

'PBUFF' — a 256K Centronics printer buffer

Don McKenzie

This easily-built project installs in-line between your computer's Centronics printer port and your printer's input connector. It will accept up to 262, 144 characters dumped from your computer and store them until your printer has completed its task, freeing you and your computer to get on with other things. This buffer has a host of features at a fraction of the cost of commercial parallel-type printer buffers, not the least being a huge "quarter-meg" of memory.

THE MAJORITY of popular computers available, for home or business use, provide a Centronics-type printer output port because the de-facto "standard" interface on most popular printers is the Centronics (or parallel) interface. Some printers (like some Epson and TI models) have a "dual" parallel-serial interface, to get the best of both worlds.

When printing-out a listing or wordprocessor file from your computer, having to wait around while it all happens is a tedium we can all do without. If this were not so, there would not be legions of commercial printer buffers on the market or buffer options/upgrades for printers! A commercial ready-built printer buffer of 64K capacity (and it's not really economic or worthwhile considering any less memory capacity) will set you back between about \$300 and \$800. A 256K commercial buffer will cost you from \$500 to \$1200 — if you can get one! If you're prepared to invest a modicum of your time, elbow grease and intellectual effort in this project then you'll be rewarded with a fully-featured printer buffer at a substantial fraction of the cost of a "bought one".

The project

This buffer project has been designed around commonly available components and for a bit of construction effort on your part, you can have a 256K printer buffer at modest cost.

The circuit is based around a Z80A CPU (E10), obtainable at ludicrously low prices these days (like \$5!). Resident operating software is held in an EPROM (E11). As this project has undergone some evolution since seeing the light of day late in 1984 (starting life as an 8K infant), there are several versions of the necessary software. Version 3.2 is for 256K memory capacity, version 2.2 for 8-64K. The former is supplied in a 27128, the latter in a 2764. Eight 41256 dynamic RAM (DRAM) chips (E1-E8) are employed for the memory. 4164s may be substituted for 64K memory capacity, but you'll need to specify V2.2 EPROM software when ordering your kit.

This month's ★ Star Project ★ is from Don McKenzie, 29 Ellesmere Crescent, Tullamarine 3043 Vic. It is available as a "short form" kit comprising pc board, EPROM with V2.2 (64K) or V3.2 (256K) resident software and full instructions for \$39. For a small additional fee, both V2.2 and V3.2 can be programmed in the one EPROM, selectable via an on-board link option.

PBUFF FEATURES

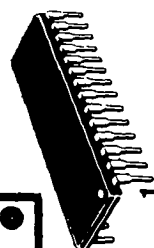
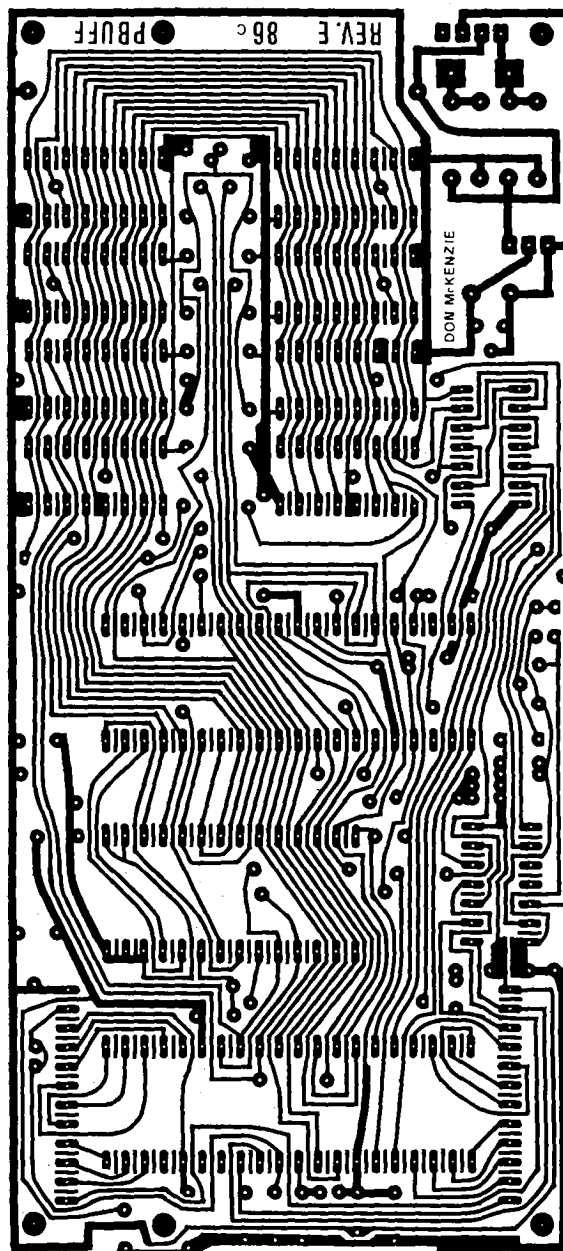
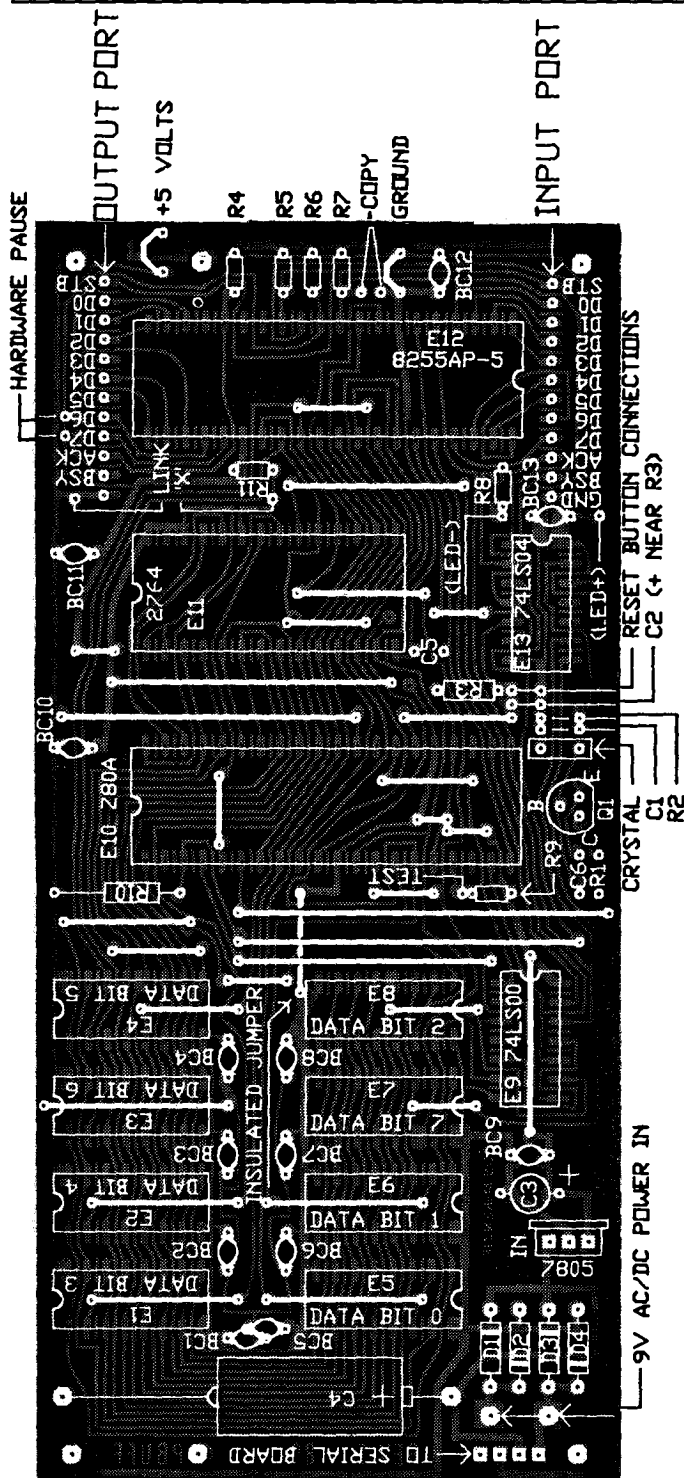
- 256K memory capacity
- Reset switch — clears buffer
- Test switch
- Copy switch — repeats last printout since reset
- Hex output — prints non-print characters
- Software pause
- Installs in-line between computer and printer
- Extensive ROM diagnostics included
- Provision for serial interface expansion
- Uses common low-cost components

Input and output interfacing is provided via an 8255 programmable parallel interface (PPI) chip (E12). A clock for the Z80 is provided by a simple transistor crystal oscillator involving Q1 and a common 3.58 MHz crystal.

Hardware reset is provided by an off-board momentary action pushbutton or spring-loaded toggle switch. Power-up reset is effected by R3-C2. The latter appears as a short circuit on power-up, and charges via R3 in about a quarter of a second.

For fault-finding, connection for an off-board TEST switch is provided. The buffer's input and output are linked and pressing the test switch generates a self-test so that you can check out whether the problem lies in the buffer or with the computer or interconnecting cables. A COPY switch provides for a printout of the last document printed since your last reset. Pads are also provided on the board for connection of a hardware PAUSE switch. Software pause can be effected by the use of a double backslash. A LED indicator ("DATA") provides status indication.

The unit may be powered in a variety of ways. If you have a source of regulated 5 Vdc that can deliver 400 mA, it can be powered from that. e.g: if you build the project into your computer, doubtless you'll have spare capacity available from the +5 V supply rail, just make sure the extra 300 mA or so PBUFF will draw won't stretch the supply's capacity. Alternatively, provision has been made on-board for the addition of a 7805 three-terminal regulator and four common power rectifier diodes in a bridge configuration. With these installed, the project may be powered from an unregulated 9 Vdc or 6 Vac source. It may be powered from a plugpack or a small mains transformer, such as the common and cheap 2155-type. ►



PARTS LIST

256K PRINTER BUFFER

Semiconductors	
D1-D4	1N4002*
E1-E8	41256 DRAMS
E9	74LS00
E10	2764, 27128 EPROM
E11	74LS04
E12	8255
E13	74LS04
LED1	TIL220R 5mm LED
Q1	BC548
REG1	7805*

Resistors all 0.25 W, 5%

R1	100k
R2	270R
R3	10k
R4-R7	4k7
R8	150R
R9	4k7
R10	1k
R11	4k7

Capacitors

BC1-BC13	10n bypass
C1	220p
C2	22µ16 V tant.
C3	10µ16 V tant.*
C4	2500µ16 V electro.*
C5	150p ceramic
C6	680p ceramic

Miscellaneous

SW1	SPST toggle switch
PB1, PB2	momentary action pushbutton
XTL	3.58 MHz crystal in HC18/U case

PBUFF Rev. E pc board; IC sockets (if required) — 2 x 14-pin, 8 x 16-pin, 1 x 28-pin, 2 x 40-pin; one each male and female in-line IDC-type Centronics connectors; suitable power supply, plugpack or transformer — 9 Vac/400 mA minimum*; small heatsink for REG1 — e.g. DSE cat. no. H3415*; suitable box (see text); 36-way ribbon cable, length to suit; 22g tinned copper wire, insulated hookup wire, nuts, bolts etc.

Estimated cost: \$100-\$140
* if required.

The pc board has been designed so that its mounting holes correspond to the moulded-in mounting pillars in one of the standard smart plastic "instrument" cases measuring about 200 × 160 × 65 mm (e.g. DSE cat. no. H-2505). However, you can suit yourself with this.

Software features

In order that any of the various DRAM makes on the market may be used in this project, the software provides for both 7-bit and 8-bit address refresh, which includes Texas Instruments' TMS4164s (64K version).

For peace of mind, software diagnostics are provided. On power-up, a sign-on message, complete with buffer memory size, is printed. If a ROM checksum error occurs, it's reported on the printout. A RAM check indicates problems by flashing the DATA LED once per second. "All OK" is signified by the DATA LED flashing three times per second. A self-test is also provided, activated by the TEST switch. This cycles the sign-on message through.

An unusual feature is the hex output. This converts ALL output to printable characters, including control codes, etc. Ever wondered what those unprintable characters were from an erroneous text file or bulletin board? Hex output will reveal all!

You can COPY a file of 256K or less, starting from the last reset or power-up. Very handy. And you can copy a file any number of times . . . until your printer runs out of paper.

Construction

You should have a reasonable tool kit, including a multimeter. A good quality soldering iron of 20 to 60 watts capacity and a small (3 mm across) wedge-shaped tip is recommended for assembling the board. A logic probe may be needed to help you with any hardware problems that you could run into. The logic probe I use is a "3800A". It is available at most electronic outlets for around \$20. Don't rush out and buy a logic probe because I said you may need one, you probably won't, but if you do run into real strife then it may be the only way out.

The very first thing that must be done is to install the bare wire straps, or links. Either use some 22 gauge tinned copper wire, or strip the insulation off some single conductor type wire. I use telephone-type two-pair cable. Have a look at the overlay diagram. This is drawn from the component side of the board. Now look at your printed circuit board. One side has the tracks, the other side is bare except for the drilled holes. The bare side is known as the component side, the other side is the solder, or track, side of the board. Compare the overlay with the component side of the board. You will now see where these straps are to be installed.

There are thirty-one (31) straps to be installed, and one insulated jumper. Do not install the strap marked "X" just yet. This is explained later on. Install the straps from the component side of the board and pull them tight from the solder side of the board, BUT . . . only 29 of them. The bare strap that you are about to install just above R4 carries +5 volts, and the strap above BC12 is ground. Don't pull these two straps tight. Leave a small loop in them so that they can be later used for connecting your multimeter or logic probe leads when you first power it up and test it. These last straps can then be soldered in and the excess leads cut off with a pair of sidecutters. Install the insulated jumper as shown on the overlay. Notice that it crosses three bare straps, which is why it needs to be insulated.

Install the IC sockets into the board. Take note of the orientation of pin 1 of the ICs, as I have not arranged the direc-

tion of the chips in a uniform fashion. This has been done to minimize the size of the board and the number of straps required.

Now for the "pigtail" components. The general procedure is to locate the individual component's position, insert the leads through the holes, seating the component down on the board, then solder the leads. Cut off the excess lead length after soldering, close to the joint.

Start with the resistors. Solder them in place one by one as shown on the overlay. Some will need to be mounted standing up as the drilled hole centres for the leads are, of necessity, too close to allow them to lay flat on the board. Bend one lead over the main body of the resistor. This will now allow you to push the stand-up resistors into their mounting holes. They can now be soldered in and the legs cut off flush with the solder joint. Bend R1 down flat towards the edge of the board before soldering it in.

Install all the bypass (BC) capacitors, followed by C1, C5 and C6. Lay C6 down flush with the board before soldering it in. Note that capacitors C2, C3 and C4 are polarised and must be soldered in the correct way around. They have a plus sign (+) on one end, or in the case of C4, a minus sign (-) on one end. Solder them into the board as per the overlay, BUT be careful when installing C4. You will notice a mounting hole near where C4 is to be installed. Depending on its physical characteristics, you may need to leave enough length on the pigtailed to allow it to be pushed to one side so that the mounting bolt can be tightened-up with a screwdriver.

If your buffer is not taking 5 V from your equipment, the next stage is to install the power supply components. Start by soldering-in diodes D1-D4. You will notice the diodes have one end marked with a white bar. This indicates the cathode end. Make sure that the diodes are mounted the correct way round, as per the overlay. Next solder in the 7805 regulator. The "7805" must be facing towards the diodes. Then fit the heatsink to it.

Insert transistor Q1 into the board and bend it flat towards the board edge before soldering its leads. If you use a DS548, the "C B E" connections are marked on the case and line up with the overlay as far as the flat side is concerned. BC548 types, although not marked, should mount into the board the same way. If you end up with some obscure brand that you are not sure of the pinout, try reversing the Q1 connections if the clock later fails to run.

Now solder-in the crystal; don't push it fully into the board, but leave enough length on the legs to allow it to bend over the top of Q1, C6 and R1. This is done to reduce the height of the crystal so that it will not interfere with any additional board that may be mounted on top of the PBUFF board. Make sure that the crystal case doesn't short to any components.

That completes the on-board components. Now for wiring-up the off-board components. All the off-board wiring is inserted through the component side of the board.

To wire-up the RESET button, connect two insulated wires at least 150-200 mm long from the reset button to the two points as shown on the overlay. The COPY switch is wired-up in the same way as the reset button using a pair of wires connected from the holes marked COPY to the SPST toggle switch.

If you're installing the optional hardware pause switch, wire it up in the same way, connecting it to the two "pause pads" on the board. The track between the pause pads must be cut before this function will work. This can be done with a sharp pair of sidecutters or a Stanley knife.

For the TEST button, connect one insulated jumper from the pad marked TEST to one lug of the TEST button. The other lug side of the TEST button must be connected to ►

ground as per the TEST circuit. Ground can be found on one side of your RESET button.

The DATA LED has one leg longer than the other, the long one is the anode, and the short leg is the cathode. Connect an insulated wire from the anode to the hole marked LED + on the overlay, and from the cathode to the hole marked LED - on the overlay.

Those pads marked "serial board out" are used with an optional serial interface.

The input and output ribbon cables and connectors are now assembled. You'll need at least a metre of 36-way ribbon cable. Crimp-on or ID (insulation displacement) Centronics connectors are recommended, the solder-on types are quite difficult to properly terminate unless you're experienced at it.

Take your ribbon cable and, using a vice, crimp one end of the cable onto the female (input) Centronics connector, and the other end onto the male (output) Centronics connector. Make sure that you line up the line 1 through connection. You'll note the cable has one line on one edge marked with a coloured stripe. Use this as the pin 1-to-pin 1 (line 1) line. Your cable can now be tested between your computer and printer.

If this checks out OK, measure back approximately 220 mm from the FEMALE connector (input) along side the wire 1 conductor. At this point, using a sharp pair of scissors, cut at right angles through the first 22 wires. You may need to first split the cable lengthways between the 22nd and 23rd wires so that you do not cut the 23rd wire with the scissors. You should have separated the through connections 1 to 11, and 19 to 29. (REMEMBER: when you have ID connectors on a ribbon cable, the wire numbers alternate. e.g: line 1 is pin 1, line 2 is pin 19 . . . 20-3-21-4-22, etc). You will be using connections 1-11 and 29.

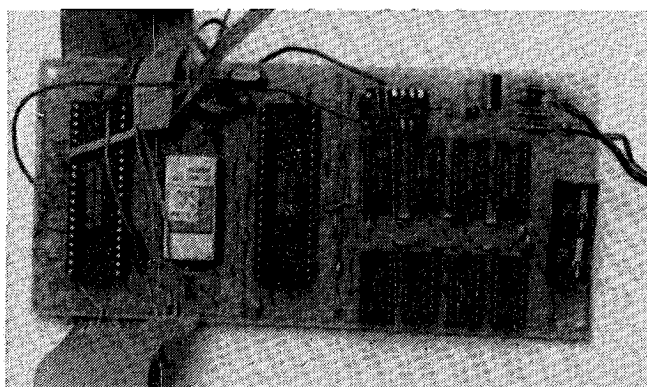
Now, using a sharp pair of scissors, nick between each wire so that they can be separated by hand back about 25 mm. Check the pin numbering on the Centronics plugs and locate pin 1. On the now split end of the cables, strip line 1 and bare the wire. Use your multimeter to verify that this wire is pin 1. So twelve wires must be stripped in each cable and soldered into the board. That is, wires 1-11 and 29. Bend the unused wires back and tape up to prevent possible short circuits. **MAKE SURE THAT YOU CONNECT THE SHORT CABLE WITH THE FEMALE CONNECTOR ATTACHED, TO THE INPUT HOLES.**

The "X" strap is used to select the upper or lower half of the EPROM. An EPROM can be supplied with versions 3.2 (256K) and 2.2 (64K) of software; upper bank 256K version, lower bank 64K version. This EPROM would be labelled "PBUFF V3.2/V2.2". Without the X strap, Ver 3.2 is selected; installing the X strap will select Ver 2.2. If the strap needs to be installed, use an insulated wire to connect the two pads together. This may need to be a loose strap to allow it to loop around the output cable or header. If you have a V3.2/V2.2 EPROM, then the buffer can be tested in the V2.2 mode with one-only 4164 or 41256 DRAM installed as the 41256 chips look like 4164s when V2.2 is selected.

Well, that finishes the board assembly. Give the board a visual check. Especially check orientation of the polarised components. Now you're ready for first tests.

Initial tests

Don't install the chips yet. Connect up your plugpack, transformer, or + 5 volt supply. The power pack connection points are shown on the overlay. As the circuit has a diode bridge at the input, it doesn't matter which way around you connect the positive and negative terminals of a dc supply. If



View of a completed PBUFF board, showing minor personal mods. (Courtesy of Bob Gareb).

you are using an existing + 5 V supply then connect it to the + 5 V and ground "loop" straps. Before applying power, first check with your multimeter that ground (0 V) and + 5 V are not shorted together.

Now power up the unit and check that the + 5 V is there before proceeding. Check the polarity of the + 5 V rail. All OK? Power down and install chips E12 (the 8255) and E13 (the 74LS04). Make sure you DON'T, DON'T, DON'T insert any chips the wrong way round. It will result in their almost certain destruction. Check the overlay for the pin 1 orientation of each IC. The "notch" up one end of the chip and the small dot shows each chip's pin 1 orientation.

Power up again and check the + 5 volts. If the LED is not already on, press the RESET button. The LED should light up brightly. No LED?, then one of the following is faulty: E12, E13, RESET button, reset circuit, LED, LED circuit, or — more likely, you have the LED wired in back to front.

Right. LED OK? Power down and install E9 (74L200), E10 (Z80A), and E11 (EPROM), and power up again.

The LED should be flashing about once per second. If the LED is flashing, it indicates that the Z80A is running and the software is doing it's job, but a RAM fault exists. With no RAM installed this is to be expected. If the LED doesn't flash, then move on to the "It Doesn't Work" Department.

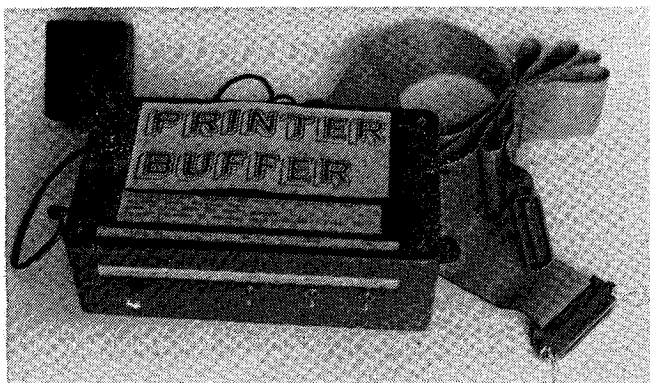
No smoke? Good, it's time to insert one RAM chip. Power down and insert a RAM chip into socket E7 (Data bit 7) watching the orientation. (Consult the overlay, pin 1 towards E9.)

Switch to COPY ON (SW1 contacts closed), power up and check your volts again. At this stage, the LED should be flashing at about three cycles per second, which indicates that RAM is present and can be written to and read from.

Now switch to COPY OFF. The LED should go out. Press the RESET button (and hold it in for the moment). The data LED should light up brightly. Release the RESET button and the LED should go out. This indicates that the software is working.

All looking OK? Power down and install the remaining seven RAM chips. Power up again. Repeat the above simple test procedures using the COPY and RESET switches. A simple RAM test is performed before the LED will flash. This test may not show up a shorted track, or a faulty RAM in some cases. If you have a suspect RAM, it can be further tested on it's own in the data bit 7 position by setting COPY ON, power up, and the LED should flash at about 3 Hz. If at any time the LED flashes at about one Hertz, then a RAM fault has been detected.

Now for a "loopback" test. Power down, connect the output port pins 1 (STROBE), 10 (ACK) and 11 (BUSY) to the input port pins 1, 10 and 11. This can be done by simply plug-



One boxed PBUFF. (Courtesy Bob Gareb). You can suit yourself on a case as the board will conveniently fit many common ones.

ging the input and output Centronics connectors together. If you have wired-up a DB25 connector to the input and a Centronics connector to the output, as some IBM and Microbee users have done, then three jumper leads can be used to connect pin 1 to pin 1, etc. When this has been done, set COPY OFF, power up and press the TEST pushbutton. The TEST function outputs a sign-on message to the printer. In this case, it outputs a string of characters to its own input port that keeps cycling through the buffer until RESET is pressed. The TEST function will light up the DATA LED to about half brilliance.

A "live" test

All happy? Power down, connect a printer, set COPY OFF then power up and press TEST. If all is well you should get the sign-on message, complete with memory size information. When the text facility is used, a ROM check is also done. If any byte in the ROM is incorrect then an error will be reported on the printout.

Now, power down and have a quick read through the "Operator Instructions". Connect your computer to the input plug. Power up, and try printing a file. It either works OK, or doesn't work at all. If it works then you can slap it in a box and forget it. Bob's your Uncle.

If it doesn't work at this stage, then go on to the "It Doesn't Work" Department.

But first, time for a caution. When marking out and drilling holes in your case front panel for the switches and LED, make sure that the front panel components don't interfere with the components on the pc board.

The "It Doesn't Work" Department

With the full RAM installed, the 7805 will get warm enough to just about burn your finger (45-50 degrees C!), but no other component should. I don't intend to hand feed you a step by step "power up, power down, power up" type format. Any time you plug in or unplug any connector or chip, then all power must be turned off BEFOREHAND. When fault-finding, always disconnect the input and output plugs.

Let me outline the four major faults found in project construction:

- (1) Bad socket solder joints (open circuit).
- (2) Faulty socket connections (open circuit).
- (3) Solder shorts between tracks or component pads.
- (4) Point not soldered (open circuit).

Faults 1 and 2 can usually be found with a logic probe. Any pin on any chip should be in one of three states. High, low,

or "bobbing" ("active"). Well, almost every pin. If no LEDs on your logic probe light up, this is known as a high impedance state. Check over all chips for ground, +5 volts and other signals. Make sure that there are no high impedance states anywhere. Exceptions: The input and output ports of the 8255 could show anything random as this may not get programmed correctly on power up. The data bus may also show high impedance states under certain conditions.

Pressing the reset button will bring some life into the data bus. If a high impedance state is found where it shouldn't belong, then check with your meter for a connection between the solder pad under the board and the pin of the chip for zero ohms. If you find no connection then pull out the chip and check between the solder pad and the socket connector itself. Still no connection? Try soldering this point again. If this doesn't work then you could be up for a complete socket replacement. A nasty job for a newcomer. Sometimes, bending the legs of the chips at a slightly different angle, or just pulling and re-inserting a chip can remove socket problems.

Faults 3 and 4 are ones that you have created. A close visual inspection and perhaps a check around with an ohmmeter will usually overcome such faults. A magnifying glass may help you.

Occasionally, you may get a faulty track on the board, with a tiny short between closely-spaced tracks or pads or perhaps an open track. These faults can be located using the methods for detection type 3 and 4 faults.

CLOCK CHECK

So much for the "dc" checks. Now to check the clock signals. Using a logic probe, check E10, pin 6. (I'll indicate the IC and pin "IC/pin". e.g. E10/6). This should be bobbing up and down, as this is the clock signal. No clock? Remove E10 and check E13/12 for activity. Still no clock? Check E13/13. If no clock is found here, try removing E13 and test the socket contact of E13/13. No clock? It has to be one of the following: Crystal, C1, C6, R1, R2 or Q1. Is Q1 connected the right way around? If you are getting the clock to pin 6 of the CPU socket without the Z80A in, and no clock with the Z80A in, then it may be the Z80A itself. If you have a good range of spare chips then substitution may bring results.

CLOCK WORKING, BUT STILL NO RESULTS?

Remove E7 and check that the LED flashes at about one Hertz. The software checks the RAM and if none is present, the LED is flashed at the slow rate. If this checks out OK, then it should mean that the system is working up to the point short of a RAM check. Install E7, set COPY ON and check for the faster flash rate. If this checks out then it appears that the system is working.

WHERE NEXT?

OK, where do we go from here? Perhaps you have incorrectly wired up the output plug. For instance, a high on the output port busy signal will stop any printout.

When the input and output plugs are connected together, COPY OFF, and TEST pressed, pins 1, 10 and 11 should be bobbing. Press the reset and check the MREQ line, Z80A pin 19. If it is bobbing then the CPU is attempting to read the ROM. Press the reset and check the IORQ line, Z80A pin 20. If this is active then the CPU is attempting to access the 8255 ports. Check all ROM and RAM signals. All pins except ground and +5 volts should be active.

CPU

There should be activity on most pins. Reset can be checked using the reset button. Pin 26 should be low when the reset

button is pressed and high when the reset button is released. E13/6 should show the inverse levels to the CPU/26. (See the circuit diagram). The 8255/35 should be the same levels as E13/6. As mentioned before, the DATA LED should light up when the reset button is pressed, and go out when released. This is an indication that the reset circuitry is working correctly. WAIT (pin 24) should be high. BUSREQ (pin 25) high. INT (pin 16) high. A13 (pin 3) bobbing after reset means that the CPU is trying to send information to the printer. NMI (pin 17) is normally high and goes low when TEST pressed.

THE QUINELLA TEST

What would happen if you had a short between Address 7 and Data bit 3, or A13 and ground, or etc, etc. I don't know, but I dare say the beast won't work at all. How do you find these shorts? Do what I call a quinella test.

Using your meter, check for zero ohms between pin 1 and pin 2 of the Z80A. Then check pin 1 and 3, 1 and 4, right up to pin 1 and 40. Step on to pin 2 and 3, 2 and 4 etc, up to pin 2 and 40. Get the idea? You end up checking pins 39 and 40. Zero ohms will be found at some points, as these points are tied together. Check the circuit to verify these shorts. If a short is found where it shouldn't be, you have found your problem; well, at least you know which tracks to look at. This quinella test can be done on all chips if no fault is found at the Z80A. Try the 8255 next.

If your printout is almost correct, but you get things like upper case "A" changing to "B" and "1" changing to "2" you have data bit zero set all the time. "A" is 41 Hex, and "B" is 42 Hex, so data bit zero is never clear. You will need an ASCII-to-hex lookup table to sort this one out. If you don't understand the hex jumbo, ASK someone who does. Once you have determined which data bit(s) is faulty, try swapping the chip in this RAM position with another to see if the fault conditions change. This will prove the RAM chip. In most cases it will not be the RAM chip, but your soldering or a faulty socket at the "BAD" location.

I could write a hundred pages and still not cover your problem, but with the above information and a little common sense, you should be able to overcome all but the really obscure fault.

Operating Instructions

Any time the PBUFF is powered up, with COPY OFF, it is ready to accept data from the computer system. Set to COPY OFF, power up and press TEST. A sign-on message, complete with buffer memory size, is printed. If there is a ROM checksum error, this will be reported on the printout.

Pressing the RESET with COPY OFF will light up the DATA LED very brightly. Release the RESET and the LED will go out.

Pressing RESET will abort any current printout, clear the buffer, and set to ASCII (normal) output mode. PBUFF does a RESET on power up.

To use the PBUFF, print your file in the normal manner as per the computer system's operating instructions. The DATA LED will flash as data is accepted by PBUFF, and the printer will start operating. If the file to print is smaller than the PBUFF memory size then the PBUFF will get all data from the computer system, release the computer system for normal operation, and finish the printing job under its own control. If the file to print is larger than the PBUFF memory size then the DATA LED will light up brightly until 256 bytes (100hex) are free, then PBUFF accepts another 256 bytes from the computer system. This pause can be seen on the DATA LED. When all data is finally loaded into the PBUFF, the LED will stay off and the computer system will be released for normal operation.

COPY: PBUFF will only copy a file that is the same size or less than the total memory size of the buffer. e.g: A 64K buffer will only allow you to copy a 64K file or less, a 256K buffer will only allow you to copy a 256K file or less. In reality, 64K buffer will store 65,280 bytes before a buffer overflow occurs and a 256K buffer will store 261,120 bytes before overflow.

The start of the file to be copied is from the point data was loaded from the last RESET, or power up. If the TEST function was used after power up, this printout will be stored at the start of the buffer to be copied. A RESET can be used to clear this data from the buffer to be copied. To copy a file, set PBUFF to COPY OFF, press reset, load the file into PBUFF, and allow it to print. When finished, throw the copy switch to ON, then to OFF. An exact copy of the printed file will be produced. If multiple copies are required, leave the copy switch in the ON position. This will print the same file over and over until your printer runs out of paper, RESET is pressed, or COPY is set OFF.

COPY ON TEST function: Press RESET, set to COPY ON, press RESET. The LED will flash at about three cycles per second. This indicates a pass of system diagnostics. If at any time the LED flashes at about once per second, then you have a RAM error. Setting COPY OFF will stop this test and ready the buffer.

HEX OUTPUT: Press RESET, set COPY ON, press TEST. The LED will flash at about three cycles per second. Set to COPY OFF. PBUFF will now output all data in HEX format as follows: MSB, LSB, space. As this requires three times the memory overhead to store, you can divide your buffer size by three. To abort printout or set back to ASCII (normal) mode, press RESET. BEWARE of internal printer buffer confusion in the HEX mode. As all output including control characters are converted to printable characters, the inter-

— to page 113 ►

A SHORT CHAT ON CENTRONICS SIGNALS

So-called Centronics compatible interface signals aren't always compatible

WIRES 1-11 should be the same on most computers/printers, however the Microbee for instance, needs the input strobe (wire 1) pulse stretched. This is covered in the Microbee engineering notes.

WIRE 12 is the "paper out" signal. A high on 12 signals the computer that the printer is out of paper. (PRINTER OUTPUT SIGNAL)

WIRE 13 is the SLCT (printer selected) line. A high indicates that the printer is ready to receive data. (PRINTER OUTPUT SIGNAL)

The following lists the major differences of most common types of printers available today. Check your manual for more information.

WIRE 14 may be an Auto-linefeed signal. A low on this line will print a line feed after every carriage return. This may be activated by a DIP switch setting in the printer. (PRINTER INPUT SIGNAL)

WIRE 31 may be Printer Initialise. A low will re-initialise the printer. (PRINTER INPUT)

WIRE 32 may be Error. It will be low when paper out, off line, or error. (PRINTER OUTPUT)

WIRE 36 — Select in, may need to be low. Could be a DIP switch setting in the printer. (PRINTER INPUT SIGNAL)

To load the buffer with the printer off line, you may need to disconnect the wire 13 and 32 through connection and ground the input wire 12.

— from page 8

nal printer buffer is never "FORCED" to empty its contents. A known dummy file may need to be loaded into PBUFF in order to "FORCE PRINT" any remaining characters in the original file. Setting COPY ON then OFF will print the same file again, which will also "FORCE PRINT" the remaining characters.

SOFTWARE PAUSE: Use the double backslash string. This pause string is two bytes of 5C HEX (92 DECIMAL) together. When the pause string is detected all output to the printer is halted, and input continues until the buffer is full. Switching the COPY switch to ON, then OFF will allow output to continue until the next pause string is detected. Don't leave the COPY switch in the ON position, as this will be the "COPY ON" condition when the buffer is empty.

On power up, the pause function is active. An override is available just in case you need to print the pause string, and you are not using the pause function. Put PBUFF into the Hexadecimal Output mode, then press RESET. The pause function is now ignored. To re-install the pause function at this stage, you have to power the unit down, or print the TEST message.

HARDWARE PAUSE: If you've fitted this option, setting pause on (switch contacts open) will stop all output to the printer. Input will continue as normal. Setting pause off allows the printer to continue. 