Fixing the ThinkJet

Martin Hepperle, September 2016, November 2024

The Hewlett Packard ThinkJet was one of the first printers using the new ink jet technology. Due to its almost silent operation and good print quality (compared to 9 needle printers of the same era) at low cost is sold in large numbers. Hewlett Packard also used the ThinkJet in various incarnations e.g. as an integrated printer in the HP Integral Computer. Even today in 2016, the same print cartridges are still produced for application in point of sales (POS) printers.

However, the ThinkJet suffers from one design flaw, which became only visible after many years in the market. The main board and the disposable print head are connected by a Flexprint ribbon cable with contact points matching the contact surfaces of the head. This contact area is often wetted by excess ink, caused e.g. by temperature variations which may push a small amount of ink out of the nozzles. The ink seems to consist of a mixture of water, alcohol, color pigments and additional chemicals which attack the thin exposed copper surfaces at the end of the Flexprint cable. So after some years of usage or storage with the print head in place many ThinkJets are actually missing the point: one or more nozzles do not fire because their connection has been dissolved.

Until today, no fix was possible – the Flexprint cable is very thin, plastic coated and cannot be soldered.

But recently, replacement ribbon cables became available for the current (2016) applications of the ThinkJet print cartridge. Unfortunately these Flexprint cables are not identical to the old cables and cannot be used to directly replace the broken Flexprints. But if we investigate a bit deeper and if we want to use the printer and not maintain it in its original state as a static museum piece we can devise a hack to fix the Flexprint cable problem.

1. Flex Cables and Print Heads

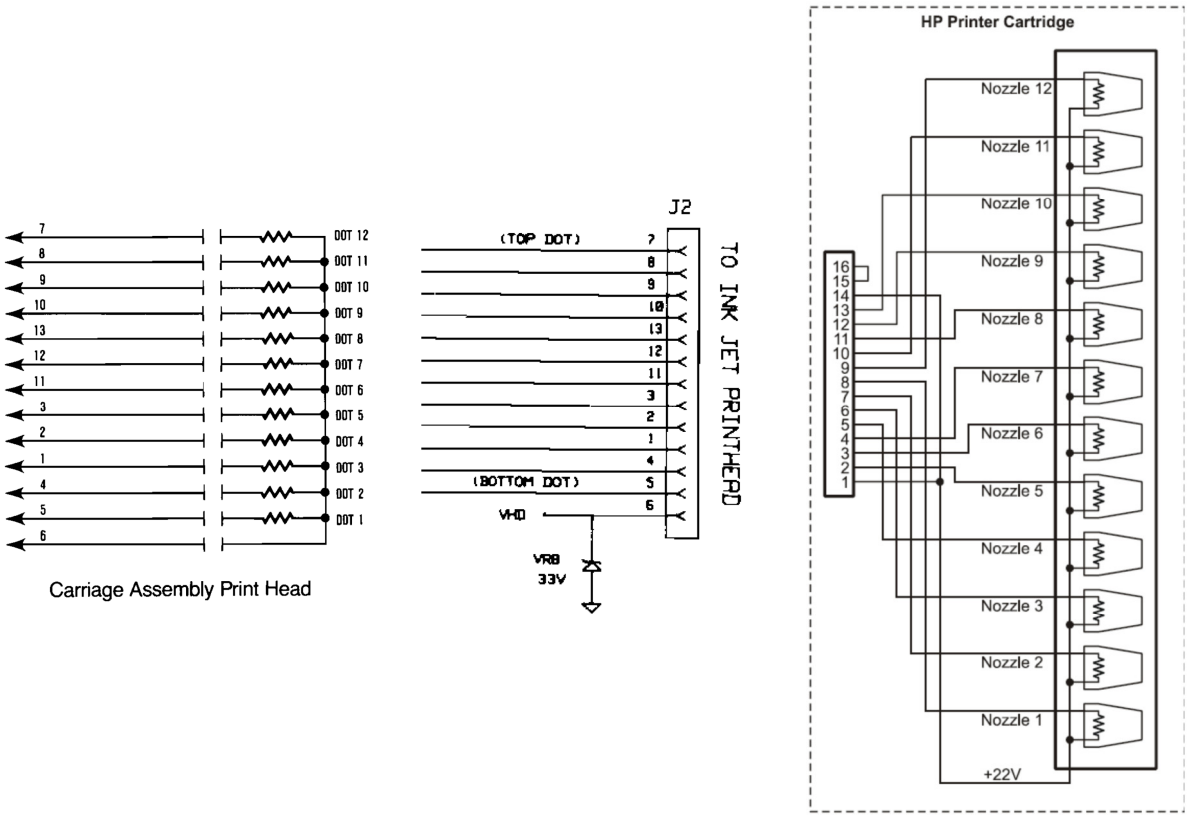

Figure 1 Connections from ribbon cable to print head nozzles. Schematics taken from Service Manual (left, center, old cable) and from Parallax documentation (right, new cable)

Let's have a look at the old and the new Flexprint cables. In Figure 1 we see wires connecting the 12 nozzle lines to GND and one common 22V power line. Thus we need exactly 13 lines to control the print head.

The right hand graph is for the new cable where traces 1 and 14 are connected together. The new Flexprint also contains a loop to detect a loose or missing cable. Thus this new cable has 16 lines – 3 more than the original one.

The following drawing shows the connections from the contact points at the print head end of the ribbon cable to the wires of the Flexprint cables (looking at the contact area).

We can see that the arrangement is very similar but not identical. An adapter can be devised to connect the new cable to the old Flexprint connection point.

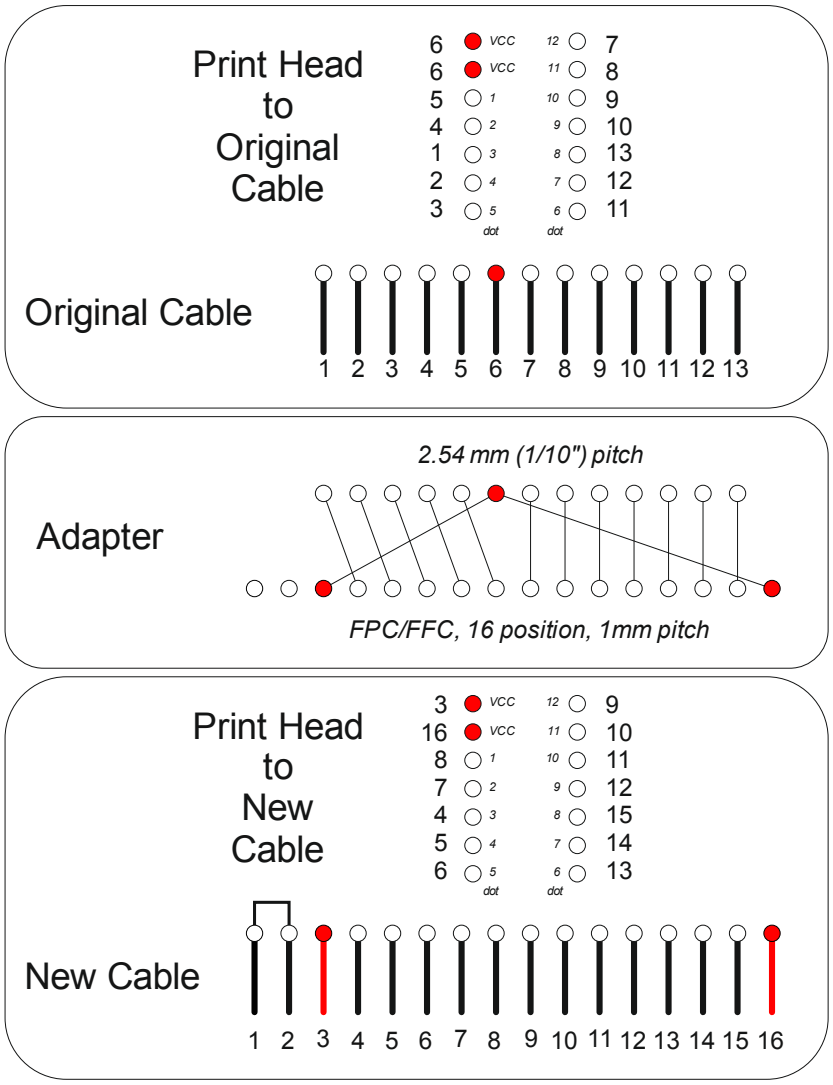

Figure 2 Connections between print head and old and new Flexprint cables.

Original Flex Print Part

Part Number	02225-80027
Part Description	Flex Circuit
Status	obsolete

New Flex Print Part

Part Number	HP Q7453A
Part Description	Flex Circuit
Status	available in 2016
Price	about $7

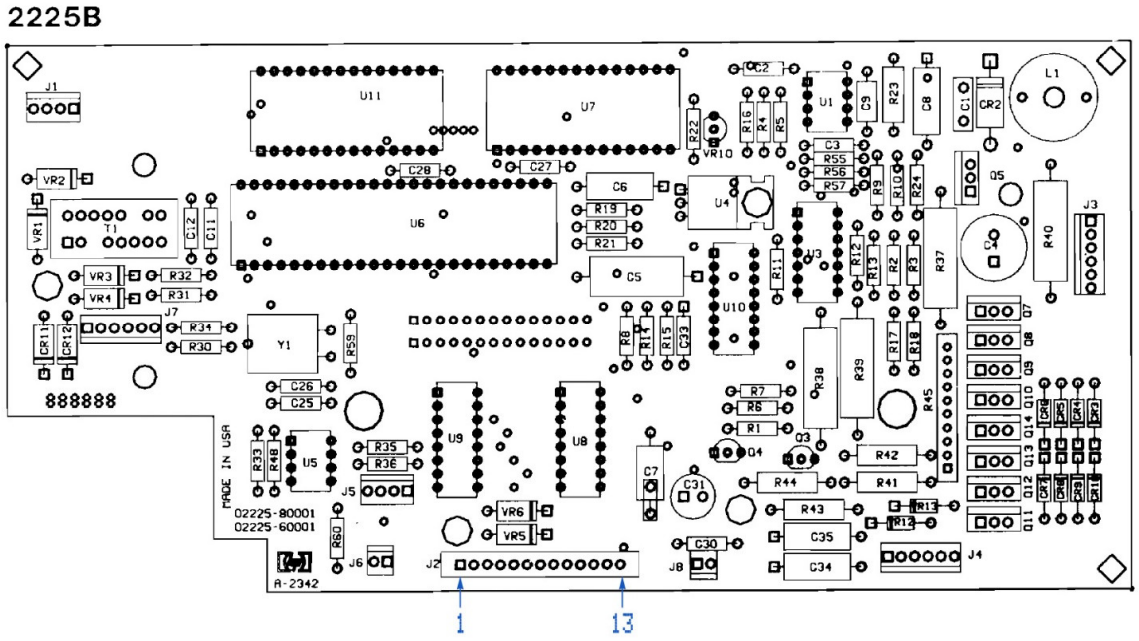

Figure 3 **The printed circuit assembly of the HP-IL version 2225B with the Flexprint cable connector.**

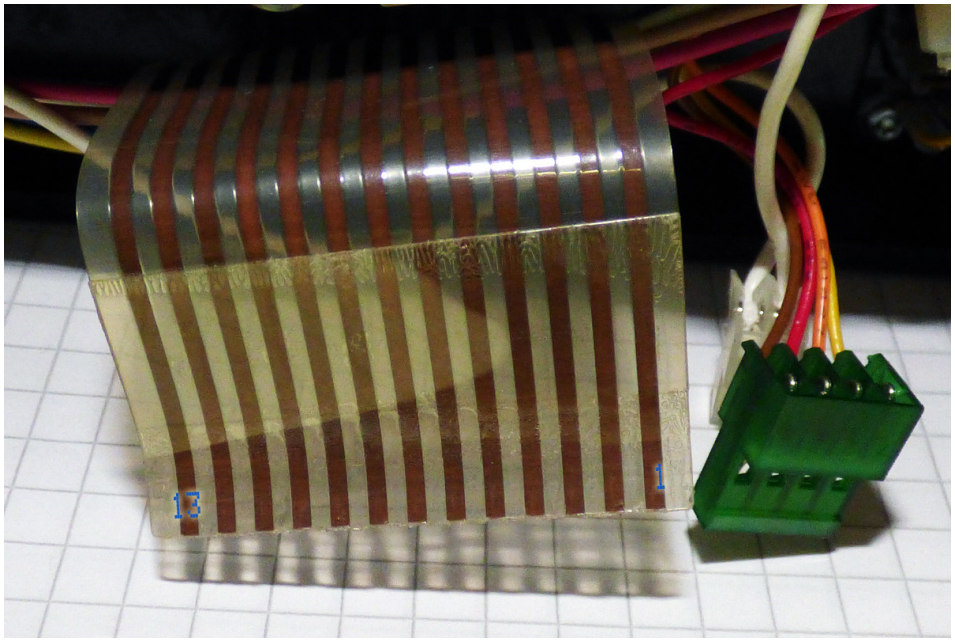

Figure 4 **The PCB end of the original ribbon cable has 13 positions spaced 2.54 mm (1/10 inch) apart. View on the reinforced (isolated) side towards the printing mechanism, therefore numbering is from right to left. The exposed contact strips are facing away from the observer.**

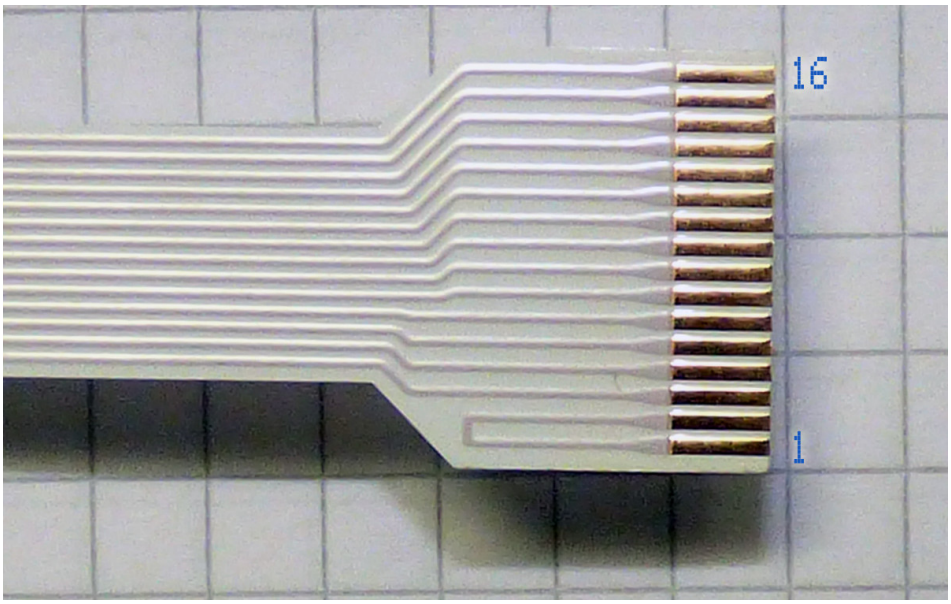

Figure 5 **The PCB end of the new ribbon cable has 16 positions spaced 1 mm apart. The first two of these form a loop to be used for a "cable present" logic.**

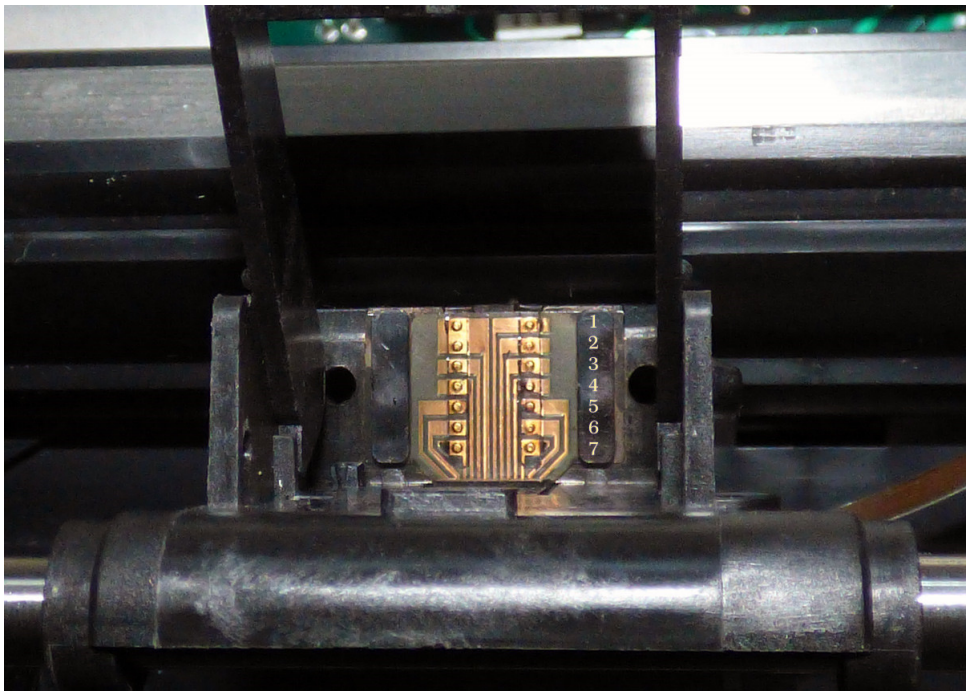

Figure 6 **A view of the original 2225 print head carriage with the 2 x 7 contact positions. The numbers only serve to count the pins – they are not linked to dot numbers or ribbon cable wire numbers. Note that positions 1 and 2 on the left row are connected to a single copper trace. The Flexprint is held in place by two rectangular mounting clips to the right and to the left of the contact dots (the numbers are printed on top of the right clip). Each clip has two small pins with hooks at its ends which pass through matching holes of about 1 mm diameter in the cartridge holder.**

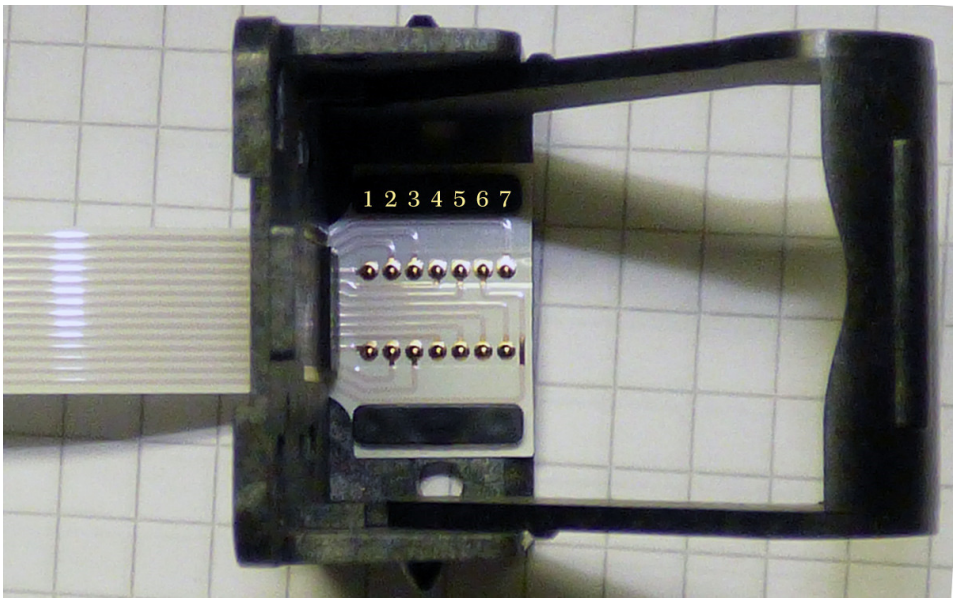

Figure 7 **The corresponding view of the new print head carriage. Note that all positions are connected to individual traces. Again, the numbers only serve to count the pins – they are not linked to dot numbers or ribbon cable wire numbers**

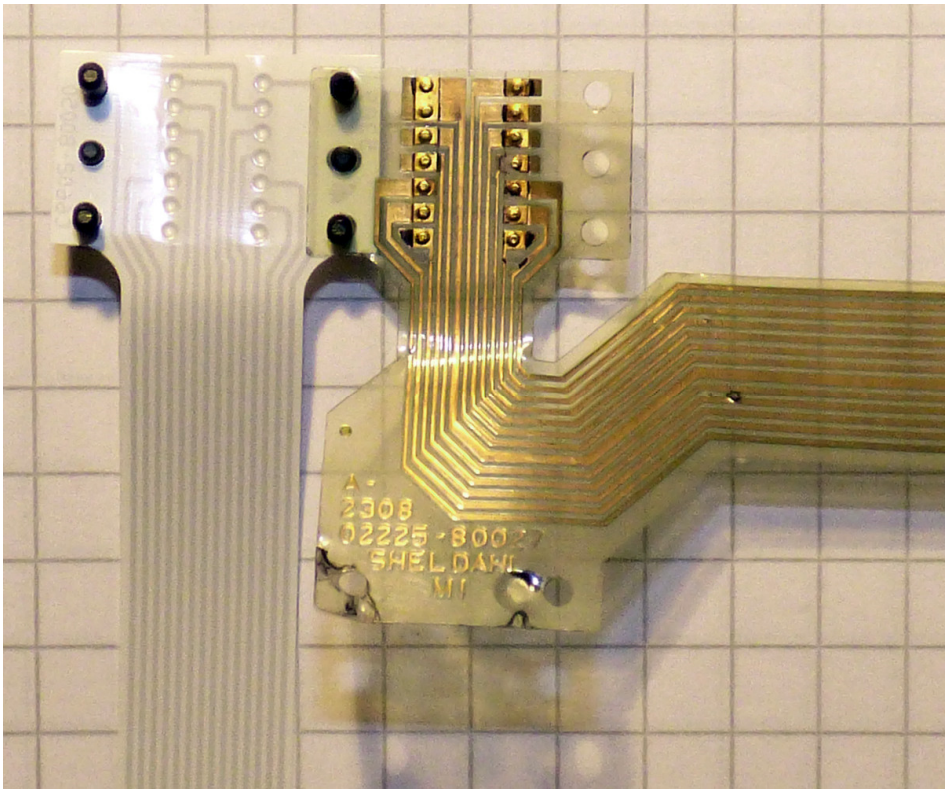

Figure 8 **The comparison of the hole pattern in the contact plate shows a promising match. However, the right angle bend has to be produced by folding the ribbon cable over. The traces are usually corroded at the point where the rectangular contact dot area meets the traces and leaves a tiny exposed copper area so that the acid in the ink can start to do its nasty work.**

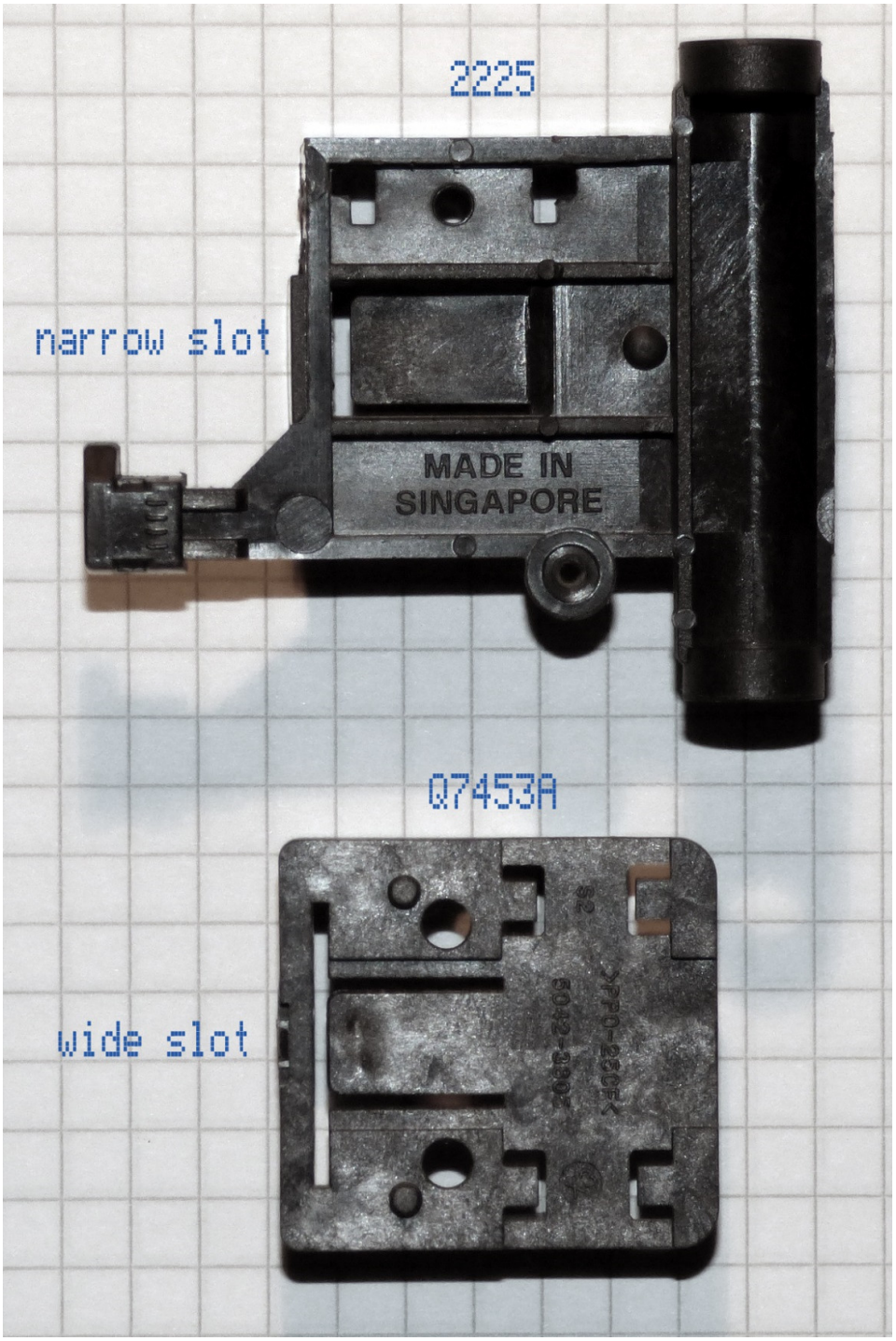

Figure 9 **The ribbon cable from the Q7453A is wider and therefore its carriage has a wider slot. The slot in the 2225 carriage is too narrow to fit the cable and would have to be widened by about 2 mm on each side, e.g. with a small hacksaw blade (eating away some material from the two stiffening ribs). As the punched "ears" of the ribbon cable can be bent when mounting the slot width can be limited to the width of the cable.**

2. Performing the Modification

Note that the pictures show the HP-IL variant of the printer which has a battery compartment. Each printer has a different printed circuit board, but the connector to the ribbon cable is always in the same place. Consult the Service Manual for your printer model.

2.1. Opening the Printer

The printer can be easily opened by removing four screws at the bottom. Note that you will need a Torx T8 screw driver with at least 40, better 50 mm length for all these screws. The operator panel in the upper case is linked by a cable to the PCB. Unplug this cable and put the upper cover aside. The transparent cover will also fall out when lifting the upper cover. You will need to insert it again when reassembling later.

Figure 10 Opening the case requires nothing more than removal of these four screws. The addional screw holds the chassis in place and will be removed later.

2.2. Removing the Chassis

I have not taken a picture of this step. The black printer chassis is mounted by two screws with metal caps inside the chassis and one screw securing the paper advance stepper motor from the bottom. You have to unplug several cables before lifting out the chassis. One of these cables is the old Flexprint cable which can be pulled out of its connector easily.

2.3. Removing the Print-Head Carriage

The carriage rides along a steel rod. It is driven by a steel cable which is secured to the underside of the carriage by a single screw.

- First remove one of the circlips on the steel rod and slide the rod out of the chassis to free the carriage. Note how the carriage slides along the guide rim molded into of the chassis and how it clears the “carriage home” sensor.
- Then remove the screw with the drive cable, but keep the screw in the eyelets at the ends of the cable to maintain the tension of the cable. This spares you to re-thread the cable later.
- Remove the clip which fixes the Flexprint to the bottom of the chassis. The cable is also attached there with some double-sided tape. Slowly pull the Flexprint up to remove it from the chassis.
- You should now have the carriage with the attached Flexprint cable in your hands.
- Unclip the bottom cover plate of the carriage. It sports two small hooks with fit into recesses in the carriage (see Figure 12).
- Then remove the two black plastic brackets on both sides of the contact points. Now you can extract the Flexprint cable from the carriage. Also remove the two small rubber pads located behind the contact rows. Wash off the old ink from all plastic parts in soap water.

2.4. Preparing the Print-Head Carriage

You have to elongate the existing slot in the carriage to accept the wider end of the new cable.

I drilled a few holes of 1 mm diameter at the edge of the horizontal plate using a small mill. Any good drill press would work or you can use a suitable jigsaw blade. The slot must be wide enough to provide space for the ribbon cable. For mounting, the “side ears” can be slightly folded to navigate the head through the slots. This keeps the part stiff and strong, even if the two ribs at the bottom are cut.

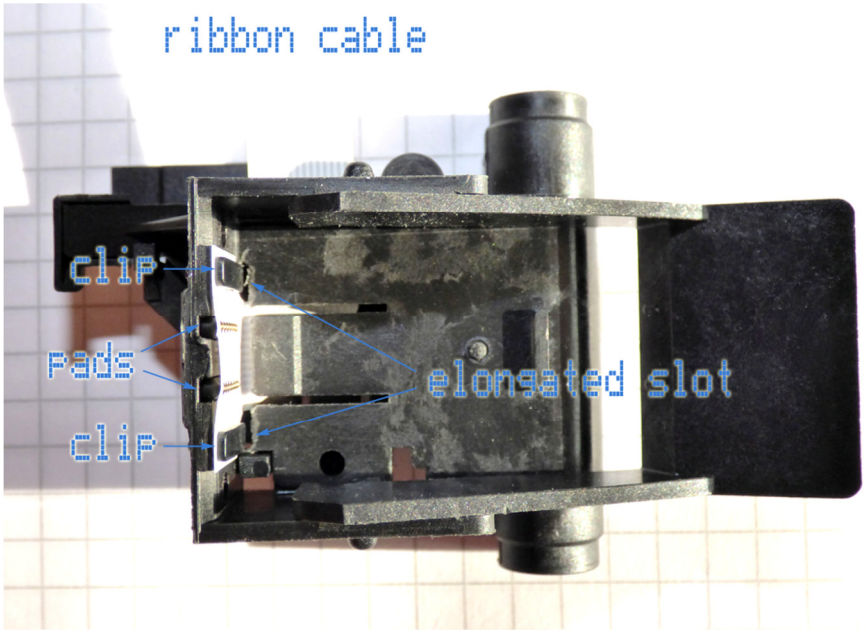

Figure 11 Modified print head carriage with new ribbon cable already installed.

2.5. Mounting Instructions

- Thread the Flexprint cable through the enlarged slot.
- Insert the two plastic clips into the holes in the ribbon cable.
- Place the two “rubber” pads into their slots in the cartridge so that their small bumps face the ribbon cable.
- Position the cable and clip the two clips into the carriage. Insert the lower pin first and then clip the upper pin into its hole. Tweezers may be your friend.
- Fold the cable with a soft bend over a 45 degrees line to route it into the proper direction.
- Clip the bottom cover back on.

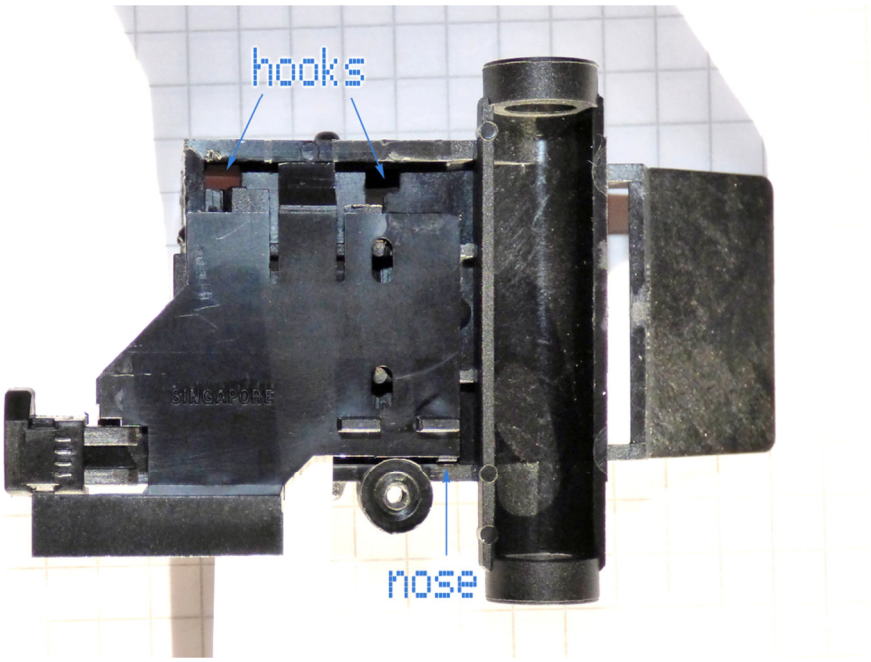

Figure 12 The bottom view shows the bottom cover in place with its two retaining hooks. It is hinged at the bottom using the indicated nose. I broke one of the hooks because I did not see in this black on black environment how the plate was held in place. Being a bit more patient, you should be able to unhook the plate without breaking anything. Note the screw hole for the drive cable at the bottom center.

3. The Adapter Harness

While one can solder wires directly to the Flexprint cable, this is not recommended. Instead we will create a small cable harness to connect the Flexprint cable to the PCB.

If you want to have something more professional looking, you could design a small adapter PCB with the ZIF socket and header pins for connecting to the printer PCB. Cheek the available space first – not all ThinkJets are created equal and especially the variants with a battery do not offer much space in this region. See section 8 below for these alternative solution variants.

A matching FFC/FPC 16 position 1 mm spacing ZIF (Zero Insertion Force) header can be bought for about 50 cents or less and is the proper counterpart. It also allows replacing the ribbon cable and makes assembly easier. Those connectors come in through-hole as well as in the more common surface mount form – I chose the through-hole variant to solder directly to a ribbon cable. If you do not have new stock, you can also create the ribbon cable by stripping an old hard disk or floppy disk drive cable. You need to prepare a cable having 13 wires. Use a knife or just tear the individual wires out of the ribbon at both ends. Strip insulation and pre-tin the ends. Wire 6 must be pulled out a bit longer to be directed to the pin3.

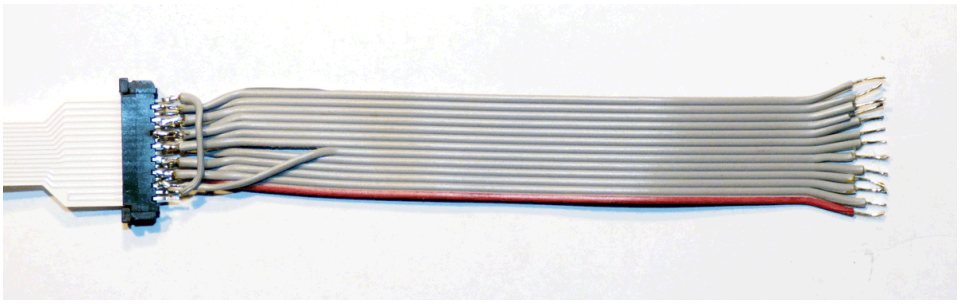

Figure 13 With some patience this adapter can be made from a ribbon cable. The red wire goes to pin 4.

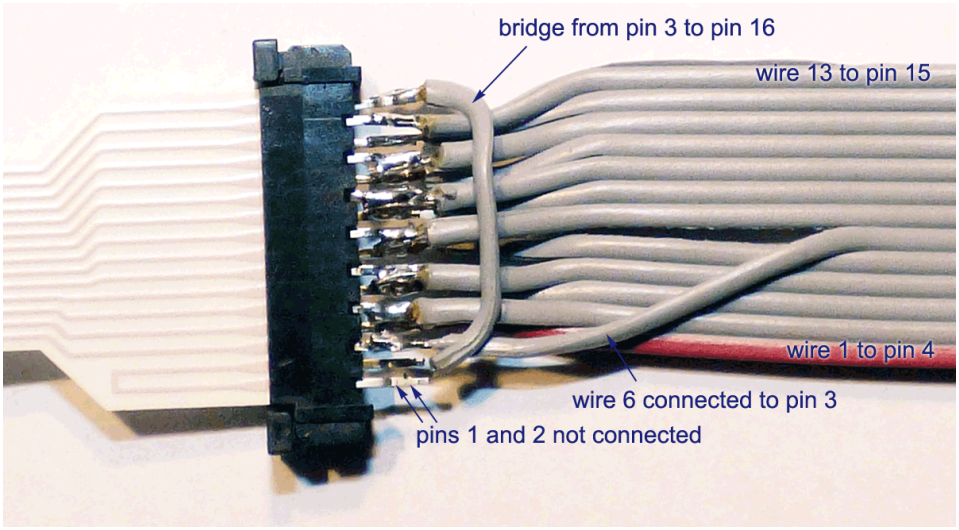

Figure 14 Detail of the ZIF header soldered to the adapter cable. With the exception of wire 6 pulled out and connected to pin3 and the bridge between pin 3 and 16 the wiring is a straight 1:1 connection and follows the scheme sketched above.

4. Installing the Adapter

- Open the ZIF socket and disconnect the Flexprint cable from the ribbon cable adapter.
- Apply some insulation tape or shrink tube to secure the soldered contacts against shorting

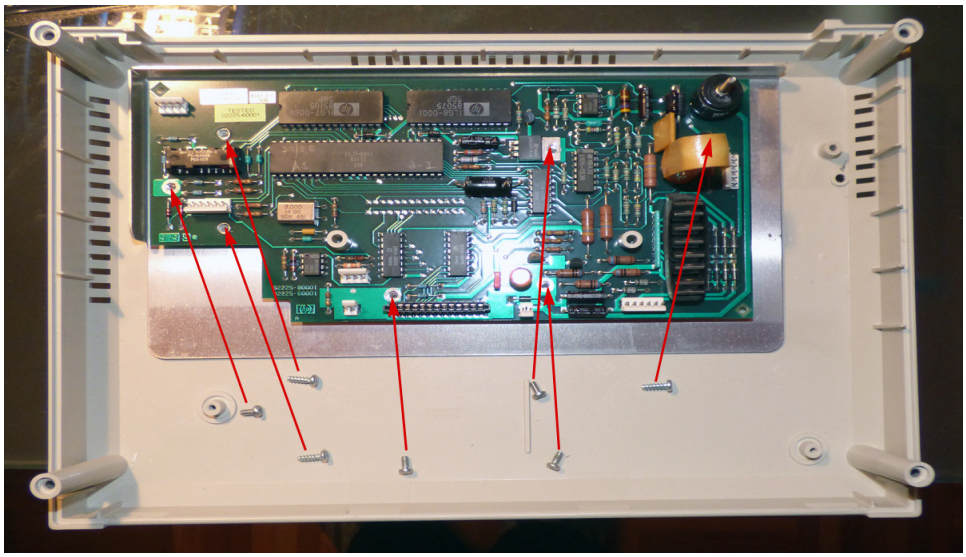

Figure 15 The seven screws that have to be removed to extract the printed circuit board.

- Remove the PCB from the printer by removing all screws (3 with metal, 4 with plastic threads).
- Carefully unsolder the original Flexprint connector on the PCB and clean the holes.
- Pre-tin the free ends of the ribbon cable,
- Solder the free ends of the ribbon cable into the PCB. Start by soldering the two left and right wires first. Then use tweezers to insert the remaining wires into their holes, solder them in and clip any excess wire ends
- Reinstall the PCB into the printer case.

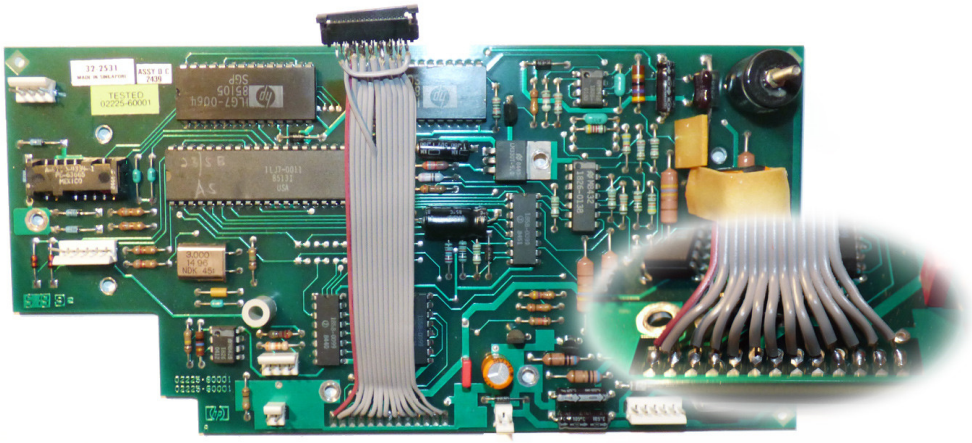

Figure 16 The PCB with the ribbon cable adapter installed. If you have cleaned the holes in the PCB nicely this is a simple solder job. The adapter cable could be shorter – about 5 cm would be sufficient. The red wire goes to pin 1.

5. Installing the Carriage

- Mount the print head carriage on its guide steel rod and reattach the drive wire with its screw. Make sure that the "gliding shoe" of the carriage is properly aligned with the guide rail in the black plastic chassis. This rail is also responsible for lifting the print head off the paper when it reaches the left edge of the paper.
- Hold the flexprint cable in its "U" shape so that the black plastic clip can be re-inserted into the bottom of the printer chassis. Make sure that it is clicked properly into the two slots.
- Adjust the free length of the Flexprint by sliding it in this plastic clip so that the print head carriage can move freely to the leftmost and rightmost position.
- Fold the free end of the Flexprint over a 45 degree line so that it can exit through the slot in the chassis towards the PCB. Do not break the Flexprint, but you can fold it with a relatively tight crease. Using a thin steel rod of 2 mm diameter can help to get a nice rounded fold. The contact side of the Flexprint will face down, towards the bottom of the printer.
- Apply some double sided tape just in front of the slot to hold the folded part down.

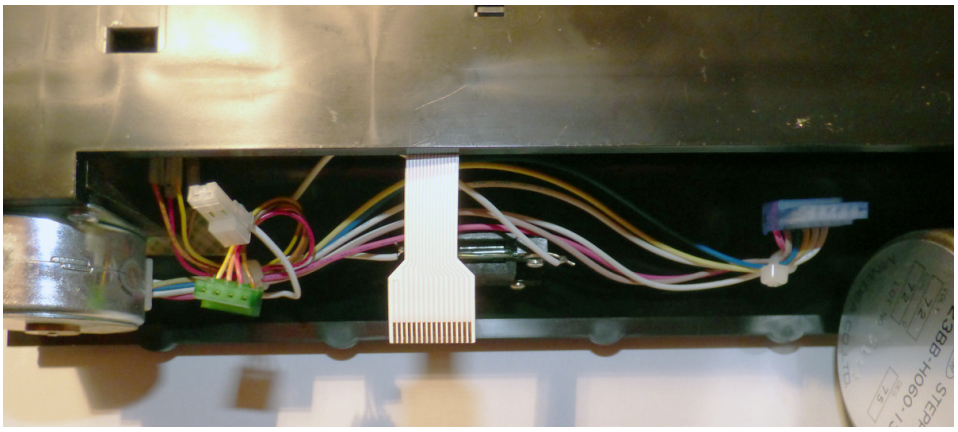

Figure 17 The end of the new Flexprint cable has been threaded through the slot in the chassis. Note that the contact side is facing downwards.

6. Reassembling the Printer

- Lower the chassis down into the front of the printer case.
- Push the Flexprint into the ZIF adapter cable and close the ZIF socket. Make sure that you have inserted it properly.
- Reconnect all connectors and check that you did not forget one.
- Move the chassis to its proper position and fasten it using the two screws with their metal caps.
- Add the stepper motor screw from the bottom.
- Connect the cable from the button panel in the upper case part to the PCB and slide the top cover in place. Do not yet insert the four screws, you might have to open the case again.
- Check the free motion of the carriage by sliding it over the whole width.

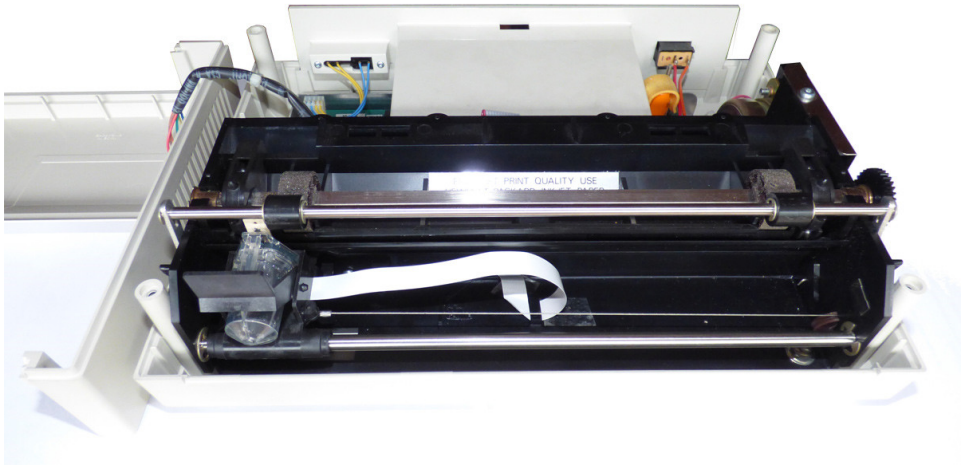

Figure 18 **The Flexprint cable can be pre-bent to keep it in the desired shape. Note the plastic clip clamping its end to the chassis bottom. You can see a loop of the Flexprint adapter ribbon cable peeking out over the front edge of the battery box – it could have been shorter. On the other hand this loop allows placing the ZIF connector into the space between chassis and battery box without interference or risk of short circuits.**

7. Ready for a Ride

- Install a print head cartridge.
- Insert a piece of paper.
- If everything looks okay, you are ready for a test print (hold the blue ONLINE and the FF keys simultaneously and then switch the printer ON. Release the panel buttons.

8. Variations

8.1. Using an intermediate PCB

Soldering the wires to a printed adapter board for a ZIF Socket is easier than soldering directly to the cable, but also a bit bulkier. The adapter PCB could be cut narrower as only 16 connections are needed.

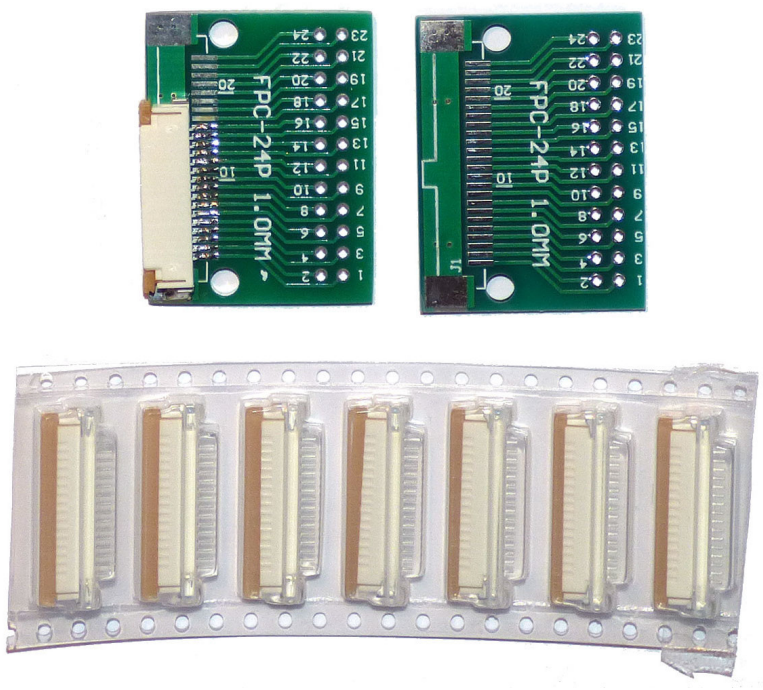

Figure 19 Such a universal PCB can be used to make an adapter for a ZIF socket and the ribbon cable.

8.2. Using a Special Flexprint Adapter

It is also possible to design a flexible printed board which goes into the old socket on the mainboard and carries a ZIF socket on the opposite end. This is the most professional solution.

Figure 20 A custom designed flexprint adapter cable.

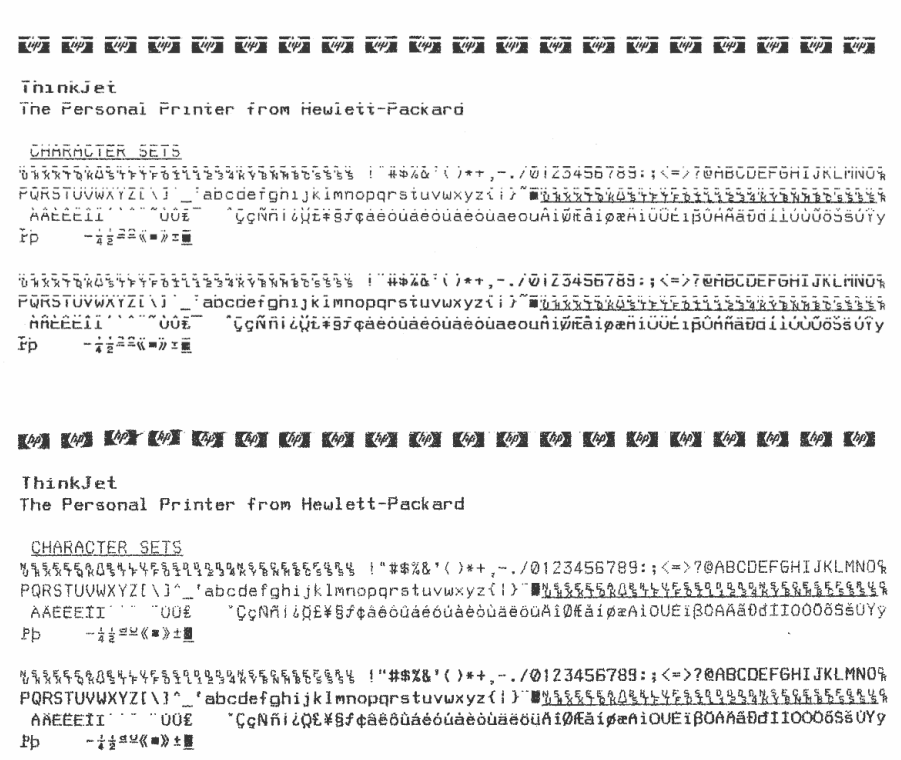

Figure 21 Test printouts. Top: original cable with two dot rows missing. Bottom: repaired ThinkJet with all dots printing. Wavy regions are not a fault of the printer but mine due to sloppy single sheet paper loading.

9. Reference: HP ThinkJet Specifications

9.1. Model numbers

2225 (A) (B) (C) (D) (P) HP ThinkJet Printer

9.2. Options

Order No.	Description	Introduced	Obsolete
2225A	HP-IB parallel, AC line power	February 1, 1984	October 1, 1993
2225B	HP-IL serial, DC battery power	February 1, 1984	October 1, 1993
2225C	Centronics parallel, AC line power	February 1, 1984	October 1, 1993
2225D	RS-232C serial, AC line power	March 1, 1985	October 1, 1993
2225P	Centronics parallel, DC battery power	November 1, 1986	October 1, 1993

9.3. Power module options

AC Voltage	Country/Region	HP model number
100 V	Japan	82241AJ
120 V	USA/Canada	82241A
220 V	Europe	82241AB
240 V	United Kingdom	82241AU
240 V	Australia	82241AG
240 V	South Africa	82241AA

9.4. Battery power options

Part number	Description
82059D	Recharger, U.S.
82066B	Recharger, Euro-220V
82067B	Recharger, U.K.
82067B Opt 1	Recharger, S. African
82068B	Recharger, Australian
82069B	Recharger, Euro-110V
82199A	Battery Pack

9.5. Serial number

The serial number is located on the bottom of the printer or on the back of the printer near the cable plug in.

9.6. Printer description

HP ThinkJet printers deliver quick, quiet, dependable printing for office, home, or on the go, and they produce easy-to-read text and graphics. Match the HP ThinkJet printer (HP2225B/P) with portable computers depending on the PC interface. The portable printers are rugged and lightweight, and its long battery life (about 200 pages between recharges) assures printing dependability wherever you go. The HP ThinkJet printer family offers 150-cps quality mode at 96x96 dots per inch (dpi) in graphics or 192x96 dpi in double-density mode.

9.7. Printer features

Print technology	Thermal Inkjet printing (monochrome)
PCL printer language	Level 1
Alternate (Epson-type) print mode	Models 2225C, D & P only-mode switches
Interfaces	Option dependent
Memory (standard)	1 KB
Memory (maximum)	1 KB
Speed - Draft mode	150 cps at 12 cpi
Speed - Quality mode	150 cps at 12 cpi
Resolution - graphics	96 x 96 dpi
Resolution - double density	192 x 96 dpi
Print Cartridge - HP Jetpaper	92261A (Black)
Print Cartridge - plain paper	51604A (Black)
Print Cartridge - HP Jetpaper	51605B (Blue)
Print Cartridge - HP Jetpaper	51605R (Red)
Monthly duty cycle	1200 pages or 40 pages per day
Media capacity	Manual, Z-fold paper, continuous-plain
Media sizes	A/A4 standard US and European
Media Types	HP Z-Fold, Plain Paper
Bitmapped fonts	1
Footprint	11.5 x 8.1 inches

9.8. Resident fonts

Print mode	Print region	Char./inch	Char./line
Normal	6.67 inches	12 cpi	80
Expanded	6.67 inches	6 cpi	40
Compressed	6.67 inches	21.3 cpi	142
Expanded compressed	6.67 inches	10.7 cpi	71

Most print modes are available in bold, underline, superscript, and subscript.

9.9. Graphics and double-density resolution (DPI)

Graphics	96 x 96 Dots Per Inch (DPI)
Double density	192 x 96 DPI

9.10. Paper handling

HP Z-fold paper - part number 51630P (250 sheets)	Continuous feed
HP transparency - part number 51630Q (50 sheets)	Manual feed
HP CX Cutsheet - part number 51630Y (200 sheets)	Manual feed

Note: HP CX paper was discontinued in June 1999.

9.11. Physical specifications

Width	11.5 inches (29.3 cm)
Depth	8.1 inches (20.6 cm)
Height	3.5 inches (8.9 cm)
Weight - 2225A	7.4 lb., 3.36 kg
Weight - 2225C	5.5 lb., 2.5 kg
Weight - 2225D	4.62 lb., 2.1 kg
Weight - 2225P	7.8 lb., 3.54 kg

9.12. Electrical

2225A, B C, D, P	
Voltage	100,120,220,240 AC (+5% to -10%)
Frequencies	47.5 - 63 Hz
Power consumption	10 W maximum, non-printing
Power consumption at 115 V AC	18 W maximum, printing

9.13. Environmental

Temperature (operating)	50 - 104 degrees F (10 - 40 degrees C)
Temperature (storage)	-4 - 140 degrees F (-20 - 60 degrees C)
Humidity	10-80% RH non-condensing
Acoustics (sound pressure level-Lpa)	<50dB(A) @ front bystander position

9.14. Warranty

One year parts and labor from the original date of purchase.

9.15. Safety certifications

Power Module: UL, CSA, TUV, SETI, LCIE, SEV, DEMKO, NEMKO, SEMKO, and SECV.

Printer with Power Module: UL and TUV. Others not required.

Printer with Power Module (EMI Certifications): FCC Class B when used with a Class B computing device (USA), VDE/FTZ Level B (W. Germany), VCCI (Japan), and SABS (South Africa).

9.16. Manuals

02225-90031	2225A Owner's Manual
02225-90032	2225B Owner's Manual
02225-90077	2225C Owner's Manual
02225-90080	2225D Owner's Manual
02225-90078	2225P Owner's Manual
02225-90079	Service Manual

9.17. Print Cartridges

HP 51604A

HP 92261A

Kodak Diconix Printhead Cartridge CAT 822 3893