PREVENTIVE MAINTENANCE

RK05/RK05J
DISK DRIVE

HOW TO USE THE PM

General
The PM procedures are written for the device and are written to maximize system performance and minimize the number of corrective maintenance calls necessary.

Format
The PM procedures are written in modular format according to DEC Standard 003. The introduction to each PM lists applicable options, time estimates, special equipment required, and diagnostics required.

Each step of the text is written in the order in which it is to be performed. Opposite each step is a checklist; each step should be checked (√) and dated as it is performed.

System PM Applications
The PM procedures for several hardware options can be configured to provide a PM manual for a system that includes each of these options. Manuals can be customized for specific product applications without extensive rework.

Frequency
How frequently a PM is performed depends largely upon system usage and site environment. The PM has sufficient flexibility to allow the customer and local Field Service to tailor the PM schedule and maintenance contract coverage to suit the requirements of each specific system, ensuring maximum customer utilization of the system with a minimum of downtime.

Symbol Usage
The following symbols represent the recommended performance frequency for each step.

M	Monthly
Q	Quarterly
SA	Semiannual
A	Annual
2 Yr	Biennial

Historical Reference
A checklist is included opposite each PM procedure sheet, so that a permanent record of completed PM procedures and dates performed may be maintained. Trends in adjustments or power supplies over a period of time may predict an impending failure or justify a more or less frequent check of the adjustment.
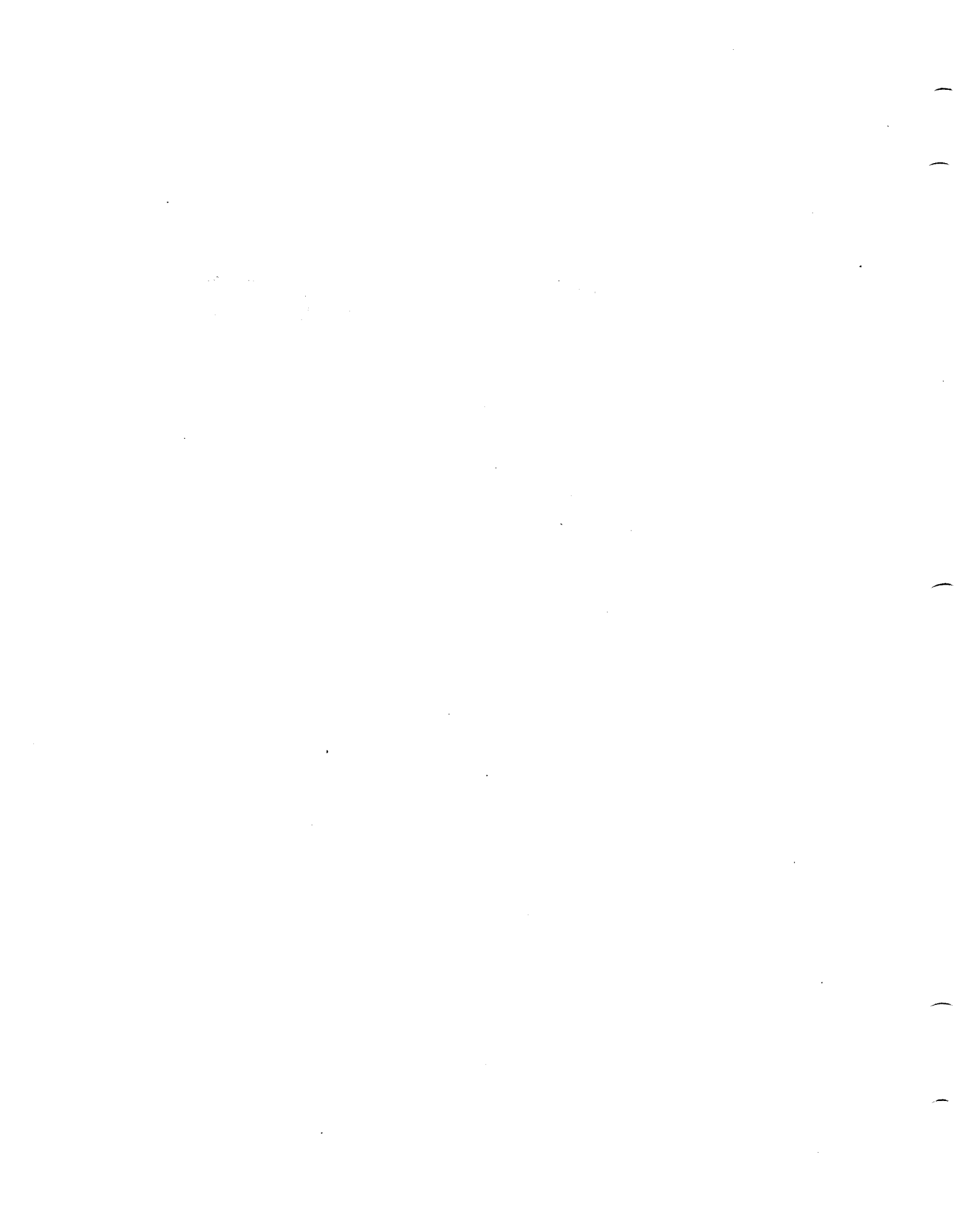
REVISION HISTORY

PRINTING	ECO LEVEL	DATE	PAGES AFFECTED
1st printing	RK05-00064	Aug 1976	N/A

1.0 Applicable Option Designation

RK05 DEC PACK DISK
RK05J 2.5 MBYTE DEC PACK DISK (new version)

2.0 Preventive Maintenance Schedule

Table RK05J-1
Preventive Maintenance Schedule

|				Step	Time† (est)
Quarterly Field Service PM (or 750 hr)					½ hour
	Annual Field Service PM (or 3000 hrs)				1½ hours
		5 yr Field Service PM (or 15,000 hrs)			2 hours
X	X	X	Inspect and Clean Heads	Q1-3	5 min
X	X	X	Inspect Disk Cartridges and Spindle Area	Q4-5	5 min
X			Clean the Prefilter	Q6	5 min
	X	X	Replace Prefilter	A1	2 min
	X	X	Replace Absolute Filter	A2	10 min
	X	X	Check for Worn Shock Mounts	A3	1 min
	X	X	Check for Spindle Wobble	A4	1 min
		X	Replace the Spindle Brush Assy	5 yr-1	5 min
		X	Remove and Clean the Blower	5 yr-2	15 min
	X	X	Clean the Pulleys	A5	1 min
	X	X	Inspect Spindle Drive Belt	A6	1 min
	X	X	Check Linear Positioner	A7	1 min
	X	X	Check Power Supply	A8-10	5 min
	X	X	Check Servo Adjustments	A11-13	20 min
	X	X	Check Spindle Runout	A14	
	X	X	Check Head Alignment	A15-16	30 min
	X	X	Check Sector Delay	A17	
X	X	X	Check for HDI	Q7-8	2 min
X	X	X	Run Diagnostic	Q10	10 min

†Minimum time estimates, providing no trouble is found.

3.0 Test Equipment, Tools and Material Required.
(See Table RK05J-2)

4.0 Diagnostics Required

11 Family	RK11 Dynamic Test	MainDEC-11-DZRKL
8 Family	RK8E Drive Control Test	MainDEC-08-DHRKB*
	*(Rev G or higher)	
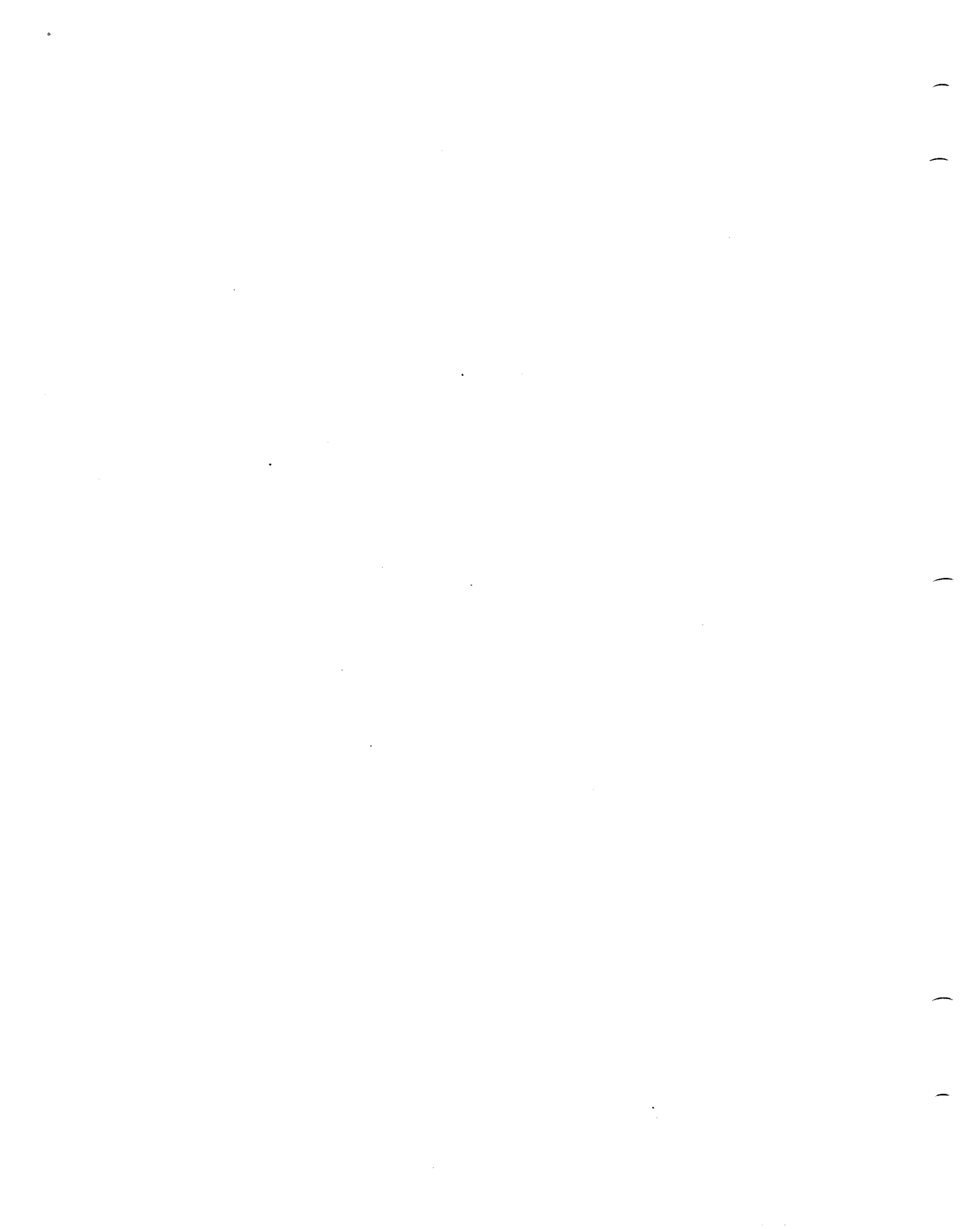
Table RK05J-2
Equipment and Parts

Equipment/Part	Model/Part No.
Multimeter	Simpson, Micronta, or equivalent
Oscilloscope	Tektronix 453 or equivalent
Probe, oscilloscope (voltage X10) (2)	Tektronix P6010
Probe, oscilloscope (voltage, X1)	DEC 29-14050, P6011
Flag, probe (3)	DEC 29-15188
Adapter, flag (3)	DEC 29-19363
Tool kit, field service	DEC 76-06864
Wrench set, 10 pieces (Hex-Key Pak No. 107)	DEC 29-13519
Kit, head cleaning	DEC 22-00007-00
Inspection mirror	DEC 29-19663
Alcohol, isopropyl 91%	DEC 29-19665
Cotton Tipped Wooden Swabs	DEC 90-08436
Blue shim stock, 0.005 in.	DEC 29-19664
Cartridge, alignment	DEC RK05K-AC
Cartridge, disk (12-sector, 11 family)	DEC 30-10350-00
Cartridge, disk (16 sector, 8 family)	DEC 30-10350-02
Motor assembly, blower	DEC 12-10807-00
Motor, induction 50/60 Hz (spindle motor)	DEC 12-10808-00
Spindle assembly, disk	DEC 12-10616-00
Brush assembly (spindle ground)	DEC 12-10985-00
Belt, woven (spindle drive belt)	DEC 12-10812-00
Filter, absolute	DEC 12-12175-01
Pad, filter (prefilter)	DEC 74-09253-00
Torque wrench 55 in-oz for old head screws	DEC 29-20994
Allen tip for 55 in-oz screws	DEC 29-20995
Torque Wrench 128 in-oz for new head screws	DEC 29-22521
3/32" Allen Tip 128 in-oz screws	DEC 29-22522
Bearing assembly	DEC 74-09386
Encoder Lamp Assy	DEC 30-10638-03
Clamp Assembly (for above)	DEC 70-12691

Freq	Operation
	Quarterly Field Service Preventive Maintenance (or 750 hours)
Q	1. Remove the Cartridge from the RK05 and remove power from the drive. Extend the RK05 on its chassis tracks and remove the top cover.
Q	2. Inspect each head using the inspection mirror. Check for the following types of contamination or damage: a. Hydrocarbon tar-like substance on leading edge of shoe. b. Light brown streaks on face or on trailing edge of ceramic. This indicates that the disk packs should be cleaned and inspected. c. Heavy oxide deposit on the face of head. This indicates that disk packs should be cleaned and drive air filters checked. d. Non particle damage, such as stains, film, residue, or cracks. e. Particle damage, such as scratches, burrs, and nicks, on the face. A succession of tiny grooves indicates an embedded particle in the disk's surface which could still be present on the disk. f. Damaged or missing foam seals around head wires.
Q	3. Clean the read/write heads with TEX pads and wand (found in head cleaning kit, DEC 22-0007). Wipe off residue with a clean, dry, lint free cloth wrapped around the wand. If stains or marks on the heads cannot be removed by cleaning, replace the heads. Do not apply excessive pressure to head surface or damage could result to head position.
Q	4a. Inspect the spindle area for foreign material. Isolate the source of any material found, and correct the cause to prevent further deposits. b. Clean the spindle cone and rim using a TEX pad. Wipe off all residue with a clean dry wipe. The spindle cone and the disk pack cone must be clean to prevent pack wobble or runout.
Q	5. Inspect Disk Cartridges for the following: a. Make sure the cartridges are DEC packs; other packs may not meet specifications. b. Check for warped doors on old and new cartridges. The door should close on its own upon removal from the drive. Warped doors will cause the center bearing to wear. c. Check for wear marks on outside of cartridge from misaligned (old) cartridge receivers. d. Inspect the sector ring for plastic particles.

OPERATION CHECKLIST

System _____ Year _____

Device _____ Ser. No. _____ Sheet _____

Month/Day	/	/	/	/	/	/	/	/	/	/	/	/

If step completed, no adjustments or corrections required ☑

If out of spec, record reading [4.9]

Then adjust or correct and indicate PM step completed [4.5]

OPERATION CHECKLIST

System _____   Year _____

Device _____ Ser. No. _____   Sheet _____

Month/Day	/	/	/	/	/	/	/	/	/	/	/	/

digital

If step completed, no adjustments or corrections required [

If out of spec, record reading ⍟⍟

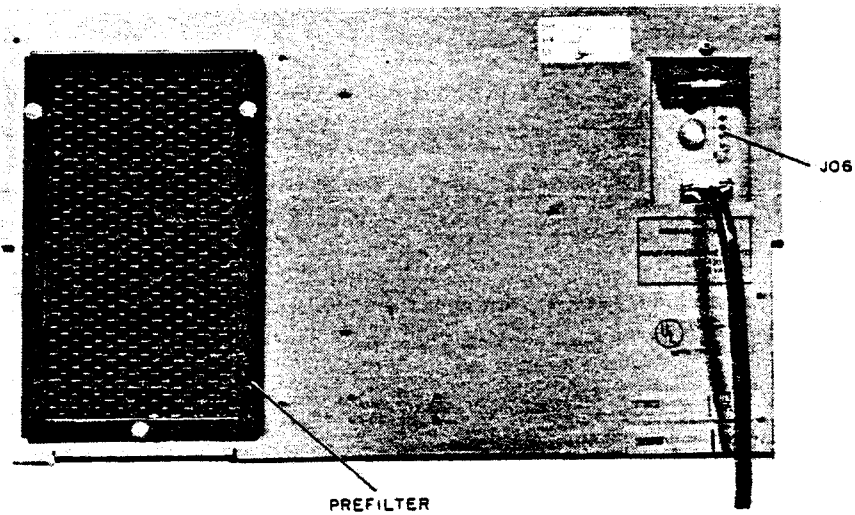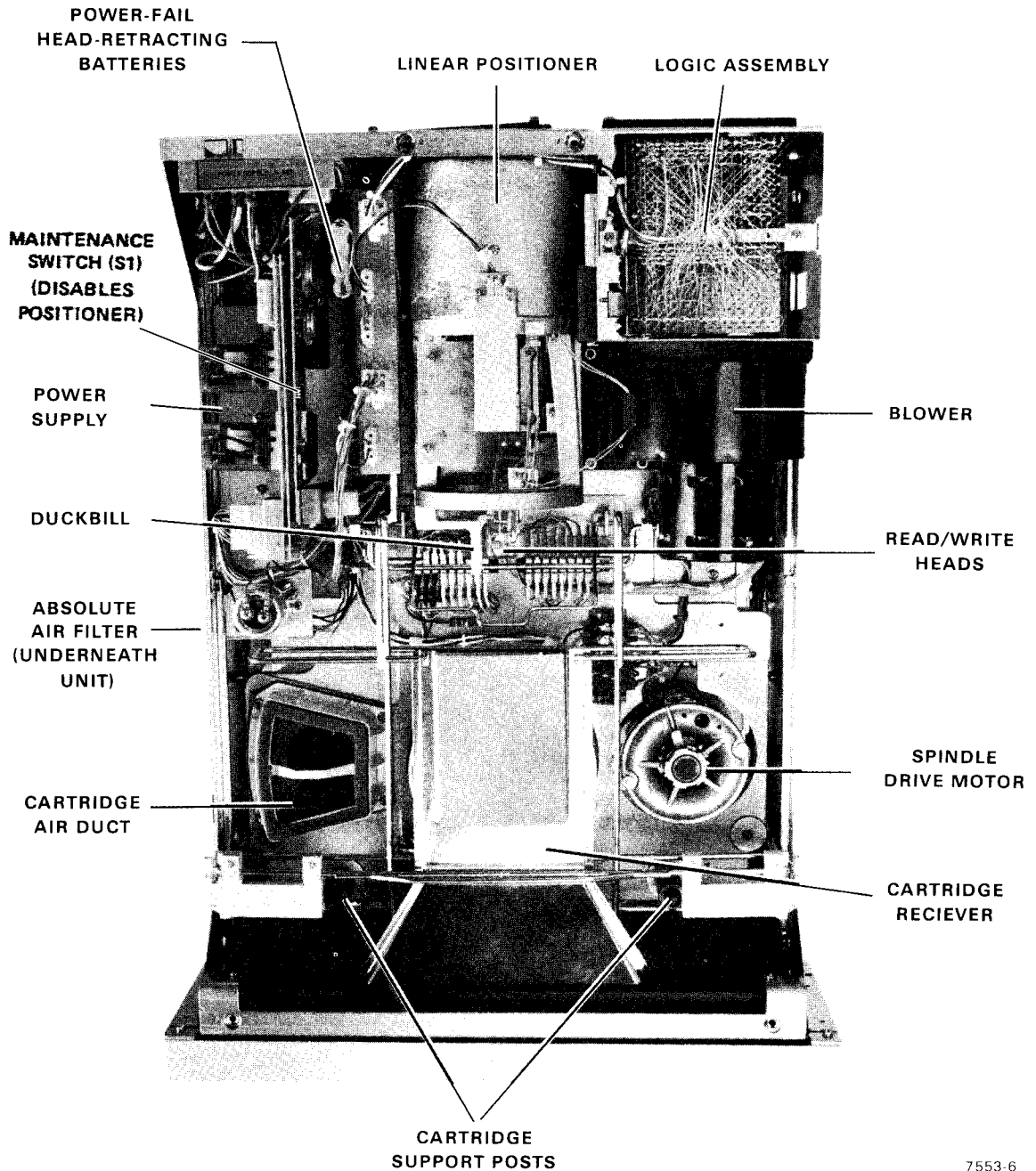Then adjust or correct and indicate PM step completed ⍟⍟

Figure RK05J-1 Prefilter

CAUTION

Interface cable (not shown) will be installed around the
outside of the filter. Do not block air flow through the
filter with the cable. Do not make loops in the cable
so large that it is pinched when sliding the chassis in
or out of the cabinet.

Freq	Operation
Q	**5. (cont)** e. Check for bearing retainer wear. Hold cartridge upside down, open door, and disk should shift slightly. Examine cone in center of cartridge viewing from the bottom. The cone should be perfect or the disk has plastic inside. f. Using a penlight, view through the door and rotate disk. Check for contamination, lump, scratch, or white plastic particles. g. Look for shiny spots on outside lip of disk or dull rub marks on top surface from outer edge to 3/4 inch in. Either of these are caused by hitting the duck bill when pack is initially loaded. h. Look for divots in the disk surface 3/4 of an inch in from the edge of the disk. This is caused during the head loading operation, by a tilted head or a bent gimbal; if this symptom is evident, change the head. **NOTE** If an annual PM is scheduled during this visit, proceed to that section at this time.
Q	6. Clean the Prefilter (RK05J-1) with a vacuum cleaner or wash in soap and water. Shake and dry thoroughly before reinstalling.
Q	7. Reinstall the same RK05 disk cartridge previously removed from this drive, unless deposits discovered on the head indicated a head crash had occurred or inspection of the pack proved it was not reusable; in which case, replace with a new disk cartridge.
Q	8a. Load the heads and listen for any head to disk interference (HDI), any audible zinging or tinging sound. b. Turn off the red maintenance switch (S1) on the H604 next to the positioner (Figure RK05J-2). Move the heads over the disk surface and listen for any HDI. c. Move the heads forward to their inner limit and return the red switch (S1) to on: the heads should return to cylinder zero (even drive). d. Take corrective action if necessary. There may be some initial noise when loading the heads. **NOTE** Complete Steps Q1 through Q8 for other drives on the system before continuing.

OPERATION CHECKLIST

System _____   Year _____

Device _____   Ser. No. _____   Sheet _____

Month/Day	/	/	/	/	/	/	/	/	/	/	/	/

DEC 12-(553)-1224-N375

digital

If step completed, no adjustments or corrections required [✓]

If out of spec, record reading [4.1]

Then adjust or correct and indicate PM step completed [4.5]

OPERATION CHECKLIST

System _____   Year _____

Device _____ Ser. No. _____   Sheet _____

Month/Day	/	/	/	/	/	/	/	/	/	/	/	/

DEC 12-(553)-1224-N375

digital

If step completed, no adjustments or corrections required ☑

If out of spec, record reading ☐

Then adjust or correct and indicate PM step completed ☐

POWER-FAIL
HEAD-RETRACTING
BATTERIES

LINEAR POSITIONER   LOGIC ASSEMBLY

MAINTENANCE
SWITCH (S1)
(DISABLES
POSITIONER)

POWER
SUPPLY

BLOWER

DUCKBILL

READ/WRITE
HEADS

ABSOLUTE
AIR FILTER
(UNDERNEATH
UNIT)

SPINDLE
DRIVE MOTOR

CARTRIDGE
AIR DUCT

CARTRIDGE
RECIEVER

CARTRIDGE
SUPPORT POSTS

7553-6

Figure RK05J-2 Location of Major Assemblies and Systems

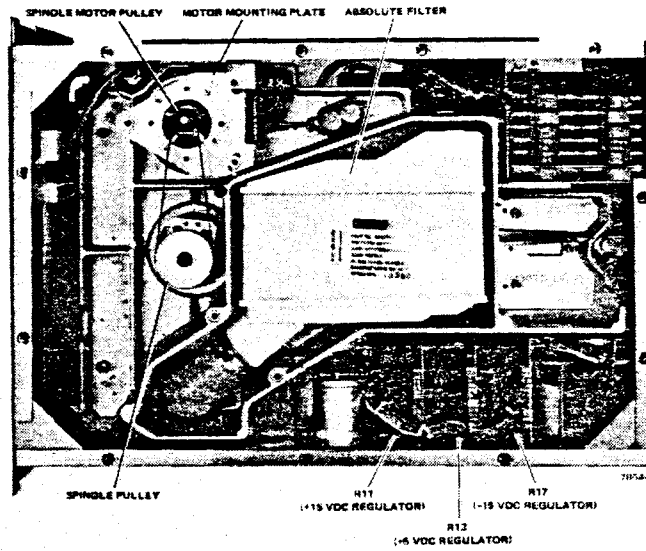| Freq	Operation
Q	9. Replace all modules and cable the RK05 to the previous RK05 on the bus. Make sure the M930 terminator is in the last slot.
· Q	10. Run Dynamic Test or Drive Control Test a. For easy diagnostic checkout, place your diagnostic pack (RK05 or RK05J) on drive zero and select other units to be checked. b. If necessary, format any new disk packs installed. c. Run the dynamic test (11 family) or drive control test (8 family). **NOTE** **DECX or other system exerciser should be run at conclusion of the System PM.**
	11. Remove your disk pack. Replace cover and cable strain reliefs on all drives.

OPERATION CHECKLIST

System _____   Year _____

Device _____ Ser. No. _____   Sheet _____

Month/ Day	/	/	/	/	/	/	/	/	/	/	/	/

DEC 12-(553)-1224-N375

digital

If step completed, no adjustments or corrections required ☑

If out of spec, record reading [4.8]

Then adjust or correct and indicate PM step completed [√8]

OPERATION CHECKLIST

System _____   Year _____

Device _____ Ser. No. _____   Sheet _____

Month/Day	/	/	/	/	/	/	/	/	/	/	/	/

DEC 12-(553)-1224-N375

digital

If step completed, no adjustments or corrections required

If out of spec, record reading ☐

Then adjust or correct and indicate PM step completed ☐

Figure RK05J-3 RK05J Disk Drive (Bottom View)

Freq	Operation
A	**Annual Field Service Preventive Maintenance (or 3000 hours)** 1. Replace the Prefilter. Remove the 3 screws holding the filter assembly (Figure RK05J-1). Replace the filter with a new one, DEC 74-09253. Reinstall the filter assembly on the unit.
A	2. Replace the Absolute Filter (DEC 12-12175-01) * a. Extend the unit on its chassis tracks and remove the bottom covers. (Refer to Figure RK05J-3.) b. Loosen the hose clamp and remove the filter, clean any dusty areas with a TEX pad. c. Install new filter ensuring that the filter is snapped into the port under blower and that the filter arrow is exposed and pointing in the direction of airflow toward the cartridge. d. Tighten the hose clamp.
A	3. Check the inside of the bottom cover for evidence of rubbing or scraping, which could be caused by work or distorted shock mounts. Replace shock mounts as needed.
A	4. Check for Spindle Wobble. a. Push the Spindle Motor Mounting Plate toward the spindle to relieve belt tension, and slip the belt off the pulleys. Ensure that the pulleys are not loose or have moved on their shaft. b. With belt removed, check for horizontal or vertical wobble of the spindle; if wobble is noticeable and excessive, replace the spindle. **NOTE** If a 5-yr PM is scheduled; perform that section at this time.
A	5. Using a clean cloth or wipe moistened with alcohol (91%), clean the spindle and drive motor pulleys; wipe off any residue with a clean dry cloth.

*ECO RK05-00064 must be installed before this step can be accomplished.

OPERATION CHECKLIST

System _____   Year _____

Device _____ Ser. No. _____   Sheet _____

Month/Day	/	/	/	/	/	/	/	/	/	/	/	/

If step completed, no adjustments or corrections required ☑

If out of spec, record reading 4.9

Then adjust or correct and indicate PM step completed √9

OPERATION CHECKLIST

System _____   Year _____

Device _____ Ser. No. _____   Sheet _____

Month/Day	/	/	/	/	/	/	/	/	/	/	/	/

DEC 12-(553)-1224-N375

digital

If step completed, no adjustments or corrections required ⌐ᴠ

If out of spec, record reading [ᴠ.ₛ]

Then adjust or correct and indicate PM step completed [ᴠₛ]

Freq	Operation
A	6. Inspect the spindle drive belt. If it is frayed or cracked, install a new belt; otherwise reinstall the same belt by pushing the spindle motor mounting plate toward the spindle and slipping the belt around the pulleys. *DO NOT STRETCH THE BELT.*
A	7. Check the Linear Positioner bearings for wear. a. Disable the positioner using the red maintenance switch (S1). b. Using a cloth or wipe moistened with alcohol (91%), clean the linear positioner guides. c. Without applying undue pressure, move carriage and coil assembly in and out while observing the four bearings on the linear positioner. Each should turn equally; if a bearing stops while moving the carriage, the carriage assembly is not properly aligned. If a bump is felt, the bearing may be worn or have a flat spot on it. With either symptom, replacement of the linear positioner is recommended.
A	8. Apply power to the drive and check the +5 Vdc (red wire) drive logic voltage. Reference Point = A01A1 Adjust R13 on the +5 Vdc Nominal Value = +5 Vdc ± 0.15V regulator (see Figure RK05J-3 Max. Pk-to-Pk Ripple = 0.25V for adjustment location)
A	9. Check the +15V (orange wire) drive logic voltage. Reference Point = A01D2 Nominal Value = +15 Vdc ± 0.75V Max. Pk-to-Pk Ripple = 0.25V **NOTE** If this voltage meets these specifications, continue to step A10; if not, check 8 to 20 Volt Regulator Adjustment in Appendix A. If any regulator exceeds 250 mV p-p ripple, it should be replaced.
A	10. Check the -15 Vdc (blue wire) drive logic voltage. Reference Point = A01B2 Nominal Value = -15 Vdc ± 0.75V Max Pk-to-Pk Ripple = 0.25V **NOTE** If this voltage meets these specifications, continue to step A11; if not, ckeck 8 to 12 Volt Regulator adjustment in Appendix A.

OPERATION CHECKLIST

System _____   Year _____

Device _____ Ser. No. _____   Sheet _____

Month / Day	/	/	/	/	/	/	/	/	/	/	/	/

DEC 12·(553)·1224·N375

digital

If step completed, no adjustments or corrections required ☑

If out of spec, record reading [4.8]

Then adjust or correct and indicate PM step completed [4.8]

OPERATION CHECKLIST

System _____   Year _____

Device _____ Ser. No. _____   Sheet _____

Month/Day	/	/	/	/	/	/	/	/	/	/	/	/

DEC 12-(553)-1224-N375

digital

If step completed, no adjustments or corrections required ___

If out of spec, record reading [4.5]

Then adjust or correct and indicate PM step completed [4.5]

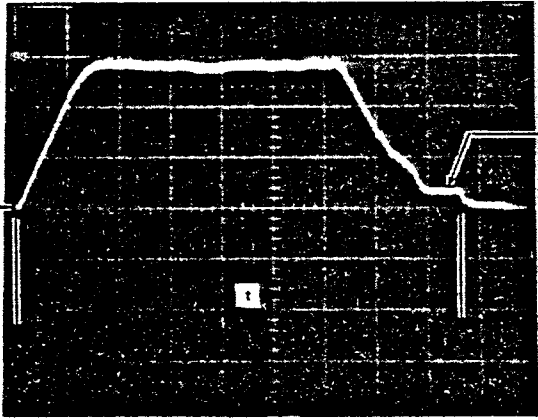| Freq	Operation
A	11. Check Full Stroke Profile Waveform.

      a.   Install original RK05K disk pack on the drive (unless found damaged). Place in RUN mode.

      b.   Connect Oscilloscope as follows:

Channel 1	=	A05H1
Sync	=	Internal
Sweep time	=	10 msec/cm
Gain	=	50 mV/cm (x10 probe) dc
Mode	=	Channel 1
Trigger	=	Channel 1 (only)
A Sweep Mode	=	Auto trigger

      c. (1) If using the tester, set cylinder address to 202, MODE to OSC, and function to RUN. (See Appendix B for tester operation.)

          (2) If using the oscillate program from Appendix C select cylinder address 202 as follows:

            11 family: LOAD ADDRESS 001000
                       Set SWITCH REGISTER to 000312, press START

             8 family: LOAD ADDRESS 7000
                       Set SWITCH REGISTER to 3120, press START

      d.   The duration of the waveform observed should be less than 90 msec, as shown in Figure RK05J-4; if not, proceed directly to step A13.

PLATEAU

0V

t=<90 ms for RK05/RK05J
t=<70 ms for RK05F

PIN	=	A05H1
SWEEP	=	10 ms/div
VERT SENS	=	0.5V/div

M0328

Figure RK05J-4 Full Stroke Profile Waveform

OPERATION CHECKLIST

System _____   Year _____

Device _____ Ser. No. _____   Sheet _____

Month/Day	/	/	/	/	/	/	/	/	/	/	/	/

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digital

If step completed, no adjustments or corrections required

If out of spec, record reading

Then adjust or correct and indicate PM step completed

OPERATION CHECKLIST

System _____   Year _____

Device _____ Ser. No. _____   Sheet _____

Month/Day	/	/	/	/	/	/	/	/	/	/	/	/

If step completed, no adjustments or corrections required [

If out of spec, record reading [4.3]

Then adjust or correct and indicate PM step completed [4̶.̶5̶]

Table RK05J-3
RK05/RK05J Servo Adjustments

	Cosine Amplitude (CA) R66 (1st Top)	Cosine Offset (CO) R64 (2nd)	Sine Amplitude (SA) R31 (3rd)	Sine Offset (SO) R29 (4th)	Velocity Amplitude (VA) R76 (7th)	Velocity Offset (VO) R73 (8th Bottom)	Acceleration R15	Limit Signal Amplitude (LSA) R80 (5th)	Limit Signal Offset (LSO) R78 (6th)	Full Profile Check	Full Stroke Position Check
Module	G93B						H604	G93B			
Test Point	A05S1				A05M1		A05H1	A05J1		A05H1	A05M1
Sync	Internal				External B03J1		Internal				
Disk Pack			Loaded					Unloaded		Loaded	
Sweep Time	10 ms/div				1 ms/div	10 ms/div	5 ms/div	2 ms/div		10 ms/div	
Ch1 Gain (DC, x10 probe)	0.2 V/div					0.2 V/div	50 mV/div	0.1 V/div		50 mV/div	0.2 V/div
Mode	Channel 1										
Trigger	Channel 1 (Only)					Normal		Channel 1 (only)			
A Sweep Mode	Auto-Trigger (free running)					Normal		Auto-Trigger			
A Triggering	—				Level Slope (+) External LF Rej		Level Slope (+) External AC	—			
Motion Routine: / Tester Method	Cylinder Address: 4 / Mode: Oscillate / Function: Run				Cyl Addr: 2 / Mode: OSC / Function: Run	Cyl Addr: 4 / Mode: OSC / Function: Run	Cyl Addr: 64 / Mode: OSC / Function: Run	Place Maintenance Switch (S1) Down (H604). Manually position head at track 100, o for zero reference.		Cyl Addr: 202 / Mode: OSC / Function: Run	
Motion Routine: / Program Control Method	Load Oscillate Program (Appendix C) 11 family: Load Address 001000: (8 Family, 7000)* / Set Switch Register 000004 (0040, 8 Fam) START				SR 000002 (0020) START	SR 000004 (0040) START	SR 000100 (1000) START	Adjust LSO (R78) for 0 V. Check voltage at inner and outer limits. Adjust smaller limit to 3 V. Return to track 100. Adjust LSO for 0 V. Return to zero. Set Maintenance Switch up.		Load Oscillate Program 001000 LOAD ADDR (11 Fam) Set SR 000312 7000 LA. (8 Fam) SR 3120 START	
Motion Routine: / Jumper Method	Connect A08P2 (Sector Address) to A08L1 (Address 4)				A08P2 to A08D1 (2)	A08P2 to A08L1 (4)	A08P2 to A08E1 (64)			A08P2 to A08H1 (128) A08E1 (64) A08C1 (8) A08D1 (2)	
Specifications	10 V p-p ± 10% (Fig. 5a)	A = B Symmetrical About Ground ± 10%	10 V p-p ± 10%	Symmetrical About Ground ± 10% (Fig. 5b)	Center Pulse 3.2 ms for 1 cycle ± 0.05 ms (Fig. 5c)	Flat Area at Ground Level (Fig. 5b)	14 ms Rise Time (Fig. 5d)	Outer Limit: 3 V – 3.5 V Inner Limit: 4 V	LSO 0 V ± 0.3 V	< 90 ms duration of waveform to end of 2nd Plateau (Fig. 4)	Amplitude Start = to End ± 5% Overshoot at end < 1 V (Fig. 6)
Action	Adjust to Specifications							Adj R80 (LSA) for 3 V	Adj R78 (LSO) for Zero Reference	If either of these two checks are out of specifications, the Servo adjustments should be rechecked in sequence of table.	

*Numbers in parenthesis refer to 8 Family processors.
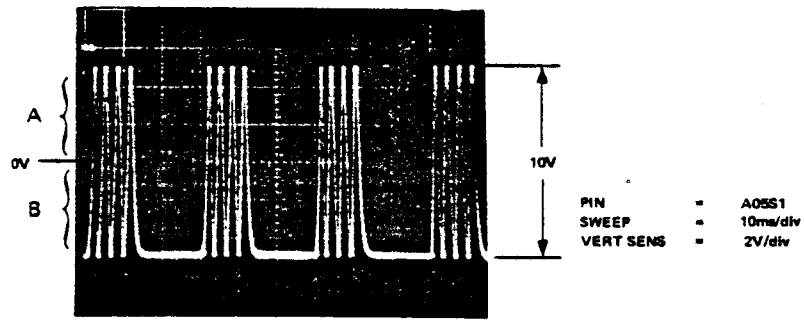
a. Cosine Amplitude/Offset Waveform

PIN	=	A05S1
SWEEP	=	10ms/div
VERT SENS	=	2V/div
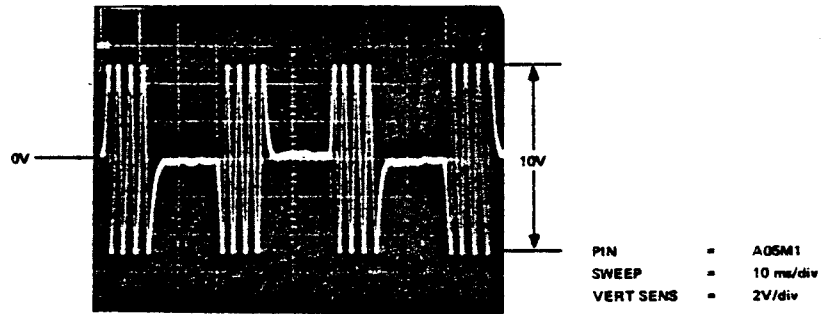
b. Sine Amplitude/Offset and Velocity Offset Waveform
(Symmetrical about Ground)

PIN	=	A05M1
SWEEP	=	10 ms/div
VERT SENS	=	2V/div

velocity = 3.2 ms for RK05 or RK05J
= 2.3 ms for RK05F

PIN	=	A05M1
SWEEP	=	1 ms/div
VERT SENS	=	2V/div
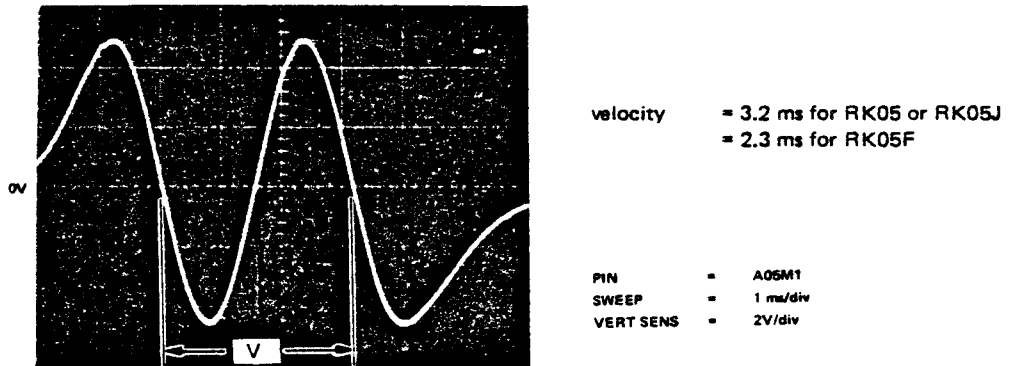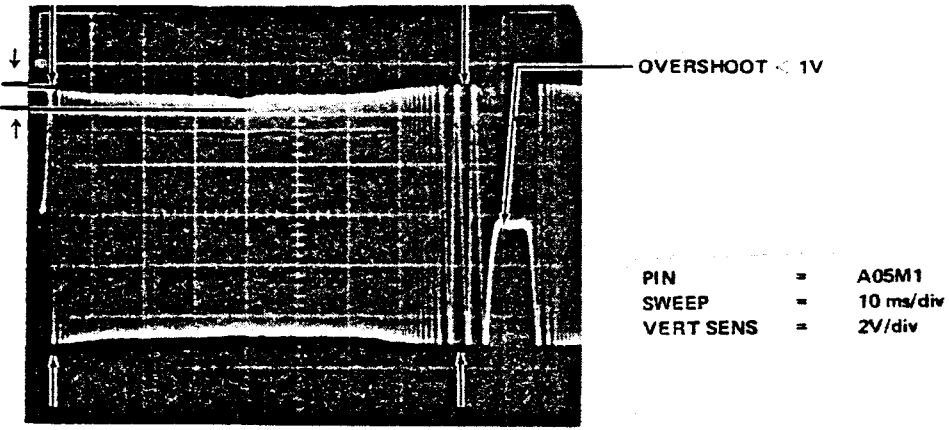
c. Velocity Amplitude Waveform

rise time = 14 ms for RK05 or RK05J
= 13 ms for RK05F

PIN	=	A05H1
SWEEP	=	5 ms/div
VERT SENS	=	0.5V/div
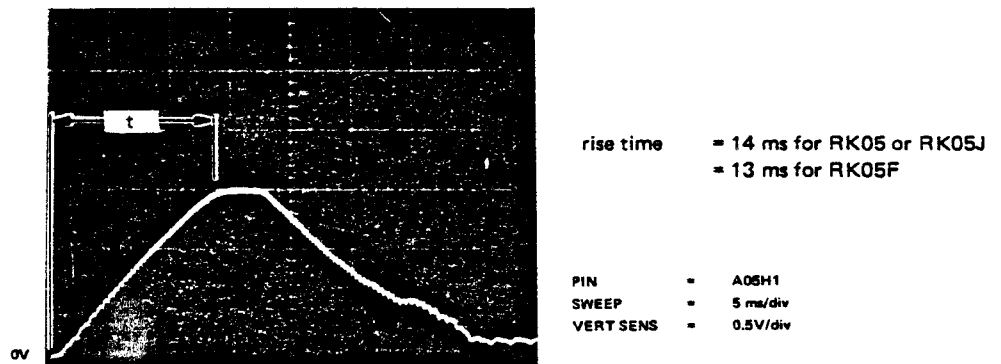
d. Acceleration Waveform

Figure RK05J-5 Servo Adjustment Waveforms

Freq	Operation
A	12. Check the Full Stroke Position Waveform. a. Change GAIN to 0.2 V/cm on oscilloscope. b. Change Channel 1 to A05M1. c. The waveform should be shown as in Figure RK05J-6; if not, proceed to step A13. Figure RK05J-6 Full Stroke Position Waveform NOTE If both the Full Stroke Profile and the Full Stroke Position waveforms were within specifications, do not adjust the servo system; proceed to step 14 of the annual PM.
A	13. Check the Servo Adjustments in the order shown, from left to right in Table RK05J-3.

OPERATION CHECKLIST

System _____   Year _____

Device _____ Ser. No. _____   Sheet _____

Month/Day	/	/	/	/	/	/	/	/	/	/	/	/

If step completed, no adjustments or corrections required ☑

If out of spec, record reading ⊡

Then adjust or correct and indicate PM step completed ⊡

OPERATION CHECKLIST

System _____   Year _____

Device _____ Ser. No. _____   Sheet _____

Month/Day	/	/	/	/	/	/	/	/	/	/	/	/

DEC 12-(553)-1224-N375

d|i|g|i|t|a|l

If step completed, no adjustments or corrections required [·]

If out of spec, record reading [ɣ.ɟ]

Then adjust or correct and indicate PM step completed [ɣ̄ɟ]

Freq	Operation
A	14. Check Spindle Runout

14. Check Spindle Runout

   a.   Ensure the drive has been running at least 30 minutes to achieve thermal stability.

   b.   Install a DEC RK05K-AC alignment cartridge on the drive to be checked. *Write protect drive.*

   c.   (1)   If using the Tester, select cylinder address 105_{10}. Set oscillate mode and momentarily press RUN switch to stop at desired address.

         (2)   If using the oscillate program from Appendix C:

             11 family: Change location 1062 from 205 to 0000 (HALT)
                             LOAD ADDRESS 001000
                             Set switch register to 000151, press START.

              8 family: Change location 7026 from 5200 to 7402 (HALT)
                             LOAD ADDRESS 7000
                             Set switch register to 1510, press START.

   d.   Connect Oscilloscope as follows:

Channel 1	=	TP3 on G180 module
Channel 2	=	TP4 on G180 module (Inverted)
Sync	=	External A02R2
Sweep Time	=	10 μsec/cm
Gain	=	0.2 V/cm (x10 probe) dc
MODE	=	ADD
Trigger	=	Normal
A Sweep Mode	=	Normal
A Triggering	=	External, AC, Level and Slope (-)

   e.   Figure RK05J-7a shows a display with negligible spindle runout, while Figure 7b shows a spindle with considerable runout.

   f.   Calculate Total Runout = % Runout $\times$ 35 μin $\times$ 100.

where

     % Runout = $(X-Y)/(X+Y)$.

For the example shown in Figure 7b:

     Total Runout = $(3.62 - 2.7)/6.32 \times 35$ μin $\times$ 100 = 507.5 μin

($>$14% runout, or $>$ 500 microinches Total Runout, is not acceptable).

   g.   If the total runout is 500 microinches or greater check to be sure spindle and disk mating surfaces are clean. If runout is not acceptable, check again using a different cartridge. If runout still is not acceptable, replace the spindle.

OPERATION CHECKLIST

System _____   Year _____

Device _____   Ser. No. _____   Sheet _____

Month / Day	/	/	/	/	/	/	/	/	/	/	/	/

DEC 12-(553)-1224-N375

digital

If step completed, no adjustments or corrections required ⌐∕

If out of spec, record reading [y.₁]

Then adjust or correct and indicate PM step completed [y.s]

OPERATION CHECKLIST

System _____   Year _____

Device _____ Ser. No. _____   Sheet _____

Month/Day	/	/	/	/	/	/	/	/	/	/	/	/

DEC 12-(553)-1224-N375

digital

If step completed, no adjustments or corrections required ☑

If out of spec, record reading ☑

Then adjust or correct and indicate PM step completed ☑

BRIGHT LINE
SHOULD APPEAR
HERE

TP3 (G180)
TP4 inverted
10 μs/div
0.2V/div (X10 probe)

(a) Negligible Spindle Runout

(b) Considerable Spindle Runout

NOTE

Spindle runout can only be checked using the DEC RK05K-AC
Alignment Cartridge. Many variables can appear as spindle
runout — temperature, dirt on spindle, disk pack imperfections.

Figure RK05J-7 Spindle Runout

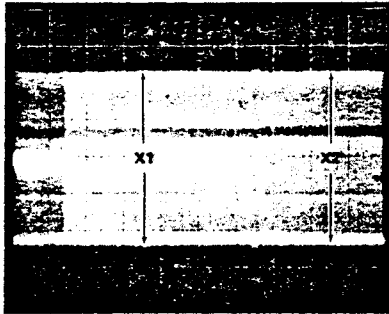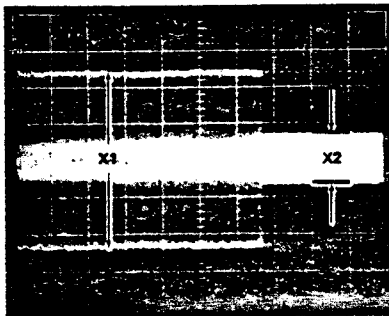| Freq	Operation
A	15. Check Head Alignment (bottom head).
	a. Change oscilloscope setting as follows: Sweep Time = 0.5 ms/cm
	b. Monitor the scope display and compare for one of the waveforms illustrated in Figure RK05J-8.
	c. Calculate the % error to determine if head is within specifications. $$\% \text{ error} = \frac{X_1 - X_2}{X_1 + X_2} \times 100$$
	d. Using a DEC RK05K-AC alignment cartridge, if the error is greater than 15%, it must be realigned to within 6%. If within specs, proceed to Step A16.
	e. Loosen clamp and the adjusting screws and manually move head back or tighten the adjusting screw as required to properly align heads.
	f. Tighten the clamp screw with a torque wrench of 55 in/oz.
	g. Back off the adjustment screw slightly.
	16. Check head alignment (top head)
	a. Select the top head using a tester or jumper. Ground (B07T2) to B08M2.
	b. Repeat the procedure in A15 above for the top head.

OPERATION CHECKLIST

System _____   Year _____

Device _____ Ser. No. _____   Sheet _____

Month/Day	/	/	/	/	/	/	/	/	/	/	/	/

If step completed, no adjustments or corrections required ☑

If out of spec, record reading ☐

Then adjust or correct and indicate PM step completed ☐

OPERATION CHECKLIST

System _____   Year _____

Device _____   Ser. No. _____   Sheet _____

Month/Day	/	/	/	/	/	/	/	/	/	/	/	/

If step completed, no adjustments or corrections required ⌈

If out of spec, record reading ⌐v.s⌐

Then adjust or correct and indicate PM step completed ⌐v.s⌐

DEC RK05-AC Cartridge   **IBM 2315 Cartridge**

a. -85%

e. Large Misalignment

b. -14%

f. -60%

c. 0%

g. -33%

*NULLS EQUAL
WITHIN 20%

d. +55%
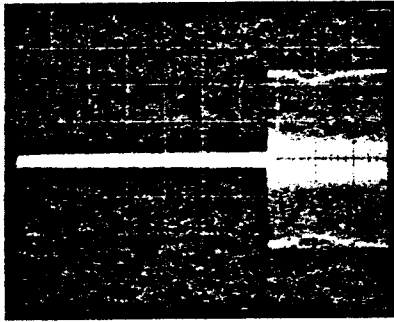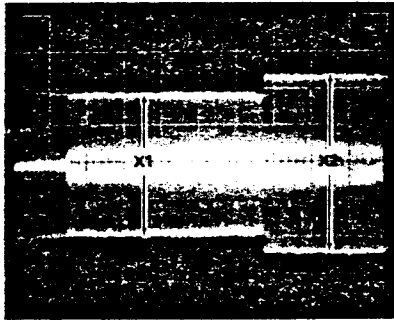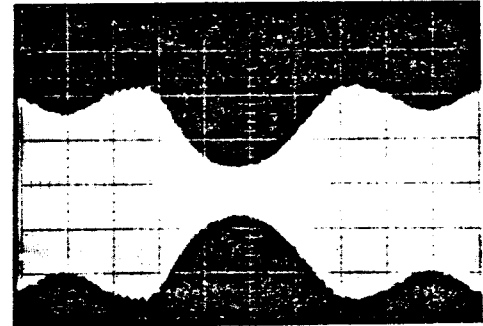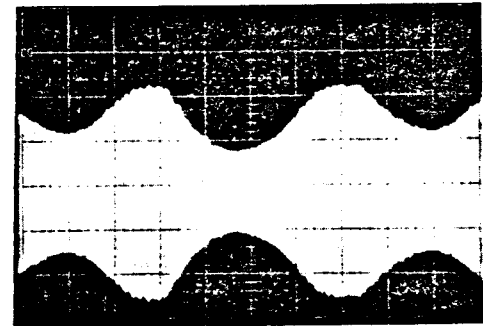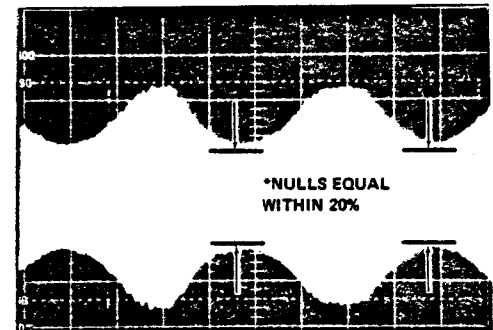
h. Head Correctly Aligned

Figure RK05J-8 Head Alignment Waveforms

Freq	Operation
A	17. Check Sector Delay from both heads. a. Change Oscilloscope as follows: Sweep Time = 10 μsec/cm. b. With the top head already selected from the previous step, measure the distance the single pulse occurs from the start of the sweep, as shown in Figure RK05J-9. c. Remove the jumper from ground (B07T2) to B08M2. Measure the distance the single pulse occurs for the bottom head. d. The specifications for the single pulses should be 70 ± 12 μsec and for the average of the upper and lower heads should by 70 μsec. Average = (Top head + bottom head delay) /2. e. If necessary, adjust R6 on the M7680 module to obtain this average (on older models, adjust R6 on the M7700 module for the same average). f. If this average cannot be adjusted by R6, relocate the Sector Transducer to the right (if the average is too high) or to the left (if the average is too low). Readjust R6 to achieve an average of 70 μsec between the two heads.

INDEX
SECTOR
(A02R2)

INDEX
SECTOR
MARK READ
FROM DISK

0V

PIN   = TP3 & TP4
SWEEP   = 10 us/div
VERT SENS = 2V/div

|←   70 ms   →|
(±12)

M0333

Figure RK05J-9 Index/Sector Waveform

NOTE
Remove ground from pin B4B1 after removal of alignment cartridge.
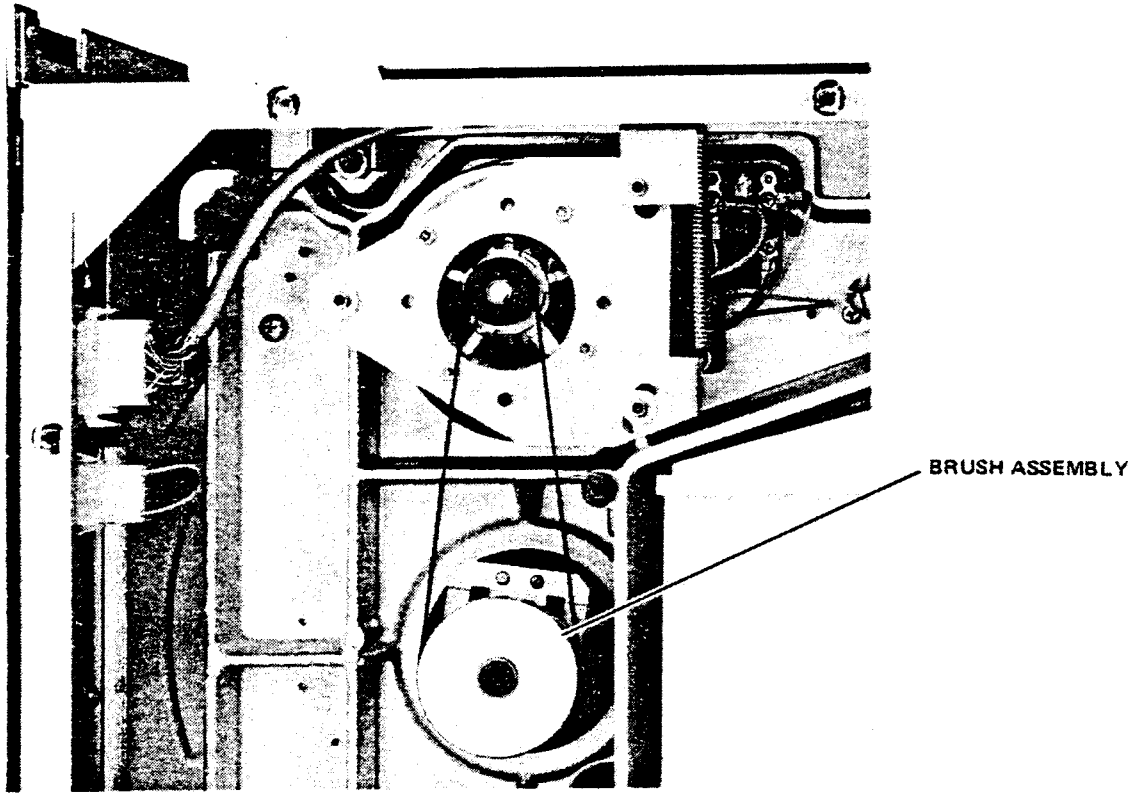Return to step 7 of the Quarterly PM at this time.

OPERATION CHECKLIST

System _____   Year _____

Device _____ Ser. No. _____   Sheet _____

Month/Day	/	/	/	/	/	/	/	/	/	/	/	/

DEC 12-(553)-1224-N375

digital

If step completed, no adjustments or corrections required ☑

If out of spec, record reading 🔲

Then adjust or correct and indicate PM step completed 🔲

OPERATION CHECKLIST

System _____   Year _____

Device _____   Ser. No. _____   Sheet _____

Month/Day	/	/	/	/	/	/	/	/	/	/	/	/

DEC 12-(553)-1224-N375

digital

If step completed, no adjustments or corrections required

If out of spec, record reading 〔4.5〕

Then adjust or correct and indicate PM step completed 〔4.5〕

Table RK05J-4
Head Alignment Summary

	Spindle Runout	Head Adjustment		Sector Delay	
		Bottom Head	Top Head	Bottom Head	Top Head
Ch 1 Test Point	TP 3 (G180)				
Ch 2 Test Point	TP 4 (G180) Invert				
Sync	External A02R2				
CE Pack DEC	(Write Protect) Track 105_{10}				
CE Pack IBM	N/A	(Write Protect) Track 105_{10}		Track 100_{10} (WR Protect)	
Sweep Time	10 μs/div	10 ms/div (IBM) 0.5 ms/div (DEC)		10 μs/div	
Gain (dc) (X10 Probe)	0.2 V/div	20 mV/div (IBM) 0.2 V/div (DEC)		0.2 V/div	
Mode	Add				
Trigger	Normal				
A Sweep Mode	Normal				
A Triggering	Level Slope (−) ac External				
Motion Routine Tester Method	Select Appropriate Cylinder Address Mode: OSC Momentarily press Run switch to stop at desired address				
Motion Routine: Program Control Method	11 Family: Load Oscillate Program (Appendix C) Change Location 1062 from 205 to 0000 (HALT) Load Address 001000 Set SR to 000151 (Track 105) or SR to 000144 (Track 100) START				
Motion Routine: Program Control Method	8 Family Load Oscillate Program (Appendix C) Change Location 7026 from 5200 to 7402 (HALT) Load Address 7000 Set SR to 1510 (Track 105) or SR to 1400 (Track 100) CLEAR, CONTINUE				
Motion Routine: Jumper Method	Connect Ground to Appropriate Pins A07B1, A07C2, A07T1 B07B2, B07C2, B07T1 — A08E1 (64) A08J1 (32) A08C1 (8) A08K1 (1) Place in run mode — A08L1 (4) | GND to B08M2* | GND to B08M2*				
Specifications:	total runout = % runout X 35 μ in. X 100 runout < 500 μ in. (Fig. 7)	DEC: if > 15% adjust to < 6% IBM: if > 50% adjust to < 20% $\frac{X_1 - X_2}{X_1 + X_2} \times 100 = \%$ error (Fig. 8)		Sector Pulse at 70 ± 10 μs Average for upper and lower head equals 70 μs (Fig. 9)	
Action:	Ensure spindle and disk mating surfaces are clean	Adjust Head Selected		Adjust R6 (M7700) older units; R6 (M7680) newer units	

*RK11-D requires surface bit of RKDA (bit 04) to be set in order to see bottom head output. Grounding B08M2 then shows output of top head.
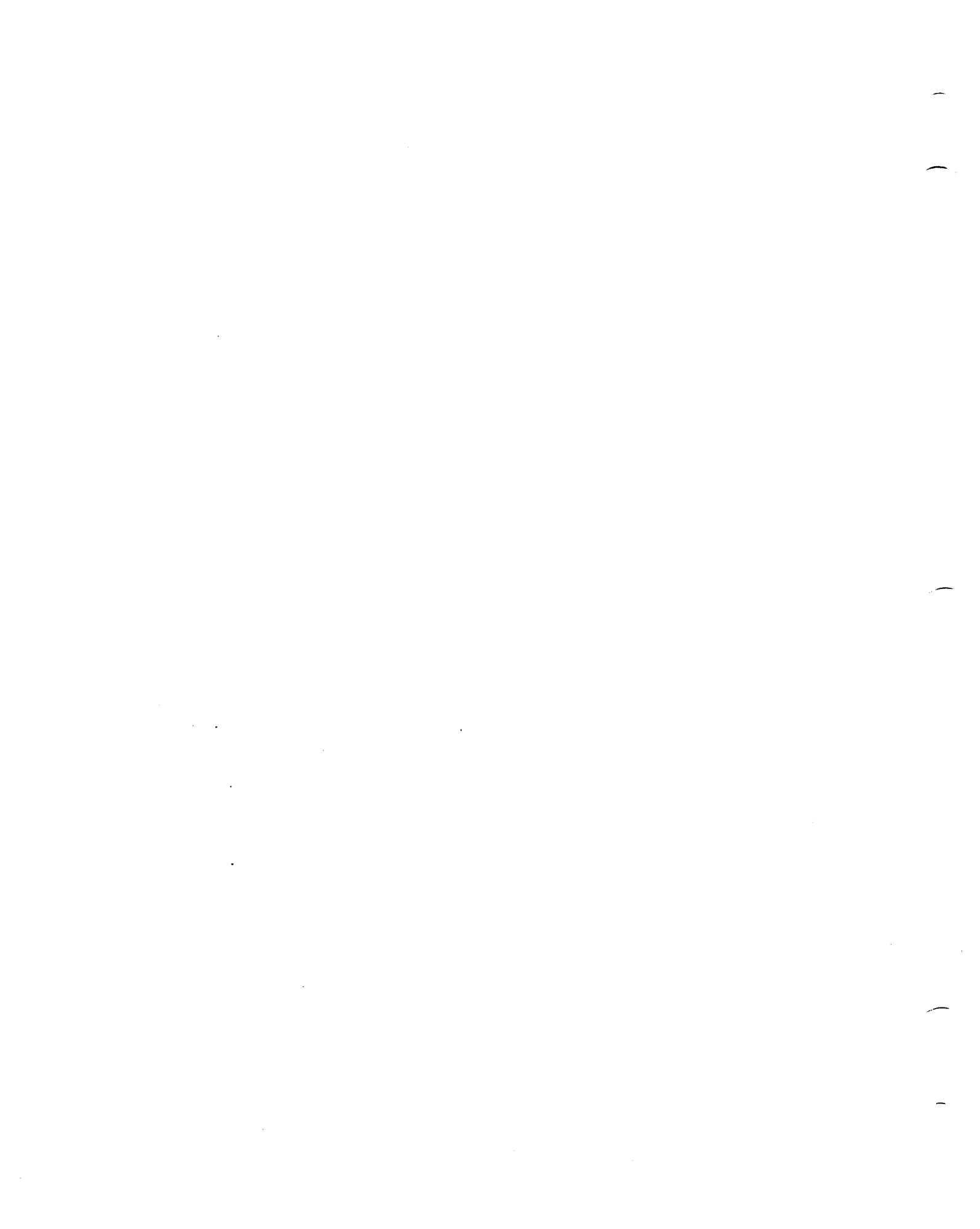Change location 1032 of oscillating seek program from XX0000 to XX0020.

VII-RK05J-23

Freq	Operation
	5-Year Field Service Preventive Maintenance **NOTE** Skip step 1 and/or 2 if the spindle or blower assembly has been replaced as the following steps are inclusive with the replacement of the spindle and blower assemblies.
5YR	1. Replace the Spindle Brush Assembly a. Disconnect the ac line cord. b. Remove the two screws holding the brush assembly (Figure RK05J-3). c. Install the new brush assembly and ensure that curved brushes are centered on the spindle hub and that the brush assembly is not cocked or twisted. Full contact of the brushes to the shaft is necessary to prevent brushes from squealing.
5YR	2. Remove and Clean the Blower. a. Remove the mounting screws from the blower shroud using an Allen head driver. Do not damage the foam seal. b. Remove the blower motor wires from TB4. Green wire Pin1, TB4 Blue wire Pin2, TB4 Black wire Pin4, TB4 c. Lift the blower assembly out of the drive. d. Loosen the locking screws holding the impeller to the motor shaft. e. Clean the impeller in warm soapy water and dry it completely. f. Wipe the inside of the blower housing clean. g. Reinstall the impeller and end plate. Ensure that the screws are tight and that the impeller is located on the shaft, so that it does not make contact with the motor or the inlet ring. h. Reinstall the assembly on the base plate and reconnect the wires to TB4. **NOTE** Return to Step 5 of the Annual PM.

OPERATION CHECKLIST

System _____   Year _____

Device _____ Ser. No. _____   Sheet _____

Month/Day	/	/	/	/	/	/	/	/	/	/	/	/

DEC 12-(553)-1224-N375

digital

If step completed, no adjustments or corrections required ☑

If out of spec, record reading 4.1

Then adjust or correct and indicate PM step completed ☑

OPERATION CHECKLIST

System _____   Year _____

Device _____   Ser. No. _____   Sheet _____

Month/Day	/	/	/	/	/	/	/	/	/	/	/	/

DEC 12-(553)-1224-N375

digital

If step completed, no adjustments or corrections required

If out of spec, record reading [v.s]

Then adjust or correct and indicate PM step completed [v̄s]

BRUSH ASSEMBLY

7854-3

Figure RK05J-10 Carbon Brush Replacement

CAUTION
Care should be taken not to short the regulators to the chassis
or to each other during this procedure.

NOTE
Use this adjustment only if RK05 FCO 00064 (5409484-00005) has been
installed or Regulators are of CS REV H or higher. While performing this
adjustment, the regulators you are adjusting should be connected while all
other regulators should be disconnected. Keep all modules installed to
provide normal loading conditions.

1. Locate the + 15V Regulator, remove it from the RK05 unit and separate it as shown in
   Figure RK05J-A1, so R2 can be adjusted.
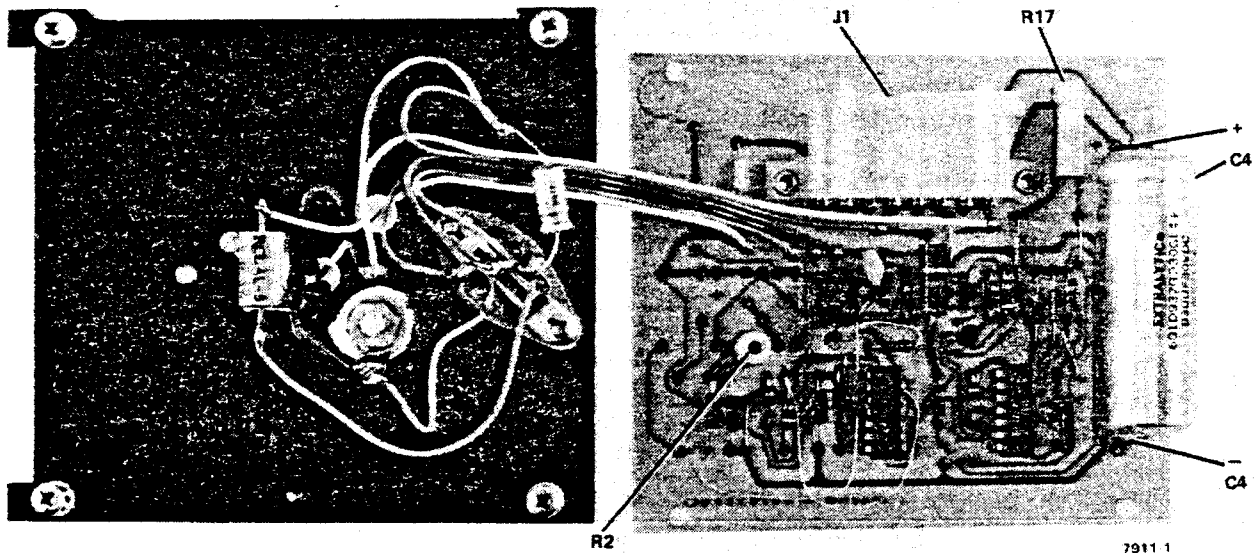
Figure RK05J-A1 8-20 Volt Regulator

2. Turn R2 fully counter-clockwise and apply power to the drive unit.

3. While observing +15V on pin A01D2 (pin with large orange wire), adjust R17 for
   17.0 V ± 0.5 Vdc. Do NOT exceed 17.5 V

4. SCOPE SETTINGS

Gain (dc)	= 0.1 V/cm	"A" Triggering Mode	= LINE
AC coupled		"A" Sweep Mode	= NORMAL
Sweeptime	= 20 s/cm	Mode Trigger	= CH1

   Place the probe on the (+) side of C4 and the probe ground on the (−) side.
   Refer to Figure RK05J-A2.

20μs / DIV

.1V / DIV

300MV
±150MV

20 40 60 80 100 120 140 160 180
(US)
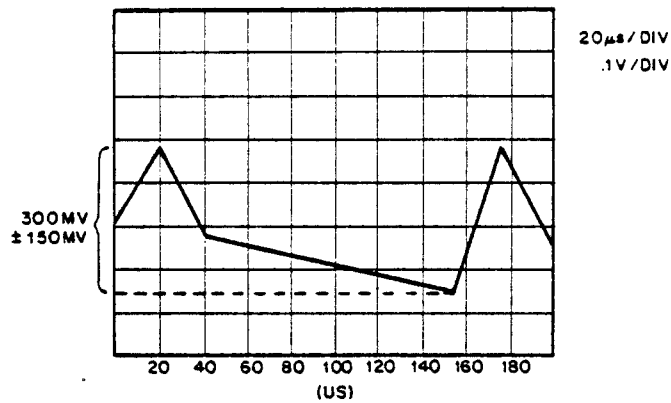
CP-2326

Figure RK05J-A2 C4 Waveform

5. Adjust R2 clockwise until the signal jumps off the screen; this is the only condition for which you are adjusting R2, as E1, the second overvoltage regulator begins to operate.

NOTE
DO NOT adjust the pot any further than necessary because
of excessive peak to peak ripple. Replace any voltage regulator
that exceeds 250 mV ripple (p-p)

6. Reduce the gain of the scope, and the signal should resemble Figure RK05J-A3.

1MS/ DIV

.5V/ DIV

2V
±1V

1 2 3 4 5 6 7 8 9
(MS)
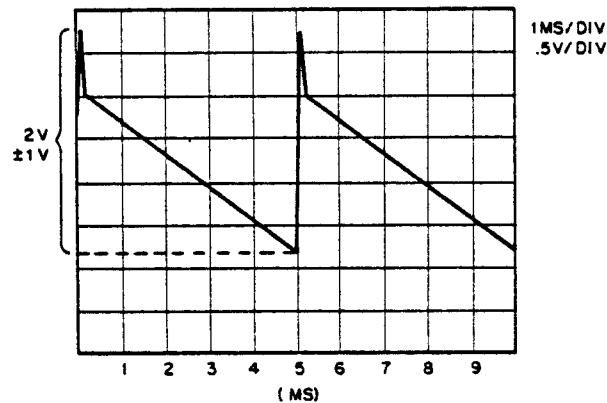
CP-2327

Figure RK05J-A3 Gain Waveform

7. Adjust R17 for a 15 V signal on the scope. Power DOWN, assemble the regulator and mount it back on the drive.

REPEAT THIS PROCEDURE FOR THE –15 V REGULATOR. VOLTAGES WILL BE NEGATIVE AND THE FIGURES WILL BE INVERTED. USE PIN A01B2 (PIN WITH BLUE WIRE). –15 V REGULATOR IS A SEPARATE UNIT.

B.1 MOVE FUNCTIONS

1. STEP — incrementing cylinder seek to limit and a high-speed return.

2. ALT (Alternate) — an incrementing seek from the cylinder address selected.

3. OSC — oscillate between 0 and the cylinder address selected (not affected by FOR/REV).

4. RAND — random cylinder seek.

5. DRIVE SELECTOR — selects the drive number selected on the M7700 module in the RK05.

6. RUN — enables all move functions.

7. RTZ — forces a zero recalibrate.

8. FWD/REV — selects the initial drive motion in step and alternate.

9. CYLINDER ADDRESS — selects any cylinder address from 0 to 202_{10}.

INDICATORS

1. ADDR INV — seeks an address greater than 202.

2. SEEK INC — failure to move the correct number of cylinders in a seek operation. Excess time to perform the seek.

3. POWER ON — indicates power is applied to the drive.

B.2 WRITE FUNCTIONS

1. *WRITE SECTOR — selects a sector (0—7) to write on. ALL writes all sectors. The unit cannot read to check headers.

2. HEAD SELECT — selects or enables the upper or lower head.

3. *WRITE button — causes a write one-shot to write or erase on sector selected.

---

*After the RK05-TA has been used to perform write or erase operations, the disk will have to be reformatted.

4. *CONSTANT WRITE — when set, writes continuously on the sector selected; the WRITE button need not be pressed.

5. *DC ERASE on — enables erase on a sector when the WRITE button is pressed.

6. DATA BITS — sets a 4-bit data pattern to be written on the sector selected.

B.3 CONNECTING THE RK05-TA OFF-LINE TESTER TO THE RK05 DISK DRIVE

1. Disconnect the ac line cord.

2. Remove the interface cable from the RK05.

3. Check the RK05 and the tester to ensure that a M930 Terminator module is present in one of them (slot 7 or 8 of the RK05, or slot 1 or 2 of the RK05-TA Off-Line Tester).

4. Connect a BC11-A cable from slot 1 or 2 of the tester to slot 7 or 8 in the RK05.

5. Disconnect connector J1 in the RK05 (logic voltage connector).

6. Plug one end of the tester power cable into the tester.

7. Check for proper keying of the pins and plug the male connector of the power cable into the female connector of J1.

8. Connect the remaining connector to the plug leading to the logic block of the RK05.

9. Reconnect the ac line cord.

10. Toggle RTZ to initialize and clear all error conditions and proceed with testing.

---

*After the RK05-TA has been used to perform write or erase operations, the disk will have to be reformatted.

11   Family

The following program may be used in place of the jumper method or tester method while performing RK05 maintenance.

Track Address

Decimal	Octal
0	0
4	4
64	100
85	125
105	151
125	175
202	312

PDP-11 Oscillating Seek Program

The PDP-11 program listed at the end of this Appendix is a handy aid when checking the servo signals or performing head alignment. After toggling in the program and patching the drive unit number, the program will cause the drive to seek back and forth between the cylinder addresses set in the left and right bytes of the switch register. Setting the same cylinder address in both bytes will make the drive stay on that cylinter.

Operating Instructions

1.   Toggle program starting at location 1000.

2.   Toggle registers R0 —R6.

3.   Toggle the drive unit number into bits 15—13 of location 1032: XX0000 will select drive XX, surface 0; XX0020 will select drive XX, surface 1.

4.   If error checking or other changes are to be added, change the NOPs in location 1050 and 1052 to jump to (ADDITIONAL) code address. Jump back to location 1054 at the end of added code.

5.   Load address 1000; start.

6.   Set desired cylinder addresses (0—312) into the left and right bytes of the Switch register.

7.   Leave zeroes in the left byte of the Switch register (switches 9—17) while setting up the G-938 card. Decimal 2, 4, 64, and 202 cylinder seeks may then be accomplished by setting octal 2, 4, 100, and 312 into the right byte of the Switch register.

NOTE
Exceeding octal 312 in either Switch register byte will require
a program restart unless error code has been added (see step 4).

8. Setting the same cylinder address in both bytes will result in continuous seeks to that address.

9. This program may be modified using the CORE and MOD commands of the UPDATE program. UPDATE may also be used to output the modified version of any program to DECtape, DECpack or DEC papertape.

10. Repetitive RESTORES may be accomplished by changing location 1060 from 011 to 015.

STARTING ADDRESS 1000

DISK ADDRESS (15–13)
CHANGE LOCATION 1032 IF
DISK IS OTHER THAN DRIVE
ZERO

GENERAL REGISTER USE

R0	WORK	
R1	177570 (SR)	
R2	1014 (SUBROUTINE)	
R3	177404 RKCS	
R4	177412 RKDA	
R5	JSR WORK	
R6	4000 STACK POINTER	

1000	11100	MOV SR, R0	START
	300	SWAB, R0	
	4512	JSR, (R2)	
	11100	MOV SR, R0	
	4512	JSR, (R2)	
1012	772	BR, START	
1014	241	CLC	SUBROUTINE
	42700	BIC	MASK OUT LOWER BYTE
	377	*	MASK OUT LOWER BYTE
	6000	ROR	ROTATE SR DATA INTO CYLINDER
	6000	ROR	ADDRESS SLOT
	6000	ROR	
1030	62700	ADD DA, R0	
	XX0000	*	XX = DISK ADD (15–13)
1034	105713	TSTB	RKCS
	100376	BPL	BRANCH IF CONTROLLER IS BUSY
	32737	BIT	
	100	*	MASK (ACCESS READY)
	177400	*	RKDS
1046	1774	BEQ	BRANCH IF NOT READY
1050	240	NOP	JUMP MAY BE INSERTED FOR
1052	240	NOP	MODIFICATION
1054	10014	MOV R0, RKDA	
	12713	MOV 11, RKCS	(SEEK AND GO)
	11	OR 15, RKCS	(RESTORE AND GO)
1062	205	RTS	

The following program may be used in place of the jumper method or tester method while performing RK05 maintenance.

C.1   OSCILLATE (0 ⟷ Desired Address)

BGN,	7000	7301	/CLA, CLL, IAC
	1	6742	/DCLR
	2	1240	/TAD DRIVE
	3	1236	/TAD SEEK
	4	6746	/DLDC
	5	6743	/DLAG
	6	6741	/DSKP
	7	5206	/JMP-1
	7010	4227	/JMS FLAG
	11	7604	/LAS (Load from SR 0→8 = cyl, 9 = Surface)
	12	7006	/RTL
	13	3241	/DCA SW
	14	7430	/SZL
	15	7001	/IAC
	16	1240	/TAD DRIVE
	17	1236	/TAD SEEK
	7020	6746	/DLDC
	21	1241	/TAD SW
	22	6743	/DLAG
	23	6741	/DSKP
	24	5223	/JMP-1
	25	4227	/JMS FLAG
	26	5200	/JMP BGN
FLAG,	7027	0000	/0000
	7030	1237	/TAD K0200
	31	1240	/TAD DRIVE
	32	6746	/DLDC
	33	6741	/DSKP
	34	5233	/JMP-1
	35	5627	/JMP I FLAG
SEEK	7036	3200	/SEEK, Set transfer done when complete
K0200	7037	0200	/Set transfer done constant.
DRIVE	7040	(Set for Drive)	/Bit 9 & 10
SW	7041	(Address Stored)	/0 → 8 = cyl, 9 = Surface

C2   PROGRAM OPERATION

1.   Load address 7000.

2.   Set SWITCH REGISTER to desired binary cylinder address in bit 0 – 8; desired surface in bit 9.

3.   Press the CLEAR then the CONT switches.

C.3   TO HALT AT A DESIRED LOCATION

1.   Change location 7026 from 5200 to 7402.

2.   Perform program operation, Paragraph C.2.