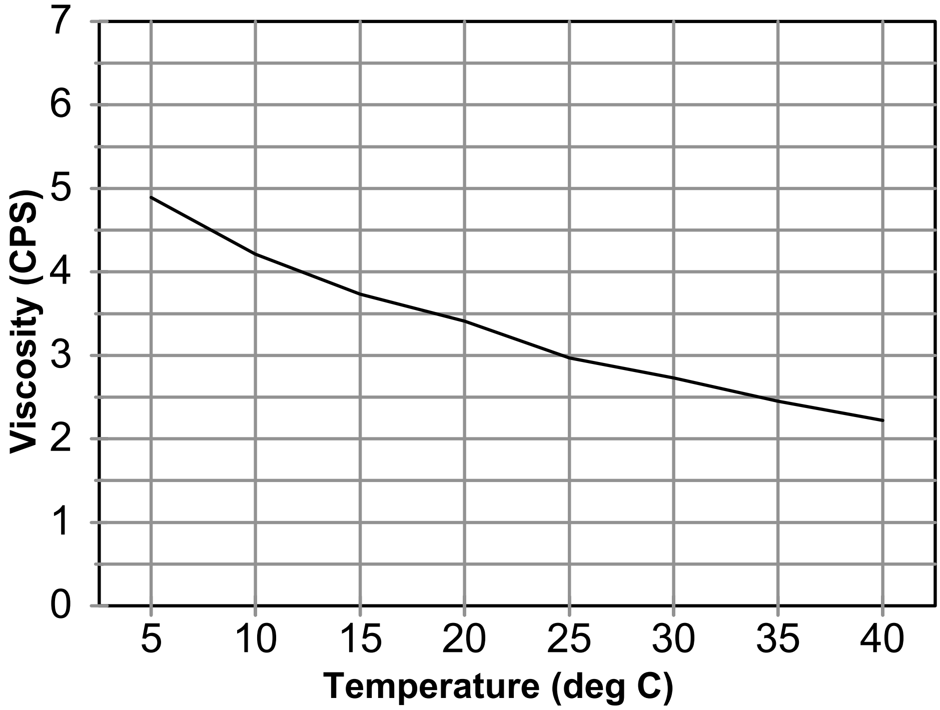
211.19 Graph 11.19 - CIJ MK 3966E thermo.

211.20 Graph 11.16 - CIJ MK 3940G black (Mi).

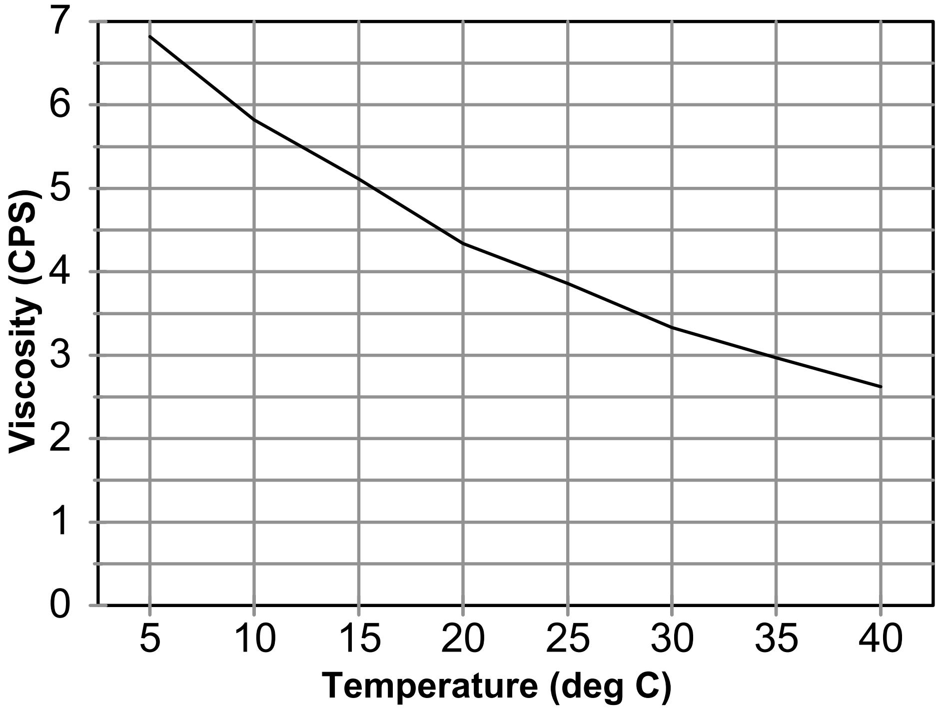
211.21 Graph 11.17 - CIJ MK 3943K white (Pi).

211.22 Graph 11.18 - CIJ MK 3946C yellow (Pi).

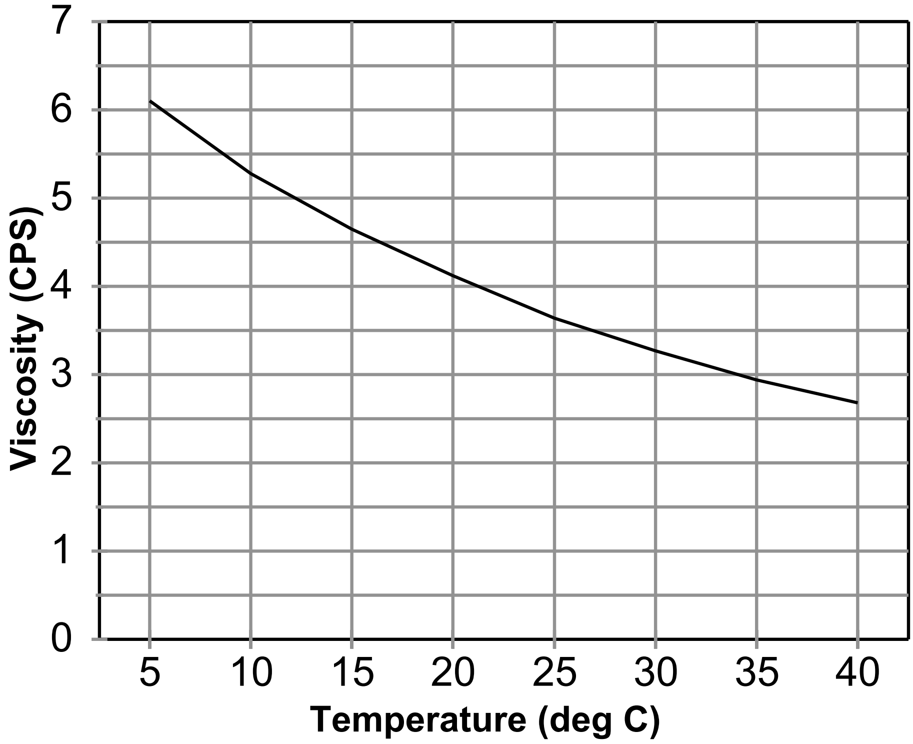
211.23 Graph 11.19 - CIJ MK 3949F black (Pi).



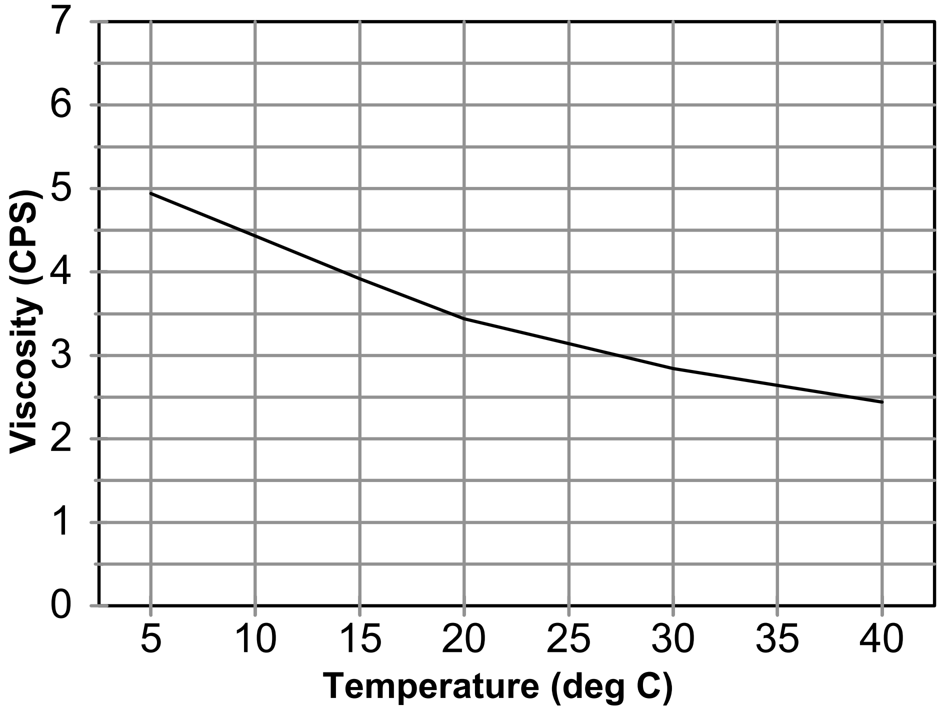
Graph 11.1 Temperature/viscosity - CIJ ET 3913G blue



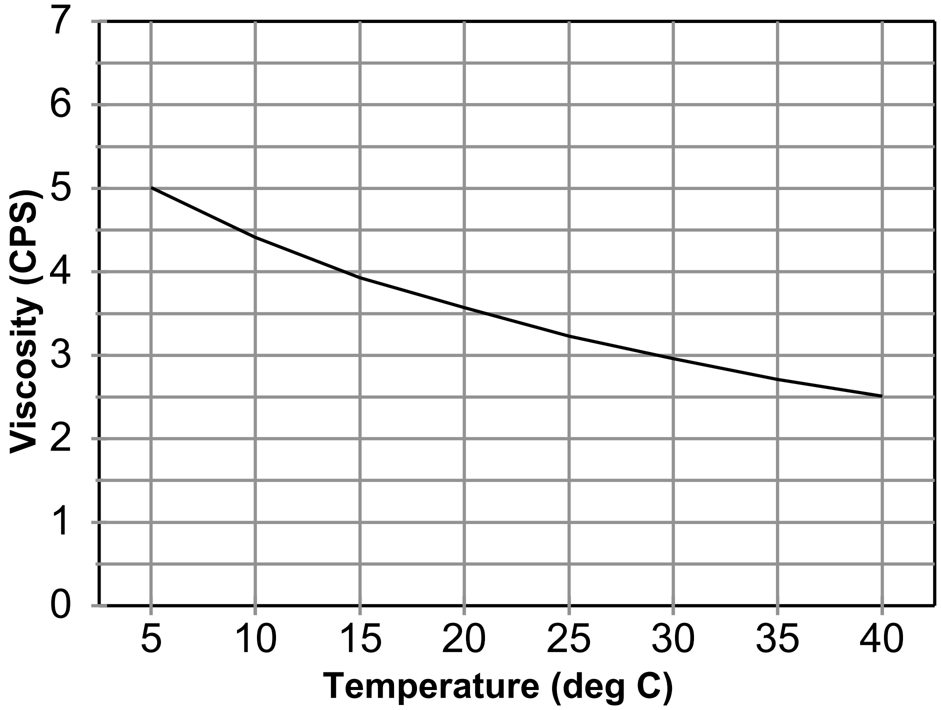
Graph 11.2 Temperature/viscosity - CIJ ET 3924J blue



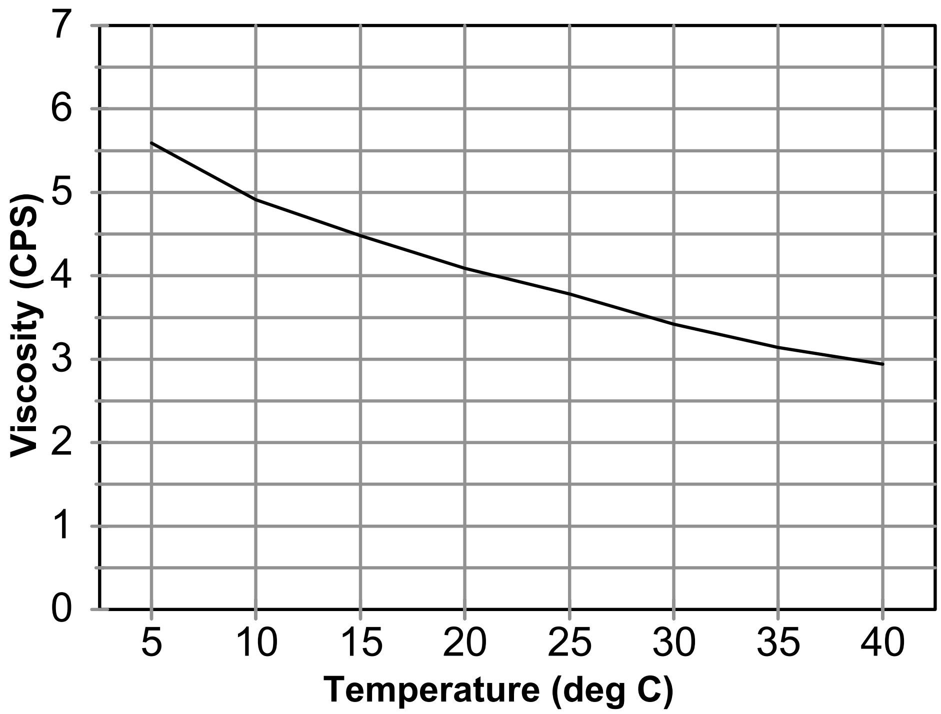
Graph 11.3 Temperature/viscosity - CIJ ET 3924J black



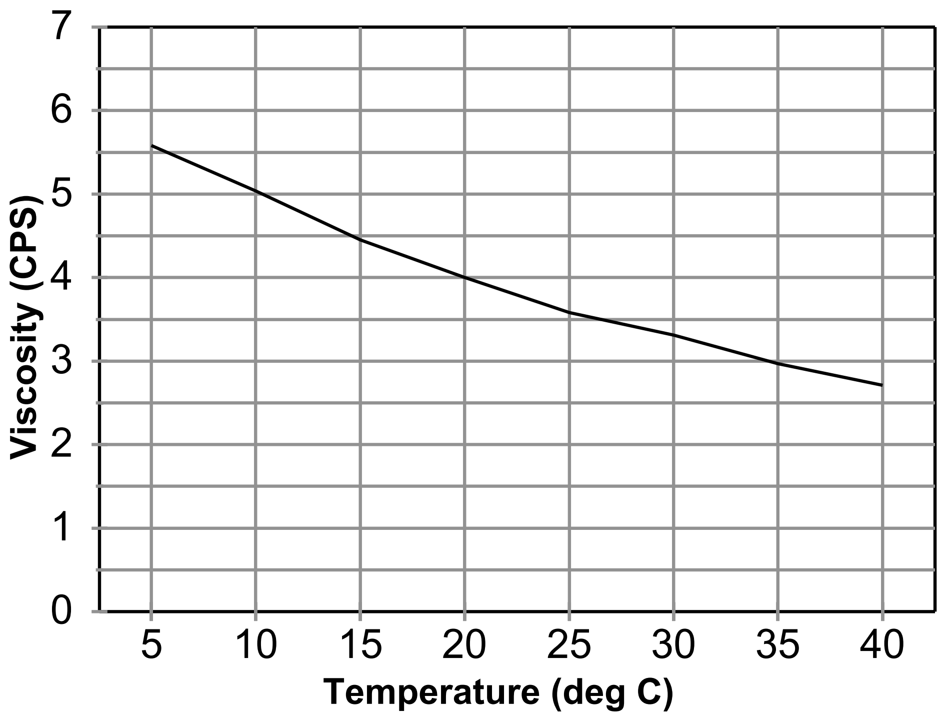
Graph 11.4 Temperature/viscosity - CIJ EA 3953A black



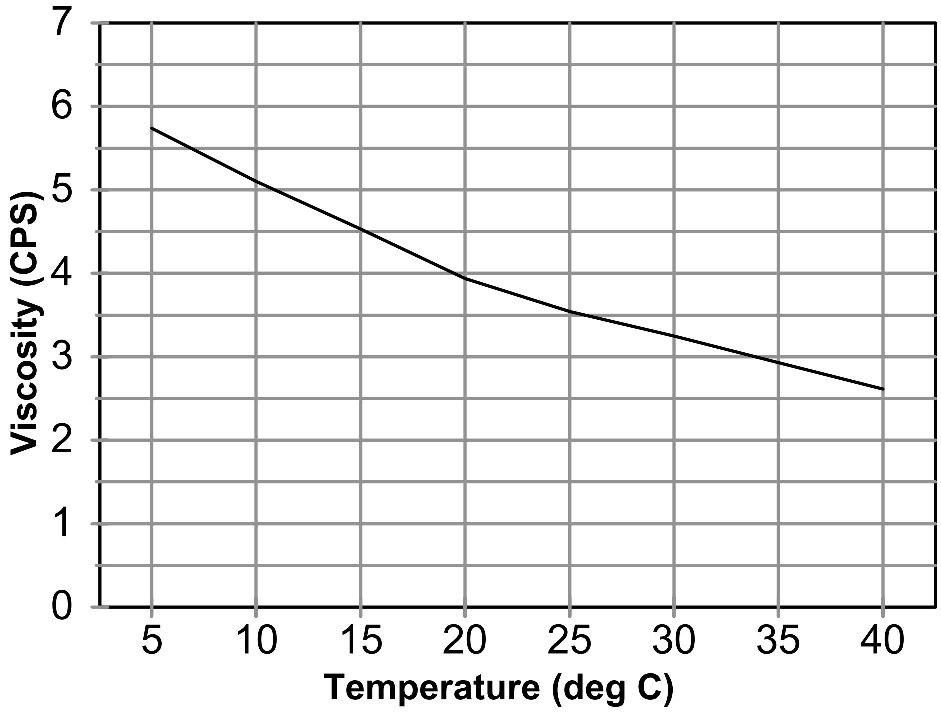
Graph 11.5 Temperature/viscosity - CIJ MK 3938D clear



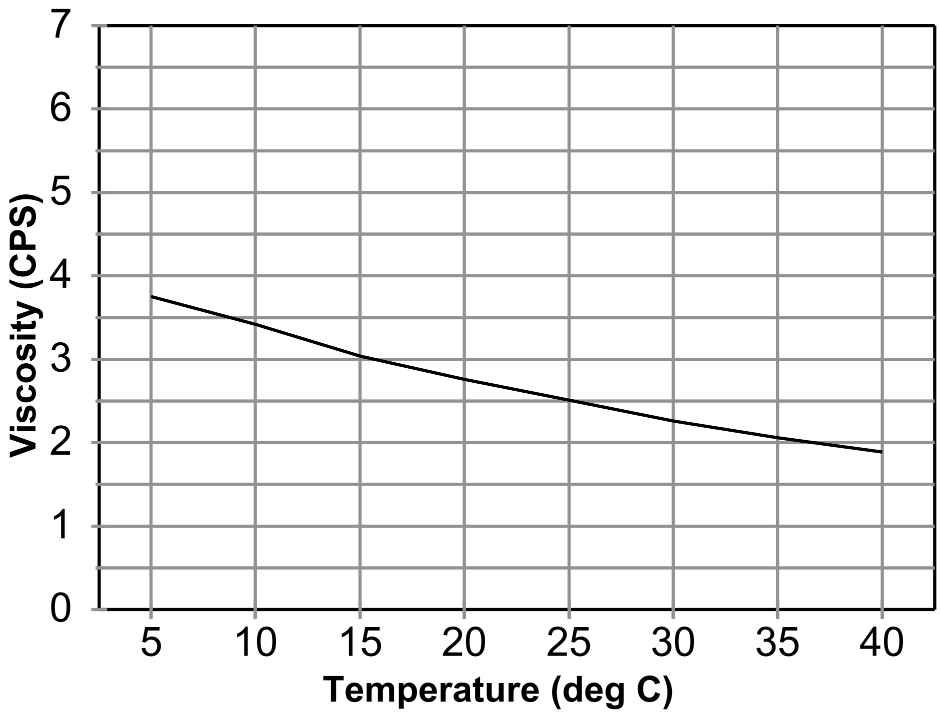
Graph 11.6 Temperature/viscosity - CIJ MK 3906J green



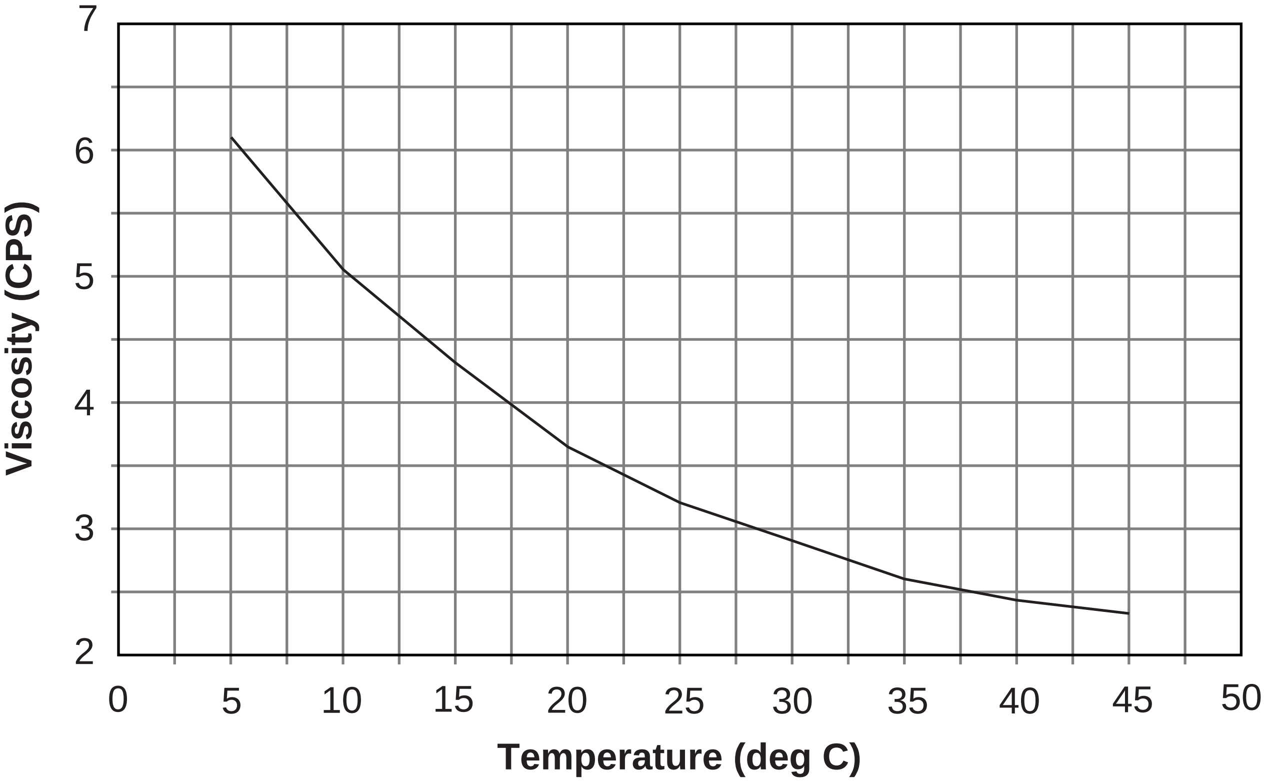
Graph 11.7 Temperature/viscosity - CIJ MK 3901D black



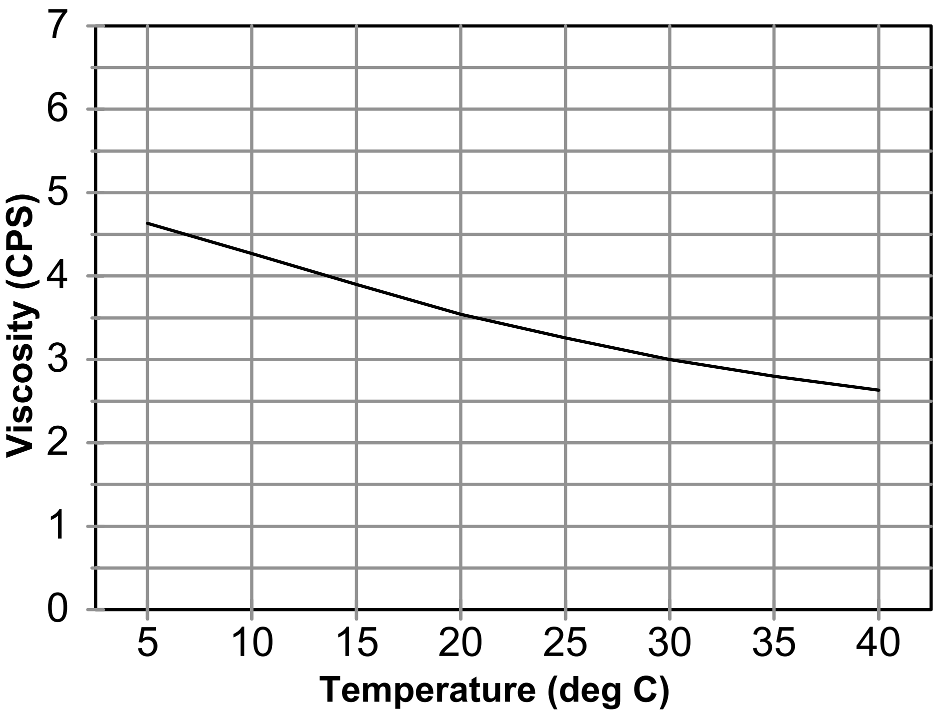
Graph 11.8 Temperature/viscosity - CIJ MA 3956D violet



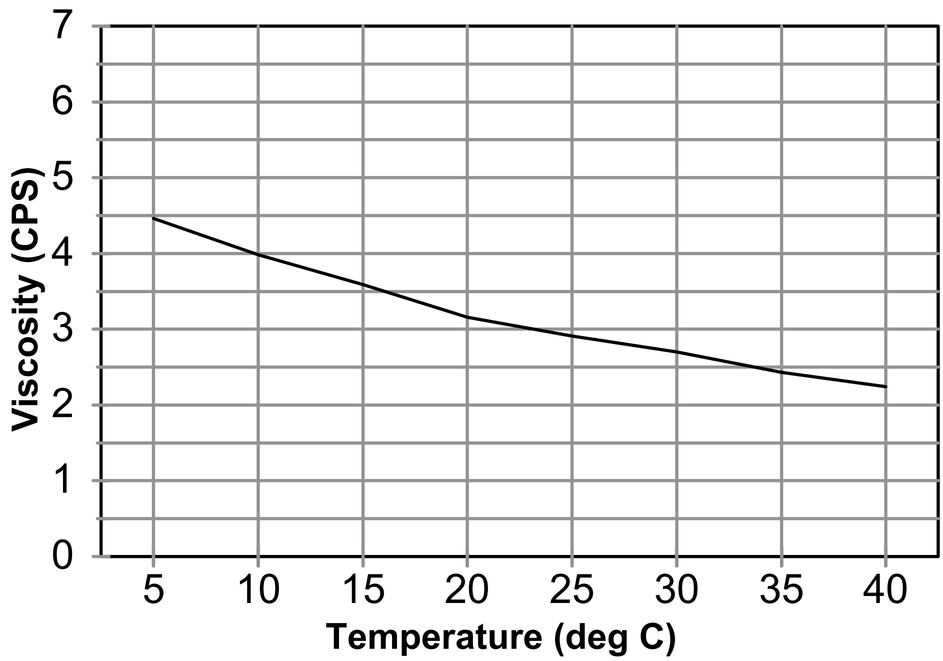
Graph 11.9 Temperature/viscosity CIJ ET 3907A black



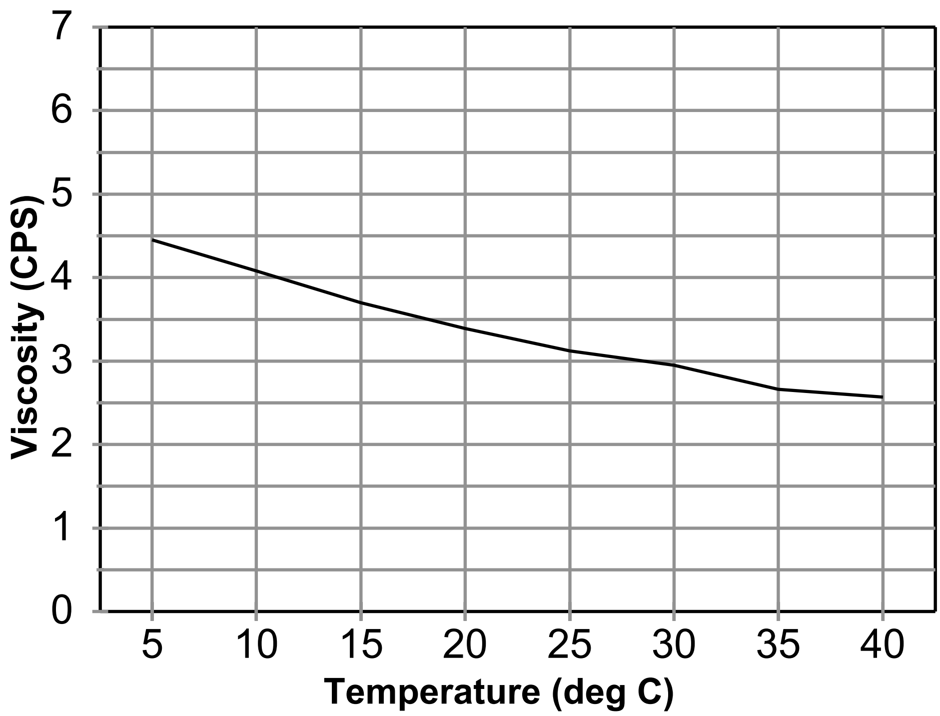
Graph 11.10 Temperature/viscosity - CIJ 3958F eggshell red



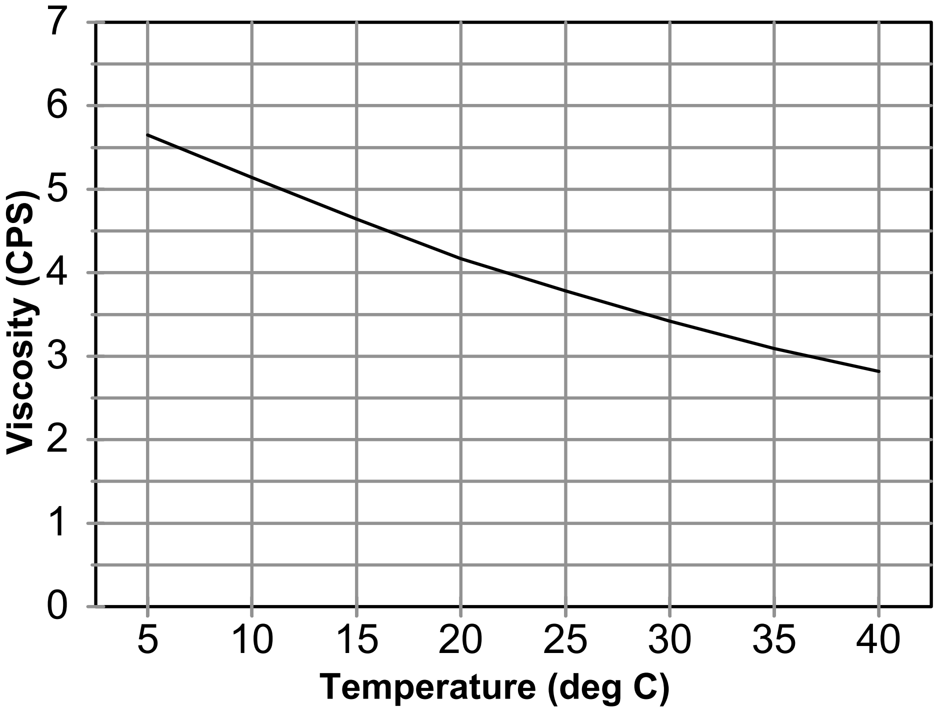
Graph 11.11 Temperature/viscosity - CIJ MK 3926A black



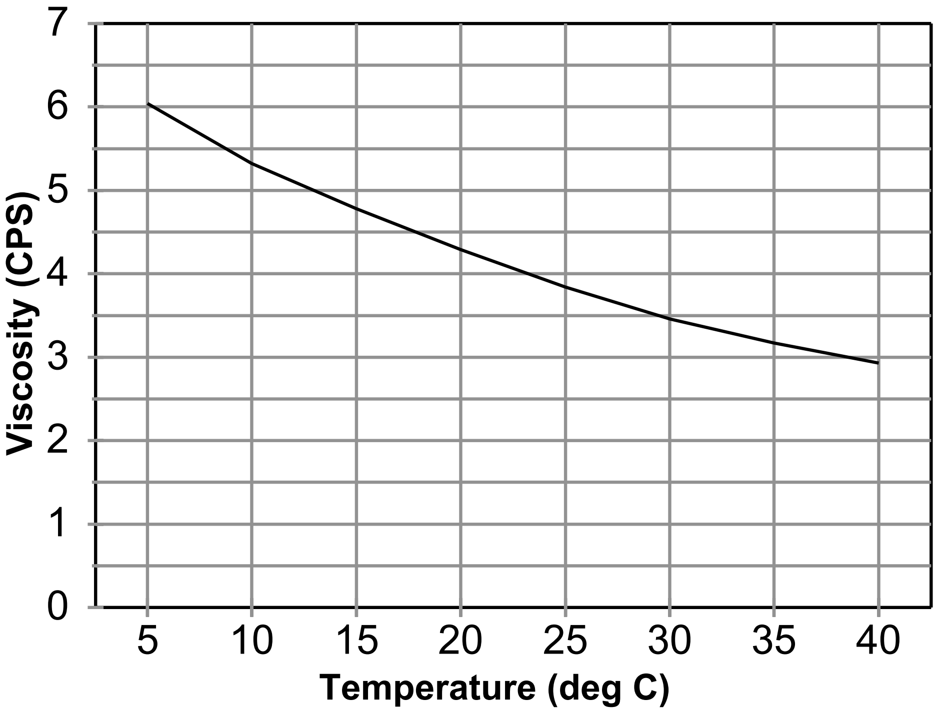
Graph 11.12 Temperature/viscosity - CIJ MK 3911E black



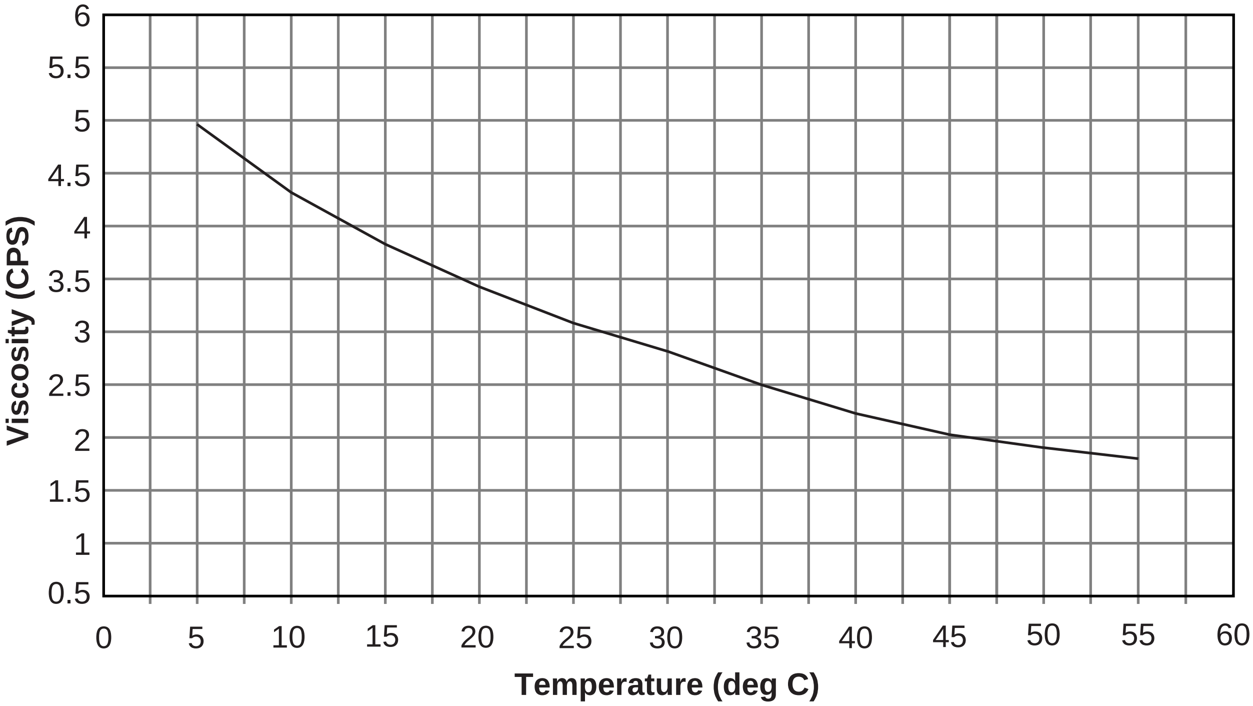
Graph 11.13 Temperature/viscosity - CIJ MK 3944A black



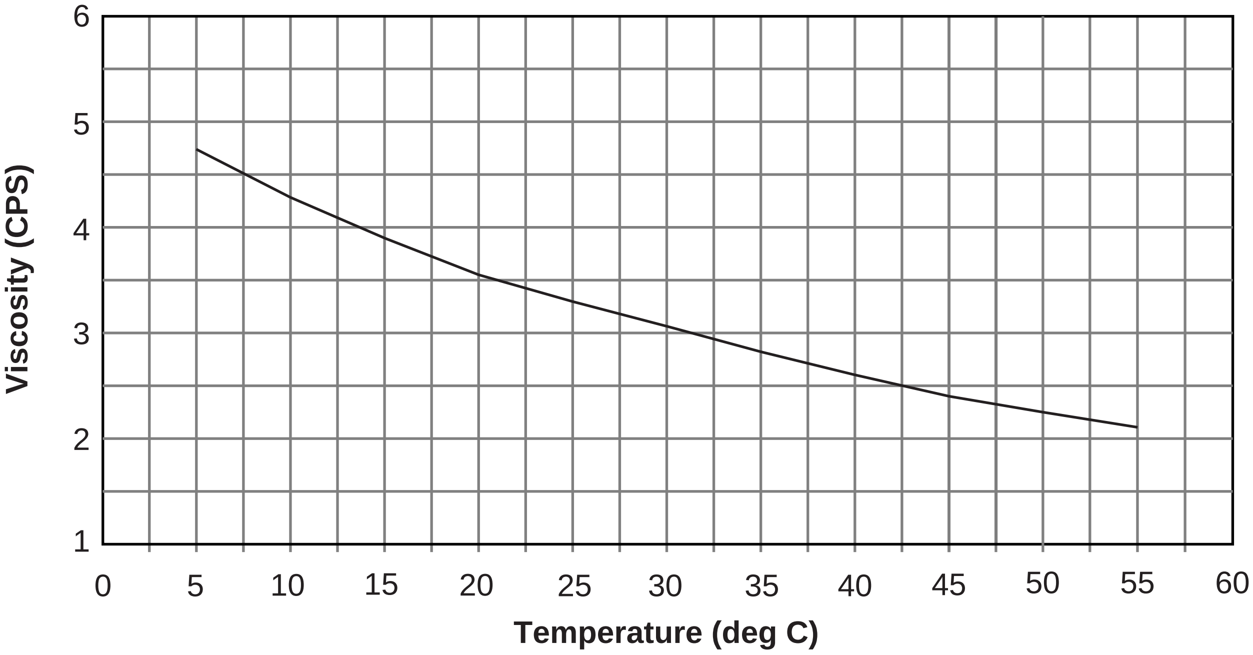
Graph 11.14 Temperature/viscosity - CIJ MK 3903F red



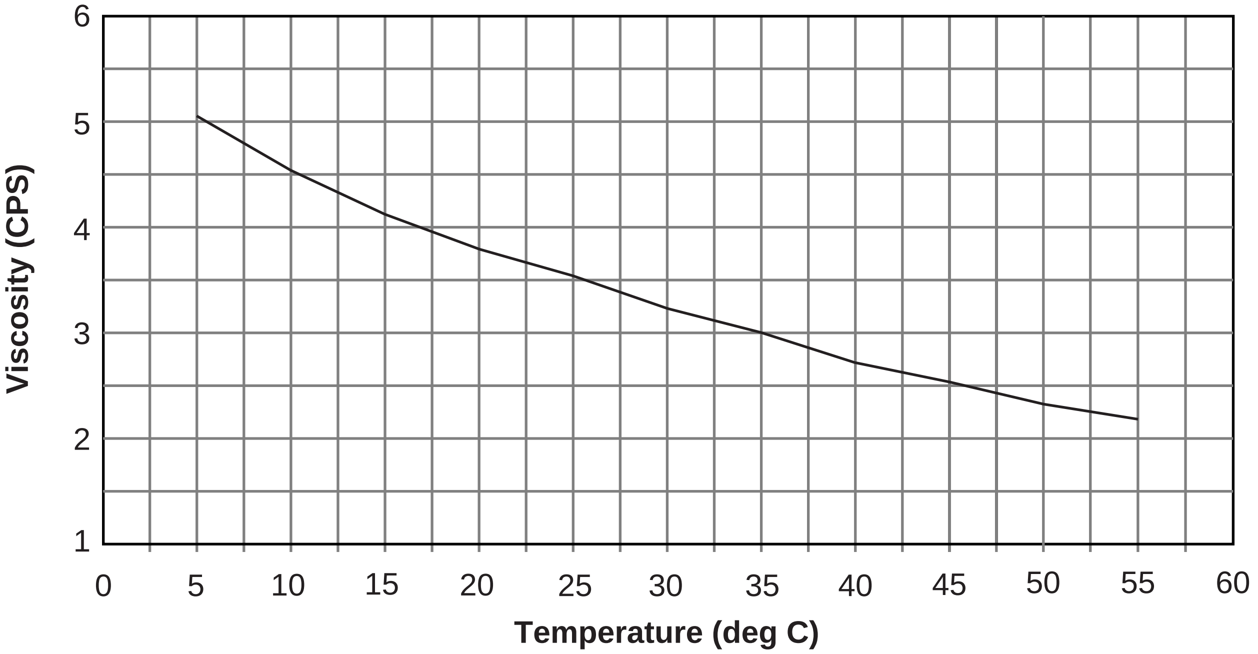
Graph 11.15 Temperature/viscosity - CIJ MK 3904G blue



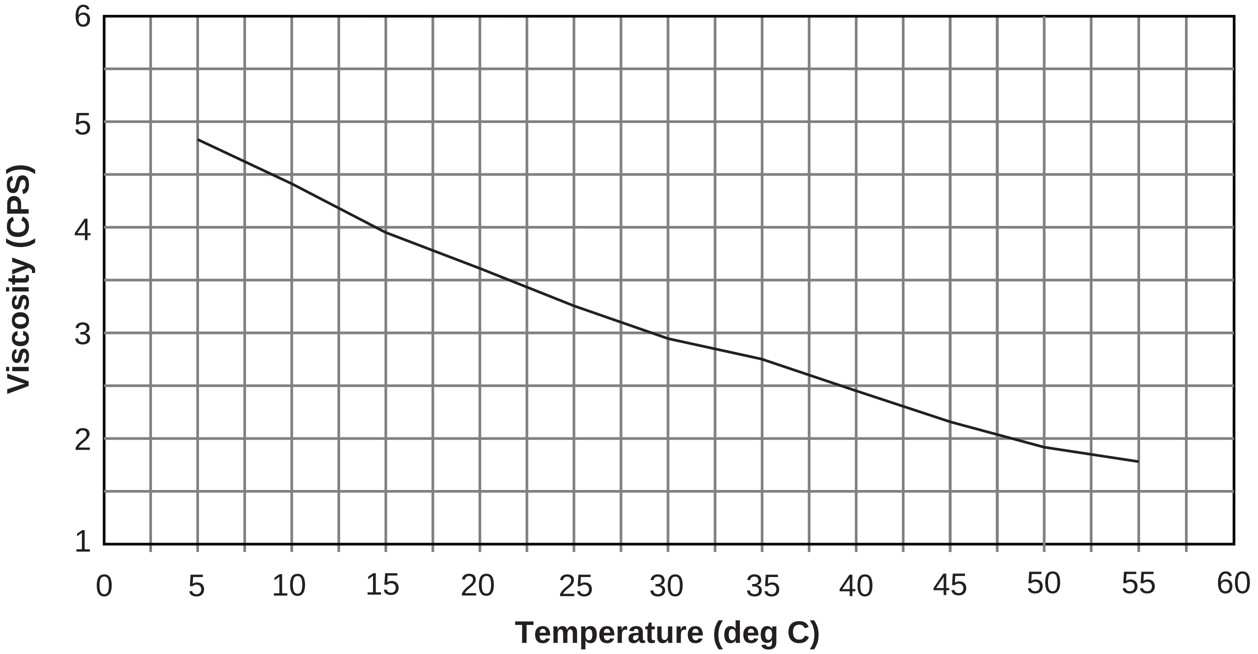
Graph 11.16 Temperature/viscosity - CIJ MK 3914H thermo



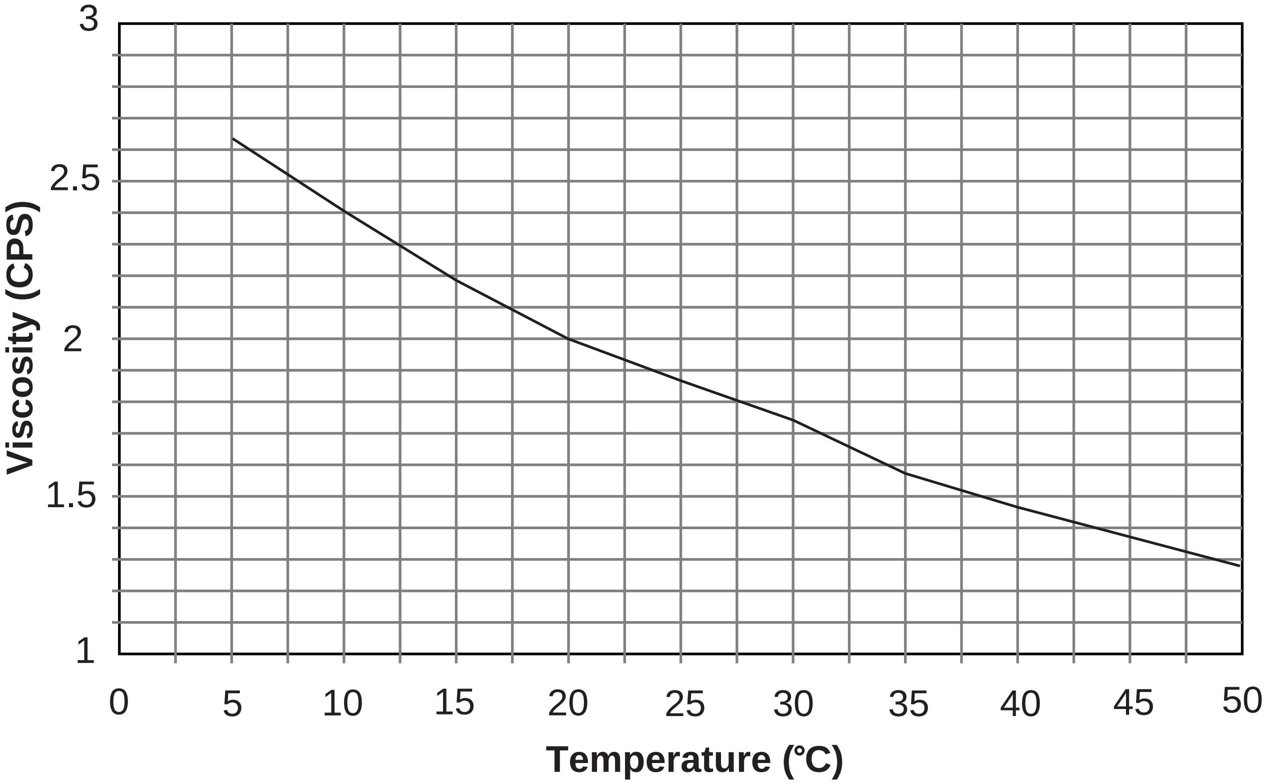
Graph 11.17 Temperature/viscosity - CIJ MK 3915J black



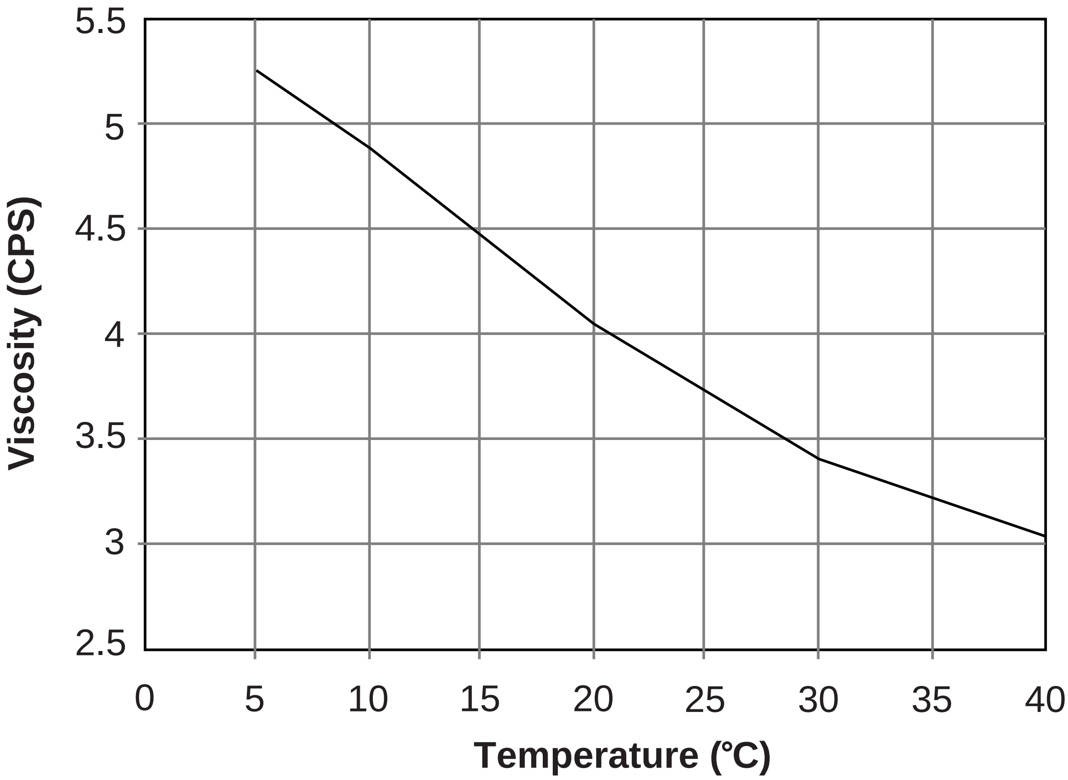
Graph 11.18 Temperature/viscosity - CIJ MK 3919 black



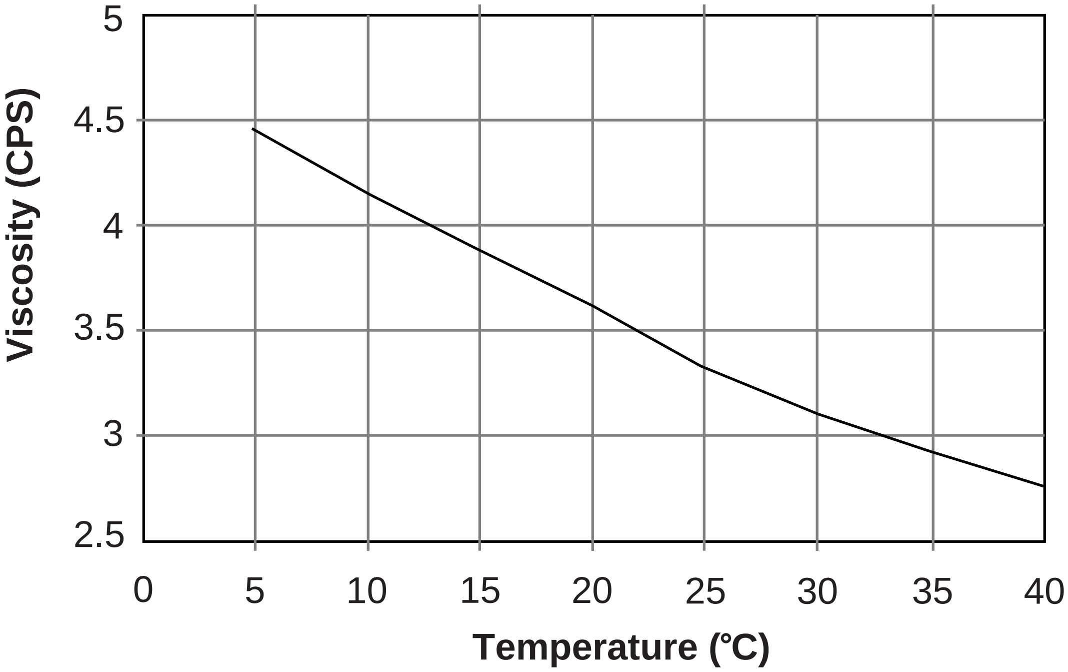
Graph 11.19 Temperature/viscosity - CIJ MK 3966E thermo



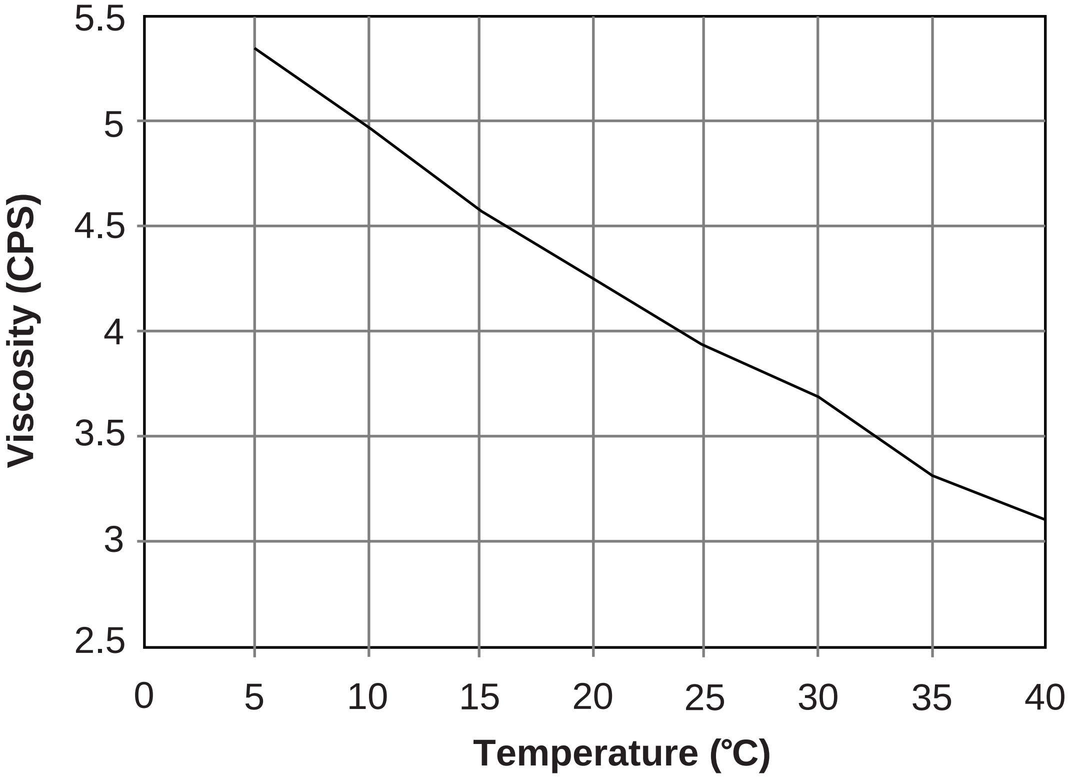
Graph 11.20 Temperature/viscosity - CIJ MK 3940G black (Mi)



Graph 11.21 Temperature/viscosity - CIJ MK 3943K white (Pi)



Graph 11.22 Temperature/viscosity - CIJ MK 3946C yellow (Pi)



Graph 11.23 Temperature/viscosity - CIJ MK 3949 black (Pi)

CONTENTS

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400 SERIES CIJ PRINTER

HOW TO USE THIS PARTS LIST

1 Figure 12.1 and the associated table give ordering information for the 400 Series CIJ printers. Figure 12.2 and Table 12.2 give details of the Stand and Traffic Light System.

2 Figure 12.3 shows the major sub-assemblies of the 400 Series CIJ printer. The associated table lists the sub-assemblies, and refers the reader out to the relevant detailed parts list.

3 Where a component is not illustrated, the letters ‘NI’ appear in column (1) against the line entry for the item.

OPTIONAL PARTS AND ACCESSORIES

4 Tables 12.3, 12.4 and 12.5 give lists of optional parts and accessories, software and documentation. There are no illustrations associated with these tables.

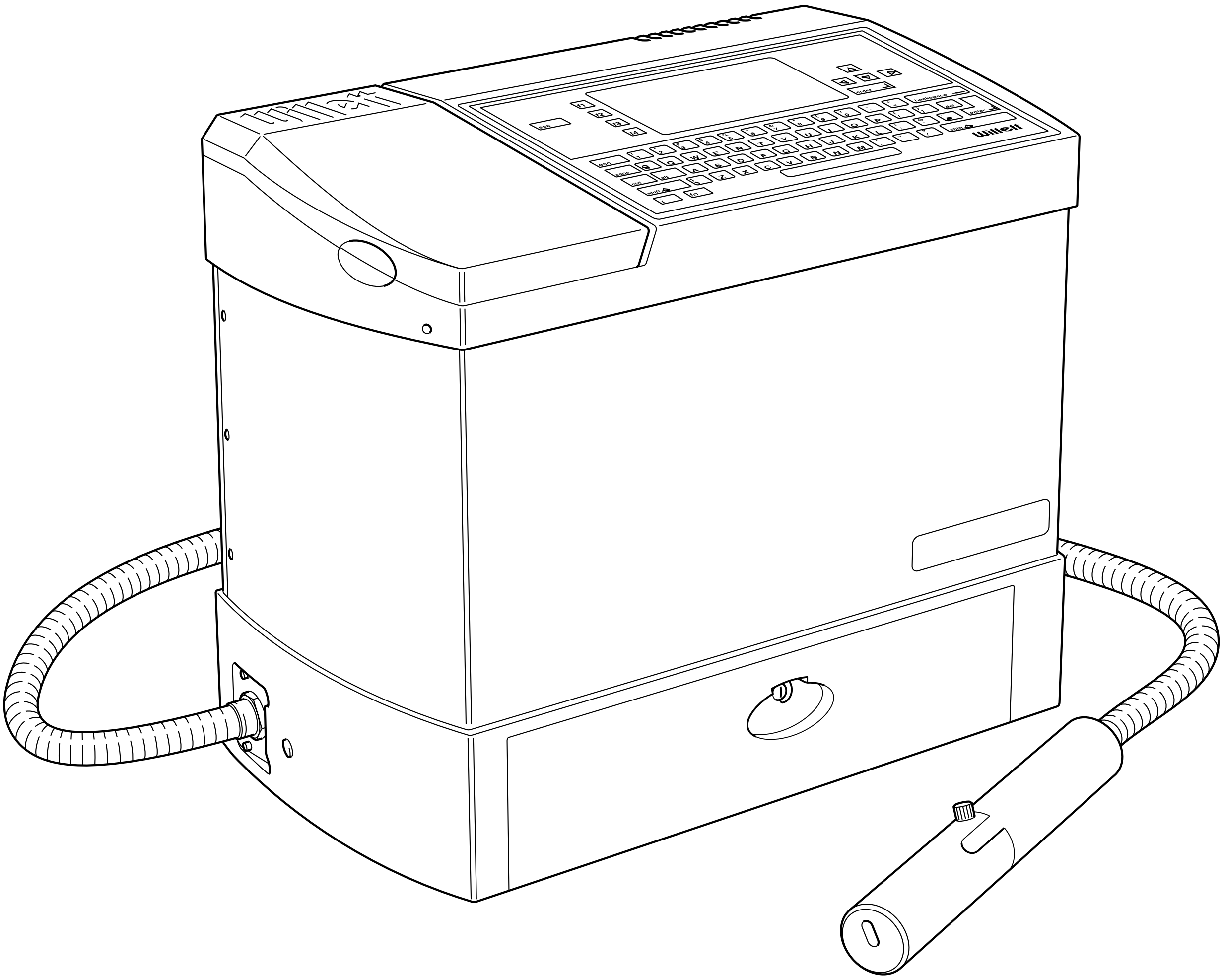

Fig 12.1 400 Series CIJ printer

ORDERING INFORMATION

TABLE 12.1 ORDERING INFORMATION

Serial (1)	Part number (2)	Description (3)	Remarks (4)
1	-	450 Si CIJ	See Note 1 & 2
	200-0450-101	● English keypad	
	200-0450-102	● European keypad	
	200-0450-103	● Scandinavian/Turkish keypad	
	200-0450-104	● Greek keypad	
	200-0450-106	● Russian/Ukranian keypad	
	200-0450-107	● Bulgarian keypad	
	200-0450-108	● Czech/Hungarian keypad	
	200-0450-109	● Polish/Latvian/Lithuanian keypad	
	200-0450-111	● Korean keypad	
2	-	460 Si CIJ	See Note 1 & 2
	200-0460-101	● English keypad	
	200-0460-102	● European keypad	
	200-0460-103	● Scandinavian/Turkish keypad	
	200-0460-104	● Greek keypad	
	200-0460-105	● Japanese keypad	
	200-0460-106	● Russian/Ukranian keypad	
	200-0460-107	● Bulgarian keypad	
	200-0460-108	● Czech/Hungarian keypad	
	200-0460-109	● Polish/Latvian/Lithuanian keypad	
	200-0460-110	● Arabic/Farsi keypad	
	200-0460-111	● Korean keypad	
3	-	460 Mi CIJ	See Note 1 & 2
	200-0461-101	● English keypad	
	200-0461-102	● European keypad	
	200-0461-103	● Scandinavian/Turkish keypad	
	200-0461-104	● Greek keypad	

(Continued)

TABLE 12.1 ORDERING INFORMATION (Continued)

Serial (1)	Part number (2)	Description (3)	Remarks (4)
4	-	460 Pi CIJ: Yellow/black ink	See Note 1 & 2
	200-0462-101	● English/USA keypad	
	200-0462-102	● European keypad	
	200-0462-103	● Scandinavian/Turkish keypad	
	200-0462-104	● Greek keypad	
5	-	460 Pi CIJ: White ink	See Note 1 & 2
	200-0463-101	● English/USA keypad	
	200-0463-102	● European keypad	
	200-0463-103	● Scandinavian/Turkish keypad	
	200-0463-104	● Greek keypad	

Ink type (Si Models) (5)
MK 3901D (Black)
MK 3903F (Red)
MK 3904G (Blue)
MK 3906J (Green)
ET 3907A (Black)
MK 3911E (Black)
ET 3913G (Blue)
MK 3914H (Thermo)
MK 3915J (Black)
MK 3919C (Black)
ET 3924J (Blue)
MK 3924A (Black)
MK 3938D (Clear)
MK 3942J (Black)
MK 3944A (Black)
EA 3953A (Black)
MA 3956D (Violet)
3958F (Red)
MK 3966E (Thermo)
DCJC (Red)

Ink type (Mi Models) (6)
MK 3940G (Black)

Ink type (Pi Models) (7)
MK 3943K (White)
MK 3946C (Yellow)
MK 3949F (Black)

(1) The printer part number and description should always be shown in the top line of the order.

(2) The second line of the order should always contain ink type information extracted from columns 5 (Si Models), 6 (Mi Models) or 7 (Pi Models).

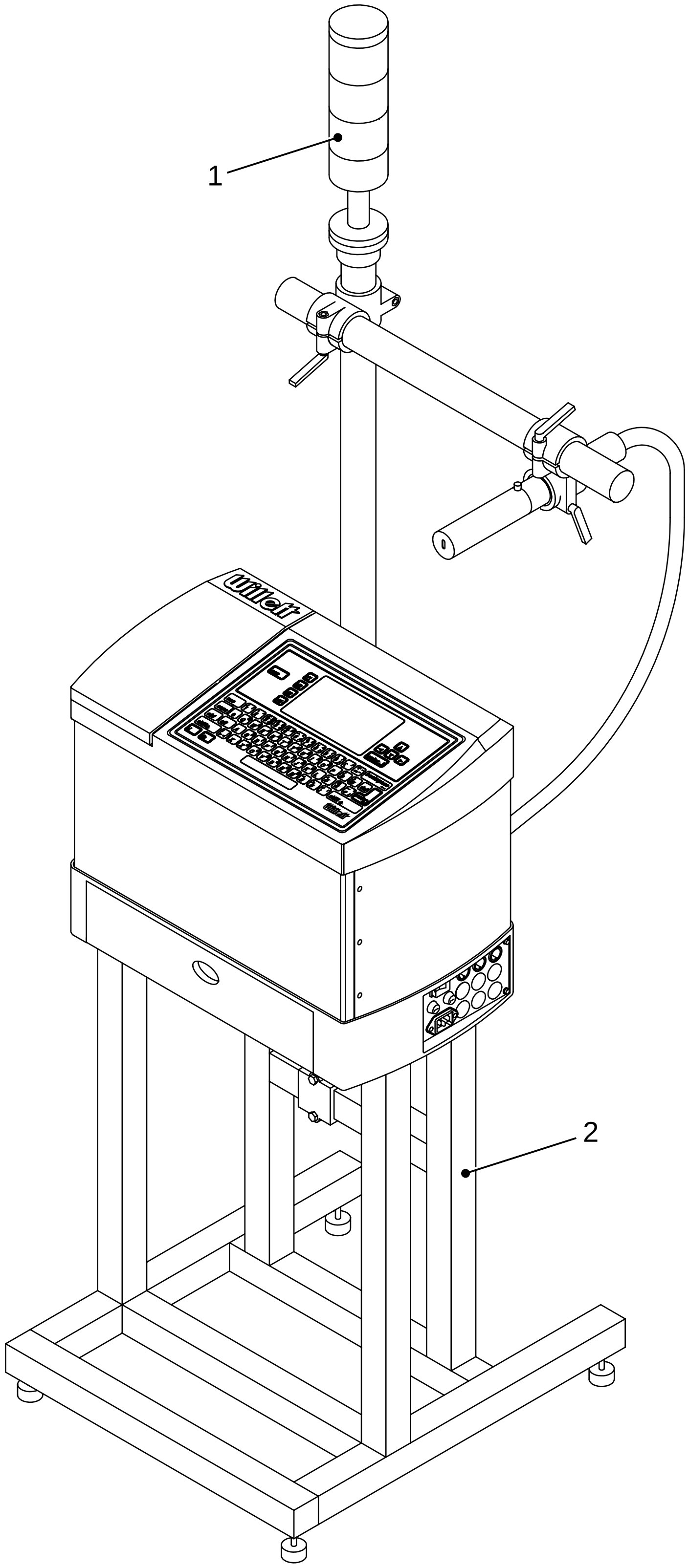

Fig 12.2 Stand and traffic light system

TABLE 12.2 STAND AND TRAFFIC LIGHT SYSTEM

Serial/ Fig ref. (1)	Part number (2)	Description (3)	Qty (4)	Remarks (5)
Fig 12.2				
1	200-0390-117	Traffic light system	1	
NI	100-0370-147	Traffic light cable assembly	1	Required for use with Serial 1
2	200-0390-114	Stand	1	
NI	500-0048-122	Lockable castor	4	Option

TABLE 12.3 OPTIONS AND ACCESSORIES

Serial (1)	Part number (2)	Description (3)	Remarks (4)
1	200-0042-005	Photocell assembly 3.5m	
2	200-0042-006	Photocell assembly 6.5m	
3	500-0071-112	24 V 5W spare bulbs	
4	527-0001-126	2500 PPR shaft encoder	
5	527-0001-127	5000 PPR shaft encoder	
6	527-0001-128	200 mm measuring wheel	
7	527-0001-129	Diaphragm coupling	
8	527-0001-130	Flange adaptor plate	
9	527-0001-131	Angle bracket	
10	527-0001-132	3 M cable	
11	527-0001-133	5 M cable	
12	200-0390-112	Expansion board	See Note
13	500-0098-337	Modem	See Note
13	100-0370-141	RS485/sensor cable assembly	
14	100-0370-175	RJ11 Connector assembly	See Note
14	100-0370-150	Photocell jumper assembly	See Note
15	100-0370-151	Shaft encoder jumper assembly	See Note
16	100-0370-157	LAN jumper assembly	See Note
17	100-0370-158	RS232 jumper assembly	See Note
18	100-0370-156	Modem cable assembly	See Note
19	100-0370-148	RID/20mA cable assembly	See Note
20	100-0370-149	MSG Select/Opto cable assembly	See Note
21	100-0370-152	Volt-free relay cable assembly	See Note
22	500-0076-134	DIN connector cap	See Note
23	500-0036-578	3 Way DIN plug	
24	500-0036-581	4 Way DIN plug	
25	500-0036-582	5 Way DIN plug	
26	500-0036-577	6 Way DIN plug	
27	500-0036-583	7 Way DIN plug	
28	500-0036-584	8 Way DIN plug	
29	204-0108-101	Printhead positive air kit	

See Section 11 for installation information.

TABLE 12.4 GENERAL SPARE PARTS AND TOOLS

Serial (1)	Part number (2)	Description (3)	Remarks (4)
1	100-3900-222	Printhead clamp	As supplied with 400 Series units
2	500-0071-112	24 V 5 W bulb	Traffic light
3	626-0100-122	Safety gloves	50 pairs
4	626-0100-028	Safety spectacles	
5	503-0001-122	Hand cleaner	250 g
6	626-0100-029	Plastic beaker	250 ml
7	500-0118-001	Plastic syringe	50 ml
8	500-0098-186	Wash bottle	250 ml
9	626-0100-028	Glass magnifier	x10
10	201-0100-001	Syringe viscometer	
11	503-0001-194	DIN connector spanner	
12	204-0208-101	Printhead clearning brush	Pi

TABLE 12.5 DOCUMENTATION

Serial (1)	Part number (2)	Description (3)	Remarks (4)
1	306-0400-101	400 Series User Guide	
2	306-0400-102	400 Series Owner Manual	
3	306-0400-103	400 Series Technical Reference Manual	
4	306-3700-111	400 Series Technical Training Manual	
5	308-0450-101	450 Si Data Sheet	
6	308-0460-101	460 Si Data Sheet	
7	308-0461-101	460 Mi Data Sheet	
8	308-0462-101	460 Pi Data Sheet	

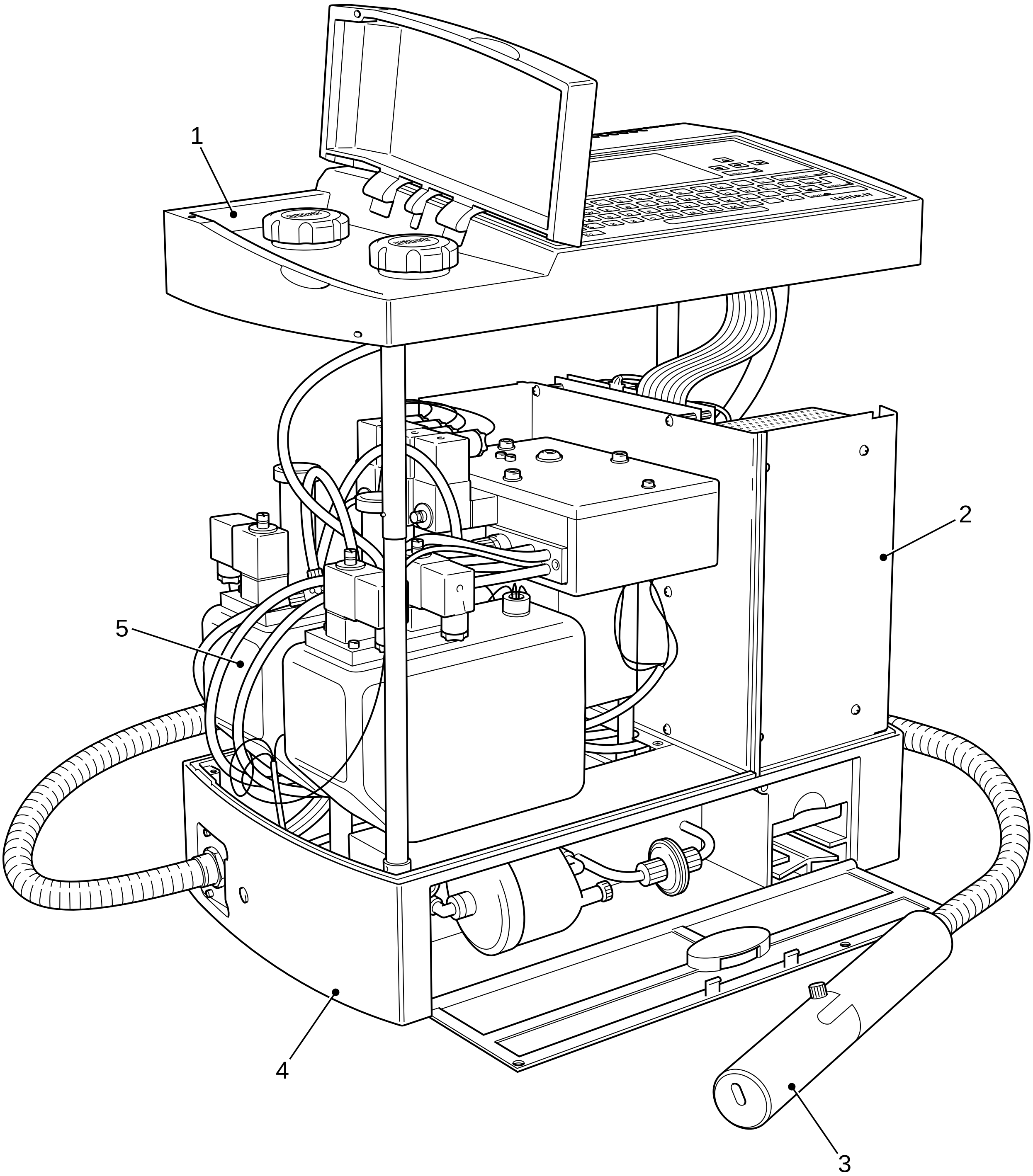

Fig 12.3 400 Series CIJ printer major sub-assemblies

TABLE 12.6 400 SERIES PRINTER MAJOR SUB-ASSEMBLIES

Serial/ Fig ref. (1)	Part number (2)	Description (3)	Qty (4)	Remarks (5)
Fig 12.3				
1	-	1 Top moulding ink system components	-	Fig 12.4
		2 Top moulding, keypad and LCD		Fig 12.5
2	-	1 Baffle plate assembly (Si & Mi)	1	Fig 12.6
		2 Baffle plate assembly (Pi)	1	Fig 12.7
3	-	Printhead assembly	1	Fig 12.8
4	-	1 Base moulding and cabinet	1	Fig 12.9
	-	2 Mains plate assembly	1	Fig 12.10
5	-	Ink system	1	Fig 12.11
-	-	Miscellaneous items	-	Fig 12.12

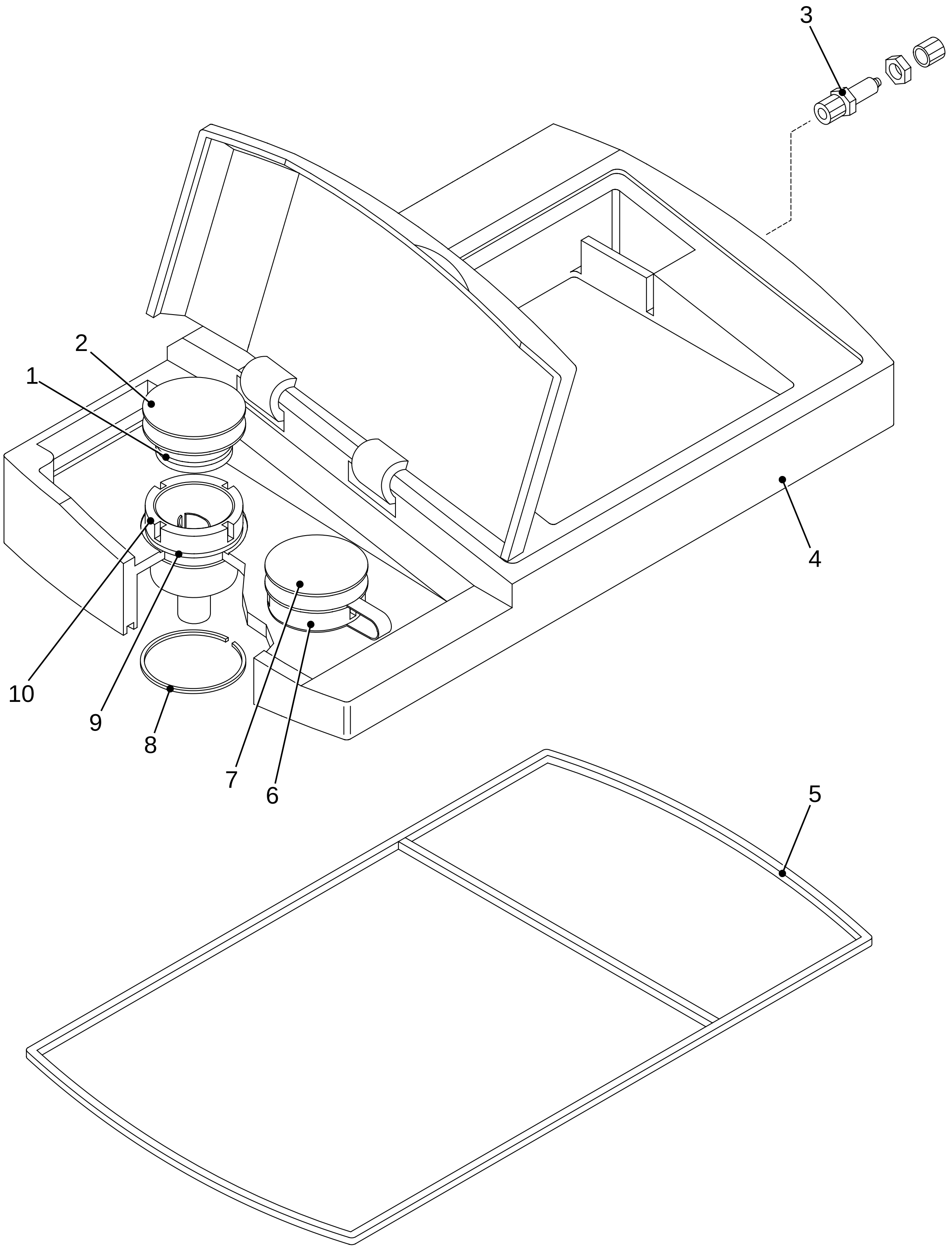

Fig 12.4 Top moulding ink system components

TABLE 12.7 TOP MOULDING INK SYSTEM COMPONENTS

Serial/ Fig ref. (1)	Part number (2)	Description (3)	Qty (4)	Remarks (5)
Fig 12.4				
1	500-0031-185	O-ring	1	
2	100-3900-278	Ink cap	1	
3	500-0041-101	Bulkhead fitting	1	
4	200-0390-105	Top mould assy	1	
5	100-0370-163	1430mm seal	1	
6	100-0370-117	Filler housing, top-up	1	
7	100-3900-276	Top-up cap	1	
8	500-0096-116	Clip	2	
9	100-3900-210	Flat seal	2	
10	100-0370-116	Filler housing, ink	1	

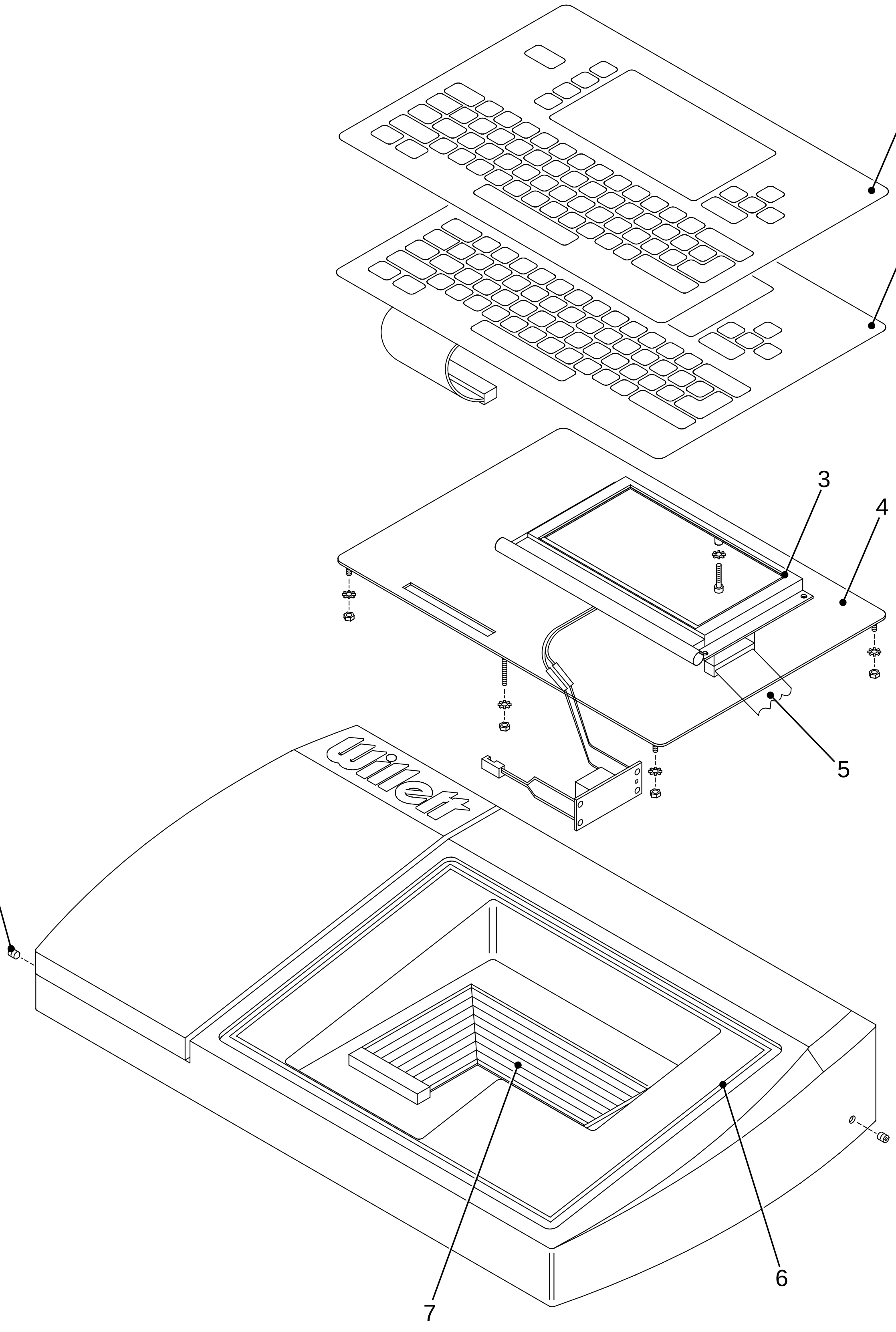

Fig 12.5 Top moulding, keypad and LCD

TABLE 12.8 TOP MOULDING, KEYPAD AND LCD

Serial/ Fig ref. (1)	Part number (2)	Description (3)	Qty (4)	Remarks (5)
Fig 12.5				
1	-	Keypad overlays		
	100-0060-101	● UK/USA	1	
	100-0061-101	● European	1	
	100-0062-101	● Turkish/Scandinavian	1	
	100-0063-101	● Greek	1	
	100-0064-101	● Japanese	1	
	100-0065-101	● Russian/Ukranian	1	
	100-0066-101	● Bulgarian	1	
	100-0067-101	● Czech/Slovakian/Hungarian	1	
	100-0068-101	● Polish/Latvian/Lithuanian	1	
	100-0069-101	● Korean	1	
	100-0070-101	● Arabic/Farsi	1	
	100-0071-101	● Hebrew	1	
2	100-0059-101	Keypad circuit assy	1	
3	200-0390-106	240 x 128 LCD panel assy	1	
4	100-0370-108	Keypad plate	1	
5	200-0390-227	Display ribbon cable	1	
6	100-3900-285	Keypad plate seal	1	
7	100-0370-160	Keypad extender	1	
8	500-0094-301	M5 x 5 grubscrew	4	

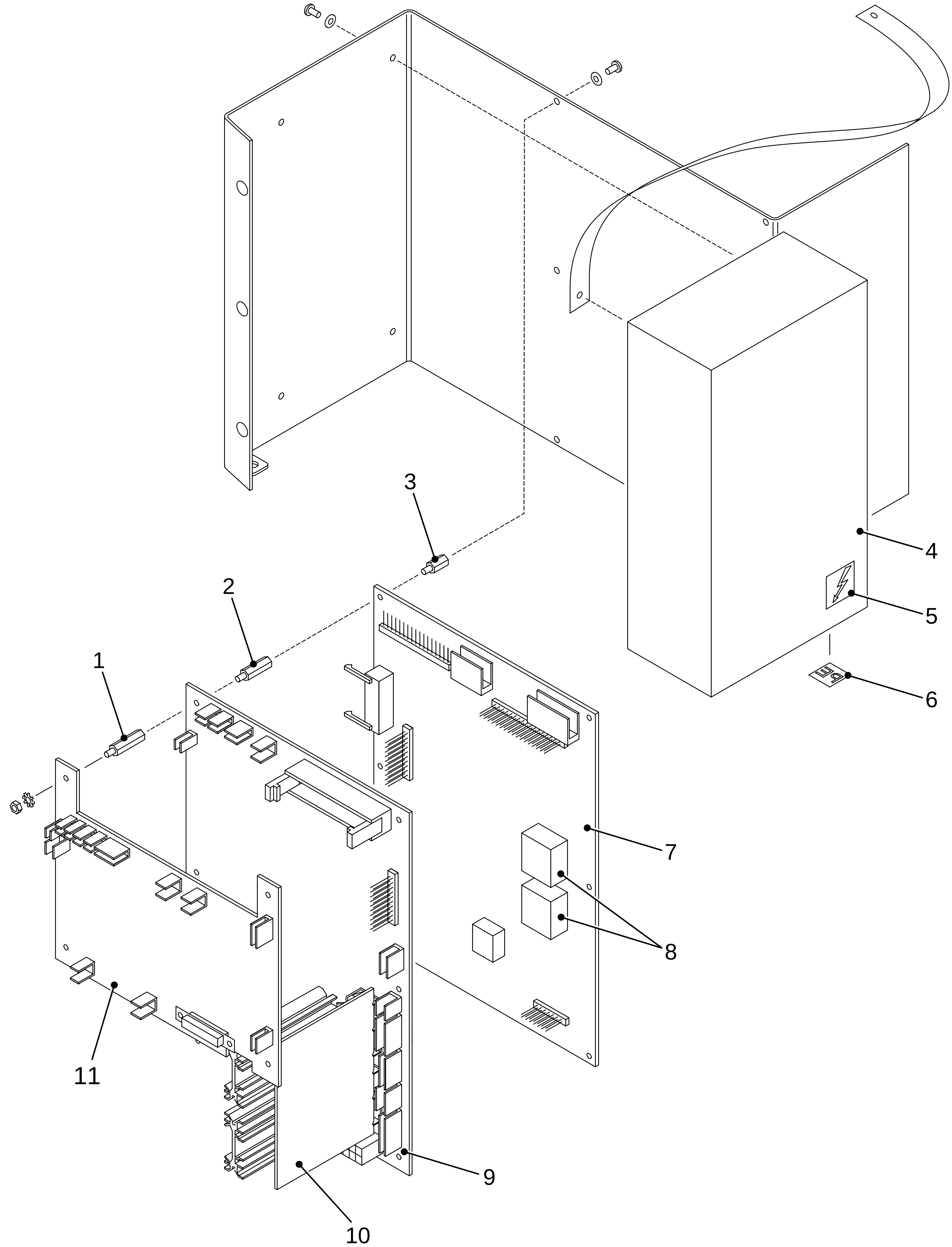

Fig 12.6 Baffle plate assembly (Si and Mi)

TABLE 12.9 BAFFLE PLATE ASSEMBLY (Si and Mi)

Serial/ Fig ref. (1)	Part number (2)	Description (3)	Qty (4)	Remarks (5)
Fig 12.6	-	Baffle plate assembly comprising:		Si and Mi
1	500-0077-184	20mm PCB stand-off	4	
2	500-0077-176	18mm PCB stand-off	6	
3	500-0077-179	10mm PCB stand-off	6	
4	200-0390-102	PSU - 80 watt with cover	1	
5	500-0067-116	High voltage label	1	
6	400-0009-264	Power label	1	
7	200-0390-111	CPU board	1	
8	500-0053-363	Flash memory AM29F040-70JC	2	
9	200-0390-211	I/O board	1	
10	200-0390-236	Ink pump motor driver board	1	
11	200-0390-112	Expansion board (optional)	1	

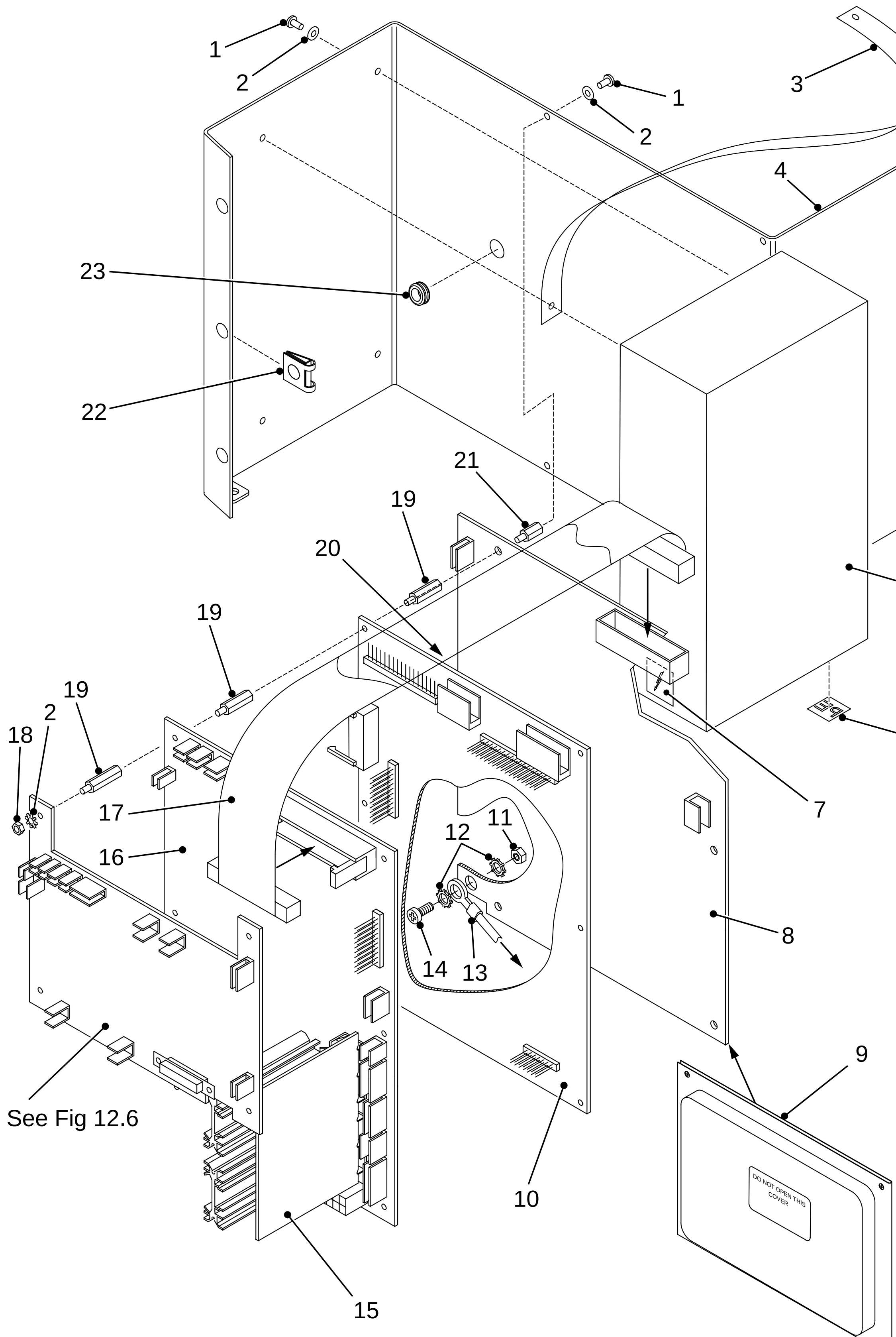

Fig 12.7 Baffle plate assembly (Pi)

TABLE 12.10 BAFFLE PLATE ASSEMBLY (PI)

Serial/ Fig ref. (1)	Part number (2)	Description (3)	Qty (4)	Remarks (5)
Fig 12.7	-	Baffle plate assembly comprising:		Pi
1	500-0005-131	M3 x 6 Pan Hd St. Stl. Screw	10	
2	500-0124-103	M3 St. Stl. E.T. Washer	16	
3	500-0042-111	Copper ground strap	1	
4	100-0370-128	Baffle plate	1	
5	200-0390-102	PSU - 80 watt with cover	1	
6	500-0067-115	Earth point label	1	
7	500-0067-116	Power label	1	
8	200-0462-222	Levels interface board	1	
9	100-0462-007	Levels interface cover	1	
10	200-0390-211	CPU board	1	
11	500-0002-104	M4 St. Stl. Hex Nut	1	
12	500-0124-104	M4 St. Stl. E.T. Washer	2	
13	200-0462-223	Interface board harness set	1	c/w Serial 17
14	500-0005-143	M4 x 10 Pan Hd St. Stl. Screw	1	
15	200-0390-236	Ink pump motor driver board	1	
16	200-0390-210	I/O board	1	
17	-	Interface board harness set	1	See item 15
18	500-0002-103	M3 St. Stl. Nut	6	
19	500-0077-176	M3 x 18 St. Stl. PCB stand-off	12	
20 (	500-0066-121	Fuse 50 mA, fast blow	8	
(	500-0066-164	Fuse 250 mA, fast blow	1	
21	500-0077-176	M3 x 10 St. Stl. PCB stand-off	6	
22	500-0048-119	1/4 turn fastener receptacle	3	
23	500-0078-133	Blind PVC grommet	1	

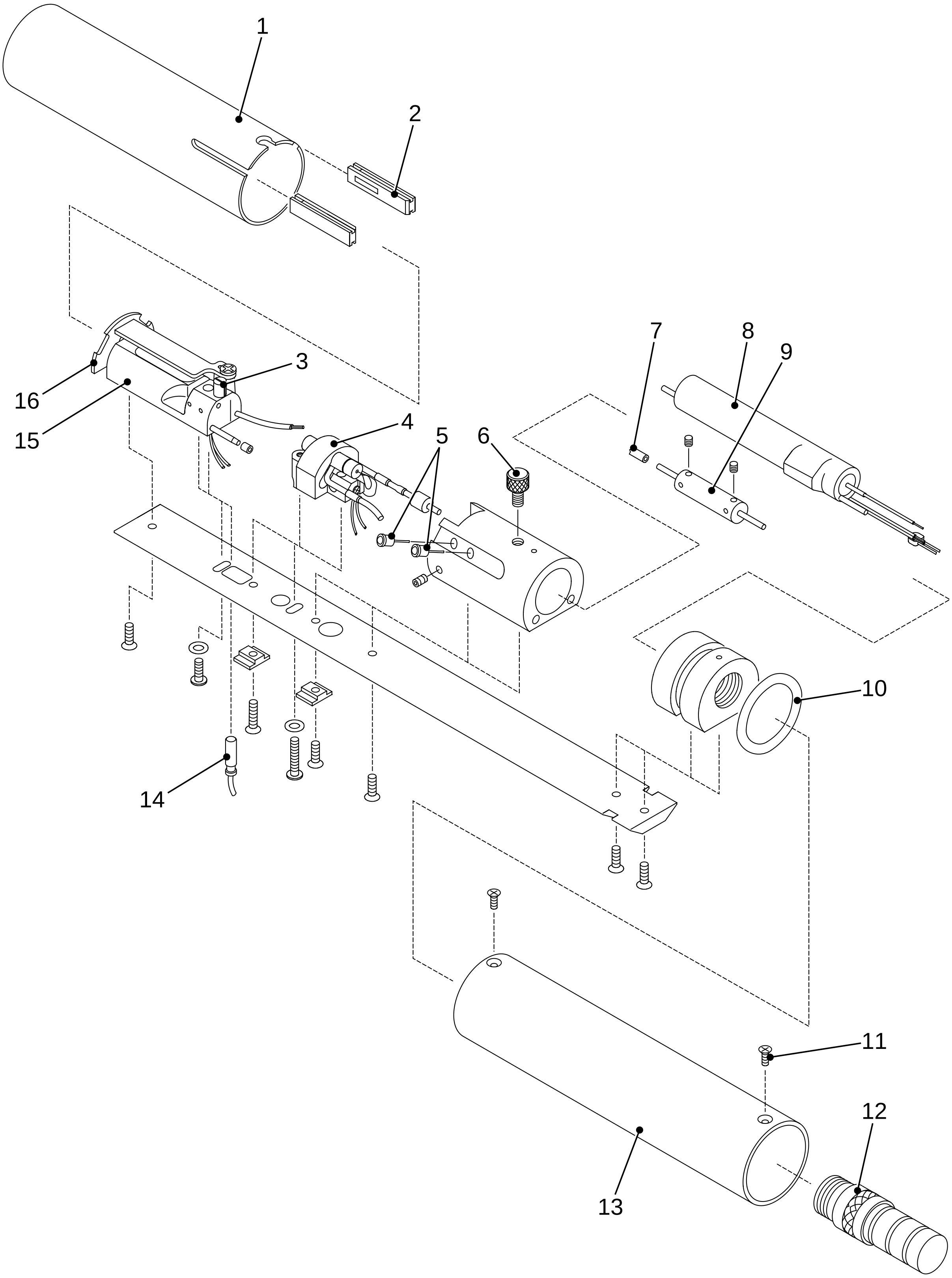

Fig 12.8 Printhead assembly

TABLE 12.11 PRINTHEAD ASSEMBLY

Serial/ Fig ref. (1)	Part number (2)	Description (3)	Qty (4)	Remarks (5)
Fig 12.8	200-0390-107	Si Printhead assembly		
	200-0461-227	Mi Printhead assembly		
	200-0462-227	Pi Printhead assembly		
1 (	100-3900-240	Front cover (Si and Pi)	1	
(	100-0461-003	Front cover (Mi)	1	
2	100-3900-237	Lid switch striker	2	
3	200-3900-135	Charge electrode/LED assy	1	
4 (	200-3900-206	Nozzle assembly (Si)	1	
(	200-0461-116	Nozzle assembly (Mi)	1	
(	200-0462-116	Nozzle assembly (Pi)	1	
5	200-3900-208	Cover switch assy	2	
6	100-1600-327	Thumbscrew	1	
7	501-0002-114	PTFE tube (Green)	A/R	
8	200-0390-113	Head heater assy	1	
9	100-3900-268	Gutter detect	1	
10	500-0031-180	O-ring 25.81 x 3.53 CS	1	
11	500-0011-121	M2 5 x 6 Csk hd St. St. Screw	2	
12	200-0390-208	460 Si Umbilical	1	
13	100-3900-243	Rear cover	1	
14	200-3900-298	Phase detector assy	1	
15 (	200-3900-207	EHT block assy (Si)	1	
(	200-0461-117	EHT block assy (Mi)	1	
(	200-0462-117	EHT block assy (Pi)	1	
16	100-3900-135	Gutter support plate	1	
17	100-0370-220	Nozzle seal (Si & Pi)	1	
NI	501-0001-004	1.6 black heatshrink	A/R	
NI	522-0080-226	22M Ω resistor	1	
NI	501-0002-132	Clear heatshrink	A/R	
NI	500-0032-004	3" tie wraps	A/R	
NI	501-0001-101	Black 3.2 heatshrink	A/R	
NI	501-0001-122	Yellow heatshrink	A/R	
NI	500-0032-102	Red tie wrap	A/R	
NI	501-0001-002	04.8 black heatshrink	A/R	
NI	500-0047-105	Solvent filter	1	
NI	500-0095-106	Temperature sensor	1	
NI	501-0002-136	Clear heatshrink	A/R	

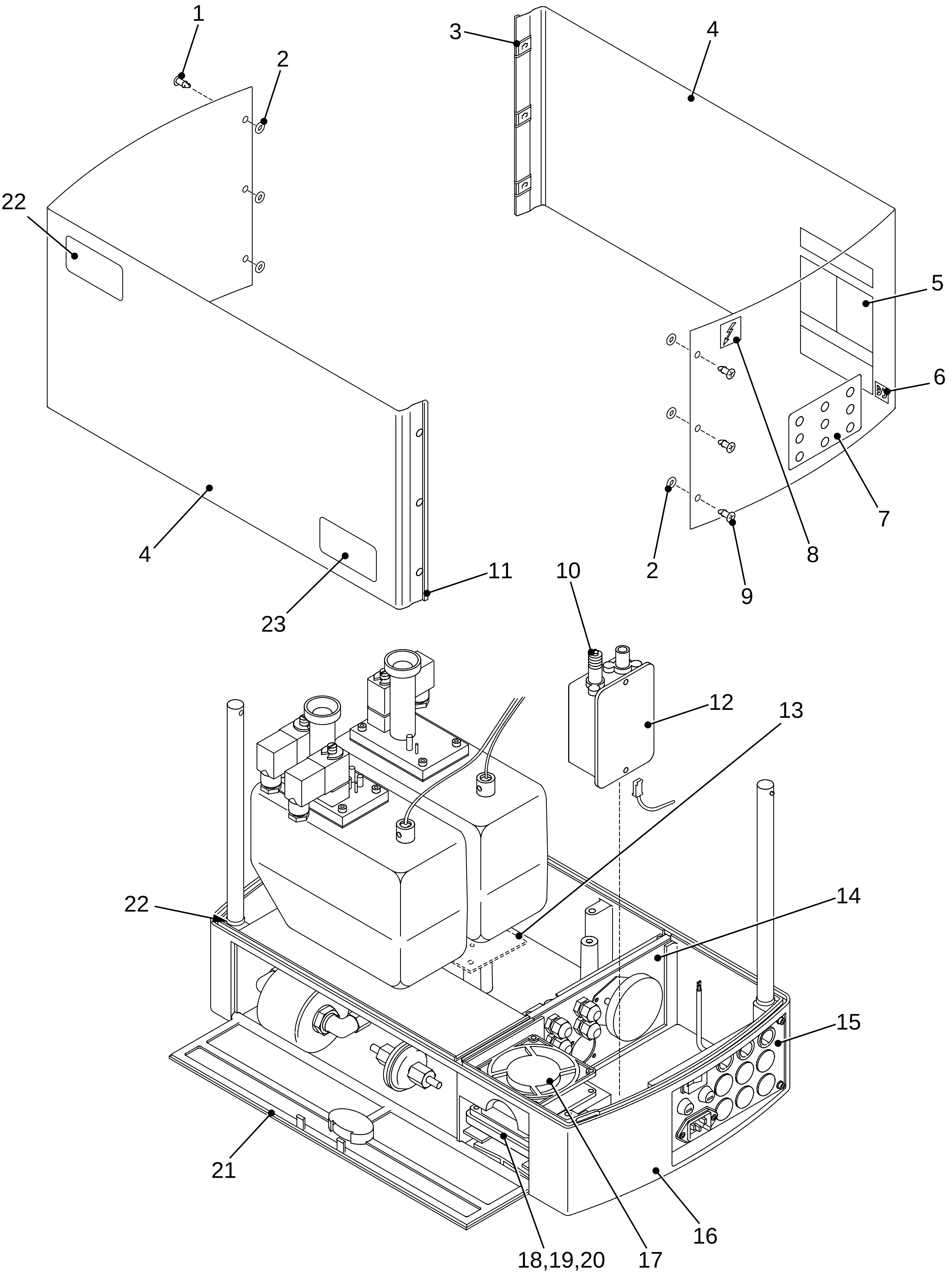

Fig 12.9 Base moulding and cabinet

TABLE 12.12 BASE MOULDING AND CABINET

Serial/ Fig ref. (1)	Part number (2)	Description (3)	Qty (4)	Remarks (5)
Fig 12.9				
1	500-0048-117	¼ turn fastener	3	
2	500-0049-101	¼ turn retainer	6	
3	500-0048-119	¼ turn receptacle	3	
4 (	100-0370-127	Outer cover (460 models)	2	
(	100-0450-127	Outer cover (450 models)	2	
5	400-0009-145	Rating label	1	
6	400-0009-132	CE label	1	
7	400-0009-295	Outlet label	1	
8	500-0067-116	High voltage warning label	1	
9	500-0048-118	¼ turn fastener	3	
10	500-0036-429	EHT module blank jack	1	
11	500-0031-187	Seal	2	
12	520-0002-104	EHT module	1	
13	200-0462-221	Ink reservoir stirrer motor (Pi)	1	
14	100-0370-140	Main harness	1	
15	-	Mains plate assy	1	See Fig 12.10
16	200-0390-223	Base moulding assy	1	
17	500-0901-135	80 x 80 fan	1	
18	500-0901-121	Fan filter assy	1	
19	500-0901-122	Fan filter element	1	Contains finger guard, filter cover and filter element
20	500-0901-126	Metallic filter gauze	1	
21	100-0370-182	Base moulding filter cover	1	
22	100-0370-163	Seal	1	
23 (	100-0450-166	450 Si badge	1	
(	100-0370-166	460 Si badge	1	
(	100-0461-166	460 Mi badge	1	
(	100-0462-166	460 Pi badge	1	
24	100-1600-373	Willett logo badge	1	
NI	100-0370-139	Power cable assembly	1	

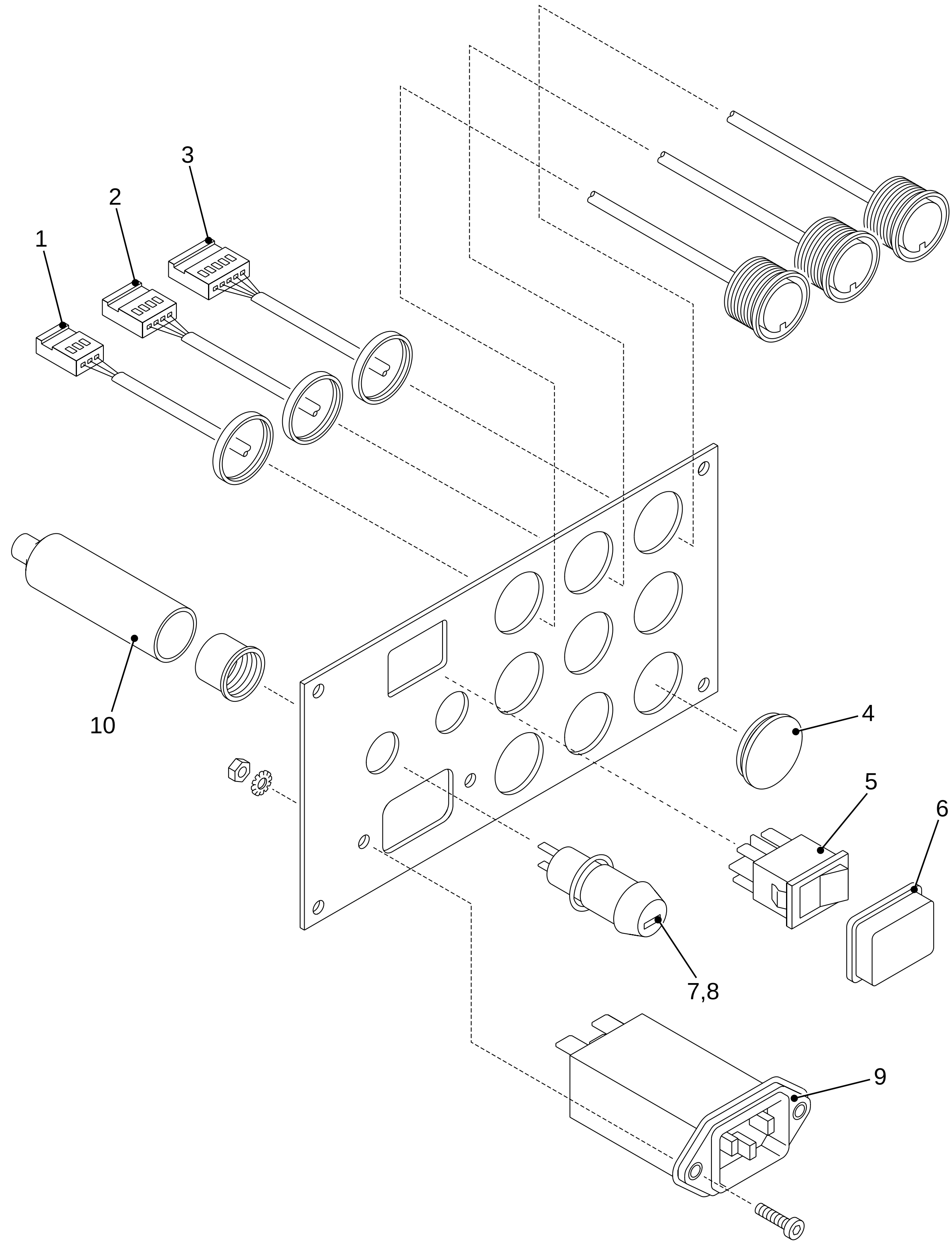

Fig 12.10 Mains plate assembly

TABLE 12.13 MAINS PLATE ASSEMBLY

Serial/ Fig ref. (1)	Part number (2)	Description (3)	Qty (4)	Remarks (5)
Fig 12.10				
1	100-0370-141	RS485/product sensor cable assembly	1	
2	100-0370-143	Shaft encoder cable assembly	1	
3	100-0370-142	RS232 cable assembly (Not 450 Si)	1	
4	500-0076-133	Blanking plug	6	
5	500-0082-119	Mains switch	1	
6	500-0082-120	Mains switch cover	1	
7	500-0066-134	Fuse holder	2	
8	500-0066-139 or	3.15A HRC A/S fuses	2	
	500-0066-119	5A HRC A/S fuses	2	
9	500-0097-117	Mains inlet IEC filter	1	
10	500-0079-110	Fuse holder boot	2	
NI	100-0370-137	Mains boot gasket	1	
NI	100-0370-136	Boot retainer	1	
NI	100-0370-135	Mains cable boot	1	
NI	500-0043-101	Mains cable	1	
NI	500-0067-115	Earth symbol label	1	

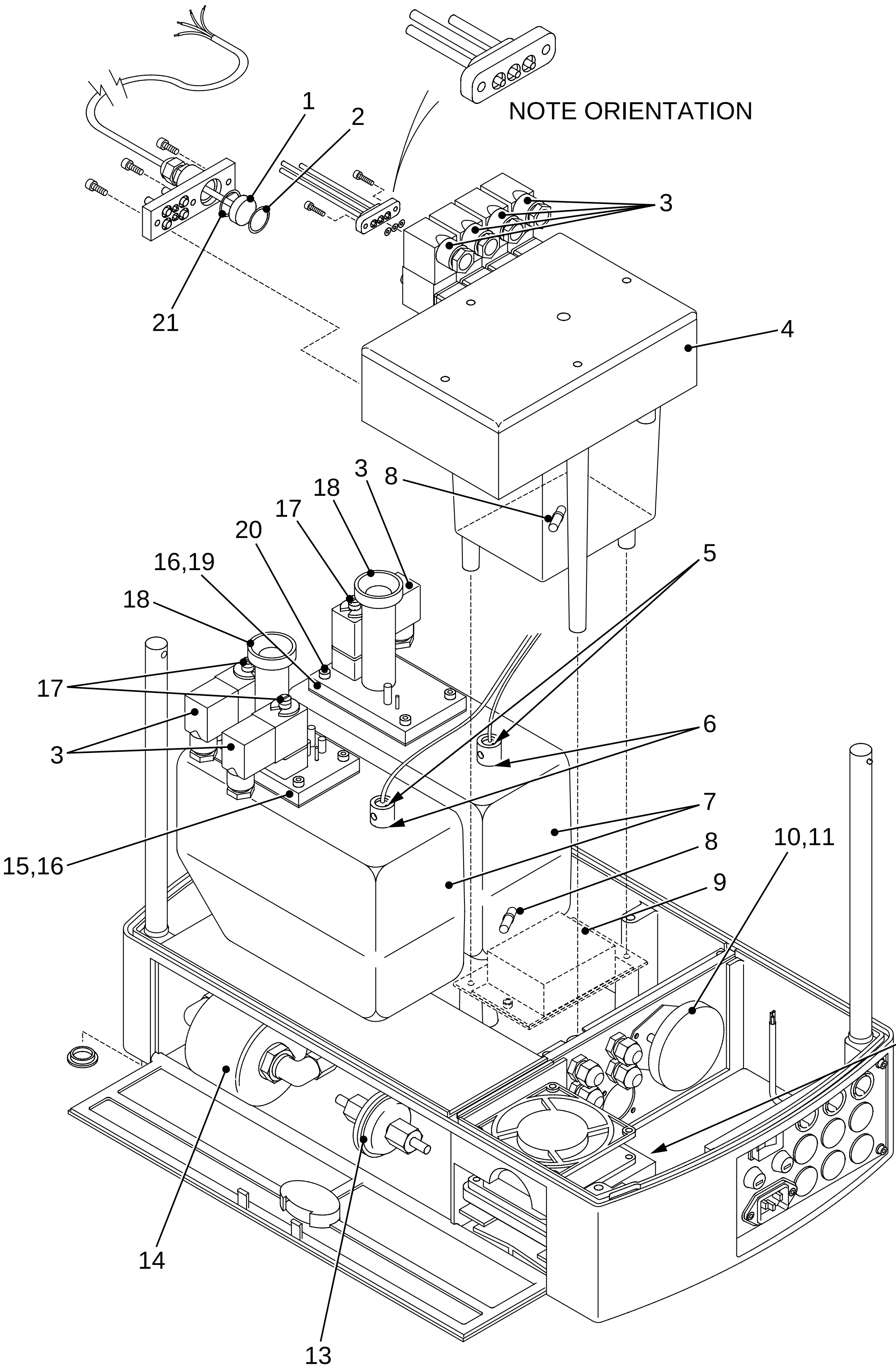

Fig 12.11 Ink system

TABLE 12.14 INK SYSTEM

Serial/ Fig ref. (1)	Part number (2)	Description (3)	Qty (4)	Remarks (5)
Fig 12.11				
1	527-0001-125	Pressure transducer	1	
2	500-0031-164	Pressure transducer front O-ring	1	
3	521-0001-135	Ink valve	7	
4 (	200-0390-104	FMS single head ink system (Si & Mi)	1	
(	200-0462-204	FMS assembly (Pi)	1	
5 (	200-0390-115	Level detect assembly (Si & Mi)	2	Contains; detector retainer, O-ring, lens, sensor holder, spacer table and lens retainer
(	100-0462-006	Level detect probe holder (Pi)	2	
6	100-0370-159	Level detect seal	2	
7	100-0370-106	Solvent/ink tank	2	
8	531-0001-112	Stirrer bar (Pi)	2	
9	200-0462-220	Mixer tank stirrer motor (Pi)	1	
10 ((	200-0390-108	Pump assembly Si, Mi & Pi (black & yellow)	1	
(	100-0462-019	Pump assembly (Pi (white))	1	
11	100-0370-111	Pump sealing gasket	1	
12	200-0390-119	Fan failure PCB assembly	1	
13	500-0047-108	30 micron filter	1	
14 (	500-0047-118	Main filter (Si & Mi)	1	
(	500-0047-123	Main filter (Pi)	1	
15	100-0370-130	Solvent tank manifold	1	
16 (	100-3900-180	Manifold gasket (Si & Mi)	2	
(	100-0370-212	Manifold gasket (Pi)	2	
17	500-0010-451	M5 x 6 nylon screw	7	
18	100-0370-126	Filler coupling	2	

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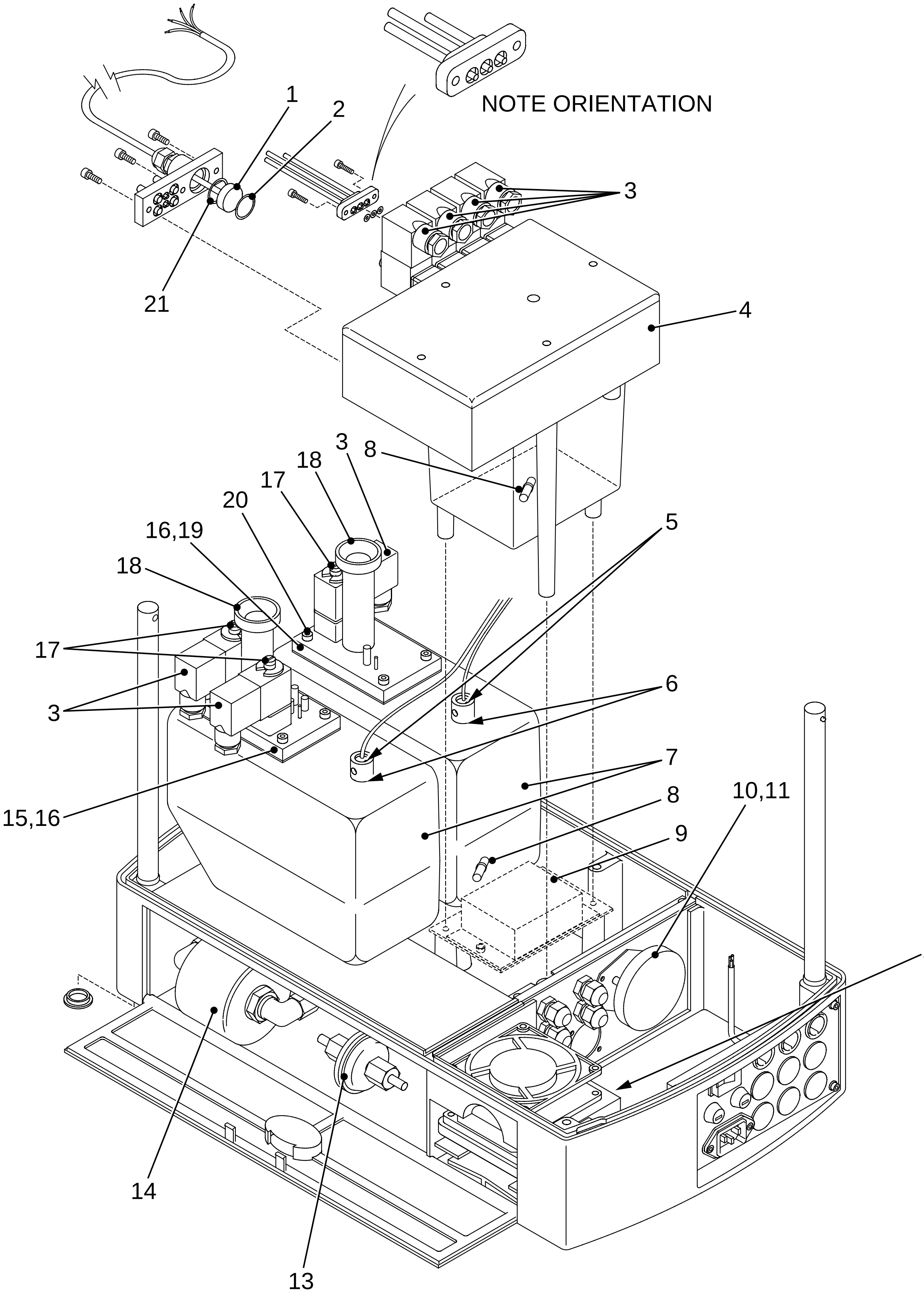

Fig 12.11 Ink system

TABLE 12.14 INK SYSTEM (Continued)

Serial/ Fig ref. (1)	Part number (2)	Description (3)	Qty (4)	Remarks (5)
Fig 12.11				
19	100-0370-131	Ink manifold	1	
20	500-0008-152	M5 x 20 cap head screws	8	
21	500-0031-201	Pressure transducer rear O-ring	1	
NI	204-0212-101	FMS level sensor assembly	1	Contains, O-ring, lens, sensor holder and lens retainer
NI	100-0390-134	Venturi assembly	1	
NI	100-0370-112	Printhead fluid connector	1	
NI	500-0031-175	4.78 x 1.78 O-ring	1	
NI	500-0031-117	1.78 x 1.78 O-ring		
NI	500-0041-265	A1 barb	A/R	Fitted to ink valves (3)
NI	500-0022-213	A1 barb sealing washer	1	
NI	100-0370-102	VMS restrictor block		
NI	500-0031-165	VMS restrictor O-ring, 12.1 x 1.6 mm	1	
NI	500-0031-166	VMS restrictor O-ring, 3.1 x 1.6mm	1	
NI	100-3900-166	Solvent meter flush cap	1	On underside of solvent manifold (15)
NI	100-3900-168	Solvent meter flush capsule	1	On underside of solvent manifold (15)
NI	501-0002-101	⅛" tubing (clear)	-	Ink feed pipe (part of umbilical)
NI	501-0002-114	⅛" tubing (green stripe)	-	Umbilical gutter pipe
NI	501-0002-113	⅛" tubing (black stripe)	-	Umbilical return pipe
NI	501-0002-115	⅛" tubing (yellow stripe)	-	Umbilical
NI	501-0002-131	6 x 4 PTFE tubing	-	Fitted to filters
NI	500-0041-110	Festo T-piece	1	

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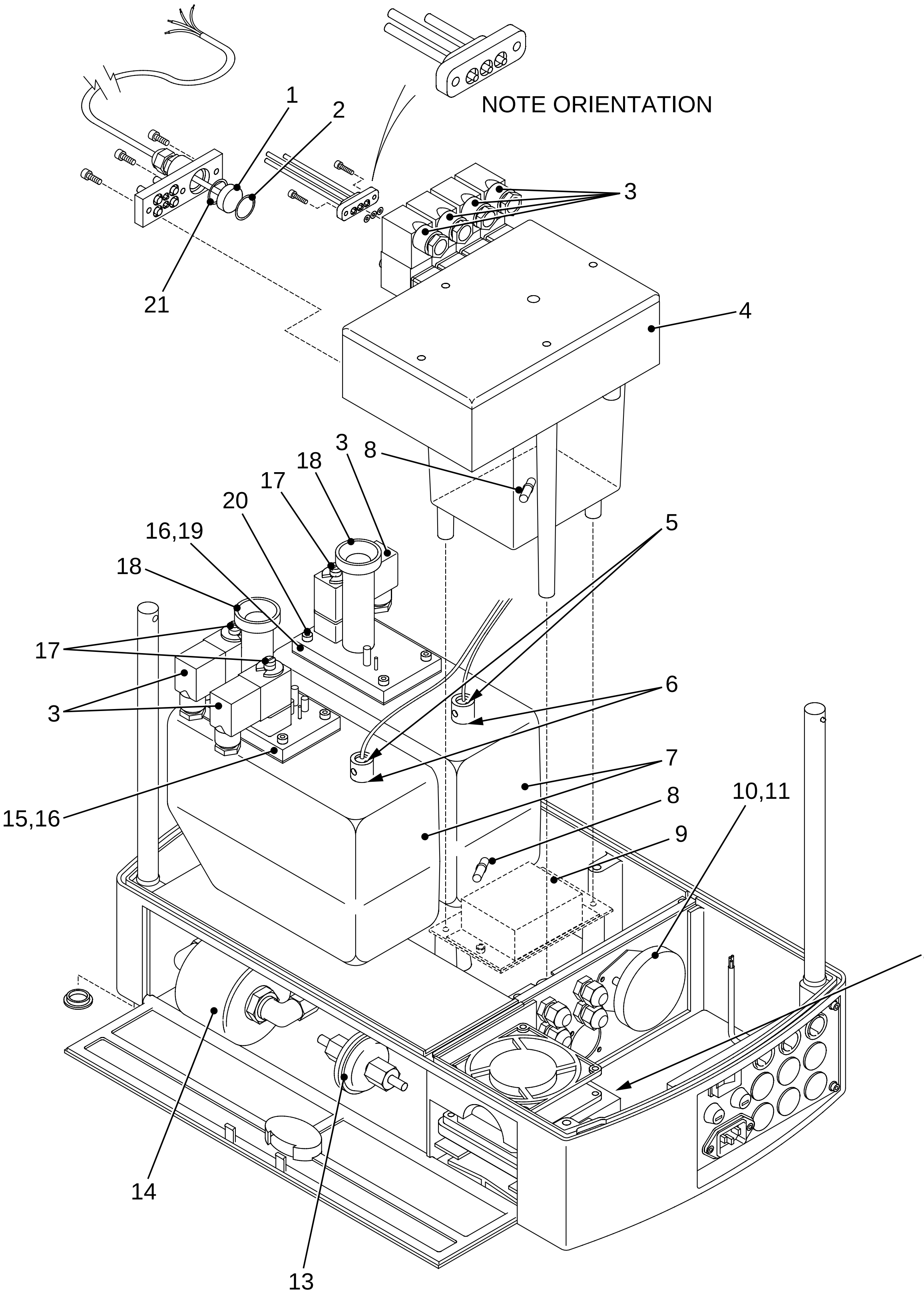


Fig 12.11 Ink system

TABLE 12.14 INK SYSTEM (Continued)

Serial/ Fig ref. (1)	Part number (2)	Description (3)	Qty (4)	Remarks (5)
Fig 12.11				
NI	500-0047-106	Solvent meter 85 micron filter	1	On underside of solvent manifold (15)
NI	400-0009-220	Vapour warning label	1	
NI	400-0009-212	INK/SOL warning label	1	
NI	500-0085-145	Level sense IR		Device only
NI	500-0085-146	Level sense IR receiver	1	Device only
NI	100-0370-179	Level sense kit	1	Contains; 5 pairs IR emitter/receiver devices with colour coded flying leads fitted
NI	-	Valve blanking screw	1	
NI	-	Valve blanking disc	1	
NI	100-0370-113	Pressure transducer manifold	1	

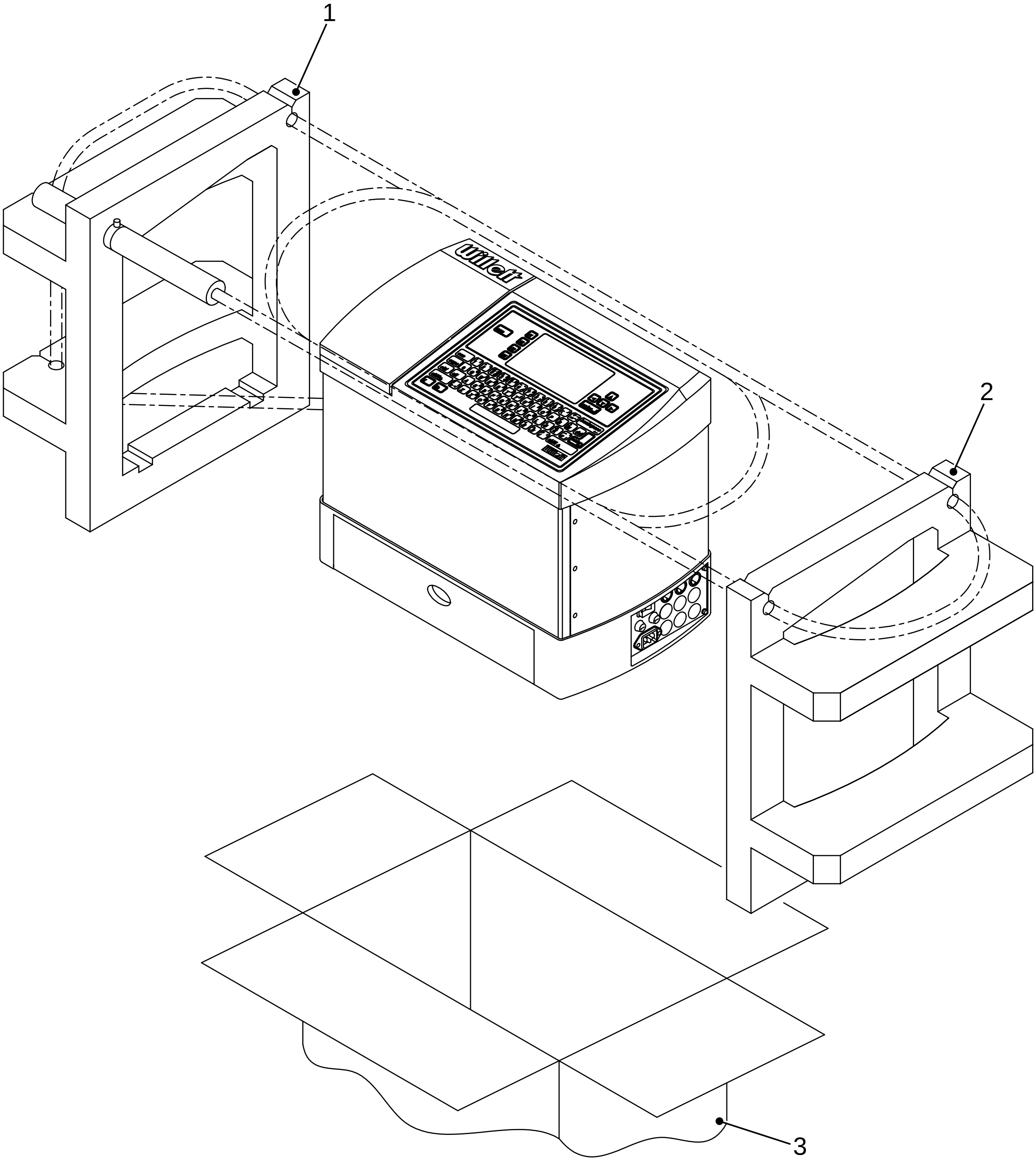


Fig 12.12 Miscellaneous items

TABLE 12.15 MISCELLANEOUS ITEMS

Serial/ Fig ref. (1)	Part number (2)	Description (3)	Qty (4)	Remarks (5)
Fig 12.12				
1	511-5200-161	Left-hand insert	1	Packing material
2	511-5200-162	Right-hand insert	1	Packing material
3	511-5000-111	Carton	1	

CONTENTS

INTRODUCTION

1 This appendix to the 400 Series Technical Manual describes the differences between the 460 Si Mk 2 and the previous model. The changes are listed below:

1.1 Top and bottom mouldings.

1.2 Keypad.

1.3 Printhead and umbilical.

1.4 Solvent reduction system.

TOP AND BOTTOM MOULDINGS

2 The 460 Si Mk 2 is fitted with new top and bottom mouldings as shown in Figure 1. The top moulding has a modified exhaust grill (Fig 1 (5)) which is fitted with a hood. The hood directs solvent laden air away from the operator. The top moulding has also been fitted with tabs which make it easier to align when it is lowered. The new top moulding is a direct replacement for the previous version and can be fitted to all versions of 400 Series printers.

3 The new bottom moulding has a re-designed recess in the centre of the filter cover (3).

4 Both mouldings have a coating which is more resistant to solvent than previous versions.

KEYPAD

5 The keypad (Fig 1 (1)) on the 460 Si Mk 2 is fitted with three status LEDs (2). The LEDs follow the sequence of the optional traffic lights described in Section 5 of this manual. They will give the operator an indication that the machine is powered up, even if the backlight saver feature has come into operation. The LEDs stand proud of the keypad so that they can easily be seen from any angle.

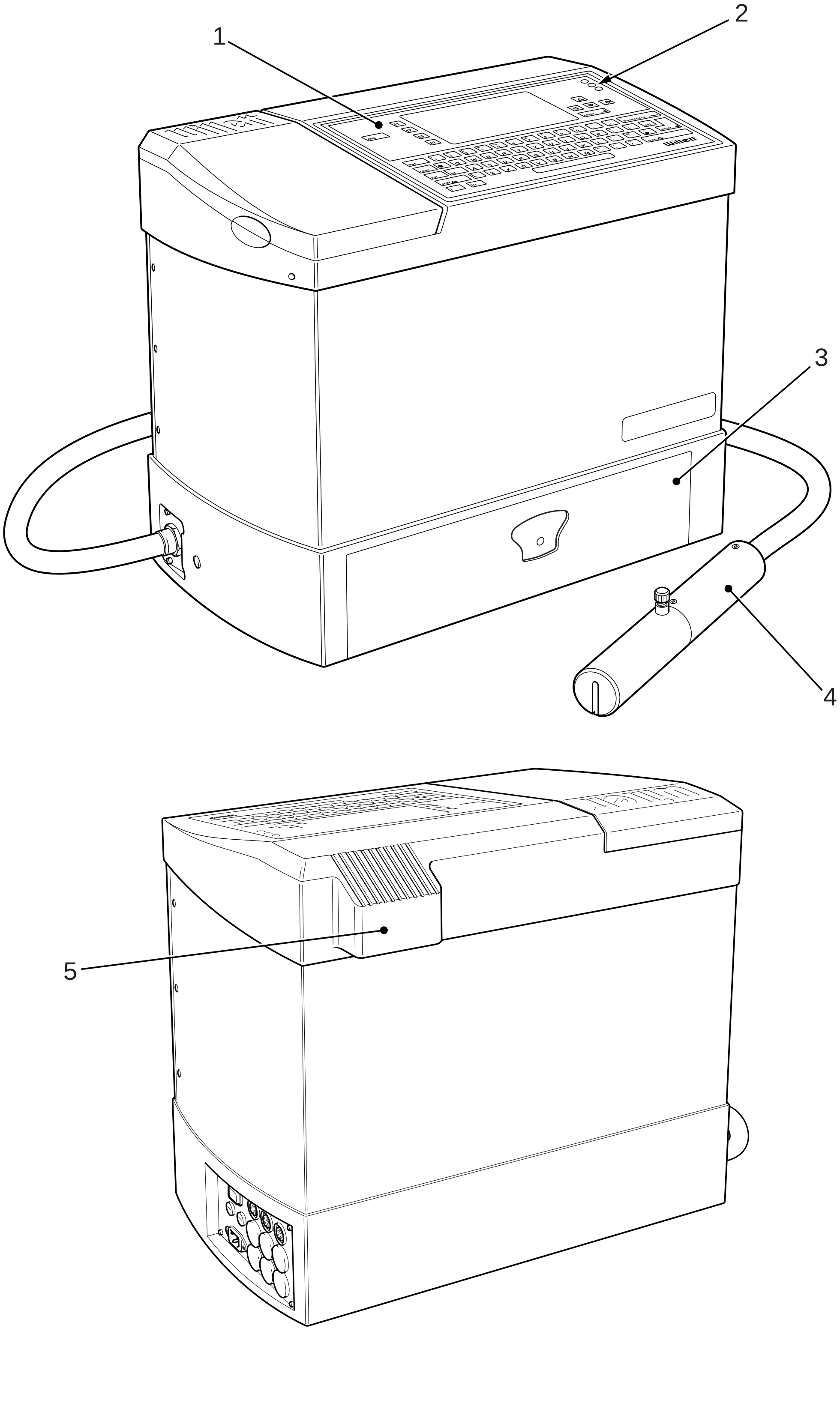
6 The new keypad can be fitted to any existing machine that has a Mk2 I/O board. The modification involves carrying out the operations below:

6.1 Replace the existing keypad and keypad plate with Mk2 items.

6.2 Fit a keypad LED drive cable between the new keypad and the 'LEDs' connector on the I/O board.

7 No software changes are necessary to operate the LEDs on the keypad as they mimic the traffic lights output of the I/O board.

8 Some older Mk 2 I/O boards may cause the keypad LEDs to be slightly dimmer.



1 Keypad
2 Status LED
3 Filter cover
4 Printhead
5 Vent hood

Fig 1 460 Si Mk2

PRINTHEAD AND UMBILICAL

9 The 460 Si Mk 2 is fitted with a re-designed printhead, (Fig 1 (4)) connected to the printer via a smooth umbilical. The new components incorporate the following features:

9.1 The printhead tray (Fig 2 (5)) is cast from stainless steel in order to provide a more rugged assembly. This includes a fixed end plate to protect the gutter when the cover is removed.

9.2 A new nozzle cradle (2) gives easier adjustment and prevents the jet from deviating due to creep and impact.

9.3 The umbilical is smooth making it easier to clean; it is more resistant to damage and more flexible.

9.4 The rear cover (3) is stainless; the front cover (6) is open at both ends making it easier to clean.

9.5 The EHT block (4) incorporates a smaller diameter gutter (1) to enable the use of the solvent reduction system (see Para 11).

9.6 The distance between the EHT block and the end of the printhead has been reduced, enabling the throw distance to be increased.

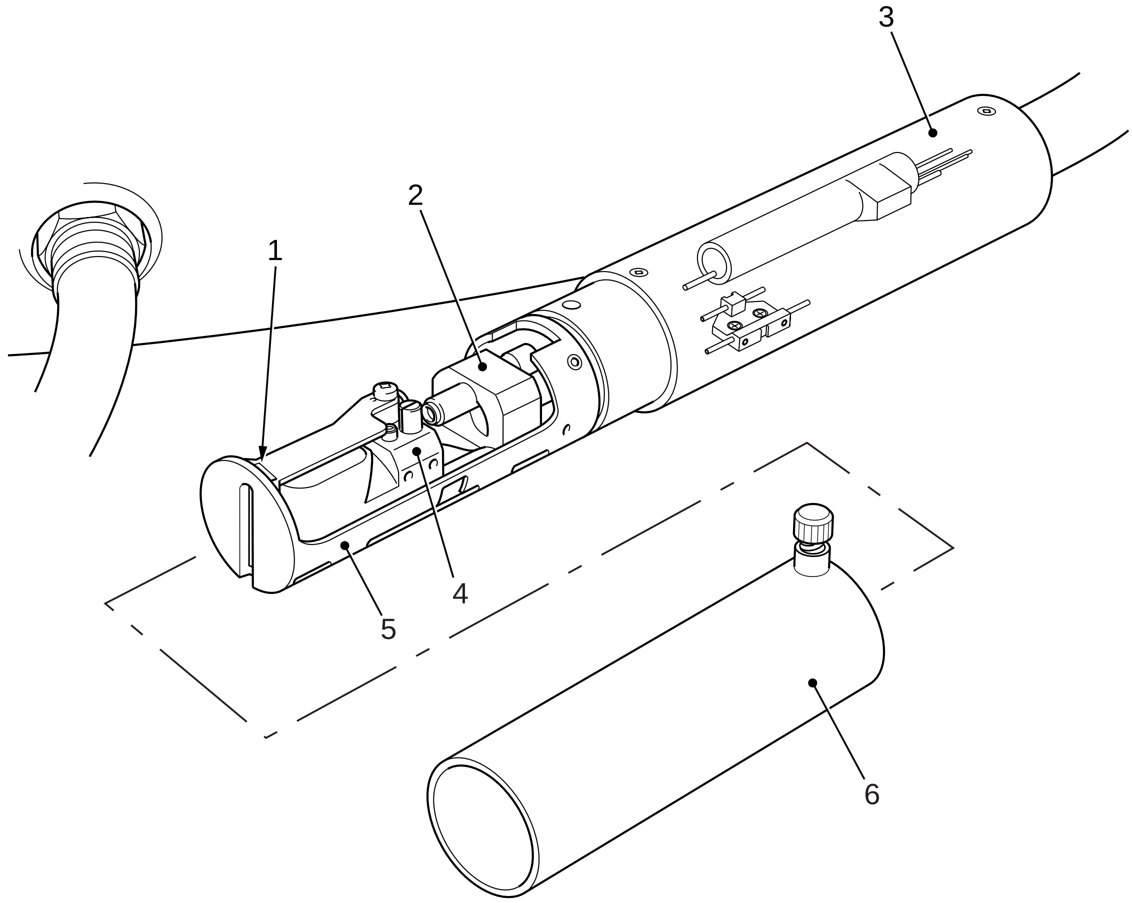
Printhead connections

10 Figure 3 shows the printhead electrical and ink system connections. Note that the 12-way and 3-core cables on the previous models have been replaced by a single 15-way cable. Some of the core insulation colours in the 15-way cable differ from the previous printhead as follows:

10.1 Connection to head heater (Blue) is now Grey (was Blue).

10.2 Connection to head heater (White) is now Green/White (was White).

10.3 Connection to head heater (Red) is now Yellow/White (was Red).



1	Gutter	4	EHT block
2	Nozzle cradle	5	Printhead tray
3	Rear cover	6	Front cover

Fig 2 460 Si Mk 2 Printhead

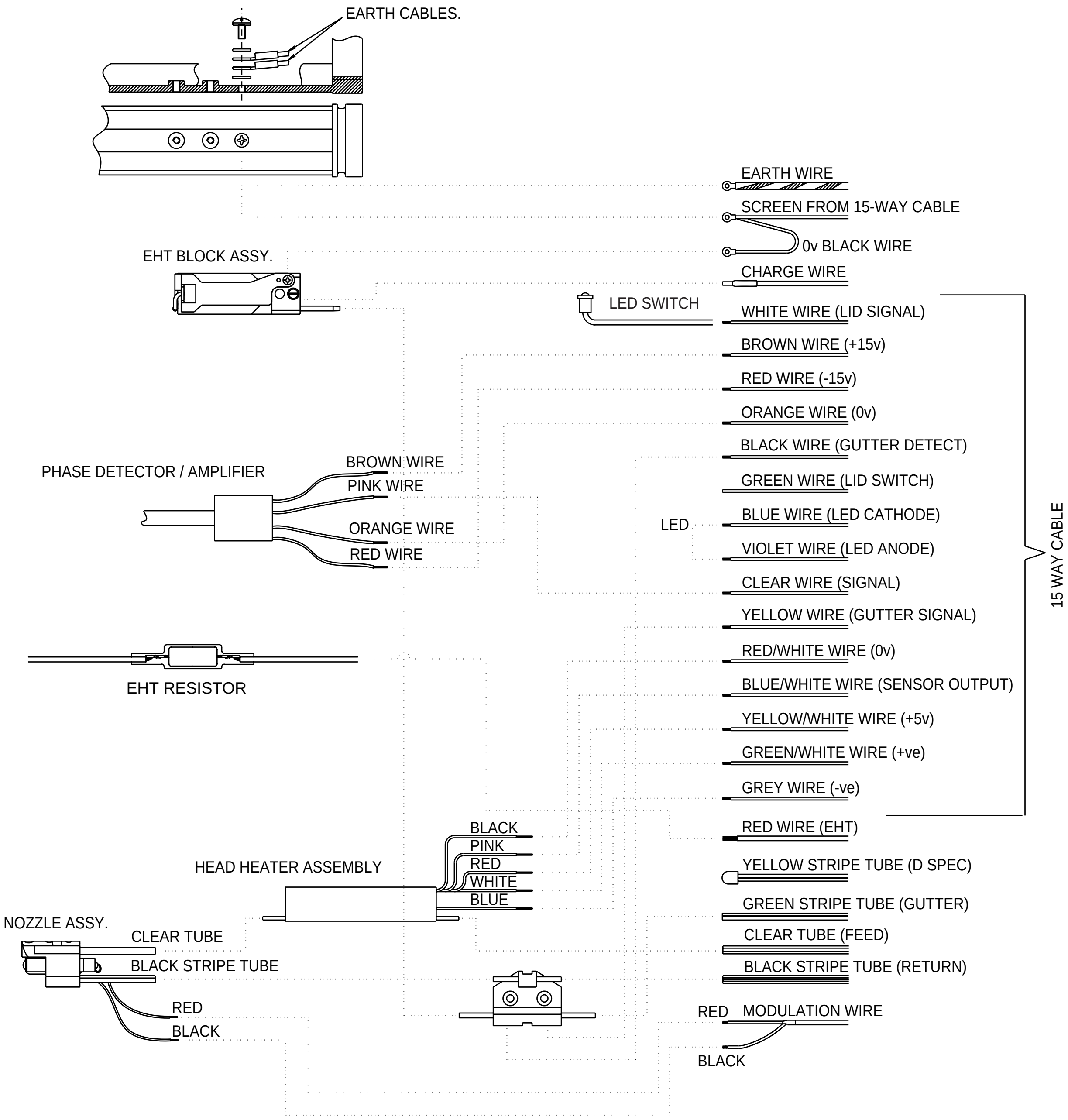


Fig 3 Printhead electrics and ink system circuit diagram

SOLVENT REDUCTION SYSTEM

11 The 460 Si Mk 2 is fitted with a solvent reduction system which cuts solvent usage by approximately 50%. The gutter valve is switched on and off during printing, halving the air sucked in at the gutter and thus reducing the solvent lost through the ink system breather. This reduces solvent odour during printing.

12 In order that gutter suction is not compromised at low ambient temperatures, where solvent consumption is less of a problem, the valve pulsing is inhibited at ink temperatures of less than 20°C (10°C ambient for stabilised machine). The valve pulsing is also inhibited when the EHT is not switched on. Full suction is therefore provided under the following conditions:

12.1 Nozzle flushing.

12.2 Clean and Quick jet shut-downs.

12.3 Head cleaning (ie when the printhead cover is removed).

12.4 During jet start and head purge operations.

13 An existing machine can be fitted with a solvent reduction system by carrying out the modifications listed below:

13.1 Install a Mk 2 I/O board (unless already fitted).

13.2 Fit a motor control PCB with gutter valve driver.

13.3 Upgrade the software.

13.4 Fit Valve Inhibit and Valve Driver harnesses.

13.5 Fit a new gutter valve (recognisable by its black base moulding).

13.6 Fit a new EHT block with a smaller diameter gutter entrance.

14 The new motor drive PCB also incorporates a Hit and Drop driver on the feed valve. This circuit reduces the feed valve solenoid voltage to approximately 12 volts after the valve has opened. This reduces valve heating and enables the 460 Si Mk 2 to be used in ambient temperatures of up to 45°C.

TABLE A1 PARTS CHANGES

Ref	Pt No.	Description	Qty	Applicability		Remarks
				Mk 1	Mk 2	
Table 12.1	200-0460-101	English keypad (Mk 1)	1	✓	✗	
	200-0465-101	English keypad (Mk 2)	1	✓	✓	
	200-0460-102	European keypad (Mk 1)	1	✓	✗	
	200-0465-102	European keypad (Mk 2)	1	✓	✓	
	200-0460-103	Scandinavian/Turkish keypad (Mk 1)	1	✓	✗	
	200-0465-103	Scandinavian/Turkish keypad (Mk 2)	1	✓	✓	
	200-0460-104	Greek keypad (Mk 1)	1	✓	✗	
	200-0465-104	Greek keypad (Mk 2)	1	✓	✓	
	200-0460-105	Japanese keypad (Mk 1)	1	✓	✗	
	200-0465-105	Japanese keypad (Mk 2)	1	✓	✓	
	200-0460-106	Russian/Ukranian keypad (Mk 1)	1	✓	✗	
	200-0465-106	Russian/Ukranian keypad (Mk 2)	1	✓	✓	
	200-0460-107	Bulgarian keypad (Mk 1)	1	✓	✗	
	200-0465-107	Bulgarian keypad (Mk 2)	1	✓	✓	
	200-0460-108	Czech/Hungarian keypad (Mk 1)	1	✓	✗	
	200-0465-108	Czech/Hungarian keypad (Mk 2)	1	✓	✓	
	200-0460-109	Polish/Latvian/Lithuanian keypad (Mk 1)	1	✓	✗	
	200-0465-109	Polish/Latvian/Lithuanian keypad (Mk 2)	1	✓	✓	
	200-0460-110	Arabic/Farsi keypad (Mk 1)	1	✓	✗	
	200-0465-110	Arabic/Farsi keypad (Mk 2)	1	✓	✓	
	200-0460-111	Korean keypad (Mk 1)	1	✓	✗	
	200-0465-111	Korean keypad (Mk 2)	1	✓	✓	
	200-0465-112	Hebrew keypad (Mk 2)	1	✗	✓	
	200-0465-113	Chinese keypad (Mk 2)	1	✗	✓	

(Continued)

TABLE A1 PARTS CHANGES (Continued)

Ref	Pt No.	Description	Qty	Applicability Mk 1	Applicability Mk 2	Remarks
Table 12.7						
4	200-0390-105	Top mould assy (Mk 1)	1	✓	✗	
	200-0390-248	Top mould assy (Mk 2)	1	See remarks	✓	If vent plate is also changed
5	100-0370-163	1430 mm seal (Mk 1)	1	✓	✗	
	100-0370-190	1430 mm seal (Mk 2)	1	✓	✓	
5.1	500-0098-103	T moll strip 530 mm	1	✗	✓	Not illustrated
Table 12.8						
1		Keypad overlays				
	100-0060-101	UK/USA (Mk 1)	1	✓	✗	
	100-0470-138	UK/USA (Mk 2)	1	✓	✓	
	100-0061-101	European (Mk 1)	1	✓	✗	
	100-0470-167	European (Mk 2)	1	✓	✓	
	100-0062-101	Turkish/Scandinavian (Mk 1)	1	✓	✗	
	100-0470-168	Turkish/Scandinavian (Mk 2)	1	✓	✓	
	100-0063-101	Greek (Mk 1)	1	✓	✗	
	100-0470-169	Greek (Mk 2)	1	✓	✓	
	100-0064-101	Japanese (Mk 1)	1	✓	✗	
	100-0470-170	Japanese (Mk 2)	1	✓	✓	
	100-0065-101	Russian/Ukranian (Mk 1)	1	✓	✗	
	100-0470-171	Russian/Ukranian (Mk 2)	1	✓	✓	
	100-0066-101	Bulgarian (Mk 1)	1	✓	✗	
	100-0470-172	Bulgarian (Mk 2)	1	✓	✓	
	100-0067-101	Czech/Slovakian/Hungarian (Mk 1)	1	✓	✗	
	100-0470-173	Czech/Slovakian/Hungarian (Mk 2)	1	✓	✓	
	100-0068-101	Polish/Latvian/Lithuanian (Mk 1)	1	✓	✗	
	100-0470-174	Polish/Latvian/Lithuanian (Mk 2)	1	✓	✓	
	100-0069-101	Korean (Mk 1)	1	✓	✗	
	100-0470-175	Korean (Mk 2)	1	✓	✓	
	100-0070-101	Arabic/Farsi (Mk 1)	1	✓	✗	

(Continued)

TABLE A1 PARTS CHANGES (Continued)

Ref	Pt No.	Description	Qty	Applicability		Remarks
				Mk 1	Mk 2	
Table 12.8						
2	100-0059-101	Keypad circuit assy (Mk 1)	1	✓	✗	
	100-0470-137	Keypad circuit assy (Mk 2)	1	✓	✓	
	100-0470-176	Arabic/Farsi (Mk 2)	1	✓	✓	
	100-0071-101	Hebrew (Mk 1)	1	✓	✗	
	100-0470-177	Hebrew (Mk 2)	1	✓	✓	
	100-0470-178	Taiwanese (Mk 2)	1	✗	✓	
4	100-0370-108	Keypad plate (Mk 1)	1	✓	✗	
	100-0370-235	Keypad plate (Mk 2)	1	✓	✓	
6	100-3900-285	Keypad plate seal (Mk 1)	1	✓	✗	
	100-0370-165	Keypad plate seal (Mk 2)	1	✓	✓	
9	100-0370-249	LED harness (Mk 2)	1	✗	✓	Not illustrated
Table 12.9				✓	✗	
9	200-0390-211	I/O board (Mk 1)	1	✓	✗	
	200-0390-250	I/O board (Mk 2)	1	✓	✓	
10	200-0390-236	Ink pump motor driver board (Mk 1)	1	✓	✗	
	200-0390-247	Ink pump motor driver board (Mk 2)	1	✓	✓	
12	100-0370-247	Harness kit (Mk 2)	1			Not illustrated
13	200-0390-147	Motor control board	1	✓	✓	Previously supplied with I/O board
Table 12.11						
1	100-3900-240	Front cover (Si and Pi)	1	✓	✗	
	100-0461-003	Front cover (Mi)	1	✓	✗	
	100-0370-196	Front cover (Mk 2)	1	✗	✓	
4	200-3900-206	Nozzle assy (Si)	1	✓	✗	
	200-0461-116	Nozzle assy (Mi)	1	✓	✗	
	200-0462-116	Nozzle assy (Pi)	1	✓	✗	
	200-0390-241	Nozzle assy (Mk 2)	1	✓	✓	
5	200-3900-208	Cover switch assy (Mk 1)	1	✓	✗	
	200-0390-235	Cover switch assy (Mk 2)	1	✓	✓	

(Continued)

TABLE A1 PARTS CHANGES (Continued)

Ref	Pt No.	Description	Qty	Applicability Mk 1	Applicability Mk 2	Remarks
6	100-1600-327	Thumbscrew (Mk 1)	1	✓	✗	
	100-0370-231	Thumbscrew (Mk 2)	1	✗	✓	
9	100-3900-268	Gutter detect	1	✓	Not Reqd	
	100-0370-216	Gutter detect	1	Not Reqd	✓	
10	500-0031-180	O ring (Mk 1)	1	✓	✗	
	500-0031-197	O ring (Mk 2)	1	✓	✓	
13	100-3900-243	Rear cover (Mk 1)	1	✓	✗	
	100-0370-195	Rear cover (Mk 2)	1	✗	✓	
15	200-3900-207	EHT block (Si)	1	✓	✗	
	200-0461-117	EHT block (Mi)	1	✓	✗	
	200-0462-117	EHT block (Pi)	1	✓	✗	
	200-0390-231	EHT block (Mk 2)	1	✗	✓	
Table 12.12						
21	100-0370-182	Base moulding filter cover (Mk 1)	1	✓	✗	Mk 2 unit supplied with base moulding
Table 12.13						
5	500-0082-119	Mains switch (Mk 1)	1	✗	✗	Superceeded by Mk 2 variant
	500-0082-145	Mains switch (Mk 2)	1	✓	✓	
Table 12.14						
3	521-0001-135	Ink valve (Mk 1 and 2)	1	✓	✓	
3a	521-0001-162	Gutter valve (Mk 2)	1	✗	✓	Not illustrated
Table 12.15						
1	511-5200-161	Left hand insert (Mk 1)	1	✓	✗	
2	511-5200-162	Right hand insert (Mk 1)	1	✓	✗	
3	511-500-111	Carton (Mk 1)	1	✓	✗	

(Continued)

TABLE A1 PARTS CHANGES (Continued)

Ref	Pt No.	Description	Qty	Applicability		Remarks
				Mk 1	Mk 2	
4	511-500-156	Packaging (Mk 2)	1	✗	✓	Replaces items 1, 2 and 3