Micro Clinic

Reports from Nick Beer and Roger Burchett

Commodore 64

We've had several of these machines in with a defective 6510 chip. The symptom is a blank, black raster. Be patient after you've replaced the 6510. After switching on it can take up to five seconds before that black raster clears to give the Commodore prompt. You may switch on, see the black raster, switch off and think you've not cleared the fault.

Intermittent black streaks across the picture, which intermittently blanked out, was traced to the 8501 VIC chip. **N.B.**

Sinclair Spectrum

A blank, black raster – slightly snowy on two occasions – has been traced to a faulty 6C001E ULA chip.

A thin liquid had been tipped inside one of these machines that was brought to us – it had run considerably. The customer accepted a large estimate so I set about putting it right. First I replaced the usual faulty transistors (ZTX650 and ZTX213) in the 5V regulator circuit, also the coil. All the 4116 RAMs had internal short-circuits (shown up by the fact that they got very hot very quickly). After replacing these the machine still didn't initialise. The CPU, ULA and ROM chips were all found to be faulty.

Sinclair power supplies give a lot of trouble. Leads and plug problems are cured by replacing the whole lead – a five minute job and the leads cost less than a pound. Several of these machines have come in where the lead has gone short circuit and the diodes have caught fire, burnt the panel and the only economical answer has been a new unit – they are clearly not adequately protected.

Don't forget the thermal fuse on the primary of the transformer when servicing these! **N.B**

Commodore 1571 Disc Drive

A Commodore 1571 disc drive intermittently wouldn't read from the disc. The trouble was due to an intermittent lead between the computer and the drive unit. **N.B.**

Amstrad PCW8256

We are beginning to get PCW8256 word processors back with power supply faults. The raster produced is small and the STK7308 chopper control chip IC5001 screams. All is returned to normal when the i.c. is replaced.

Although sales of Amstrad machines have been good we've had few faults. One that does crop up from time to time is misadjusted heads on the cassette units, such as the CPC464. We suspect that these have all been "adjusted" by their owners. **R.B.**

Commodore 64

Hear tearing out time: a Commodore 64 wouldn't load from a 1530 (Taiwan made) data cassette. The head was slightly worn but fitting a new one made matters worse – now programs couldn't be found at all. Just to be perverse I fitted an old, worn head which had across it a groove that was plainly visible to the naked eye. We could now load some of the programs before they crashed! If you come across this apparently absurd reversal of what you'd normally expect look at R6 on the cassette. It should be 2·2MΩ but some were made with 220kΩ. I have to admit to some hours wasted and a bad night's sleep on this one. **R.B.**

Micro Clinic

Reports from Roger Burchett and Nick Beer

Sinclair Spectrum

It's been said before that the first check with these machines should be on Tr4 and the −5V line. The machine can initalise and appear to be o.k. (until the keyboard is used) with the −5V line missing, so to save time and heartache remember to make voltage checks first.

Colour problems with later Spectrums and Spectrum Pluses are generally due to the SN94459N chip – replace it with an LM1889. **R.B.**

Acorn Electron

My colleague found the d.c. power socket dry-jointed and the output lead broken at the power pack end. Too late though: on this machine the ULA (type 12C021) appears to succumb first. It's expensive at over £20. The moral of course is always to look after your power supplies. **R.B.**

Printers

We've started to take on printer repairs – more by default than design. A Micro Peripherals MP165 (an NEC clone) is owned by a local printer who kept on using it with a very dodgy head. On fitting a new one we found that the descenders and the underlining were missing. One of the pins was not firing, due to the relevant driver transistor (type 2SD1308) being short-circuit collector-to-emitter.

Next came an Epson FX80 which would work with an Amstrad but not with a BBC computer. On setting up a test we found that the BBC computer knew the printer was connected and kept on trying to fill the printer's buffers without success. While checking around the parallel interface we found that pin 29 was permanently low. This is a return for the "busy" line. The pull-up resistor (3·3kΩ) is part of a multiple thick-film package which appeared to have a bad connection on one leg. To be sure we changed it. Why the printer worked with an Amstrad computer is not too clear. Perhaps someone with knowledge of IBM and compatibles can explain this? **R.B.**

Sinclair Spectrum Plus

We sold a batch of "new" Spectrum Pluses to a local school and congratulated ourselves on beating Dixons etc. for the order. That was a mistake! We've had a few back with odd problems which we've had to repair ourselves under guarantee. The common link is that they've all received attention before.

One machine had had reset problems since we'd supplied it. The reset had been slow and not always completed. Also the logo had occasionally been accompanied by the flashing cursor. On investigation the machine turned out to be a Spectrum issue 3B that had been converted to a Spectrum Plus. The reset arrangement was novel – instead of taking the CPU reset pin to chassis it took the 5V line to chassis! No apparent damage had been caused by this brutal treatment and the machine now works normally.

Following this we've had a number of other Spectrum Pluses with old boards inside. One was a real heartache. It came in with Tr4 short-circuit and a number of chips damaged. We did a memory check before boxing it up and found that it worked only as a 16K machine. To shorten a long story, it would appear that Sinclair sold a number of 48K machines that were working only with 16K – labelling them as 16K of course. The extra 32K of RAM was soldered in (no holders), ready to spring any poor unsuspecting soul about to upgrade them a surprise. This particular board had been recycled in a Spectrum Plus case and had been sold again (in a large Liverpool store), still only as a 16K machine. No one appears to have checked it at any stage during this procedure. Just to add a little spice to the fun, the membrane was very intermittent on extend mode, delete and symbol shift. As we're a long way from Liverpool we repaired all this and levied a nominal charge, hoping to get the loss covered by future business.

Way back in BC (before computers) we made it our policy always to check TV sets before delivering them. We continued this policy AD (after digital?) and it has paid dividends over and over again. We refuse to sell an item still boxed unless the customer is adamant. Even so we recently missed an Amstrad printer whose ribbon was twisted. **R.B.**

Atari 1010 Cassette Decks

We've had a number of these with the plastic function selector buttons broken. Replacement requires quite a bit of dismantling but is fairly straightforward. **N.B.**

Commodore 64

This machine wouldn't stop at the end when loading a program from a cassette or wouldn't load after acknowledging finding the program. The cause was a faulty 6510 chip. **N.B.**

Sinclair Spectrum

In this Spectrum both Tr4 and the 5·1V zener diode had gone short-circuit, thus preventing operation of the power supply. **N.B.**

Micro Clinic

Roger Burchett and
Steve Beeching, T. Eng.

Sinclair Spectrum Plus

I've mentioned before the Spectrum Plus computers sold to a local school after modification. This one did at least appear to have started life as a Plus, being an Issue 6A machine. It had been in with every stock fault imaginable. Through all this there had been complaints of slow resets and locking up. It was also suggested that the membrane was faulty. We changed this, but I could never see any other definite fault. One day my colleague managed to duplicate the fault(s) and rang me up about it. Have you ever tried fault-finding by phone? Although an experienced software man he doesn't claim to be an engineer. Armed with a meter, he had checked the CPU's pins and found pin 25 (/BUSREQ) low. It was presumably floating, the meter's internal impedance pulling it down. We eventually discovered that the pull-up resistor for this line, R30, was missing. As a result the CPU thought it was getting requests for an external device to take control of the bus.

On test the machine again locked up. This time we discovered that pin 24 (/WAIT) of the CPU was floating. The pull-up resistor for this line, R29, which is next to R30, was the cause of the problem. When removed it promptly fell in half.

It seems that this machine had been well and truly got at. **R.B.**

JVC HC7

We've had several problems with these machines. One had an intermittent display. The cause was an intermittent 5V supply to the display controller chip due to a dry-jointed link next to C407. On another the fault was intermittent resetting to the start-up pages while a program was running – these start-up pages are displayed as an introduction after a power-up reset. We first changed the MSX controller chip but the fault turned out to be in the main LH0080A microprocessor chip. It was running slightly warm, though this is not unusual.

Intermittent audio, which sometimes sounded as if it was running slow, was traced to a poor connection at pin 11 of the MSX controller chip. This pin feeds clock pulses to the AY-3-99810A programmable sound generator chip for timing purposes.

Power supply failure was not the only fault on one computer. While checking we tried a substitute power supply, but the computer failed to reset and produce the introductory pages. Further fault tracing revealed that both the MSX controller and the microprocessor chips had to be replaced to restore normal operation, though we suspect that only the latter was faulty. **S.B.**

Micro Clinic

Reports from Christopher Holland, Ken Taylor and Roger Burchett

Amstrad CPC464/CPC6128

In my experience there are two chips that give trouble in these computers. The first is the pluggable ULA device which causes the unit to be inoperative with no welcome on the screen: substitution soon eliminates this problem.

The second and less obvious i.c. is the sound generator chip, an AY-3-8912. The sound section of the chip doesn't give problems. It's the section which forms part of the interface between the keyboard buttons and the rest of the circuit that causes trouble. There are two main fault symptoms: either a row of garbage is displayed on the monitor at switch on, after which the keys cease to have any effect; or depressing a key results in two letters appearing on the screen, e.g. depressing "Q" will result in "QW" registering. This problem can occur as the computer warms up.

If certain keys are inoperative however don't blame this chip. This fault will be down to the keyboard itself, particularly if the later type of keyboard is used – the one with the clear plastic membrane on to which conductive tracks are etched. Visual examination, bearing in mind the keys that are inoperative, will soon reveal the break in the track. A possible cure is to use the conductive paint sold for repairing car rear window heaters to bridge the break in the tracks. This isn't always successful, but is worth a try as the membranes aren't available on their own and complete keypads don't come cheap. **C.H.**

Amstrad CTM644 Colour Monitor

When confronted with a dead monitor, try the following fault-finding procedure. If the 5V and 12V lines are present check whether R521 or the circuit protector in series with it is open-circuit. If so check the 2SD1397 line output transistor Q405. If a cold check eliminates the transistor, try replacing the circuit protector which can go open for no reason. It will probably fail again at switch on however, in which case a new diode-split line output transformer will be required.

If there are no outputs at the secondary side of the switch-mode power supply check the following items: C515 and the crowbar circuit zener diode D510 in the 100V supply; the 12V regulator IC503 in the 12V supply; IC502 and transistor Q502 in the 5V supply. In all probability however the fault will lie in the primary side of the power supply.

In this case check for 300V d.c. across pins 1 and 14 of the STK7308 regulator chip. If this voltage is present, check the 3·6V zener diode D507 before changing the i.c. – also make sure that neither of the 180kΩ resistors R506/7 has gone open-circuit. If there's no voltage across the STK7308 this will be due to either the fuse, R501 (5·6Ω, 5W) or R502 (1Ω, 3W) being open-circuit. These items normally fail because the chip itself has gone, but after replacing the i.c. and any open-circuit items check D507 and R511 (10Ω) before switching on – otherwise your shiny new STK7308 may instantly expire. **C.H.**

Commodore 64

The chip marking in the Commodore 64 can be very misleading. This machine for example obviously had a supply line fault – even the indicator LED was flickering. The cause was a defective i.c. which was marked 8715 2984. "Never heard of it" was our first response, but as the PCB is well marked we checked the chip (U26) with the circuit diagram and found it to be a standard 74LS373.

The faulty i.c. was rapidly detected because of its temperature – it's always worth doing a quick "touch" check on all the i.c.s before starting to make more detailed tests. Service manuals for the Commodore 64 are available from HRS Electronics Ltd.: a circuit diagram for the 64 is available in the *Programmers' Reference Guide.* **K.T.**

Atari 1300

No machine is improved by being christened but the keyboard membrane on this one is particularly vulnerable to spillage. It consists of a flexible printed circuit which is contacted by a conductive plastic bridge at the end of each key stem. As there's no seal or liquid trap even a slight spillage drips on to the circuit tracks on the top surface of the membrane.

The machine brought in for repair had track erosion that affected a group of keys. I don't know whether Atari spares are available, but a perfectly satisfactory repair was carried out by using RS silver conductive paint applied carefully to bridge the gap. When using this paint remember that it has a very high resistance in the wet state: it should be allowed to dry for an hour or so before testing the machine. **K.T.**

Sinclair Spectrum Plus

This machine came in with a simple looking fault that proved to be one of the more elusive ones. At power up the screen area was completely black and the logo didn't appear. It had apparenty gone part way through the initialisation process, so there couldn't be much wrong.

Testing the signals at the CPU and ROM pins produced different results each time checks were made – this should have been a clue that an unusual fault was present. After removing both the CPU and the ROM I found slightly low resistances on the data lines. The cause was faults in the 32K extension memories – five of the TMS4532 memory chips were found to be faulty! These can be checked by measuring the resistance between the data lines and 0V. With the CPU and ROM removed a reading of 10kΩ is satisfactory: a normal working computer gives a reading of 5-6kΩ. In any case a quick comparison between all the data lines is a useful exercise. Connect the red (negative) lead to 0V if you're using a standard analogue meter.

Eliminating the extension memory by removing IC25/6 or cutting the control tracks to these i.c.s had no effect on this fault. Only removing the faulty chips or cutting the data tracks to them cleared it. **K.T.**

Commodore 64

Computer repairs have dwindled somewhat now that I no longer do trade work. But at least I no longer get horrible

little boys with battered Spectrums in which apparently every chip is damaged. So I get more profit for less work, due to better maintained machines that (usually) have only one fault at a time.

No sound on one of these machines was caused by the 6581 sound generator chip (cries of "surprise, surprise"!). Another one initialised, but without the message. The cause was a faulty BASIC ROM (901226-01). Simple stuff. It can't go on like this, there's obviously something horrible around the corner – watch this space! **R.B.**

Micro Clinic

Reports from A.G. Grace, Brian Renforth and John de Rivaz, B.Sc. (Eng.)

Spectrum Plus

We've had similar Spectrum Plus faults to those described by Ken Taylor in the January Micro Clinic.

When one machine was powered up the screen showed a changing brick pattern but no Sinclair logo. The current consumption was excessive at over 1A – it should be nominally 680mA. The ROM, CPU and ULA chips were checked by fitting them in a known working machine. The ROM and CPU were o.k. but the ULA proved to be defective. Unfortunately the same fault was present when the ROM and CPU chips plus a new ULA were fitted in the defective machine. A quick prod around with the logic probe then showed that the CPU had crashed (/halt pin 18 = 1). The ROM, CPU and ULA were again removed and power applied. The logic probe was then used to check the data bus – all lines should have been high due to resistors R9-R16. Lines D1, D2, D4, D5 and D6 were found to be low however. A resistance check showed a direct short-circuit and we next found that pin 14 (data out) of IC16/17/19/20/21 was shorted to ground. Lifting pin 14 of these i.c.s removed the excessive current drain. IC25 and IC26 were at this stage removed to disable the top 32K.

A scope probe check then revealed that the /RAS control signal for the lower 16K RAM was missing at pin 4. It was present at pin 35 of the ULA. A resistance check showed a contact resistance of 14Ω between the ULA and its socket. Fitting a new socket re-established the signal – but still didn't clear the fault. Address line A6 was found to be present at one side of R20 but not the other side. A resistance check showed that R20 had infinite resistance. Replacing R20 cured the remaining faults, allowing the machine to initialise correctly – but only as a 16K machine (IC25/26 removed).

Phone calls to various distributors revealed that the TMS4532 and the MSM3732 have been obsolete for a couple of years, the replacement being the 4164 series. Which links do you use with these devices? I assume the Texas link is used and either link 3 or link 4 depending on whether the upper or lower 32K is used.

Incidentally, the EAR socket circuit is shown incorrectly in Ken Taylor's series of articles. C32 is in parallel with D13 and C35 in series with R36 (see Figs. 5 and 12). **A.G.G.**

BBC Model B

The three LED indicators for cassette motor, caps and symbol shift would light up intermittently, the rest of the computer working perfectly. On inspection we found that the print around a couple of LED pins had broken, causing intermittent contact. Apparently the symptoms put in an appearance after the keyboard panel had been removed and refitted: the LEDs had been knocked while the panel was being refitted – it's easy to do. A permanent cure was effected by bridging the print with thin wire. **B.R.**

Unwanted Customers

Some years ago when the Spectrum appeared on the scene we coincidentally received a handful of ZX81s returned shortly before the guarantee period had expired, all with the same complaint – that the keys didn't work. We were asked to exchange the machines for Spectrums, with the difference paid. Naturally we were suspicious, and on each occasion we could see that the keyboard had been deliberately dented by a screwdriver blade! We didn't miss such customers after telling them where to go for their Spectrums! **B.R.**

Patching up a QL

The Sinclair QL has no proper parallel port for a printer. Usually a serial-to-parallel converter is used. As part of a disc interface, the Sandy Superqboard has a parallel port which worked perfectly for a time with an Epson MX80FT2 printer. Eventually however the computer failed to take any notice of the printer's busy signal, with the result that gibberish was printed. An oscilloscope check revealed that the output from the printer wasn't rising above a few millivolts instead of to the 5V specified. Adding a 1kΩ resistor to the 5V line cured the fault.

It's worth noting that printers have several different ways of acknowledging data from computers, but each computer usually uses only one of them. Thus a printer may work with one computer but not another, the reason being that the acknowledgement pin used with the computer the printer doesn't like is in some way incompatible. **J.deR.**

The SPEM QL Digitiser

Suppliers of the SPEM digitiser, which allows pictures from a video source to be digitised and displayed on the QL computer's screen and to be printed out, may get complaints if the user tries to display the input TV picture on the computer's monitor. This is a feature of the equipment, provided for in the switching, and is explained in the manual.

When I tried this the picture wouldn't lock. On examination I found that no sync pulses were being supplied to the monitor. A simple circuit (see Fig. 1) was added to pick them up from within the unit and feed them to the appropriate pin on the output. **J.deR.**

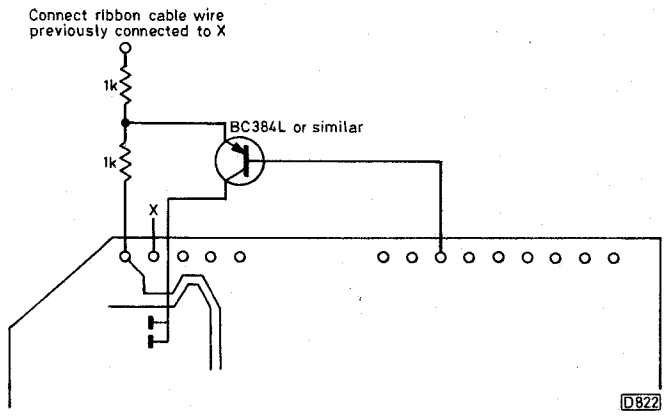

Fig. 1: Modification to the SPEM digitiser board to provide video source sync pulses to the QL's monitor.

Micro Clinic

Commodore C64

The complaint with this fairly early C64 was that it locked up, with garbage on the screen. On starting it up nothing worked at all except that there was a blank, synchronised raster on the screen. The owner had reported that before the final breakdown it would sometimes lock up after about half an hour to an hour, displaying whatever was on the screen with the addition of random characters.

On opening it up I found that the main 5V supply was at about 12V. The power supply arrangements are a bit obscure. There are two 5V supplies, a 12V supply and an unregulated 9V supply – the latter feeds the tape recorder. The 12V supply is used by the 6567 display chip, the 6581 audio chip and the audio amplifiers. The small 5V supply, which is on the main baseboard, feeds the video and clock circuits while the main 5V supply feeds the rest of the chips. It was this latter supply that was causing the trouble as the regulator had failed. It's located in the power supply, which is potted, so the only solution is to discard the old one and get a replacement.

When this was obtained and fitted the display became a border containing garbage, so further investigation was needed. On this machine the memory consists of four 4164 chips, each holding one bit of each byte in the memory. Little further hunting was required to find the defective chip here. Had there been more than one defective chip the pattern would have changed.

The machine's owner was very lucky, but would have been luckier still had the power supply not been potted, as a repair would have been cheaper than a new supply. I speak with feeling about this: as the machine belongs to one of my grandchildren the eventual cost fell on me!

M.C. Matthews, B.Sc.

Microcomputer Notes

Commodore C64

After reading about Mr. Matthews' problems with one of these microcomputers (February issue, page 257) I thought that some comments on my own experiences with them might be of help. To recap, the problem reported by Mr. Matthews was a blank screen but no other results, the cause being failure of one of the regulators in the potted power supply.

In one case I cut down the potting on the transformer as far as possible in order to expose the lead-out wires for the mains input and the 9V secondary. I ignored the 5V secondary as I don't trust the regulator used here. Instead, a good-quality switch-mode power supply was used to provide the 5V output. The unit to hand happened to be a 180W Gould unit. Obviously this power isn't required but, being an efficient power supply, the unit draws only sufficient current from the mains supply to provide 5·2V across its output terminals, and maintains this output with impressive accuracy over a load current range of zero to more than 30A.

The second repair along these lines was for a friend who wanted the system up and running to keep his children out of mischief. As a 9V transformer was on this occasion ready to hand no attempt was made to hack the old power supply apart, though the original power lead came in handy. The switch-mode power supply I used this time came from the monitor unit of a professional system that had been scrapped. The option now exists to provide −5V, −12V and +12V rails as well as the standard +5V and 9V a.c. supplies should these be required by another unit.

The biggest advantage of computer type switch-mode power supplies is that when they fail, which appears to be rare in comparison with three-terminal linear regulators, they usually cease to function and cut off the outputs. This is much preferable to a series element going short-circuit and dumping the unregulated secondary voltage on to the 5V output.

If a linear regulator is retained, a precaution I consider to be well worthwhile is to add a crowbar thyristor. Simply connect the thyristor between the 5V rail and chassis. Use a low-value resistor and capacitor from the gate to chassis. A simple transistor and potentiometer as a "variable zener" connected from the 5V line to the thyristor's gate allows precise setting of the trip voltage. This arrangement saves a fortune in expensive house-coded LSI chips.

I. Field

Amstrad PCW9512 Printer

This printer produced consistently faint printing and was much quieter than usual. A telephone enquiry to Amstrad produced the answer "replace the hammer armature". This is plastic with a ferrous insert, and can develop cracks. Like Donald Bullock, when I did this the result was that the printer ceased to produce any impression at all.

According to the gentleman on the phone, there should be a 2·4V pulse at the hammer current test connector. As this was the case I concluded that the fault was a mechanical one. I'd been warned that the position setting of the hammer electromagnet is very critical. The fixing screws were very hard to undo. Once they were loose the magnet could be repositioned and resecured, using Loctite on all the screws. Doing this provided a complete cure.

P.S. Wallis, G3YJI

Micro Clinic

Roger Burchett

Commodore faults seem to come in groups. The fault with several Commodore 64s that came in recently was blank video, with no chips overheating and the kernel ROM being selected at power up. The solution was to replace the kernel ROMs.

Ken Taylor put his finger on it (forgive the pun!) when he advised checking the temperature before wading in with the meter etc. This symptom is often caused by faulty RAM(s), but they usually show up quite quickly by overheating.

Sinclair Spectrum

A plain, unmodulated display *can* be caused by a faulty ULA chip. This is not a common fault but when you do get it a quick check can be made on the ULA if it's in a holder – 15, 16 and 17 are the relevant output pins.

An old Issue 2 machine in a keyboard came in with the complaint that it crashed. All the stock faults were present – dry-jointed power socket, dirty edge connectors, etc. – but the machine was very reluctant to initialise after these had been attended to. When it did, all functions were normal. Gently flexing the board would then make the machine crash. As there's no support for the centre of the board I thought that maybe heavy-handed connection of the keyboard had cracked it. While examining it carefully with an eyeglass however I noticed that one of R33's end caps was off. This 680Ω resistor is fitted under the heatsink, so how it came to be broken is a mystery. It's in the ROM select line from the ULA chip – hence the inability to select the on-board ROM.

I had an interesting problem recently with a Spectrum 48K: the keyboard worked all right, caps shift too, but symbol shift and extended mode produced incorrect symbols. The ROM was responsible for this. All the symbols were valid, they just appeared to be on the wrong keys: presumably there was a fault in the ROM's column/row matrix.

Acorn Mouse

It's worth noting that the switches used in the Acorn mouse are the same as those used for most front-panel controls in electronic VCRs. A quick, effective and, most importantly to us, profitable repair can thus be done without recourse to Acorn's agents. I mean the smaller type of switch of course, as used by Mitsubishi, not the large type used by Sharp amongst others.

Worn Cassette Player Heads

Will not load from a tape is a common accusation these days as microcomputers and cassette units bought some Christmases ago reach middle age. A BBC micro and a brace of Commodore 64s were unfairly accused recently. The BBC micro was being used with an Acorn unit and the wear was visible to the naked eye. Incidentally, full volume output also usually prevents loading – 6 or 7 on the numbered volume control is about right. The C64 is even more critical with respect to playback head wear, also of the type of head fitted. It's best to use genuine Commodore types, though increasing the value of R8 (should be 2·2MΩ) in the filter can help with other heads.

Micro Clinic

Reports on microcomputer servicing problems from Roger Burchett and Nick Beer

Sinclair Spectrum

Although this machine seemed to be working normally, when an Opus disc drive was purchased the computer ignored it. The cause was traced to pin 27 of the CPU chip being stuck low. Replacing the chip provided a cure – pin 27 is the /M1 line and was telling the disc drive that something else was being loaded.

As the edge connectors appeared to have had plenty of use I was left wondering what had happened to cause the fault. As luck would have it another of these machines came along – with a blown ULA chip because the customer had pushed the computer into the disc drive and then switched on without bolting the two together. Now the slot in the Spectrum's edge connector can become slightly enlarged, and the Opus's key is rather thin. It's possible for the connectors to short together if the two are left free. After changing the ULA I checked for any other damage – and found that the CPU's pin 27 was stuck low. Problem solved! **R.B.**

Dragon 32

We've been doing a few rapairs on these machines recently. The most common fault is failure of IC15 (74LS783), causing rubbish to be printed on the screen. These chips are unfortunately rather expensive. **R.B.**

Sinclair Spectrum

The following tales show how careful you have to be when working on micros. The computer had a faulty ROM and after removing it and fitting a holder for the replacement I found I had a dead keyboard. After checking the ULA chip I started to look for solder splashes, using an eyeglass. Not being able to find one, out came the trusty scope. After much running around the circuit it finally dawned on me that the /INT line was not going low enough for the CPU to scan the keyboard. There was a minute solder splash under the CPU's holder: it was removed by sliding a piece of paper under the holder. The /INT line was going down to about 2V. A lot of wasted time and slapped wrists!

The next machine had been "got at" in some way by a small boy, but we didn't know the exact details. Transistor Tr4, the ROM and the CPU were all faulty, but the machine still wouldn't initialise when these had been replaced. Again out with the scope: data line 5 was found to be shorted to chassis. This once more meant an eyeglass search for something conductive. The cause was found under the ULA's holder: it looked like silver paper. Presumably this had got in during the said small boy's investigation, i.e. he took it apart while eating something wrapped in silver paper! Perhaps something easy now? **R.B.**

Sinclair Interface 1/Microdrive

The ULA in the interface can suffer if the interface moves about or is suddenly disconnected. The usual result is a "microdrive not present" message when a microdrive cartridge is loaded, and sometimes the Spectrum won't initialise due to a grounded data line. Just occasionally a ULA chip will overheat spectacularly, causing a crater in the case just above it. As the ULAs are expensive it pays to bolt the two machines together.

It's surprising how many odd faults will go away if the main board edge connectors and the microdrive/interface connectors are given a good clean. I cannot stress this point enough. In the long run it pays to examine each machine carefully after repair. **R.B.**

Sinclair Spectrum

Several of these machines have been brought in with a permanent black raster and white border. The cause is a faulty ULA chip. **N.B.**

Sinclair Spectrum Plus

A common problem with these machines is no colour due to a faulty encoder chip. We find that it usually happens when the "SN" equivalent of the LM1889 is fitted. **N.B.**

Acorn Electron

The customer had opened up this machine and diagnosed a faulty regulator as the 5V and −5V lines were missing (they're marked on the PCB you see). What he didn't do,

and what I always do to give myself enough room to work, was to disconnect the keyboard. The voltage lines then returned. There's an 0·47μF tantalum capacitor on the keyboard panel – it was leaking heavily. **R.B.**

Sinclair QL

The customer brought in her Microvitec monitor, saying that it wouldn't work with her Sinclair QL. She didn't think to bring the computer in! We connected a BBC computer to the monitor, using the nearest lead to hand, but what we didn't know was that this computer had an intermittent fault somewhere in the RGB output section (it's normally used with a u.h.f. input only TV set). Alarm and panic (this is where I was brought in). The monitor was o.k., so the QL was sent for. After much head-banging we were able to duplicate the fault – the reset button was sticking in! This all involved a lot of running around, because the customer had humped along a 14in. monitor but not the little computer . . . **R.B.**