Setting-up & Optimizing the OTARI MTR-90 Tape Transport with T/REDS™ or Black/REDS™

... an outline of set-up & alignment points for smooth tape handling.

I. Important Mechanical Considerations

In setting up the Otari MTR-90, the first thing is to assure that all tape contacting rollers, tacho - capstan shafts and heads are fully straight and parallel and set at proper height. The process to accomplish this goal varies from tech to tech, but one should have access to precision gauge blocks and parallels before attempting to judge the "straightness" of the tape path. *Many super techs recommend the use of our Tape Path Gauge Block for careful, and carefree mechanical alignment. It is the solution to the MTR-90's tape path quagmire! A TPGB is generally available for rental for $125.00 per week. Check with us.....*

1. The swing arm assemblies must be straight & shafts perpendicular. The posts are set at exactly 90° to the bracket. If not, you should replace the original Otari swing arm assemblies. *(We have very strong replacements available - see our HardArms™)* [Note: It has been shown that a machine with many hours and/or severely bent arms may have problems with the bearing housings which support the arms. Over time these housings may become distorted making it impossible to achieve true tape path parallelism even with new arms. A problem here can be demonstrated by rotating the assembly 180° and noting if the problem reverses itself.]

2. Particular attention should be paid to the capstan motor and its mounting. We have noted many capstan motors which are "tilted". The mounting flange may actually be bent likely due to the 3 point mounting which fails to adequately support the motor on the side closest to the outgoing swing arm. One should carefully note the wrap around the capstan roller and look for any signs of uneven tension. *(see MDI's Capstan Motor Alignment Collar).*

3. Carefully evaluate the head assembly and, if necessary, send it out for relap and optical alignment. *(We can help here too!... EMC ElectroMag does a fabulous job with Otari head assemblies!)*

4. Install MDI's ***T/REDS™*** *or* ***Black/REDS™*** Capstan and Tacho rollers. (see instructions)

5. Install MDI's ***Improved Swing arm Return Springs***. (see below)

for products mentioned above, see: http://www.PrecisionMotorWorks.com/Products.htm

II. Set-Up / Electromechanical

There are four test points on the **Reel control PCB**. [Note: Make sure you have the appropriate extender board to perform the following.]

For the supply **(SUP)** side there are two test points.
TP 4 corresponds to the wiper output of the servo pot for the supply swing arm
TP 6 corresponds to the output of the gain **(GAIN)** and offset **(POS)** amplifier for the supply side

Setting-up & Optimizing the OTARI MTR-90 Tape Transport

For the take-up **(TUP)** side there are two test points
TP 3 corresponds to the wiper output of the servo pot for the take-up swing arm
TP 1 corresponds to the output of the gain **(GAIN)** and offset **(POS)** amplifier for the take-up side

The first adjustment is to set the centering of the servo pot at the base of each swing arm. Block the swing arm so that it is set at mid-position. This would be the point where the long axis of the swing arm is parallel to the front edge of the deck plate. With the swing arm blocked in mid-position and while looking at the test point on the reel control board that corresponds to the wiper of the servo pot, rotate the servo pot in its mount until you attain **ZERO VOLTS** at the test point. Typically - look for zero volts ±2mV.

With the wiper output of the servo pot at zero, move to the test point that corresponds to the output of the first gain stage in the reel servo **(TP6 & TP1)**. This amplifier has gain and offset controls. These are the **SUP** and **TUP "GAIN"** and **"POS"** trimmers that appear on the front face of the reel PCB. With a **ZERO VOLTS** input, set the position trimmer to end up with **ZERO VOLTS** at the output.

Setting appropriate swing arm spring tension is **Very Important.** The Otari supplied springs generally max out at about 490-500 grams and we do not feel that the Otari recommended spring tensions (380-420 grams for 2" tape) are of a high enough value. Too low a value will result in transport instability, slipping, dirty rollers & premature glazing! **After having replaced the original Otari tensioning/return springs with the improved MDI springs,** set the tension such that it requires a minimum of 450 to as much as 470 grams to hold the swing arm up to mid-position, as measured with a reliable spring scale. The values for both sides should be as evenly matched as possible. [Note: The improved springs have a greater range of adjustment and the adjusting nuts will end up somewhere near the middle of their travel. Some machines may require a higher tension (500 plus grams) particularly those machines running the high output, thicker based tapes. Some trial and experimentation may be required.]

The next step is to go for the up and down mechanical limits for each swing arm. This is done back at the first test points that correspond to the servo pot wipers. The swing arm travel should be limited so that the output of the servo pot ranges from +600mV to -600mV. The end limit stops are the little black "L" brackets that hang under the linking arm that connects the swing arm to the tensioning spring and solenoids. (refer to manual)

When the swing arms are in their rest positions the servo pots will be outputting 600mV. The polarity of this voltage will be different on **SUP** and **TUP** in all but the earlier MTR 90 mkII machines (A thru D lot). When the servo pot output range is ±600mV as defined by the mechanical end stops the **GAIN** control is adjusted to set this voltage swing as measured at the test point that corresponds to the output of the first amplifier on the reel control board to ±4.00 Volts.

[Note: This maybe higher than some of the MTR 90 manuals specify and in a machine with standard set-up, using Otari or Athan rollers using 499 or 996 tape this gain often has to be lower to avoid instability. In most machines, using the 'REDS rollers and following this set-up, this gain can be held at the higher value without instability.]

The final adjustment of the position controls is done with tape on the machine **in mid-reel** while in play. [Note: Make sure you are not using a valuable alignment tape to make the following adjustments!]

With the Reel Servo PCB extended, monitor the test points corresponding to the servo pot wipers. **TP4** for **SUP** and **TP3** for **TUP**. Put the machine into play and measure the voltages at **TP4** & **TP3.** With correct spring tension, you should read approximately **65 mV - 75 mV** at these points but of different polarity. While in play adjust each **POS** trimmer slowly clockwise so that the swing arms move **toward the back of the deck** and the voltage at the **TP's** approach **± 0.0 volts** or essentially null. [Note: Some experimentation may be required to optimize this setting for your particular machine. Just remember "arms towards the back of the deck".]

Finally, stop the tape at the mid-point of the reel. [Note: We are assuming that you have removed the sheet metal top cover.] Carefully place your spring scale around the base of the swing arm roller shaft. (i.e. the base of the shaft.) If the hook on your scale won't "hook" the base, fashion a piece of wire to wrap around it. Gently pull each swing arm, one at a time, toward the front of the deck. Note the value (oz.'s or grams) at which point the tape just begins to move toward the same side reel. This value should now be 8-8.5 oz. or 225-240 grams and, ideally, both sides should be matched to within 10 grams. This is an approximation of dynamic tape tension and confirms that you have correctly accomplished the set-up. [Note: A calibrated Tentelometer should indicate approximately 300 grams on either side for 2" tape.] If not, we suggest that you go back and check the spring tensions as outlined earlier. Shuttle the tape in FF & RW and note how the transport behaves. It should appear solid and predictable. If not, we urge you to go on to check the fast wind speeds. (refer below & to manual)

Once the servo pot centering, mechanical limits, spring tension, reel servo gain and offsets are set you should again look carefully at the tape travel to assure that height and parallelism are indeed correct.

III. In addition...

If there still seems to be tensioning or slip problems, you should go back and check your previous work. If all the above is O.K., there are other areas that warrant checking. Outlined in the manual there are two pots on the transport control board that regulate current supplied to solenoids that control the swing arms to increase tension during direction changes and accelerations - these are the **Reel Tracking** adjustments. Additionally, there are the **Capstan and I/O** adjustments that define the capstan servo loop in play and winding states.

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[Note: We find that with a properly set up machine there is no problem running the machine such that the wind speed stabilizes at 48 kHz as measured at the capstan motor tach board. This may sometimes be run as high as 52 kHz with **'REDS ™**, a prime machine and careful servo alignments but this is pushing the machine's capabilities and is not recommended.]

Including a thorough cleaning and assuming there are no major problems, it should take from two to four hours to fully set up the reel servo, reel tracking and capstan servo alignments.

As always, MDI welcomes any comments and or suggestions and we stand ready to provide technical support to any and all who are using our products.

Notes:

The reader should note that, at this point, we cannot provide the data for the 1" digital Otari/Mitsubishi transports. We believe that much of what is covered here will move nicely into the digital domain. Of course, 1" tape requires appropriate tension values. We do offer replacement springs of appropriate value for 1" tape. These values were determined by running 1" tape on our MTR-90 MkII 1" transport. We welcome any input from our readers.

PrecisionMotorWorks provides this procedure to purchasers of ***'REDS*** to help new users achieve the best possible performance from their machines. The person following this procedure should understand that the performance of any tape recorder is a function of many interrelated systems and components, the alignment of only some of which are detailed herein. The person using this procedure should do so carefully and understand that this is not an Otari authorized procedure. **MDI** is not responsible for the results obtained by persons following this procedure.

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