Notes on 5050 series capstans from AnalogRules.com

You MUST lubricate your capstan motor's upper bushing often !!!

One of the major causes of capstan failure is lack of lubrication.
So make sure you've got the proper oil and use it every few months !!!
You can purchase the correct Oil at Precision Motor Works :
Purchase Otari Capstan Oil here

http://www.precisionmotorworks.com/shop/contents/en-us/d17.html

Directions as to how to lubricate your Capstan Motor are in your
Machine's Manual which you can download for free at AnalogRules.com
and is included in this set of documents.

DO NOT OVER LUBRICATE - use just a drop or two of the CORRECT oil !

Otari 5050 series capstan motors are all slowly going bad...
usually lack of lubrication as noted above... or just wear,
but also over time, the drive coils can work their way off their
mounts inside the motor and fall into the turning rotor of the motor,
causing it to freeze up.

So if you begin to hear a ticking sound inside the motor itself -
you can check this by just spinning the capstan shaft by hand
with the Poweer OFF...

DO NOT TURN THE MACHINE ON again if you hear
any scraping or ticking noises!!!

You will immediatly need to send the motor to a good tech
who then can see if the motor coil can be reset in place,
or have the coil replaced if it is damaged.

I send Otari Motors to Athan Corp in South San Francisco for rebuilding.

Running the capstan with a loose drive coil will at best cause severe
Wow and Flutter, at worse completely destroy your motor.

New Old-Stock good replacement Capstan Motors are expensive to find,
and good used ones also hard to find as almost all used Capstan motors
are worn out from use and need rebuilding. So buying a used capstan motor
on eBay or the like is usually not a good thing to do.

Rebuilding a capstan motor costs about $ 350.00 IF it can be rebuilt.

A new Old stock unused Capstan motor costs between $550 - $750
and that's IF you can find one... they are very rare now.

Check my Parts listings for the Otari 5050 machines to see if
I might have a good Capstan in stock:

http://www.analogrules.com/frames/Otari5050parts.html

More Notes and Tips on 5050 series Capstans... from AnalogRules.com

If a 5050 servo capstan motor stops working AND when turning the shaft
by hand with the power OFF you do NOT hear any clicking or scraping...
and the shaft turns easily....

Then you likely have a bad or intermittent switch... either the
SPEED Selector switch or the Vari-Speed switch.

Try exercising each switch a few times and that may solve your problem... as these switches rarely get used, and thu s can get a little corroded inside over time, especially the Vari-Speed switch.

You should also spray clean the switches to help them stay in good condition.

Remove the AC power cord before you go opening up your machine!

Note it is VERY rare to have an electronic problem in the Capstan Servo card,
so look elsewhere first - I've never seen a bad servo card and I've worked
on well over a hundred 5050 machines. So more than likely it is a bad motor
or a bad switch.

If the motor does NOT turn easily by hand □
DO NOT TRY AND FORCE IT....

It means there's something inside the motor that has come loose
and you should NEVER OPEN THE MOTOR UP YOURSELF.
You can damage the motor by opening it up incorrectly... send it off to a good tech who is experienced in Otari Moto rs.

I use Athan corp in South San Francisco to rebuild Otari Motors

4.2.3 LUBRICATION

The only component requiring lubrication is the capstan.

Lubricate the capstan every four months, or after each 1,000 hrs. of operation (whichever occurs first), or as required using the recommended lubricating oil (Table 4-1). For lubrication, proceed as follows, referring to Fig. 4-3:

(1) Remove the pinch roller cap by turning the cross-head screw counterclockwise.

(2) Remove the pinch roller from the pinch roller shaft.

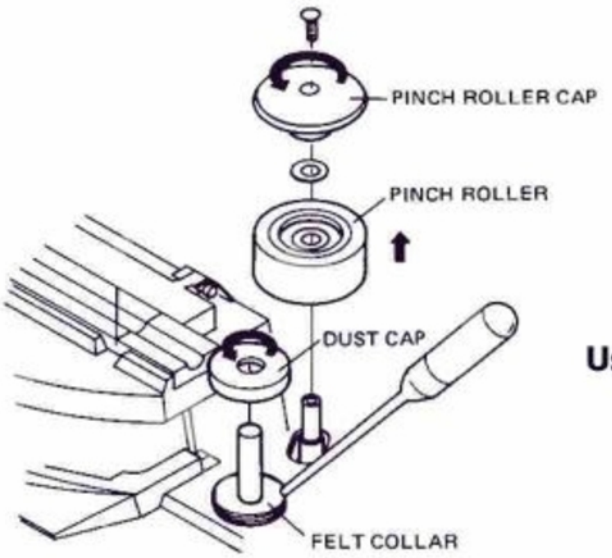
(3) Remove two screws attaching the head housing cover to the tape deck. Remove the head housing cover.

(4) Remove three screws that hold the lower head cover (skirt) to the deck panel. Remove the cover.

(5) Remove the metal dust cap from the capstan shaft by turning it counterclockwise.

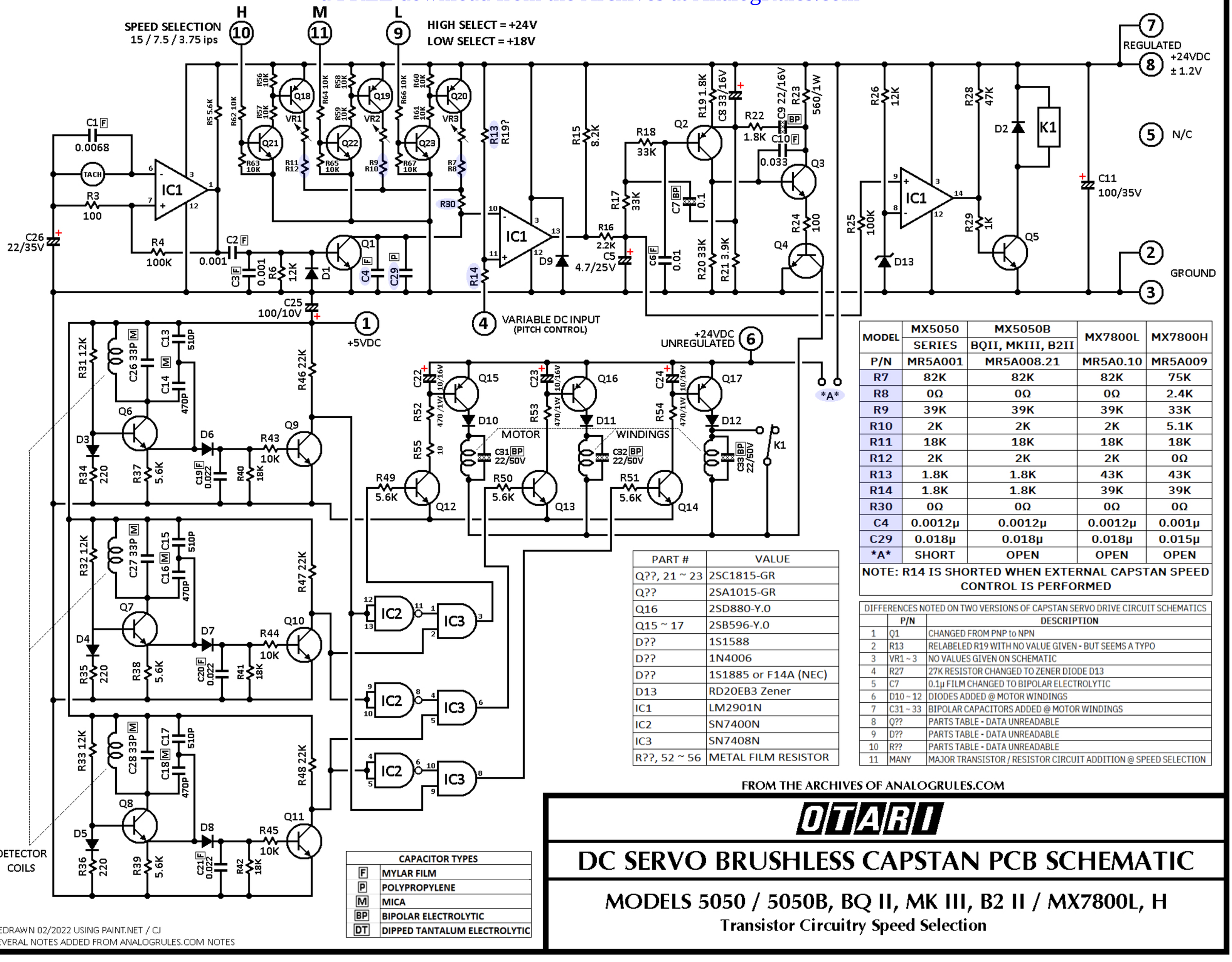
(6) The felt collar should now be visible. Apply two or three drops of oil onto this felt collar. Please do not over-lubricate.

(7) Wipe off any excess oil and replace the dust cap. Also replace pinch roller and pinch roller cap after replacing lower head cover (skirt) and head housing cover.



Use ONLY OTARI oil part # PZ9E003

NOTE: Most 5050's and other Otari's do NOT have a felt collar !! Drop a few drops of oil onto the Bushing.!



MODEL	MX5050 SERIES	MX5050B BQII, MKIII, B2II	MX7800L	MX7800H
P/N	MR5A001	MR5A008.21	MR5A0.10	MR5A009
R7	82K	82K	82K	75K
R8	0Ω	0Ω	0Ω	2.4K
R9	39K	39K	39K	33K
R10	2K	2K	2K	5.1K
R11	18K	18K	18K	18K
R12	2K	2K	2K	0Ω
R13	1.8K	1.8K	43K	43K
R14	1.8K	1.8K	39K	39K
R30	0Ω	0Ω	0Ω	0Ω
C4	0.0012µ	0.0012µ	0.0012µ	0.001µ
C29	0.018µ	0.018µ	0.018µ	0.015µ
A	SHORT	OPEN	OPEN	OPEN

NOTE: R14 IS SHORTED WHEN EXTERNAL CAPSTAN SPEED CONTROL IS PERFORMED

PART #	VALUE
Q??, 21 ~ 23	2SC1815-GR
Q??	2SA1015-GR
Q16	2SD880-Y.0
Q15 ~ 17	2SB596-Y.0
D??	1S1588
D??	1N4006
D??	1S1885 or F14A (NEC)
D13	RD20EB3 Zener
IC1	LM2901N
IC2	SN7400N
IC3	SN7408N
R??, 52 ~ 56	METAL FILM RESISTOR

CAPACITOR TYPES	
F	MYLAR FILM
P	POLYPROPYLENE
M	MICA
BP	BIPOLAR ELECTROLYTIC
DT	DIPPED TANTALUM ELECTROLYTIC

DIFFERENCES NOTED ON TWO VERSIONS OF CAPSTAN SERVO DRIVE CIRCUIT SCHEMATICS

	P/N	DESCRIPTION
1	Q1	CHANGED FROM PNP to NPN
2	R13	RELABELED R19 WITH NO VALUE GIVEN - BUT SEEMS A TYPO
3	VR1 ~ 3	NO VALUES GIVEN ON SCHEMATIC
4	R27	27K RESISTOR CHANGED TO ZENER DIODE D13
5	C7	0.1µ FILM CHANGED TO BIPOLAR ELECTROLYTIC
6	D10 ~ 12	DIODES ADDED @ MOTOR WINDINGS
7	C31 ~ 33	BIPOLAR CAPACITORS ADDED @ MOTOR WINDINGS
8	Q??	PARTS TABLE - DATA UNREADABLE
9	D??	PARTS TABLE - DATA UNREADABLE
10	R??	PARTS TABLE - DATA UNREADABLE
11	MANY	MAJOR TRANSISTOR / RESISTOR CIRCUIT ADDITION @ SPEED SELECTION

FROM THE ARCHIVES OF ANALOGRULES.COM

ATARI

DC SERVO BRUSHLESS CAPSTAN PCB SCHEMATIC

MODELS 5050 / 5050B, BQ II, MK III, B2 II / MX7800L, H

Transistor Circuitry Speed Selection

REDRAWN 02/2022 USING PAINT.NET / CJ
SEVERAL NOTES ADDED FROM ANALOGRULES.COM NOTES

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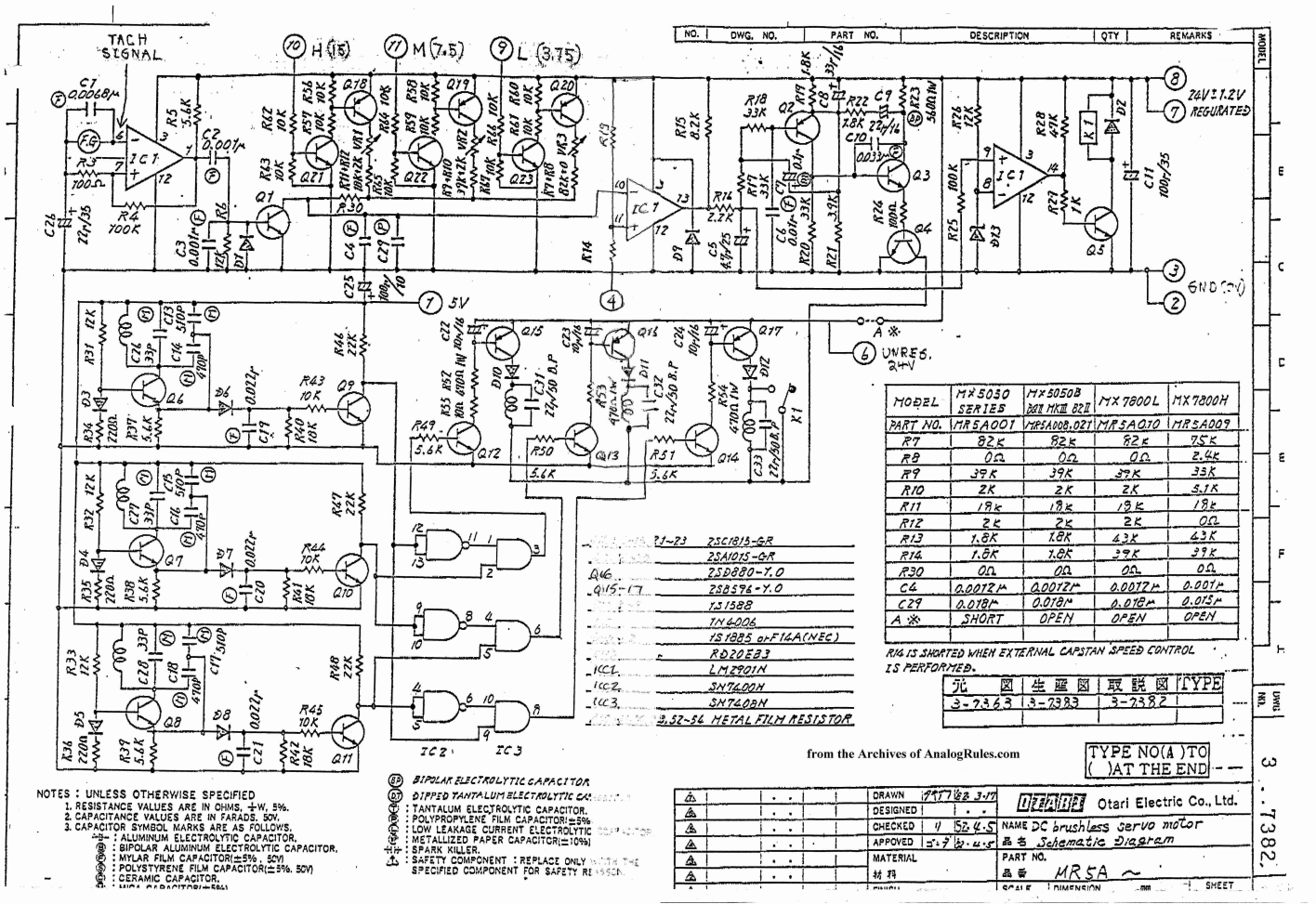


4.4 CAPSTAN MOTOR DRIVE CIRCUITS

If the TAPE SPEED selector is set to HIGH, the recorder power switched on and tape is loaded (with the left/right tension arm in the up position), the capstan motor begins to rotate at 1,000 rpm, and when the transport is put in the play mode, it increases to 2,000 rpm.

Q18 is in the on state when power is switched on and this raises the DC level of U11-1 which then switches on Q19 to start the motor.

The 1,200Hz output from the TACH generator applied to U11-14 is amplified and a square wave is output from its pin #14. This square wave is differentiated by C25, R90, R91 and the plus side of this waveform switches on Q16. When the recorder is switched on, U8-1 goes to "L", Q14 and Q15 switches on and this output is applied to the integration circuit of R92, R93 and C47/C48. Therefore, a sawtooth waveform made by the signal from the integration circuit and on/off action of Q16, is applied to comparator U11-8. The rectified output from the integration circuit of R98, R99 and C27 passes through Q18 and DC amplifier U11-1 and applied to Q19 which control current to the capstan motor.

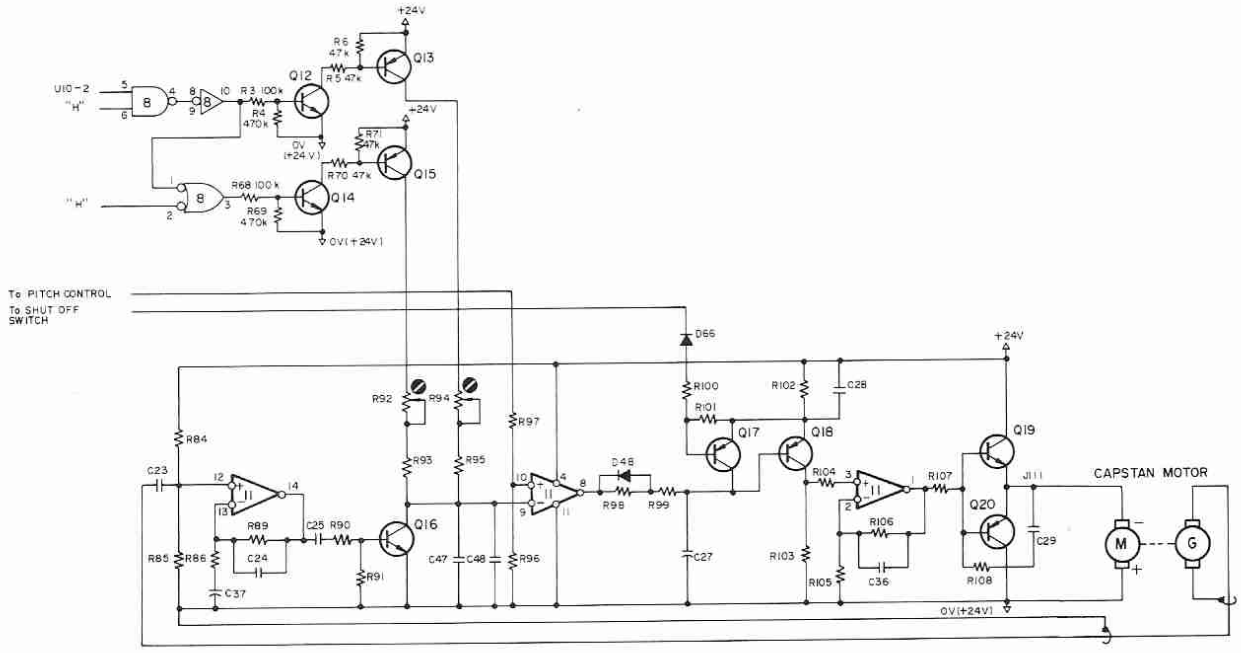


Fig. 4-4

Q20 switches on when Q19 is off, to act as a braking circuit by absorbing the counter electromotive force from the motor.

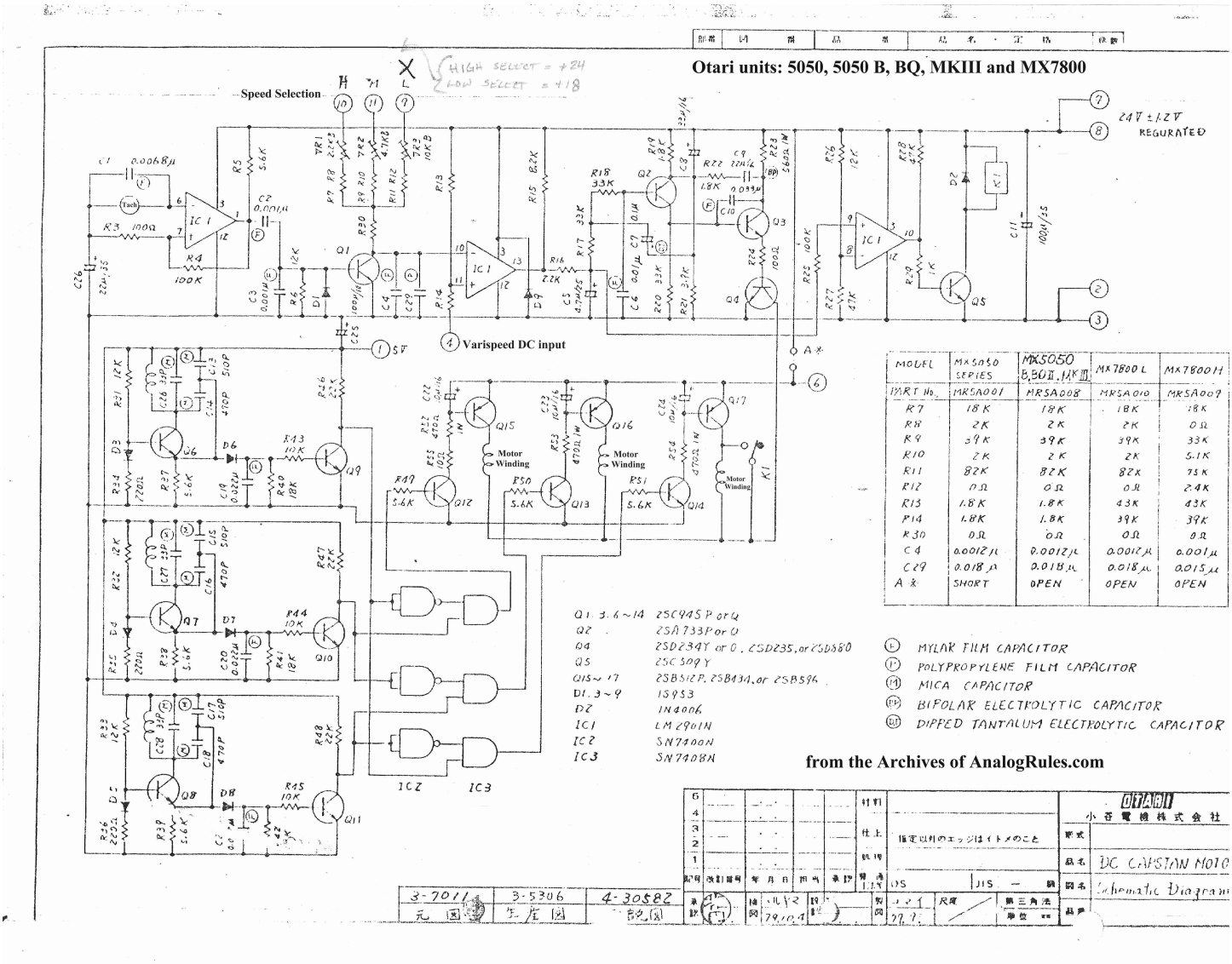
When the PLAY button is depressed, the "L" output from U9-17 is passed through an inverter and applied to U8-5; on the other hand, as the signal to U8-6 is also "H", the output of U8-4 is an "L" but on being inverted by U8-10, the "H" level output is applied to Q12.

Q12 and Q13 is then switched on and its output applied to the integration circuit of R94, R95 and C47/C48. At the same time, the "H" output of U8-10 makes the output of U8-3 go to "L" thus switching off Q15.

By this alternating switching of Q13 and Q15, the integration circuit constant is affected and output duty of comparator U11-8 is changed. As a result, the motor revolution changes from 1,000 rpm to 2,000 rpm, and consequently, the TACH output of 1,200Hz rises to 2,400Hz. The TACH output at 1,000 rpm is about 350mV.

If the TAPE SPEED selector is at LOW, U8-6 remains at "L" and consequently, U8-4 is "H" which thus holds Q12 and Q13 at OFF state, and therefore, the capstan motor revolution will remain at 1,000 rpm even when the transport is put in the PLAY mode.

When the shut off switch is on (left/right tension arm in down position), Q17 is switched on to force the U11-1 output to "L" which then switches off Q19 and the motor is stopped. However, the motor will continue to run in the EDIT mode, even if the shut off switch is on, as the EDIT switch is in series with the shut off switch.



MODEL	MX5050 SERIES	MX5050 B,BQ II, IIIK III	MX7800L	MX7800H
PART No.	MRSA001	MRSA008	MRSA010	MRSA009
R7	18K	18K	18K	18K
R8	2K	2K	2K	0Ω
R9	39K	39K	39K	33K
R10	2K	2K	2K	5.1K
R11	82K	82K	82K	75K
R12	0Ω	0Ω	0Ω	2.4K
R13	1.8K	1.8K	43K	43K
R14	1.8K	1.8K	39K	39K
R30	0Ω	0Ω	0Ω	0Ω
C4	0.0012μ	0.0012μ	0.0012μ	0.001μ
C29	0.018μ	0.018μ	0.018μ	0.015μ
A※	SHORT	OPEN	OPEN	OPEN

MX-5050 CAPSTAN MOTOR SERVO SYSTEM

THEORY OF OPERATION

The Capstan Motor Drive Amplifier contains the circuitry necessary to drive the three-phase, brushless, DC Capstan Motor, as well as signal amplification and conditioning circuitry for the Capstan Tach pulses.

The Capstan Motor rotor contains four sections of non- magnetic material, and there are three Detector coils located in the motor housing. When the motor is stopped, one of the non-magnetic sections will be adjacent to one of the detector coils. Each detector coil is the inductor in an LC oscillator (Q 6 and C 26, Q 7 and C 27, and Q 8 and C 28 being the transistor/capacitor pair associated with each detector coil) which oscillates at approximately 130 kHz. When the non-magnetic portion of the rotor is adjacent to a detector coil, that oscillator becomes detuned, and stops oscillating. When an oscillator stops oscillating, the logic circuitry causes the corresponding Armature coil to be energized, causing the rotor to move towards it. As the rotor turns, the non-magnetic sections cause each oscillator to stop oscillating in turn, causing each armature coil to be energized in sequence.

Changing the capstan motor speed causes the dc voltage applied to the comparator IC 1 to change, changing the pulse width of the signal sent to the pulse-width to voltage converter (Q 2 and Q 3). The resulting voltage change is applied to the Armature coils to change the motor speed. If an abrupt change in motor speed is sensed, relay K 1 is activated which shorts one armature coil until the circuit stabilizes.

The rotor carries a toothed gear which passes in front of a pickup head flanked by two permanent magnets. As the rotor rotates, the toothed gear passes through the magnetic flux created by the permanent magnets. The resulting fluctuations in the magnetic field are sensed by the pickup head and converted to a pulse train. These pulses are amplified before being applied to the comparator IC 1 where they affect the pulse width of the signal sent to the pulse- width to voltage converter (Q 2 and Q 3) to control the motor speed.

There are three adjustments on the Capstan Motor Drive PCB, VR 1 which adjusts the speed at 15 ips, VR 2 which adjusts the speed at 7.5 ips, and VR 3 which adjusts the speed at 3.75 ips.

The speed of the Capstan Motor can be varied by the Pitch control or from an external source of DC voltage by changing the DC voltage applied to the comparator IC 1.

CAPSTAN BOARD

PIN 11 = 7½ IPS
PIN 10 = 15 IPS
PIN 9 = 3¾ IPS

} +24v High Speed Select
+18v Low Speed Select

PIN 8 = N/C
PIN 7 = +24v
PIN 6 = +24v
PIN 5 = N/C
PIN 4 = Pitch Control
PIN 3 = Ground
PIN 2 = Ground
PIN 1 = +5v