Servicing the Ferguson 3V29 VCR

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This popular VCR of early Eighties vintage was designed and built by JVC but was distributed by a number of manufacturers under their own brand names and model numbers. It came on the market at the time of a video boom, and in consequence was sold and rented in large numbers. Ten years later many of these machines are circulating on the secondhand market in excellent order, having stood the test of time. Because of their reliability and a ready supply of cheap spares, these machines are often well worth overhauling. In this article I'll be highlighting some common problems. I'd also point out that these machines are ideal for training purposes: they are basic, easily accessible for servicing, spares are cheap, advice is not difficult to come by and, should you do something silly to them, they are usually very forgiving.

The basic JVC version is Model HR7200, but in the UK the Ferguson 3V29 is more often encountered. Other guises include the Decca/Tatung VHR8300, the Granada VHSWJ1 and the ITT TR3913. It's a basic model with a single-event timer and wired remote control. The 3V30 (JVC HR7300) looks much the same but has a multi-event timer and Dolby sound: it was distributed through Thorn rental outlets as the Baird 8930. The various manufacturers who marketed these machines had their own customised front panels, which enabled the layout of the controls to be varied. They are quickly identifiable however by their characteristic pop-up cassette housing, the large preset tuning cover to the right of this and the three-position standby/on/timer switch at the front left.

Modifications and Variations

During the two-three years when these machines were in production several major modifications and additions were introduced. This is something that must be taken into account when using circuit/layout diagrams for fault finding and when considering the use of panels from a scrap machine. The main changes are outlined below. Fig. 1 shows the basic panel layout.

The luminance/chroma/audio (YCA) board at the bottom of the machine underwent three major design changes during production, the modifications being confined mainly to the luminance and f.m. circuitry. In the earliest version all the YCA circuits are on the main panel. The second version had a noise-cancelling circuit added using a chip designated IC1 (not to be confused with the audio processor chip which is also labelled IC1): this circuit couldn't be contained on the main panel, so a sub-panel mounted beneath the presetter board was added. Connectors 161-162 and 171-174 were added to the main panel to link it to the sub-panel. The third version has an enlarged sub-panel to accommodate extra noise-cancelling circuitry, while the main panel has extra interconnection sockets. In addition, with this version the f.m. and luminance signal paths on the main panel were altered drastically, making it difficult if not impossible to trace signals using one of the earlier diagrams.

Another major area of change is the motor drive amplifier (MDA) circuit and board. In the earliest machines the drum MDA circuit consists almost entirely of discrete components: the board is mounted vertically in front of the cassette housing. A little afterwards the twenty nine transistors were replaced by a single HA13008 chip. The modified PCB is mounted in the same position. Subsequently the main servo board on the left-hand side was redesigned to accommodate the drum and capstan MDA circuits – the compartment forward of the housing was left vacant. The servo and MDA circuits remained unchanged, i.e. the same chip set was used, only the board layout being different.

A new microcomputer/system control board was introduced at the same time as the combined servo/MDA panel. The later version has a different plug/socket arrangement. Thus the two boards are not interchangeable, though the individual chips are.

There's also a version (Baird 8940/JVC HR7350) with stereo sound: this has a new servo chip set, the circuitry bearing no resemblance to the earlier versions – not even the i.c. circuit reference numbers are the same. The main change here is the replacement of the 28-pin HA11711 servo chip with a 40-pin BA851A (IC2 on the new board). Two BA6302A chips replace the three VC1029 frequency-voltage converter chips. In the earlier circuits the third VC1029 is used for reel motor control during visual search: in this later version IC8 doubles as capstan speed control for playback/record and reel motor control during search. Another significant change in the 8940 is the accommodation of the Dolby stereo sound PCB in the vacant compartment in front of the cassette housing. This is worth noting as it is not unknown for an unsuspecting engineer to look for an MDA fault on the Dolby stereo sound board! This model was amongst the first of the stereo VCRs, prior to hi-fi sound: it was not a great success because the stereo sound still used the lateral audio tracks and, as a result of the low tape speed (23·39mm/sec), the audio quality was nothing like hi-fi.

The majority of machines have an f.m. test point (TPFM) atop the deck terminal 1 board. In the 8940 the f.m. test point is on the servo panel: it's towards the rear of

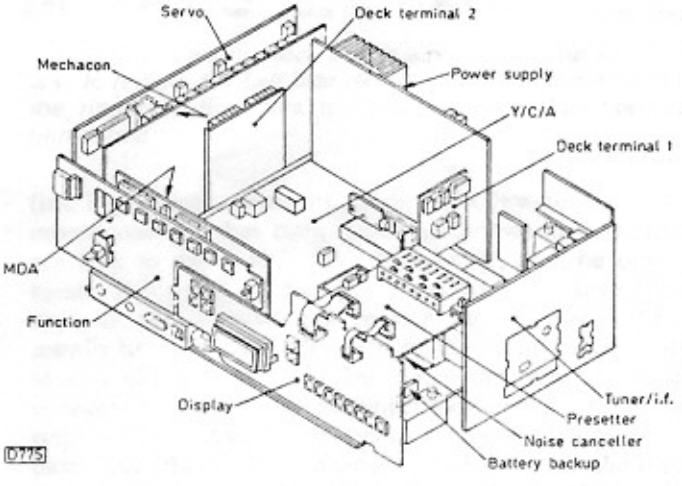

Fig. 1: Panel layout. The earliest versions didn't have the noise-canceller board or battery back-up. On later versions the MDA circuit was put on to the servo board, leaving an empty compartment behind the function board. On the stereo sound version this compartment was used to house the additional audio circuits. The deck terminal 2 board is needed only with the combined servo/MDA board: it was added to accommodate the interconnections between the MDA, the system control and the motors.

the board and is designated TP9.

Another addition with the 8940 is a ni-cad battery and charger circuit to provide clock and timer back-up in the event of mains failure. These items are located next to the noise-canceller sub-panel beneath the presetter board.

In some cases it's possible to interchange panels between different versions of the machine, but this is rarely possible without having to carry out modifications.

Basic Mechanical Overhaul

In most cases a 3V29 can be restored to normal working order by replacing the pinch roller, the loading belt and the cassette lamp. This should of course be accompanied by thorough cleaning of the tape path. If this basic overhaul has restored normal operation, it simply remains to check the tape path for signs of tape curl, the reel idler operation, the take-up spool torque, the condition of the heads, and the tuning presets. Once these points have been attended to and any repairs required have been carried out the average machine will be ready to give a further four-five years of trouble-free operation. Many other problems arise quite frequently however. A more detailed account of these and how to cope with them follows.

Mechanical Faults

A pinch roller that has done more than a thousand hours of service generally needs replacement because it becomes concave, see Fig. 2. Thus the tape will slide up or down with respect to the audio/control head. The result is poor quality h.f. audio response or poor tracking due to loss of the CTL pulses. Both symptoms can be intermittent. Creasing of the tape edge may also occur.

The same symptoms can be caused by a distorted pinch-roller mounting bracket. It becomes distorted when excessive pressure is applied whilst removing the pinch roller fixing screw. It's worth checking for this during each routine service. Fig. 3 shows the method of checking the mounting.

The back-tension band is not a source of trouble with these machines. If it appears to be well worn however it should be replaced. According to the service manual the torque should be set at between 30-40g-cm, using a back-tension cassette. The only correct way to set back tension is to use some form of tension gauge. If you are working on only the occasional machine however, out of interest rather than as a repair service, the 3V29 is, unlike many other models, very tolerant and will often allow you to set the tension using the method outlined below (see Fig. 4) – but I must emphasise that you do so at your own risk. Tension is adjusted by moving the foot (A) from left to right. Without a tension gauge, fitting a new band in the same mechanical position as the old one will usually give you approximately the correct tension. Where the original band has been moved (you can tell if the locking glue has been broken), approximately correct tension should be obtained by aligning the slot in the foot with the adjacent hole in the chassis. This forms a good starting point when you do use a tension gauge.

The loading belt in this machine is notorious. When it stretches it will either fail to close the after-load switch, as a result of which the machine will unload after about ten seconds, or it will fail to close the unload switch, with the result that the motors continue to rotate after unloading and the cassette housing won't open. Both symptoms may be intermittent.

To replace the belt, remove the loading motor assembly

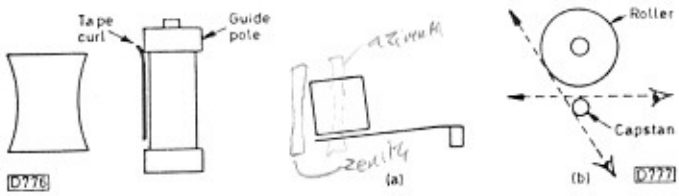

Fig. 2 (left): A concave pinch roller results in uneven pressure on the tape, which will slip up or down on the exit guide pole. It's best to check the pinch roller by removing it.

Fig. 3 (right): It's essential that the pinch roller is vertical. A distorted pinch roller mounting bracket is shown at (a). The pinch roller can be checked, see (b), by pressing the roller towards the capstan with a finger, leaving just a narrow gap through which the roller can be sighted. Use the capstan as a reference. Check from two angles, as shown, for zenith and azimuth distortion.

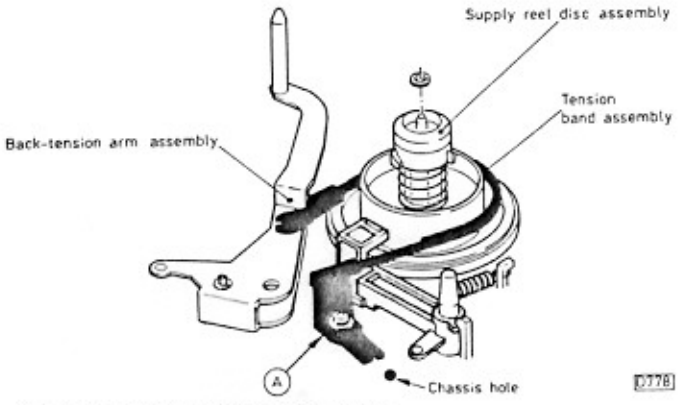

Fig. 4: The back-tension assembly.

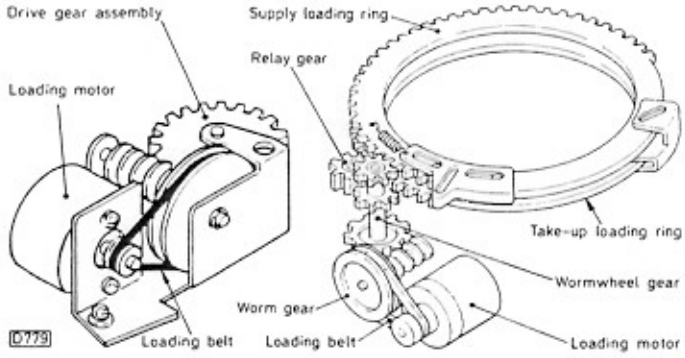

Fig. 5: The loading block and loading rings. The simplest way to replace the belt is to remove the block, but note that the rings are then free to move and can thus become unmeshed.

(see Fig. 5) and release the circlip. But beware: when the motor assembly has been removed the two loading rings are free to move and, after reassembly, may be out of mesh. This problem can occur even when you take great care as you remove and replace the assembly. What usually happens is that the gears on the motor block rotate as you change the belt. Thus when the motor block is reinserted the gear teeth no longer locate with those in the rings. One's natural instinct is to gently juggle the motor block until the teeth are aligned, but this is when the rings move out of mesh. What you should do is to lower the motor block on to the rings and, if the teeth don't engage immediately, gently rotate the motor pulley until they do. The operation isn't difficult: I've managed it successfully in a customer's front room on many occasions.

If the rings do become unmeshed, remove the loading block, fully retract both the slant poles, look to see that the

teeth on both rings are aligned above each other, then reinsert the loading motor block. Now check the loading, ensuring that the guide rollers locate firmly in the V notches.

You may occasionally encounter a machine in which the loading motor has lost its torque, or where a tooth on one of the drive gears has come adrift. These are not common problems with the 3V29 however.

Still connected with the loading belt, another problem you might encounter is the afterload switch actuation bar sticking. This bar is on the top of the deck, running beneath the supply spool, the back-tension arm and the sub-deck. It has a hook at one end – this presses against the switch when loading is complete. The bar sticks because the hook is bent: the latter occurs because many engineers do this in a vain attempt to correct the fault caused by a stretched loading belt (they are usually not aware that the belt is the culprit, and bending the bar seems to be the obvious cure).

It's not possible to straighten the bar from beneath the deck – this will introduce a kink that will cause sticking – and the bar cannot be removed as it's secured to the chassis by rivets. The best thing to do is to remove the back-tension arm, the sub-deck and the loading rings, after which the bar can be straightened from above, using a wide, flat-bladed screwdriver and some gentle percussion.

As with many other VCRs, the take-up clutch is a common cause of trouble. Intermittent tape spillage into the machine, or the machine going into the stop mode during play, are more often than not caused by a defective clutch or the take-up idler which is between the clutch and the take-up spool.

The manual quotes a take-up torque of between 60-150g-cm. A torque gauge is not essential however. Diagnosis of a defective clutch can usually be carried out by playing the latter part of a three-hour tape and watching the spool operation for a brief period: you will see the spool begin to stall.

The reel idler also gives its fair share of trouble. Apart from poor fast winding and failure to reel the tape into the cassette when unloading, the reel idler is also the main cause of poor visual search performance. During search the reel motor comes under the control of a servo that uses the control-track pulses for feedback. If the idler is worn or dirty, the servo will not be able to maintain proper control of the nine times normal tape speed.

Another cause of poor search is a slightly dirty CTL head. The head may provide sufficient output for normal play, but in the search modes the CTL output falls and the servo accelerates the reel motor to the full fast-wind speed.

Occasionally, apparent failure of the reel idler may be due to distortion of the plate spring behind the idler. This spring keeps the idler pressed against the motor pulley when it's jockeying between the two spools. If the spring is distorted the idler won't throw over. You can usually straighten and retension the spring.

Unlike other makes that I could mention, the reel motor rarely gives trouble. Before you condemn it I would recommend that you rule out all other possibilities.

Because of the age of these machines, worn or hardened spool carrier tyres are common. If they need to be renewed it's advisable to replace the clutch and the reel idler at the same time (unless new ones have recently been fitted).

The guide rollers should never fail. But thousands have had to be replaced because they have been adjusted without releasing the locking screw at the rear base. If the top of the roller appears to be chewed, scope the f.m. waveform while a known good tape is being played and look for signs of dropout. If dropouts are evident it's best to remove both rollers and inspect the shafts. Look for scouring caused by the locking screws. I always replace the guide roller(s) when scouring is evident – experience has shown that a lot of time can be wasted trying to set the rollers when in fact they've become distorted.

Here's a practical hint when adjusting the guide rollers. Holes in the V notches make it possible to release and secure the hexagonal locking nuts with the machine in the play mode. After adjustment it's advisable to secure the screws with the rollers in this position, as otherwise they have a tendency to move out of alignment when unloading.

A number of things can cause poor tracking and a poor f.m. waveform. When you feel that you've tried everything possible to correct this situation the slant pole(s) are suspect. In several machines I've come across a slant pole has worn at the point where the tape runs round. In all cases the wear has been almost unmeasurable and invisible but a replacement pole has cured the problem.

A common problem occurred in the early days when someone would fit the drum rotor back on its shaft in the wrong position. This puts the PG magnets out-of-phase with the video heads, causing all sorts of upsets. Most engineers today are aware of this problem, but do bear it in mind if you have to remove the rotor: the locking screw must locate against the flat on the shaft.

The cassette housing is robust and quite reliable. Occasionally you come across one where fluff or fur have become entangled around the damper fan mechanism, the result being that the housing won't come right up. The main problem with the housing itself is refitting it after service. If it's too far back, i.e. away from the front of the player, the machine may eject the cassette whilst in the play mode. If it's too far forward it will fail to eject at all. There was originally a housing alignment jig, but I doubt whether many people ever used it. In the main, correct operation will be obtained when the housing is fitted loosely, pulled fully forward, then pushed back about one millimetre. Secure the housing then check its operation by playing a tape then pressing eject, preferably with your hand over the housing just in case!

The capstan motor is on the whole reliable but is occasionally responsible for wow and flutter. The main complaint about it however is the noise it produces – the motor tends to hiss constantly when running. Before you spend a large amount of money on a replacement note that they are like this from new.

The drum motor is equally reliable, but you can come across one where a Hall element has failed or where the PCB breaks inside the motor, the result being that it either takes off at full speed or runs at a snail's pace. I also had one machine in which patterning and noisy chroma were caused by a defective rotary transformer. The f.m. waveform in one channel was clearly noisy, and a replacement lower drum assembly (after replacing just about everything else) provided a cure.

Electronic Faults

In its youth the 3V29 had its fair share of electrical faults. This was quite unlike the earlier 3V00/3V16/3V22 series which mainly suffered from mechanical failure such as distorted loading arms and gears. I should add that many of us were at the time tired of rebuilding those machines and viewed an electrical fault as a relief!

Electrical faults with the 3V29 are rare nowadays. When they do occur, a replacement panel from a scrap machine can usually be quickly found. But many electrical faults are

easy to trace, and repair is often quicker than realigning a replacement panel. Here's a rundown on the more common faults I've had.

Any of the five fuses on the power supply panel can fail due to age – they rarely fail because of a fault condition. With a dead machine it's prudent to start by making a quick check on these fuses. At the start I mentioned that the 3V29 is very forgiving. By this I meant that should a spanner or meter probe fall into the works the only damage suffered is very often a blown fuse on the power board. This cannot be said of certain other VCRs.

Dry-joints can occur anywhere. Some of the more common ones are as follows:

(1) At Q101 on the YCA panel. The result is loss of the "all time 9V" supply and hence all the switched supplies.

(2) At the tuning block assembly or associated transistors (presetter board). The symptoms are won't tune or intermittently jumps off tune.

(3) At the connector terminals on top of the full erase head. The symptoms are as follows: the picture and sound are recorded correctly (the old video tracks are erased by the h.f. f.m. signal while the sound track is erased by the audio dub head) but colour patterning is evident because the f.m. doesn't remove all the l.f. chroma of the previous recording.

(4) At various transistors in the audio stages (YCA panel). The symptom is intermittent sound, perhaps only when recording.

These machines can suffer from breaks in the wiring looms. They occur where a wire enters the plug connector. As the breaks are usually within PVC sleeving they are not obvious. Once you've located a break, the best way of dealing with it is to remove the terminal pin from the plug and remake the connection by soldering the wire to the pin, which can be removed by pressing the barb in gently with a fine screwdriver. When reinserting the pin, be sure to open the barb first otherwise the pin will push out as you reconnect the plug.

Cracks in the servo panel can result in the capstan motor taking off at full speed due to loss of the FG signal. These cracks occur in two places: in the top left-hand corner, by plug 61/62, and along the bottom edge close to Q2. The most effective repair is to hard wire across the print using insulated wire.

With any older VCR failure of the stop sensor lamp is the most common cause of an inoperative machine. Just once in a while however a new lamp doesn't restore operation with a 3V29. Where this is the case the most likely suspect is the feed transistor Q1, which is mounted on the deck terminal 1 board. When replacing this, note that it's a pnp device. A BC307 usually works.

With any electronic equipment, ensuring that all the power supply lines are present and correct is an essential initial check. As with most VCRs the 3V29 has a number of supply lines that are switched to change the mode, i.e. the Play 9V, Rec 9V, E-E 9V etc. lines. Supply switching is carried out by a set of mode-control transistors on the YCA panel. An open-circuit transistor results in loss of the relevant supply. Problems also occur when one of the transistors is leaky, with the result that the supply is permanently present. This can be interesting. With a leaky E-E switch transistor for example the machine will record correctly but operation of the luminance, chroma and servo circuits in the play mode is totally incorrect as the circuits receive both the Play and E-E supplies. Fig. 6 provides an outline of the mode-control circuit.

Small isolating inductors are used to prevent interaction between circuits via the supply lines. Occasionally one of these coils goes open-circuit, the result being failure of one small area of the circuit.

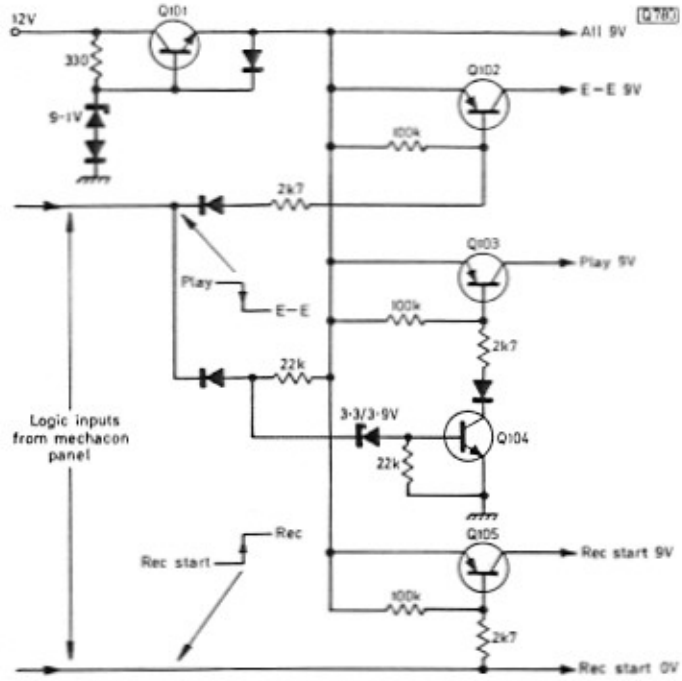

Fig. 6: The mode-control circuit. It's on the YCA board.

Watch out for failure of the 32V tuning supply. The regulator consists of Q8 and IC3, which are on the tuner/i.f. panel. An unregulated 40V supply feeds the circuit. This has its own 315mA fuse (F5) on the power supply panel.

Failure of the reel motor to operate can be due to a defective circuit protector (CP2) on the mechacon panel. It's shown as a 10Ω resistor in some circuit diagrams but in even the earliest machines I've never found anything other than a circuit protector.

IC12 on the mechacon panel tends to be blamed for other reel motor faults. It's a reliable device however and I've found that the cause of the fault usually lies elsewhere. Possibilities include regulator Q2 on the main chassis, behind the drum motor, an inverter in IC8 on the mechacon panel and faults in the wiring looms.

Chip failure is not frequent but does occur. In my experience two of the most troublesome devices are the VC1029 frequency-voltage converter chips and the IR2403 logic inverter chips. The operational amplifiers in the VC1029 chips (servo and MDA panels) fail occasionally. The IR2403 contains seven separate inverters. It's not uncommon for one of the outputs to become permanently short-circuit to the negative side of the supply, a fault that can be confirmed with an ohmmeter. This type of chip is used extensively on the servo and mechacon panels.

If visual search results in loss of line lock with the tape accelerating to the fast wind speed, clean the CTL head and check that it's correctly aligned. During search the reel motor comes under the control of a servo that uses the control track pulses for feedback.

If the front display is dim and patchy forget it! The vacuum fluorescent display is a thermionic device which, as with all such devices, loses emission.

In Conclusion

Given an overhaul the majority of these machines should be able to provide another four or five years service. They and their clones have proved to be the true workhorses of the video world.