



Intermittent Faults

Harry laments the problem of dealing with intermittent faults in a variety of situations.

Holdings of Blackburn Ltd was started originally by my father-in-law James Holding, who in his spare time started buying and selling second-hand office dictating equipment. He eventually opened a shop and moved into photography and tape recorders. By the late 1950s, he wanted to expand the electronics side of the business. He knew me through church connections and I agreed to take on this task but our plans had to be put on hold while I completed my compulsory two years of National Service. Towards the end of my National Service a large Hi-Fi exhibition was advertised in London, which Mr Holding asked me to attend. Because I was rather keen on his daughter Brenda (we have now been married for over 55 years), this sounded like a good excuse for a bit of leave. I got him to write me an official letter on his company note paper and a few days' leave was granted. Brenda managed to tag along and the three of us had an informative and pleasant few days.

When I eventually started work at Holdings, none of the staff were electrically qualified and a lot of the electrical wiring at the shop had been carried out by an odd-job man. The old style 5A and 15A amp three-pin sockets had been extended into un-fused un-earthed three-pin and bayonet-cap sockets with lengths of twin lead and the shop's electrical system looked like an accident waiting to happen. At my insistence a ring main system was installed and some very unsafe practices were banned.

Leaving Equipment for Repair

Previously they had farmed out repairs but when I took over this work, I soon found out that getting non-technical staff to book in repairs creates quite a few problems. Tape recorders arrived with notes such as 'Give it a good overhaul' with no indication at all as to what the customer was actually complaining about.

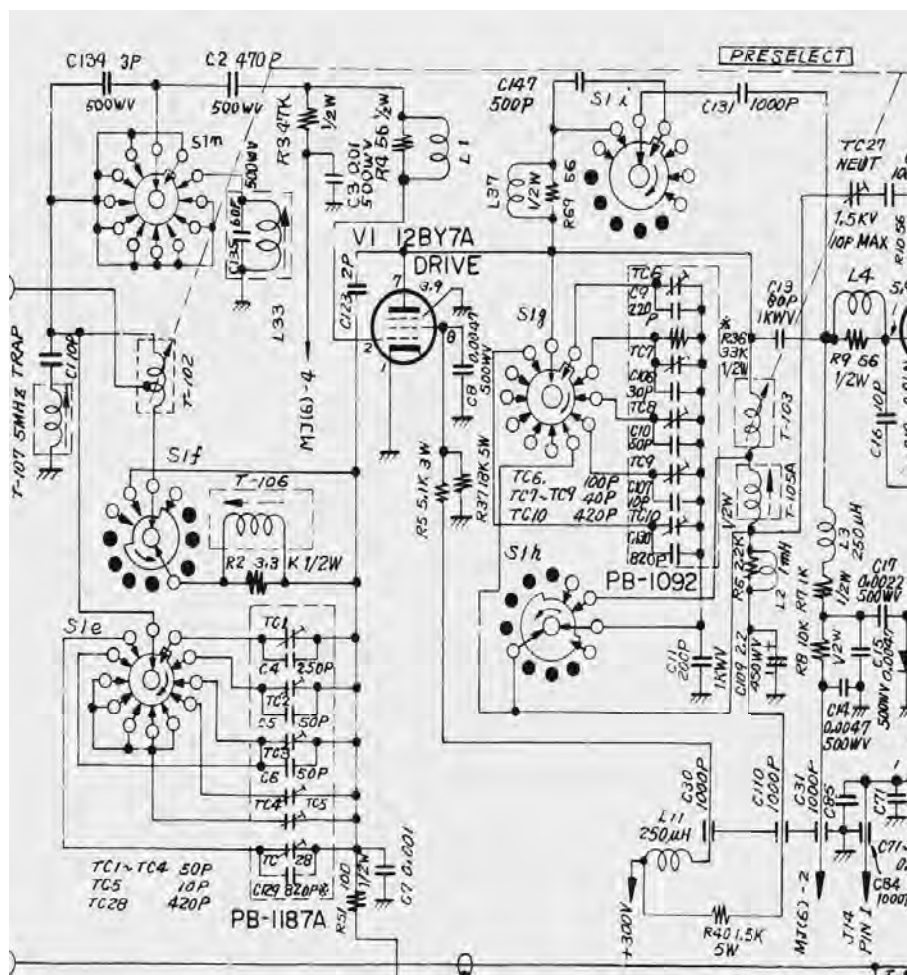


Fig. 1: Location of C11 in the FT-101 circuit.

To avoid any loss in translation, if you are leaving any kind of equipment for repair, it is best to attach a note with full details of the complaint along with your day and evening telephone number. Avoid vague comments because no engineer is going to have time to test every operating combination. He (or she) simply wants to know what the main faults are.

"Do You Know Anything about Tape Recorders or Record Players?"

I am sure that quite a few PW readers have had this question from their neighbours, who have valued recordings but ancient equipment that will no longer play. This can often happen due to lack



Fig. 2: This what C11 looks like.

of use, causing the drive belts to become hard and stiff, or to idler pulleys or rollers that have been left engaged for years, developing a dent. You are unlikely to be able to obtain replacements but you may

be able to effect a cure as follows.

Either remove the stiff belts and/or dented drive or roller and place them into a bowl of boiling water or heat them with a hair dryer in situ for a couple of minutes. You should then find that it is possible to mould the item back to its original shape. Refit it, and with luck the recorder or player should then run and enable the recording to be transferred to a modern medium.

I was reminded of this old dodge when I tried to refit the back on a digital watch and found that the thin waterproofing washer would no longer fit. I heated it up with a hair drier. It then returned to its original shape, fitted perfectly, and I once again had a waterproof watch.

Likewise, I set out to discover why the suction on our vacuum cleaner had become somewhat reduced. Between the dust collecting receptacle and the cleaner is a rubber seal. It had shrunk, become stiff and was causing an air leak. I removed it, warmed it up with a hair drier, stretched it back into its original shape and our cleaner is once again as good as new.

Intermittent Faults

It doesn't matter if they repair cars, washing machines, Hi-Fi or amateur radio gear, any technician will tell you that intermittent faults are the bane of their lives. I have spent many hours trying to track down such complaints – if a fault will not occur, you can't repair it!

I was often asked how much I charged per hour for carrying out repairs but as far as fault finding is concerned, this question makes no sense at all (Would you rather pay £50 an hour to someone who nails the fault in 30 minutes or £25 an hour to someone who takes a couple of days to find the trouble?).

A fault that a few customers had as early Yaesu FT-101s got older, was intermittent interference on reception, which continued even when the antenna was removed. Of course, like an aching tooth at the dentist, the fault would disappear as soon as the rig was brought in to my workshop. The first time I had this complaint the rig in question was returned to the customer unrepaired because I couldn't find anything wrong with it but he still had problems. Eventually, after taking the rig home with me, I found it would occasionally 'play up' for a few minutes but I still was not much nearer to finding the cause of the

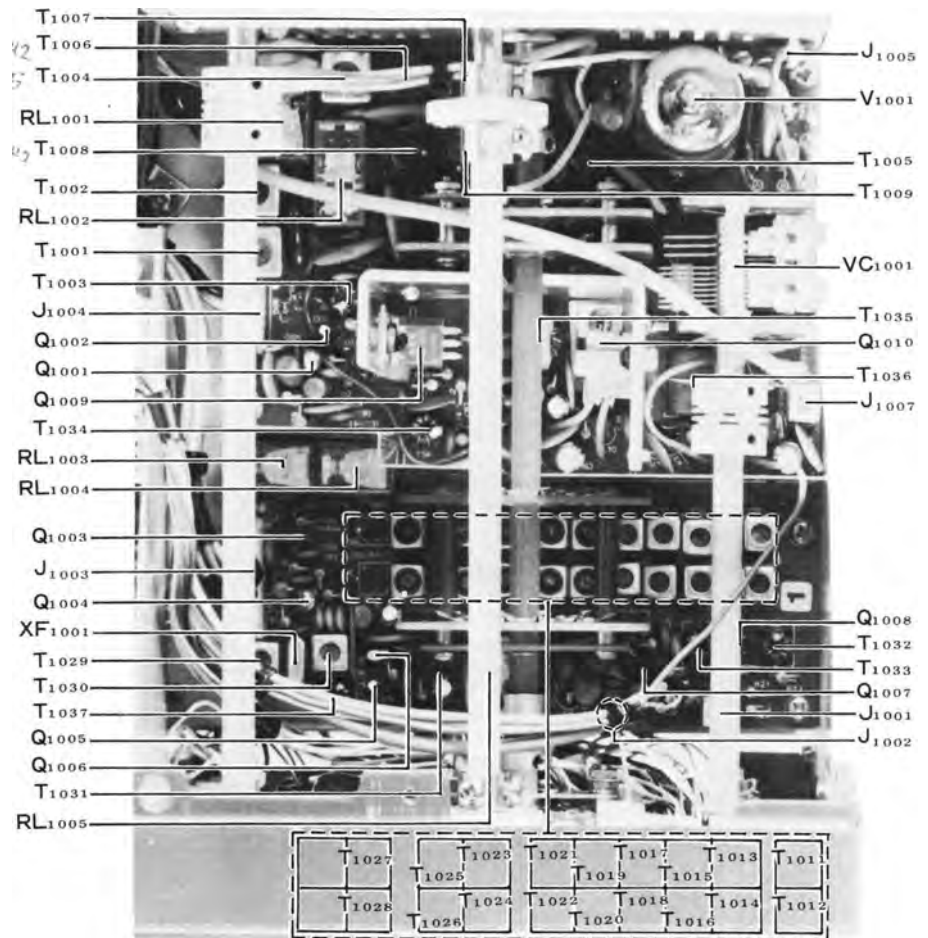


Fig. 3: The underside of the FT-102 RF board, with the relays buried under switches and spindles.

trouble. After wasting many hours, the fault was tracked down to an intermittent leak on C11, **Fig. 1**. This was surprising because it is not in the receive path but is in the driver anode and PA neutralising circuit and, to be honest, I only found it by chance. I noticed that the fault could sometimes be cured or triggered by removing and then immediately refitting the driver valve. At first, I thought the problem was the valve but swapping C11 completely cleared the trouble.

Well, if I had charged the customer an hourly rate, it would have amounted to over twice the value of the rig so I just had to make a reasonable charge and book it to experience.

Over the next few years several other FT-101s came in with the same fault. I therefore charged these customers a little extra for my 'experience' and I made up for the time I had wasted when I had first come across the problem.

Capacitors looking like C11, as shown in **Fig. 2**, seem quite reliable in the short term, but can be guaranteed to fail in old age and should be checked. (If I look in the mirror, I see something with a very

similar mortality rate!)

Many intermittent faults can be difficult to track down. A high or low temperature can often trigger a problem and I have been known to bring rigs home and leave them in the garage overnight (or even to leave small rigs in the fridge). Alternatively, squirting freezing fluid or applying a hair dryer to the circuit boards will quite often start the trouble.

Once the fault has occurred, you are on your way because at least you know what you are looking for. Gently poking and prodding around may then allow you to localise it. This can, however, be deceptive because when you apply pressure at one end of a circuit board, the board may flex and disturb a component or connection at the other end. If in doubt, it is often best to concentrate your efforts on the most likely causes. Relays are a prime cause of poor contacts, and tapping or pressing them will usually show whether they are the problem. Bad soldered joints tend to occur on the larger parts such as regulators or output transistors that are subject to vibration, particularly when the device

is bolted to the chassis or a heatsink. The contacts on plug-in circuit boards are another source of trouble and these can usually be cleaned with something like Servisol. The crimped connectors in multi-way plugs that run to and from circuit boards can also be a problem. If one of these is found to be intermittent when its connecting lead is flexed, often the simplest way to cure the problem is to remove the plug and solder the leads directly to the circuit.

Smoking Was Good for My Wealth

I started work as an apprentice radio and TV engineer in 1952. At that time TVs were not to be found in every household and many people went down to the pub to watch the TV. Pub TVs were rather hard worked and frequently needed servicing. The cathode ray tube was mounted behind a plate glass protection screen so in a pub's smoke-laden atmosphere it was not long before the electrostatic charge on the tube attracted a coating of nicotine, making the picture dim. This also happened, but to a lesser extent, in customers' homes, especially if they smoked or, as was very common then, had a coal fire.

A frequent cause of intermittent operation of TVs in those days was bad connections between the valves and the valve holders, which smoking also contributed to. Being the workshop junior, I often found myself dismantling TVs to clean the screens. I also had to remove the valves, scrape their pins with a penknife, squirt cleaning fluid on the valveholders and wiggle them about a bit while I refitted them.

(I cleaned them one at a time and avoided the error that a trainee once made in a local nursing home. He was sent to collect the patients' false teeth for cleaning but wasn't told to make any records. He put them all together and then found he could not match the teeth to the patients!)

When I later progressed to repairing tape recorders, radios and Hi-Fi equipment, smokers once again helped pay my wage. I would frequently get equipment brought to me from pubs, would squirt cleaning fluid on the PCBs and watch a yellow stream flow off. Fortunately, equipment seemed to have been specially designed so that the ingress of nicotine did not do its worst until the guarantee had run out! Switches then became intermittent, variable



Fig. 4: Levering out small relays with a bent screwdriver.

controls became noisy and internal preset bias potentiometers became intermittent and blew output transistors. All good business for the service department.

Later the fun really started when I moved into servicing amateur radio equipment. 'Joe' would walk into his cold shack, light a fag and switch on his FT-101. The fan would draw in the smoke, which would condense on the cold rig and eventually, if Joe was lucky, its operation would become intermittent. He would then bring the rig to me and I would have to clean a few relays and switches. If he was unlucky, there would be a flashover in the PA stage and he would have to make a much larger contribution to my following month's salary.

The FT-102

When the first samples of the Yaesu FT-102 arrived, I thought the radio was excellent. Instead of using loads of switching diodes in the RF stages, Yaesu had taken the more expensive route of fitting small relays to do the job. This reduced cross-modulation and certainly improved the receiver and I thought it was a great rig but, oh dear, Yaesu had not allowed for what would happen when the rigs were used by heavy smokers! After a year or two they started coming into my workshop with insensitive receivers and various intermittent faults.

The effect of smoke on amateur radio equipment, as I eventually realised, is very much dependent on the number of small relays fitted. In addition to the normal

transmit/receive relays, the FT-102 had five small RF switching relays mounted on the RF board. Even worse, most of these relays were impossible to clean because the plastic covers could not be removed, due to them being mounted under various control spindles and switches, **Fig. 3**. The time involved in removing the relays, cleaning them, refitting them and then finding that one still did not work, was out of proportion to the value of the relays so the only answer was to swap the lot, which was easier said than done.

Removing and Fitting New FT-102 Relays

At first glance removing and fitting new relays in the FT-102 looks nearly impossible without removing the entire RF board but this is quite a task and many radio amateurs made a real mess of their rigs trying. I always 'cheated', which you can do this way.

Remove the metal inspection cover, which is in the chassis under the RF board, to gain access to the underside of the relays. Use a solder sucker to remove as much solder as possible from the relays and then on the relays that have obstructions stopping them being lifted straight up from the RF board, cut the relay pins as short as possible. If you then bend the flat end of a small screwdriver as per **Fig. 4**, you will be able to lever the relays out of their sockets, after you have once again melted the remains of the solder, and then gradually tease them out of the rig.

To fit the new relays, clean the holes in the PCB with a fine drill, then cut the relay pins so that they are only just long enough to reach through the PCB and be soldered. Then with a little patience and some sticky tape, you should be able to squeeze them under the switches and spindles and solder them in position.

After fitting sets of relays, quite a few of the rigs continued to come back after a year or so with the same health problems and I was forced to give my customers a choice – they either got rid of their fags or their FT-102. From watching the TV programme *GP's Behind Closed Doors*, I see that it is not only 'Rig Doctors' that have this problem.

Spare Parts

Please note; that it is now many years since I retired so I am sorry but I can no longer help regarding sources of Yaesu spares. Try Yaesu UK or Google. 