

In the Shop with Harry Leeming G3LLL

Harry G3LLL looks at problems with an FT-1000 and intermittent connections and, as always, offers advice on solving these often elusive nuisances.

A good customer, 'Tony' sent me an E-mail regarding his FT-1000, asking if he could bring it round. I sold very few of these when I had the shop and so I'm not that familiar with them. They are rather complex and extremely heavy so I was not that keen but I had nothing much on! So after first checking that I had a service manual, I said I would have a go but held out no promises.

The first thing I did was to give the rig a full test and note the effects of all the controls. The transceiver would transmit but was dead on receive and all that could be heard in the speaker was a very slight background noise. This changed in level as the squelch control was rotated but there was no other sound. I went round trying the various controls and to my surprise a loud hiss came from the speaker and the receiver seemed to come to life - if the speech processor was switched on. There was still no sign of any stations, however, which seemed rather odd.

My first approach to any odd faults in microprocessor controlled equipment is to do a complete reset, so I switched off the back-up battery and switched the rig on and off a few times with the power lead disconnected. (Doing this will often cure the most strange and illogical faults but this time it didn't!).

The fact that the speech processor had an effect when in the receive mode pointed to a fault in the transmit/receive switching and so my next move was to check the voltages on the 9V transmit and receive switching lines. The receive line checked out correctly, being slightly negative when the rig was in the transmit mode, and +9V when switched to receive. But the transmit rail was still live to the extent of +3V when the rig was set at receive. The FT-1000, like most modern rigs, is full of switching diodes so, I wondered if one was leaking?

Next Step

The next step was to try pulling out the plugs that connected the switching rails to the various circuit boards and when the one on the r.f. board was removed, the 3V disappeared from the transmit switching line. A screwdriver 'tickled' on the input terminal of the i.f. stage showed that from

this point on the receiver was now live. Further investigation lead me to D1006 on the r.f. board, which was short circuit and which I duly replaced with, believe it or not, a 1N4007 1A 1000V rectifier.

Switching diodes are the modern replacement for the multi-wafer wave change switches that were used in older equipment but they can cause problems and simply replacing them is not always a final solution. I have had quite a few rigs returned within a few months of repair with the complaint, 'same fault as before', after I have fitted the 'correct' diodes during repair. In these cases they are obviously being subject to excessive voltages but the exact cause, whether caused by static charges, nearby lightening or an adjacent transmitter, can be anyone's guess.

Many of the switching diodes used are only rated at around 100V. Some years ago, I read in the Technical Topics column of *RadCom* a comment about the 1N4007 1000V/1A silicon rectifier diode. The author **Pat Hawker G3VA** had tested these on the h.f. bands and had found them to be indistinguishable in performance to normal switching diodes but very much more robust. In the last few years, I have

used the 1N4007 diodes many times as replacements for switching diodes at the front-end of h.f. transceivers and have never had one fail. So, I felt confident when I let Tony have his rig back.

I had tested the unit out and waved it 'goodbye' sure that all was well. The next day, however, I got a 'phone call from its owner. The auto a.t.u. (a.a.t.u.) would not work and the built in s.w.r. meter gave a permanent high reading. What on earth was going on? Tune-in to this column in two months time to find out!

The FT Club

If you want help with or to find manuals on older Yaesu equipment, try the FT club at www.foxtango.org It is quite a site and Carol should be congratulated for all the work she has put into it. Why not join? It's free.

Intermittent Connections

Whatever kind of electronic repairs you work with, the bane of life is an intermittent fault. Typically, the equipment will stop working correctly, only to have all functions restored when the slightest attempt is made to trace the fault.

Often, intermittent faults will be found to clear if a certain area of a circuit board is gently poked with an insulated tool. But even in these cases, the fault may well be at the opposite end of the board and great patience is needed if you are to track down the cause of the problem.

With an intermittent fault it's well worth

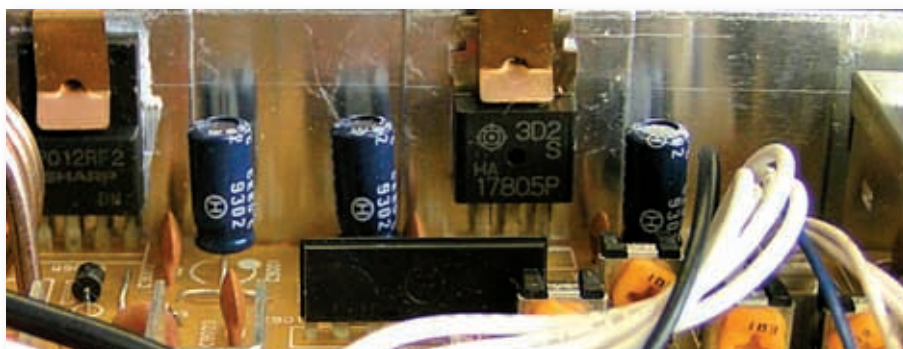


Fig. 1: The fault in this FT-990 was traced to the regulator board.

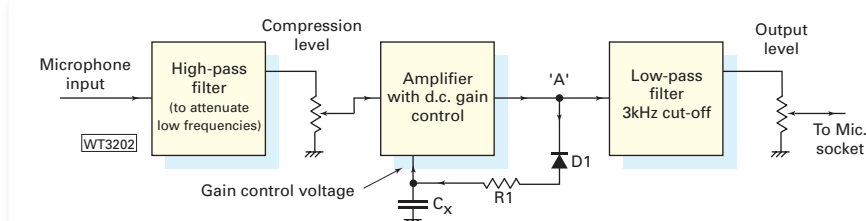


Fig. 2: Sophisticated compressors can be fitted externally to most rigs.

looking first at three of the most common causes of intermittent faults. These are:

Crimped leads in plugs. These tend to become unreliable after about 10 to 15 years, especially if a smoker has used the equipment. In these cases a little gentle movement of the leads will usually provoke a reaction and once the offending plug has been found, it should be removed and the previously crimped connections soldered. (For some odd reason this is a common fault with the FT-707).



Relays. It's surprising as to how a relay at one end of a board can be affected by movement at the opposite one; the only sure test is to remove the relay's cover and then to gently prod at the contacts with an insulated tool. Once you have found the relay that's the source of the trouble, apply cleaning fluid and operate it rapidly whilst still wet. **Remember, that you must not use a cleaning fluid that contains a lubricant on any relay or you will do more harm than good.** Try something like Aero-Klene 50 obtainable from Maplin but even then double check that it will not harm the plastic first. (If the relay can be removed, a better cleaning job will result if you draw a suitable thickness of feeler gauge through the wet contacts.)

Transistors and regulators with heat sinks (those types that are clamped to the chassis). After years of operation, and the action of expansion and contraction together with vibration, the joints on these devices are very prone to fail.

An Intermittent FT-990

'Joe' turned up with an FT-990, that I had sold him 12 years previously and, which now occasionally would not switch on. The slightest tap on the top would cure it and from then on nothing he could do would make it fail, until it was left switched off for some considerable time, when the process would repeat itself!

Now, unlike the FT-1000 I sold quite a lot of FT-990s but even so I have never had much experience at servicing them, as they were just too reliable! In business the cost of repairing a batch of faulty equipment can

be expensive and as many people have found to their cost, you can't say that you have made a profit selling something until the guarantee runs out! With the FT-990, however, there were no such worries as they were a 'sell and forget rig' and are still one of my long-term favourite rigs.

In the case of Joe's rig, after checking out all the possible intermittent faults, I eventually traced the fault to the regulator board, a picture of this, (as fitted to the FT-990DC), which did not contain an internal PSU, is shown in **Fig. 1**. As you will see the two regulator transistors use the metal chassis as a heat sink and while the connections looked okay, one was sometimes not quite 'making' and was presumably oxidised.

Tapping the rig on top had caused just enough movement to clean the connection and so restore operation for a few hours. To be on the safe side, I resoldered all the connections on the two regulator transistors and the rig was then as good as new.

Speech Processing

The built in automatic level control system, (a.l.c.), used in most rigs acts as a speech compressor but rather more sophisticated compressors can be fitted externally as shown in the simplified block diagram in **Fig. 2**. If the output at point 'A' becomes too high it's rectified by D1. This charges Cx via R1 and the resulting negative voltage then turns down the gain of the voltage controlled amplifier. How effective this compressor will be depends to some extent on the value of Cx.

If it's too large a high voice peak will turn down the audio gain and all sounds following this will then be low in volume for several seconds while Cx holds its charge. If it's too small, the gain (and any background noise) will go up and down constantly and the audio will sound very 'chopped'.

For Amateur Radio use a well-designed clipper is preferred to a compressor, and the layout of one of these is shown in

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Harry's waiting to hear from You!

As I am now retired, I like to hear about problems with older equipment, particularly pre-1990 Yaesu rigs. If you want a direct reply please remember to send me your E-mail address or enclose a stamped addressed envelope. Send your letters to: **Harry Leeming G3LLL, 'The Cedars' 3A Wilson Grove, Heysham, Morecambe LA3 2PQ. Tel: (07901) 932763. Email: G3LLL@talktalk.net**

Remember the mains supply is potentially lethal. Unless you really know what you are doing, always pull the mains plug out, do not just switch off at the wall socket, when working on equipment.

Fig. 3. This device 'chops off' the voice peaks when they exceed the voltage at which the clipping diodes conduct. The whole audio level can then be lifted without over modulating, resulting in a louder and (hopefully) clearer-to-read signal. This is not, however, as simple as it seems as it seems because two problems arise.

The first problem is, if a wave is clipped many harmonics at multiples of the original frequency are created. For example clipping a 500Hz wave will result in extra frequencies every 500Hz (1000, 1500, 2000, 2500 and so on) up to many kHz. These will be heard as distortion and, if it was not for the 3kHz cut off filter or some other restriction of the signal bandwidth, they would also broaden the transmission and cause interference to other stations.

The second problem is that with excessive clipping, loud sounds will be turned into square waves. Squarewaves tend to tilt and overshoot when passed through an amplifier and in doing so can produce new peaks that are as high as the ones that have been removed.

Fortunately, the loudest voice sounds tend to be those at the lowest frequencies and by attenuating these using a low frequency filter, it's possible to limit their amplitude prior to the clipping diodes. By careful juggling with the characteristics of the filters, coupled with intelligent use, such as not shouting into the microphone, it's possible to get quite a boost in readability with an audio clipper, however, as I will explain in the June issue there are better ways of speech processing.

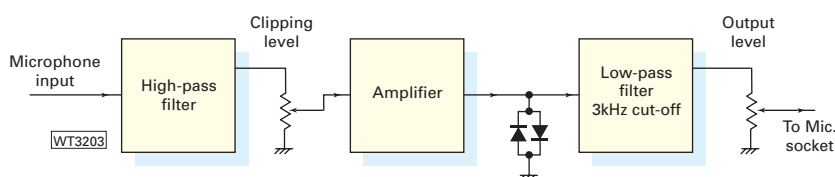


Fig. 3: Layout diagram of a clipper.