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ELECTRONIC AND AVIONICS SYSTEMS

MAINTENANCE MANUAL

BENDIX/KING®

KS 177/178/179

SERVOS

MANUAL NUMBER 006-05553-0003
REVISION 3 SEPTEMBER, 1983

KING RADIO MAINTENANCE MANUAL HISTORY AND REVISION INSTRUCTIONS

MANUAL	KS 177, KS 178, and KS 179 Servos
REVISION	3, September, 1983
KING PART NUMBER	006-5553-03

Where R&R appears in the action column, remove the page now in the maintenance manual and replace it with the enclosed page; otherwise, ADD or DESTROY pages as listed. Retain these instructions in the front of the maintenance manual as a Record of Revisions.

PAGE	ACTION	REASON FOR CHANGE
MAIN COVER	R & R	UPDATED
HISTORY REVISION	R & R	UPDATED
KS 177		
i	R & R	UPDATED
5-15/5-21	R & R	UPDATED
KS 178		
i	R & R	UPDATED
5-15/5-19	R & R	UPDATED
KS 179		
i	R & R	UPDATED
4-2	R & R	UPDATED
5-10	R & R	UPDATED
5-16/5-21	R & R	UPDATED
6-1/6-2	R & R	UPDATED
6-3	ADD	UPDATED
6-5	ADD	UPDATED

KING RADIO MAINTENANCE MANUAL HISTORY AND REVISION INSTRUCTIONS

MANUAL KS 177, KS 178, and KS 179 Servos
REVISION 2, January, 1983
KING PART NUMBER 006-5553-02

Where R&R appears in the action column, remove the page now in the maintenance manual and replace it with the enclosed page; otherwise, ADD or DESTROY pages as listed. Retain these instructions in the front of the maintenance manual as a Record of Revisions.

PAGE	ACTION	REASON FOR CHANGE
MAIN COVER	R & R	UPDATED
HISTORY REVISION	ADD	UPDATED
KS 177		
5-11/5-12	R & R	ADDED NEW VERSIONS
Section VI	R & R	UPDATED
KS 178		
i/ii	R & R	UPDATED
5-1	R & R	UPDATED
5-11/5-12	R & R	ADD NEW VERSION
Section VI	R & R	UPDATED
KS 179		
i/ii	R & R	UPDATED
5-1	R & R	UPDATED
5-9/5-10	R & R	ADDED NEW VERSION
Section VI	R & R	UPDATED

KING RADIO MAINTENANCE MANUAL HISTORY AND REVISION INSTRUCTIONS

MANUAL	KS 177, KS 178 and KS 179 Servos
REVISION	1, September, 1982
KING PART NUMBER	006-5553-01

Where R&R appears in the action column, remove the page now in the maintenance manual and replace it with the enclosed page; otherwise, ADD or DESTROY pages as listed. Retain these instructions in the front of the maintenance manual as a Record of Revisions.

PAGE	ACTION	REASON FOR CHANGE
COVER	R&R	UPDATE
HISTORY REVISION	ADD	UPDATE
KS 177		
5-19/5-20	R&R	TYPING ERROR
KS 178		
5-11/5-12	R&R	TABLE 5-5 INFORMATION CHANGED
KS 179		
5-9/5-10	R&R	CHANGED VOLTAGES AND CHANGED ANALOG TO KS 179
5-13/5-14	R&R	ADDED ADJUST AND CHANGED ANALOG TO KS 179

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ELECTRONIC AND AVIONICS SYSTEMS

MAINTENANCE MANUAL

BENDIX/KING®

KS 177

PITCH SERVO

MANUAL NUMBER 006-05276-0003
REVISION 3 SEPTEMBER, 1983

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SECTION IV
THEORY OF OPERATION

4.1 INTRODUCTION

This section contains the General and Detailed Theory of the KS 177 Pitch Servo. The General Theory contains block diagram information on the overall operation of the unit and should be referenced to Figure 4-1. The Detailed Theory contains the circuit operation of the unit in detail and should be referenced to Figure 6-5. Information on alignment and troubleshooting can be found in section V of this manual.

4.2 GENERAL CIRCUIT THEORY

The KS 177 Pitch Servo (Figure 4-1) is an electrically driven servo that converts autopilot electrical error signals into control surface position. It also provides electrical signals to the autopilot system indicating an up or down out-of-trim condition in the pitch axis of the aircraft. The KS 177 is equipped with an adjustable overpower slip clutch that allows the pilot manual authority over the servo actuator.

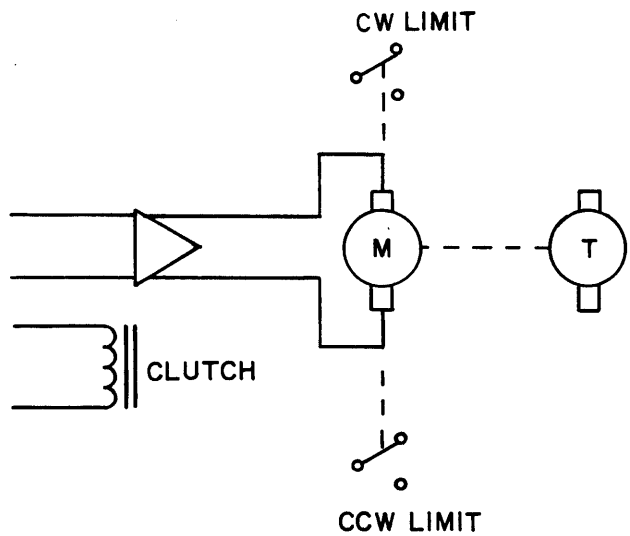


FIGURE 4-1 PITCH SERVO BLOCK DIAGRAM

4.2.1 ENGAGE SOLENOID

The Engage solenoid on the KS 177 is designed to operate from +14VDC or +28VDC depending upon the external strapping. When using the KS 177 in a 28 volt installation, pins B and M are connected, which series connects the two separate windings. The clutch engage signal (+28V) enters pin E and current flows to ground through the series coils. Diode CR105 serves as an arc suppressor to shunt the negative field developed by the coils to ground as the solenoid is turned off.

The solenoid is converted for +14VDC operation by connecting pins M to E and B to C. This parallels the two coils. Engage operation is identical, with the +14VDC signal entering pin E.

4.2.2 MOTOR SPEED SENSING

Motor M202 is mechanically connected to the drive motor (M201) and sends a DC signal directly proportional to the speed of M201 to the KC 191 or KC 192. This signal provides stability in the servo loop.

Certain versions of the KS 177 contain two resistors, R117 and R118, in the motor speed sensing lines which are used to scale the DC signal out at a level needed on certain aircraft.

4.2.3 TORQUE LIMIT SENSORS

The clockwise and counter-clockwise torque limit sensors are located on the engage plate. Aircraft elevator loads are transmitted through the control cables and slip clutch assembly to the servo engage plate assembly. The load causes the motor assembly to move laterally, actuating one of the small microswitches on the engage plate. Screws in the engage plate and motor mount enable the switches to be positioned to detect factory specified torques. The normally open contacts of each switch are routed to pins J and R, and on to the KC 191 or KC 192 computer as an indication that auto-trim signals should be activated.

4.2.4 SERVO VARIATIONS

Variations in the KS 177 servo include different motors, slip clutch settings, speed sense scaling resistors and torque sensing thresholds. The changes in the motor and motor gearheads between the KS 177 versions cause subsequent speed changes as measured at the capstan.

4.3 DETAILED CIRCUIT THEORY

KC 191 or KC 192 servo drive for counterclockwise rotation is applied to pin L through R101, then to I101A. I101A is operated in a non-linear mode until Q103 and Q201 are in the breakdown region. R103 provides current limiting between Q103 and I101A. C102 provides for high frequency oscillations to be shunted. R105 provides for low current drift over a wide temperature range and prevents thermal runaway. When the output of Q201 exceeds 2.2 volts, Q103 and Q201 go into their breakdown region and the gain of I101A becomes a gain of 1. R106 is also supplied through I101A, pin 1, to Q203. Q203 provides a pull down for M201 and provides a ground for the motor.

The emitter of Q201 supplies the high side and tracks I101A. The more voltage at the emitter of Q201, the faster M201 turns. RV101 provides arc suppression off the armature windings of the motor to prevent transistor burnout. R107, CR101, and Q101 provide servo protection in case pin L and pin D are both turned on at the same time. IF pin L and pin D both try to drive at the same time, Q101 shorts the base of Q104 and Q102 shorts the base of Q103. This prevents the servo from turning in any direction and it goes into a shutdown mode until either of the inputs goes low.

Clockwise rotation, at pin D, is applied through R108 to I101B. I101B is a non-linear amplifier until Q104 and Q202 reach their breakdown voltage and turn on, at which time I101B becomes a gain 1 amplifier. Voltage to Q104 is supplied through R110, and the emitter of Q104 supplies the base of Q202. The emitter of Q202 supplies the voltage to motor M201. C104 prevents high frequency oscillations as the motor runs through it's linear region. R112 prevents current runaway and provides temperature compensation on Darlington transistor Q202 in high temperature modes. R114, CR102, and Q102 are the other side of the turn-on to help keep the servo from burning out if both sides should turn on at once.

I101B, pin 7, also supplies Q204 through R113. Q204 provides the pull down to ground for M201. R115 and CR103, a 30 volt zener diode, provides a reference for I101A/B. If the 28 volt line goes above 30 volts it is clamped at 30 volts to prevent damage to I101A/B. C105 clamps any voltage spikes on the 28 volt line to prevent damage to the amplifiers or Q201, Q202, Q103, or Q104. M202 provides a tach feedback output through R117 and R118. These resistors provide the proper tach voltage output. The clutch engage solenoid in the 28 volt mode has its two windings connected in series; B is jumpered to M, and E is supplied with 28 volts. In the 14 volt configuration the two windings are connected in parallel; M is connected to E, and B is connected to ground. CR104, R116, and Q105 provide a ground for the trim sensing switches when the autopilot is engaged. Trim sensing switches S101 and S102 are at ground when the auto pilot is engaged. When a heavy load is experienced, the switches go from the normally closed position to the normally open position.

When I101A/B receive a positive voltage on the input, the output is less than one volt, or at ground potential. This is due to the fact that I101A and I101B have a single supply. When they try to invert the positive voltage they drive it to ground.

SECTION V
MAINTENANCE

5.1 INTRODUCTION

This section contains information on tests, alignment, inspection, cleaning, repair, and troubleshooting procedures for the KS 177 Pitch Servo. Information concerning semiconductor and integrated circuit maintenance, along with specific operating characteristics can be found in Appendix A of this manual.

Basic digital logic theory can also be found in Appendix A. This information is provided to aid the technician in developing a working knowledge of commonly used devices and should not be interpreted as unit theory of operation.

5.2 TEST AND ALIGNMENT

5.2.1 TEST EQUIPMENT

The following test equipment or equivalent is required to properly align and test the KS 177. All test equipment must be checked and confirmed that it is within its calibration period before attempting alignment.

A. King KTS 158 Component Bench Tester:

   KPN 071-5064-00

B. Digital Multimeter:

   Fluke 8000A

C. Torque Wrench:

   SNAP-ON TEP-6FUA

D. Servo Torque Stand:

   KPN 047-4238-01, from KTS 151 Servo Test Kit KPN 050-1603-00 as modified by Service Aid KTS 151-103.

5.2.2 DEFINITION OF STANDARD TEST TERMS AND CONDITIONS

A. Unless otherwise indicated, all voltage measurements are with respect to Pin C (Power Ground).

B. Clockwise (CW) and counterclockwise (CCW) rotation of the capstan is rotation as viewed from the capstan end of the unit.

C. Unless otherwise indicated, all specifications are for performance at ambient room temperature and humidity.

D. Slip clutch performance specifications apply to a new clutch or a clutch with new parts only after the run-in. The run-in shall consist of slipping the clutch into a load of 15 LBF-IN in a CW direction for at least 45 minutes and in a CCW direction for at least 45 minutes.

E. When vibration to minimize friction is required for a test, the unit shall be subjected to a vibration of .002 to .005 inch double amplitude at a frequency of 1500 to 2000 cycles per minute.

F. Solenoid engage voltage and disengagement shall be tested with the servo oriented so that the solenoid axis is horizontal.

G. All tests shall be performed with the unit cover in place, except as noted.

KING
KS 177
PITCH SERVO

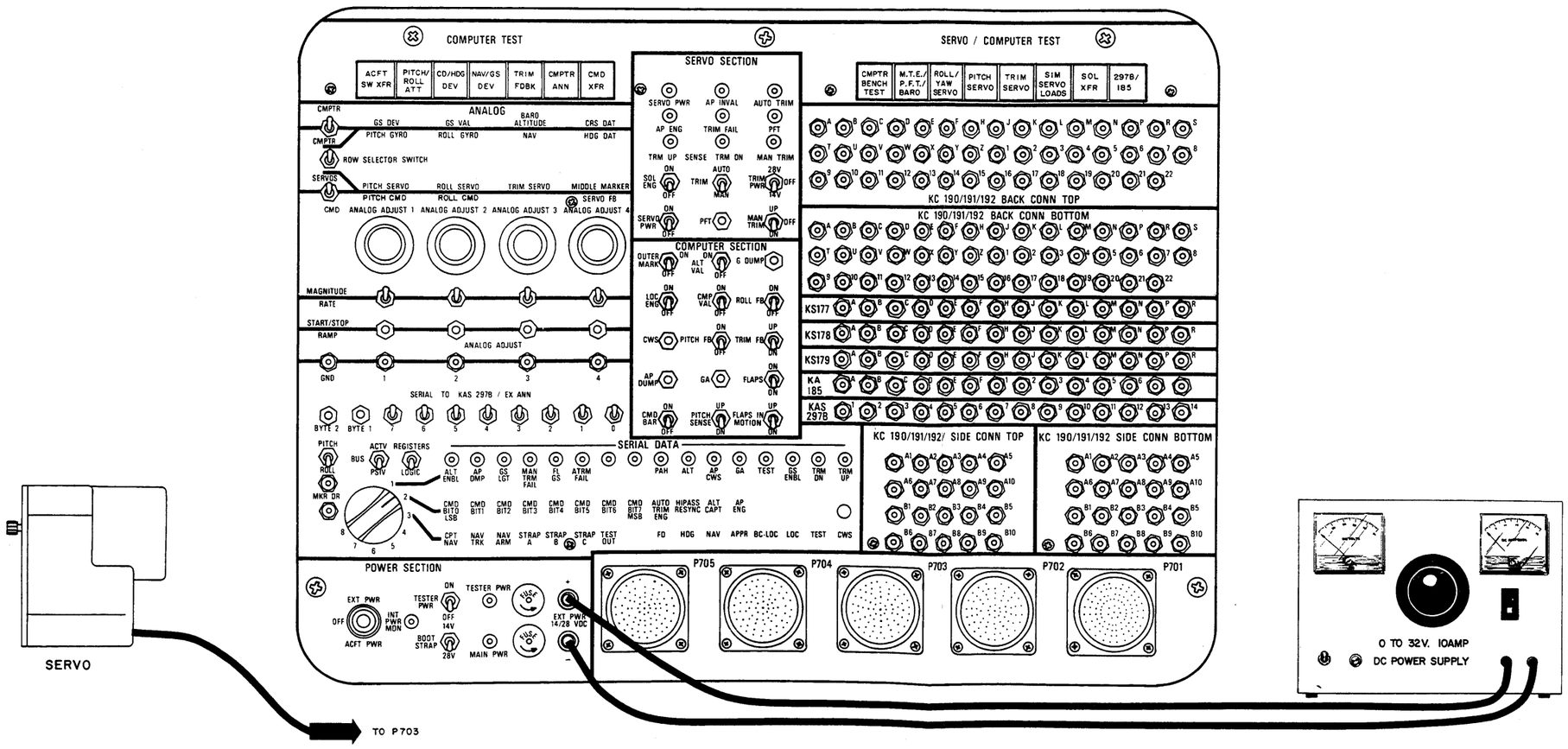


FIGURE 5-1 TEST SETUP
(Dwg. No. 696-3650-00, R-0)

5.2.3 FINAL TEST DATA SHEET

Connect test equipment and servo as shown in Figure 5-1.

NOTE

The term "OK" indicates that particular function is working properly.

5.2.3.1 Initialization

a. Switch the EXT PWR/ACFT PWR switch to OFF.

b. Connect P703 on the KTS 158 to the KS 177 under test.

c. Check the bus voltage of the aircraft that the KS 177 is installed in and test the KS 177 at that voltage. The KS 177 will operate on either 14VDC or 28VDC.

d. Connect the proper input voltage to the KTS 158 EXT PWR test jacks.

e. Set the switches on the KTS 158 as shown in Table 5-1.

CONTROL	LOCATION	POSITION
All switches	Computer Test Section	Out
PITCH SERVO switch	SERVO/COMPUTER TEST section	In
SOL XFR switch	SERVO/COMPUTER TEST section	In
All other switches	SERVO/COMPUTER TEST section	Out
SERVO PWR switch	SERVO SECTION	On
All other switches	SERVO SECTION	Off
All switches	COMPUTER SECTION	Off
ROW SELECTOR switch	ANALOG section	Down
SERVOS/CMD switch	ANALOG section	Servos
MAGNITUDE/RATE 1 switch	ANALOG section	MAGNITUDE
BOOT STRAP switch	POWER SECTION	Same as power bus
TESTER PWR switch	POWER SECTION	On
EXT PWR/ACFT PWR switch	POWER SECTION	EXT/PWR

TABLE 5-1 INITIALIZE CONTROL SETTINGS

f. Connect voltmeter to Test Jack 1 and GND in ANALOG section.

g. Adjust ANALOG ADJUST 1 control for 0.0VDC on voltmeter.

NOTE

The instructions in paragraph 5.2.3.1 e, f, and g must be performed at the beginning of the tests in each of the following paragraphs.

5.2.3.2 Engage Clutch (28VDC Units)

a. Install the KS 177 in the torque fixture (Figure 5-2).

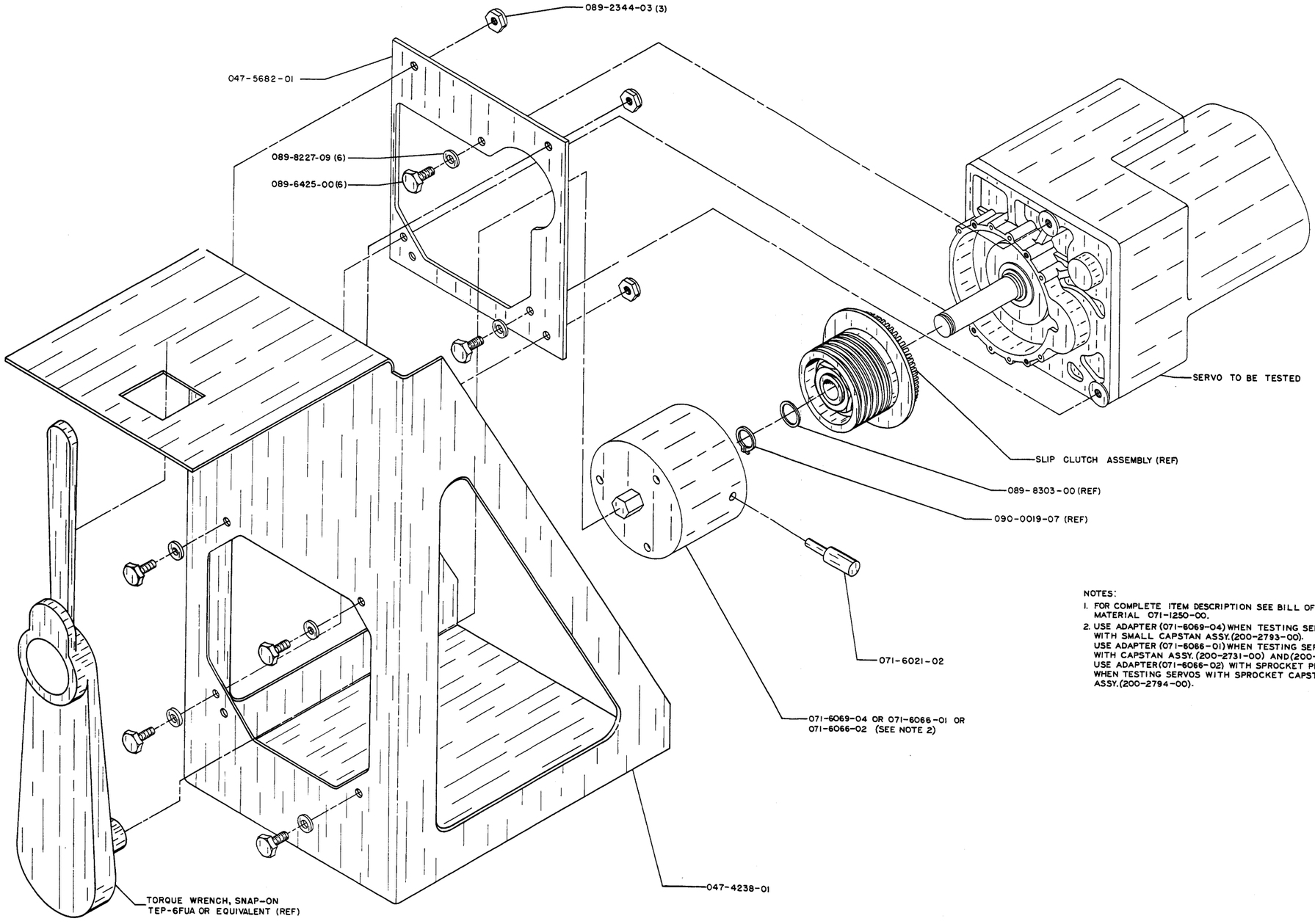
b. Perform the instructions in paragraph 5.2.3.1 e, f, and g.

c. Perform the procedures contained in Table 5-2.

STEP	CONTROL	LOCATION	POSITION	INDICATION	RESULT
1	EXT PWR	Bench power supply	Adjust	+20VDC	
2	SOL ENG switch	SERVO SECTION	On	KS 177 engage clutch engages without hesitation.	
3	ANALOG ADJUST 1	ANALOG	Adjust fully CCW	Slip clutch slips for greater than two revolutions without disengaging.	
4	SOL ENG switch	SERVO SECTION	Off	KS 177 engage clutch disengages in less than 1 sec.	
5	SOL ENG switch	SERVO SECTION	On	KS 177 engage clutch engages.	
6	ANALOG ADJUST 1	ANALOG section	Adjust fully CW	KS 177 slip clutch shall slip for greater than two revolutions without disengaging.	
7	SOL ENG switch	SERVO SECTION	Off	KS 177 engage clutch disengages.	
8	EXT PWR	Bench power supply	Adjust	+28VDC	

TABLE 5-2 ENGAGE CLUTCH (28VDC Units)

KING
KS 177
PITCH SERVO



NOTES:

1. FOR COMPLETE ITEM DESCRIPTION SEE BILL OF MATERIAL 071-1250-00.
2. USE ADAPTER (071-6069-04) WHEN TESTING SERVOS WITH SMALL CAPSTAN ASSY.(200-2793-00). USE ADAPTER (071-6066-01) WHEN TESTING SERVOS WITH CAPSTAN ASSY. (200-2731-00) AND (200-2792-00). USE ADAPTER (071-6066-02) WITH SPROCKET PINS (071-6065-00) WHEN TESTING SERVOS WITH SPROCKET CAPSTAN ASSY.(200-2794-00).

FIGURE 5-2 SERVO TEST KIT ASSEMBLY KTS 158
(Dwg. 300-2944-00, R-0)

5.2.3.3 Engage Clutch (14VDC Units)

a. Install the KS 177 in the torque fixture (Figure 5-2).

b. Perform the instructions in paragraph 5.2.3.1 e, f, and g.

c. Perform the procedures contained in Table 5-3.

STEP	CONTROL	LOCATION	POSITION	INDICATION	RESULT
1.	EXT PWR switch	Bench Power Supply	Adjust	9 ± 0.1VDC	
2.	SOL ENG switch	SERVO SECTION	On	KS 177 engage clutch engages without hesitation.	
3.	ANALOG ADJUST 1 (PITCH SERVO)	ANALOG	Adjust fully CCW	The slip clutch shall slip greater than two revolutions without disengaging.	
4.	SOL ENG switch	SERVO SECTION	Off	KS 177 engage clutch disengages within less than 1 sec.	
5.	SOL ENG switch	SERVO SECTION	On	KS 177 engage clutch engages.	
6.	ANALOG ADJUST 1	ANALOG	Adjust fully CW	The slip clutch shall slip for greater than two revolutions without disengaging.	
7.	SOL ENG switch	SERVO SECTION	Off	KS 177 engage clutch disengages in less than 1 sec.	
8.	EXT PWR switch	Bench Power Supply	Adjust	+14VDC	

Table 5-3 Engage Clutch (14VDC)

5.2.3.4 Motor and Tach Performance

a. Perform the instructions in paragraph 5.2.3.1 e, f, and g.

b. Perform the procedures contained in Table 5-4.

STEP	CONTROL	LOCATION	POSITION	INDICATION	RESULT
1.	SOL ENG switch	SERVO SECTION	On	KS177 engage clutch engaged.	
2.	Connect voltmeter to Test Jack D and Test Jack L in KS177 section.				
3.	ANALOG ADJUST 1 (PITCH SERVO)	ANALOG	Adjust	0.0±0.5VDC	
4.	ANALOG ADJUST 1	ANALOG	Adjust slowly CCW	Until capstan just starts to rotate.	
5.	Connect voltmeter to Test Jack D and Test Jack C in KS177 section. Ensure that value is more positive than -2.0VDC.				
6.	ANALOG ADJUST 1	ANALOG	Adjust	-10.0±0.5VDC	
7.	KS 177 capstan shall rotate at a speed specified in Table 5-5 in a CW direction ± 15%.				
8.	Connect voltmeter to Test Jack A and Test Jack P in KS177 section. Ensure that voltage is equal to motor speed measured in step eight, multiplied by the TACH multiplier given in Table 5-5 ± 15%. Ensure that voltage is negative.				
9.	Connect voltmeter to Test Jack L and Test Jack D.				
10.	ANALOG ADJUST 1	ANALOG	Adjust	0.0±0.5VDC	
11.	ANALOG ADJUST 1	ANALOG	Adjust slowly CW	Until capstan just begins to rotate.	
12.	Connect voltmeter to Test Jack L and Test Jack C in KS177 section. Ensure that voltage measures more positive than -2.0VDC.				
13.	ANALOG ADJUST 1	ANALOG	Adjust	-10.±0.2VDC	

STEP	CONTROL	LOCATION	POSITION	INDICATION	RESULT
14.	KS 177 capstan shall rotate CCW at a speed specified in Table 5-5 ± 15%.				
15.	Connect voltmeter to Test Jack A and Test Jack P in KS177 section. Voltage shall be equal to motor speed measured in test 13 multiplied by TACH multiplier given in Table 5-5 ± 15%. Ensure that the voltage is positive.				
16.	SOL ENG switch	SERVO SECTION	Off	----	
17.	Connect voltmeter to Test Jack 1 and Test Jack GND in ANALOG section.				
18.	ANALOG ADJUST	ANALOG	Adjust	0.0±0.05VDC	

TABLE 5-4 MOTOR AND TACH PERFORMANCE

KS 177 P/N 065-0050-	Paragraphs 5.2.3.4-7, 5.2.3.4-14 Capstan No-load Speed (RPM)	Paragraphs 5.2.3.4-8, 5.2.3.4-15 Tach Multiplier	Paragraphs 5.2.3.5-2, 5.2.3.5-6 Breakout Torque (LBF-IN)	Paragraphs 5.2.3.5-3 5.2.3.5-7 Slip Clutch Torque (LBF-IN)	Paragraohs 5.2.3.5-3, 5.2.3.5-7 Trim Sense Torque Level (LBF-IN)
-01	4.07	1.32	Slip Clutch Torque ± 15%	See Note 2	11 ± 1
-04	2.68	0.685	Slip Clutch Torque ± 15%	See Note 2	6 ± 1/2
-06	4.07	1.08	Slip Clutch Torque ± 15%	55 ± 5	11 ± 1
-07	4.07	1.08	Slip Clutch Torque ± 15%	42 ± 4	11 ± 1
-08	4.07	1.08	Slip Clutch Torque ± 15%	49 ± 5	11 ± 1
-09	4.07	1.08	Slip Clutch Torque ± 15%	45 ± 5	11 ± 1
-10	4.07	1.32	Slip Clutch Torque ± 15%	See Note 2	6 ± 1/2

TABLE 5-5 ALTERNATE VERSION DATA (Con't.)

NOTE

1. This table contains information on units that are currently released. As different part number units are released this table will automatically be updated.

2. The Slip Clutch Torque on most KS 177's is not preset from the factory and will vary from aircraft to aircraft. The Slip Clutch Torque is set during certification and the value can be obtained from the specific aircraft STC installation manual of the Aircraft from which the KS 177 was removed.

TABLE 5-5 ALTERNATE VERSION DATA

5.2.3.5 Slip Clutch Performance

a. Install the KS 177 in the torque fixture (Figure 5-2).

b. Perform the instructions contained in paragraph 5.2.3.1 e, f, and g.

c. Perform the procedures contained in Table 5-6.

STEP	CONTROL	LOCATION	POSITION	INDICATION	RESULT
1	SOL ENG switch	SERVO SECTION	On	KS 177 engage clutch engaged	
2.	ANALOG ADJUST 1	ANALOG section	Adjust	While adjusting slowly CCW, observe clutch breakout point. Breakout torque shall be within torque specified in Table 5-5.	
3.	ANALOG ADJUST 1	ANALOG section	Adjust Fully CCW	Slip clutch torque given in Table 5-5.	
4.	Connect voltmeter to Test Jack D and Test Jack L on KS177 section.				
5.	ANALOG ADJUST 1	ANALOG	Adjust	0.0±0.5VDC	
6.	ANALOG ADJUST 1	ANALOG	Adjust	While adjusting slowly CW, observe that slip clutch breaks out. Break out torque shall be within torque specified in Table 5-5.	
7.	ANALOG ADJUST 1	ANALOG	Adjust fully CW	Slip clutch torque given in Table 5-5.	
8.	SOL ENG	SERVO SECTION	OFF	----	
9.	Connect voltmeter to Test Jack 1 and Test Jack GND in ANALOG section.				
10.	ANALOG ADJUST 1	ANALOG	Adjust	0.0±0.05VDC	

TABLE 5-6 SLIP CLUTCH PERFORMANCE

5.2.3.6 Trim Switch Performance

a. Connect torque wrench to KS 177 capstan using 071-6066-02 or 071-6069-04.

b. Perform the instructions in paragraph 5.2.3.1 e, f, and g.

c. Perform the procedures contained in Table 5-7.

STEP	CONTROL	LOCATION	POSITION	INDICATION	RESULT
1.	SOL ENG engaged	SERVO SECTION	ON	KS 177 engage clutch engaged.	
2.	Connect multimeter to Test Jack J and Test Jack C in KS177 section. Ensure that resistance is greater than 1 megohm.				
3.	Connect multimeter to Test Jack J and Test Jack C in KS177 section. Rotate KS 177 capstan CW until multimeter indicates 200 ±200 ohms. Torque wrench shall read torque given in Table 5-5.				
4.	Remove torque from KS 177 capstan until multimeter indicates greater than 1 megohm. Ensure that torque wrench reads within 4 LBF of reading in step 3.				
5.	Connect multimeter to Test Jack R and Test Jack C. Ensure that multimeter reads greater than 1 megohm.				
6.	Connect multimeter to Test Jack R and Test Jack C. Rotate capstan CCW until multimeter indicates 200 ±200 ohms. Ensure that torque wrench reads torque specified in Table 5-5.				
7.	Remove torque from KS 177 capstan until multimeter indicates greater than 1 megohm. Ensure that torque wrench reads within 4 LBF-IN of test reading in step 6.				

TABLE 5-7 TRIM SWITCH PERFORMANCE

5.2.3.7 Solenoid Performance

a. Perform the instructions in paragraph 5.2.3.1 e, f, and g.

b. Perform the procedures contained in Table 5-8.

STEP	CONTROL	LOCATION	POSITION	INDICATION	RESULT
1	SOL ENG switch	SERVO SECTION	ON	KS 177 engage clutch engaged.	
2.	Observe the position of the servo drive gear with respect to the large gear on the capstan. The capstan should be able to rotate one quarter of a degree to one eighth of a degree (Figure 5-3).				

TABLE 5-8 SOLENOID PERFORMANCE

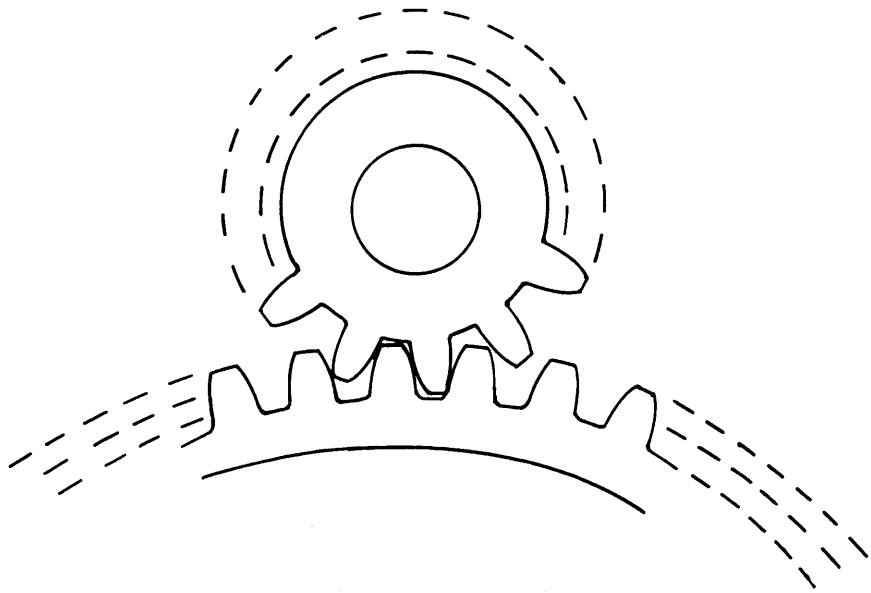


FIGURE 5-3 SERVO GEAR MESH

5.2.4 ALIGNMENT

Alignment procedures for the KS 177 pitch servo are an integral part of the test and assembly procedures and should be performed as described in paragraphs 5.2.3.3a, this procedure, and 5.3.4.

5.2.4.1 Capstan Shaft and Capstan End Play Alignment

NOTE

THE MOTOR/ENGAGE PLATE ASSEMBLY MUST BE REMOVED TO FACILITATE CAPSTAN SHAFT INSTALLATION.

Drawing Reference - Figure 6-1, pages 6-3 and 6-5.

a. Install snap ring (090-0019-07) and washer (089-8304-00) onto center of shaft and slide shaft into the servo plate with the snap ring and washer on the capstan side of the plate.

b. Install washers (089-8295-01/03) as required and snap ring (090-0019-07). The "as required" washers are to achieve an end play of .002 to .008 inch.

c. Install capstan, washer (089-8303-00), shim washers (089-8295-01) as required, and snap ring (090-0019-07). The "as required" washers are to achieve an end play of .002 to .008 inch.

5.2.4.2 Motor Engage Plate End Play Alignment

NOTE

THE SOLENOID ASSEMBLY MUST BE REMOVED TO FACILITATE MOTOR ENGAGE PLATE INSTALLATION.

a. Carefully slide the engage plate assembly onto the main plate. Secure with screw (089-6129-04), washer (089-8225-00) and shims (089-8199-00/01) as required to achieve .002 to .008 inch end play.

b. Install PC board and solenoid per the assembly procedure.

5.2.4.3 Solenoid and Servo/Capstan Gear Alignment

a. Slide the solenoid onto the arm of the engage plate assembly and secure the solenoid with 3 screws (089-6030-04) and lock washers (089-8017-37).

b. With the 3 solenoid mount screws loose, slide the solenoid up or down to obtain .001 to .008 inches of backlash between the motor pinion and its capstan mounting gear.

Reference Figure 5-3, page 5-15, and Figure 6-1 on pages 6-3 and 6-5.

5.2.4.4 Autotrim Sense Micro Switch Alignment

a. Mount the appropriate capstan adapter to the unit. With the servo setting on the bench in the same position it is mounted in the aircraft, connect a 0 to 15 inch pound torque wrench so that it extends out horizontally to the right of the unit.

b. Engage the servo solenoid manually or with the test set at your option. Slowly apply a CCW torque to the capstan (CCW if you were looking directly at the capstan) until the CW (forward) switch clicks. The reading on the torque wrench should be in accordance with Table 5-5 on page 5-11. If the reading is not within this range, adjust the set screw nearest the front of the unit, the set screw that is contacting the engage arm of the front micro switch, as follows: if the reading was high, adjust the set screw in (CW); if the reading was low, adjust the set screw out (CCW).

c. Repeat paragraph b as necessary to achieve trim switch activation within the proper range.

d. With the CW (forward) switch engaged, slowly reduce the torque applied to the capstan until the switch clicks open, the reading on the torque wrench should be within 4 inch pounds of the engage point checked in paragraph b.

e. If the reading in paragraph d is not within the 4 inch pound range, manually twist the motor assembly so that the CW (forward) switch clicks on and the engage arm makes contact with the right rear stop set screw. Adjust the right rear set screw in, while holding pressure, until the switch clicks off. Adjust the set screw back out until the switch just clicks on, then on out a quarter turn more. Repeat paragraphs d and e as necessary to obtain the correct switch range.

f. Correct the torque wrench to the capstan adapter so that it extends out horizontally to the left of the unit. Repeat paragraphs b and c in the opposite direction for the CCW trim sense switch, adjusting the second set screw from the front.

g. Repeat paragraphs d and e in the opposite direction, adjusting the left rear stop set screw. The micro switches should now engage and disengage within specifications.

5.3 OVERHAUL

5.3.1 VISUAL INSPECTION

This section contains instructions to assist in determining the condition of the KS 177 assembly by inspection. Defects resulting from wear, physical damage, deterioration, or other causes can be found by these inspection procedures. To aid inspection, detailed procedures are arranged in alphabetical order.

A. Capacitors, Fixed

Inspect capacitors for case damage, body damage, and cracked, broken, or charred insulation. Check for loose, broken, or improperly soldered connections.

B. Chassis

Inspect the chassis for deformation, dents, punctures, badly worn surfaces, damaged connectors, damaged fastener devices, loose or missing hardware, component corrosion, and damage to finish.

C. Connectors

Inspect connector for broken parts, deformed shells or clamps, and other irregularities. Inspect for cracked or broken insulation and for contacts that are broken, deformed, or out of alignment. Also, check for corroded or damaged plating on contacts and for loose, improperly soldered, broken, or corroded terminal connections.

D. Covers and Shields

Inspect covers and shields for punctures, deep dents, and badly worn surfaces. Also, check for damaged fastener devices, corrosion, and damage to finish.

E. Insulators

Inspect all insulators for evidence of damage, such as broken or chipped edges, burned areas, and presence of foreign matter.

F. Resistors, Fixed

Inspect the fixed resistors for cracked, broken, blistered, or charred bodies and loose, broken, or improperly soldered connections.

G. Terminal Connections Soldered

1. Inspect for cold-soldered or resin joints. These joints present a porous or dull, rough appearance. Check for strength of bond using the points of a tool.

2. Examine the terminals for excess solder, protrusions from the joint, pieces adhering to adjacent insulation, and particles lodged between joints, conductors, or other components.

3. Inspect for insufficient solder and unsoldered strands of wire protruding from conductor at the terminal. Check for insulation that is stripped back too far from the terminal.

4. Inspect for corrosion at the terminal.

H. Wiring

1. Inspect open and laced wiring of chassis, subassembly chassis, and parts of equipment for breaks in insulation, conductor breaks, cut or broken lacing and improper dress in relation to adjacent wiring or chassis.

5.3.2 CLEANING

A. Using a clean, lint-free cloth lightly moistened with a mild cleaning detergent, remove all foreign matter from the equipment case. Wipe dry using a clean, lint-free cloth.

B. Using a hand controlled dry air jet (not more than 15psi), blow the dust from inaccessible areas. Care should be taken to prevent damage by the air blast.

C. Clean the receptacle and plugs with a hand controlled dry air jet (not more than 25psi) and a clean, lint-free cloth lightly moistened with an approved mild cleaning solvent. Wipe dry with a clean, dry, lint-free cloth.

5.3.3 REPAIR

This paragraph describes repair procedures, along with any special techniques for replacing damaged or defective components.

A. Connectors

When replacing a connector, refer to the appropriate PC board assembly drawing and follow notes to ensure correct mounting and mating of each connector.

B. Diodes

Diodes used are silicon and germanium; use long nose pliers as a heat sink under normal soldering conditions. Note the diode polarity before removal.

C. Integrated Circuits

Refer to Appendix "A" for removal and replacement instructions.

D. Wiring

When repairing a wire that has broken from its terminal, remove all old solder and pieces of wire from the terminal, restrip the wire to the necessary length and resolder the wire to the terminal. Replace a damaged wire with one of the same type, size, and length.

5.3.4 DISASSEMBLY/ASSEMBLY PROCEDURES

5.3.4.1 Removal of the Dust Cover

a. To gain access to the components of the servo, remove two (2) screws, KPN 089-6344-04.

b. Slide the Dust Cover off and over the connector.

5.3.4.2 Removal of the Cable Guards

To remove the cable guards first remove mounting screws, KPN 089-6123-05.

5.3.4.3 Removal of the Trim Switches

a. Unsolder the wires which connect the Trim Switches into the wiring harness.

b. Remove the two (2) screws, KPN 089-6119-06, which hold the switches to the engage plate.

5.3.4.4 Removal of the Tach Motor

a. Unsolder the wires which connect the Tach Motor to the wiring harness.

b. Remove the four (4) set screws, KPN 089-5853-04, that secure the drive gears.

c. Slide the gears off the shafts.

d. Remove the three (3) screws, KPN 089-6119-04, that secure the Tach Motor bracket to the drive motor.

e. Remove the two (2) screws, KPN 089-7021-00, that secure the Tach Motor to the bracket.

5.3.4.5 Removal of the Drive Motor/Engage Plate Assembly

a. Unsolder the wires which connect the drive Motor to the wiring harness.

b. Remove the three (3) screws, KPN 089-6030-04, and lockwashers, KPN 089-8017-37, that secure the solenoid to the mainplate, KPN 073-0430-XX.

c. Carefully slide the solenoid off the arm of the engage plate assembly.

d. Remove the return spring, KPN 078-0118-00,and the plunger, KPN 076-1098-01, from the solenoid. At the same time ensure that no wires are pulled from the harness.

e. Remove the two (2) screws, KNP 089-5903-05, that secure the PC board, KPN 200-6304-00, to the main plate. At the same time ensure that no wires are pulled from the harness.

f. Remove one (1) screw, KPN 089-6129-04, washer and shims (if any) which secure the engage plate assembly to the main plate.

g. Carefully slide the engage plate assembly off the main plate.

5.3.4.6 Disassembly of the Motor/Engage Plate Assembly

a. Remove two (2) screws, KPN 089-6119-04, one screw (1), KPN 089-6119-02, and two (2) spring retainers, KPN 047-5716-03 and 047-5621-00.

b. Remove the torque spring, KPN 078-0124-00.

c. Remove the snap ring, KPN 090-0019-09, shims (note number and location of shims for possible future installation), KPN 089-8294-01, and washer, KPN 089-8282-02.

d. Slide off the engage plate from the motor. The bearing, KPN 147-5059-01 is filled with Mobile Grease # 2B and is pressed in the engage plate. The 076-1241-XX bearing is bonded to the motor hub.

e. To remove the switch actuator slide the washer off the bushing and unscrew the two (2) screws, KPN 089-6067-05.

f. To disassemble the motor, drive the roll pin through the pinion gear and then slide the gear off the motor shaft. Be sure to adequately support the pinion gear to prevent bending of the metal shaft.

5.3.4.7 Removal of the Capstan/Slip Clutch Assembly (Large Diameter Capstan)

a. Remove the snap ring, washer and the shims (if any).

b. Slip the capstan/slip clutch assembly and washer off the shaft. Be careful to retain the proper number of shims to facilitate proper reassembly.

c. The shaft can be removed only after the motor has been removed.

d. Remove the snap ring, washers, and shims (if any).

e. Slide the shaft from the main plate.

f. Be careful to retain the proper number of shims to facilitate proper reassembly.

5.3.4.8 Disassembly of the Capstan/Slip Clutch Assembly (Large Diameter Capstan)

a. Remove the locknut that holds the entire assembly.

b. When removing the Belleville springs observe their orientation. The first spring out has its cup facing the capstan; the second one has its cup facing out and the third one has its cup facing the capstan.

c. The assembly will then break down in the following order:

(1) carbon-on-steel clutch plate

(2) copper clutch disc

(3) capstan

(4) copper clutch plate

(5) carbon-on-steel clutch plate

5.3.4.9 Removal of Capstan/Slip Clutch Assembly (Small Diameter Capstan)

a. The capstan/slip clutch assembly can only be removed if the motor has been removed first.

b. First remove the snap ring and shims (note number and location of shims), on the back side of the main plate.

c. Pull the capstan from the main plate.

d. Slide the washer off the shaft. Retain the proper number of shims to facilitate proper assembly.

5.3.4.10 Disassembly of the Capstan/Slip Clutch Assembly (Small Diameter Capstan)

a. The capstan drive gear is pressed onto a roll pin and can be removed by carefully prying between the gear and capstan.

b. Slide the gear off the shaft.

c. To disassemble the slip clutch assembly, remove the snap ring and unscrew the locknut which will in turn decompress the three (3) belleville springs.

d. As the Belleville springs are removed, note their orientation. The first washer out has its cup facing the capstan, the second one has its cup facing out and the third one has its cup facing the capstan.

e. Next remove the following:

(1) Spacer

(2) Carbon-on-steel clutch plate

(3) Copper clutch disc

f. To remove the capstan, line up the small hole drilled into the groove in the capstan with the pin. The pin is a slip fit in the shaft and should easily drop through the hole.

g. Slide the capstan off the shaft, being careful not to drop the copper clutch disc out from the rear of the capstan.

h. The carbon-on-steel clutch plate can now be pulled off the shaft. The amount of pull may seem more than usual since the plate is slightly press fitted onto the shaft.

5.3.4.11 Disassembly of the Solenoid Assembly

a. Unsolder or snip and mark the wires which connect the solenoid to the wiring harness.

b. The roller can be removed from the plunger (removed during removal of the motor) by driving out the pin.

c. The entire assembly can be broken down into individual pieces by the removal of the screw.

d. The plunger stop can now be dropped out.

e. The solenoid coil and spacer can now be slid from the frame.

5.3.4.12 Transistor Removal

a. Power transistor replacement is easily accomplished without removal of the circuit module.

b. Simply remove the screws which fasten the transistors to the sockets. There is no need for unsoldering the leads.

5.4 TROUBLESHOOTING

The purpose of this section is to provide procedures and assistance in troubleshooting the KS 177 Pitch Servo. The troubleshooting charts are written with all indications as they would appear when the KS 177 is connected to a full flight system. Throughout this section, it is assumed that the system problem has been thoroughly diagnosed as a KS 177 problem.

5.4.1 TROUBLESHOOTING ASSISTANCE

When replacing any of the power transistors in the KS 177, check the insulators for areas where particles beneath them may have punched through and would thus short the collector of the transistor to the chassis.

5.4.2 TROUBLESHOOTING CHART

SYMPTOM	PROBABLE CAUSE	TROUBLESHOOTING PROCEDURE
Aircraft will not auto trim, trim self test works satisfactorily	Trim threshold switches alignment is incorrect	Check threshold switch arm alignment
	Trim switch grounding	Check operation of Q105
	Trim threshold switches inoperative	Replace defective trim threshold switch
No CW servo movement during flight CCW movement satisfactory	CW side of amplifier open	Check operation of Q104, Q202, Q204
No CCW servo movement during flight CW movement satisfactory	CCW side of amplifier open	Check operation of Q103 Q201, Q203
No servo movement during flight	Motor open	Check operation of M201
	Solenoid not engaging	Check operation of solenoid
	No power to servo	Check internal wiring
Pitch movements "pumping" or "wallowing" during flight	Tach open or tach gear off	Check operation of M202

ILLUSTRATED PARTS LIST INTRODUCTION

INTRODUCTION

The purpose of this parts list is for identification and requisition of parts. Part numbers listed in this Illustrated Parts List meet critical equipment design specification requirements. Use only those part numbers specified in this section for replacement of parts. Whenever a "caution" is posted concerning the use of a particular part, adherence to the appropriate replacement must be followed.

EXPLANATION OF ILLUSTRATED PARTS LIST

Terminology used on the parts list(s) is listed below.

1. Symbol-Denotes the component reference for both schematic diagrams and mechanical drawings. Example: CR401, whereas CR means Diode device and 401 is its assigned numerical code. The following designators are used by King Radio.

Circuit Designation	Component
C	Capacitor
F	Fuse
I	Integrated Circuit/IC
J	Fixed Connector
L	Inductor
Q	Transistor
P	Plug
R	Resistor
S	Switch
T	Transformer
U	Resistor/Capacitor Network
V	Photocell/tube
Y	Crystal
CJ	Circuit Jumper
CR	Diode
DS	Lamp
FL	Filter
TP	Test Point
WG	Waveguide

2. Part Number-The part number is assigned by King Radio Corporation. The first three digits denote the type of device. Example: 007-1200-00; the 007 denotes a discrete device. The following list are some of the prefixes commonly used by KRC.

Prefix	Component
007	Transistor/Diode
017	Filter
019	Transformer
019	Inductor
030	Connector
111/096/102/106	Capacitor
120	Integrated Circuit
13X	Resistor

3. Description-Defines minimum specification of the component/part. Examole: XSTR S NPN SRF2325 is Transistor, Silicon, NPN and the vendor part number is SRF2325. Example: CAP EL 150UF 50V is Capacitor, Electrolytic, value is 150 microfarad and voltage rating is 50 volts. Following are some of the abbreviations used under Description.

Abbreviation	Word
AL	Aluminum
BIFLR	Bifilar
CC	Carbon Composite
CF	Carbon Film
CH	Choke
CAP	Capacitor
CAP CR	Ceramic
DC	Disk Ceramic
DIO	Diode
EL	Electrolytic
FC	Fixed Composition
FERR	Ferrite
FLTR	Filter
FT	Feed Thru
HV	High Voltage
HW	Half Watt
IC	Integrated Circuit
MC	Monolithic Ceramic
MY	Mylar
PC	Polycarbonate
PF	Precision Film
PP	Paper
PS	Polystrene
QW	Quarter Watt
RES	Resistor
S	Silicon
SCR	Screw
SM	Silver Mica
STDF	Standoff
SW	Switch
TERM	Terminal
TN	Tantalum
TST PT	Test Point
TW	Tenth Watt
VA	Variable
WW	Wire Wound
XFMR	Transformer
XSTR	Transistor
XTAL	Crystal

4. Code UM- Unit of measure, Example: EA for each. The following units are used through the Illustrated Parts List.

Abbreviation	Word
EA	Each
FT	Foot
AR	As Required

5. BOM- Bill of Material is a breakdown of units or parts used to assemble one item.

6. Assy No.- Assembly Number is the assigned number used to identify a mechanical drawing.

ILLUSTRATED PARTS LIST

The Illustrated Parts List (IPL) is organized basically in the following three divisions, Bill of Material (200-XXXX-XX), Parts Layout (300-XXXX-XX), and the Electrical Schematic Diagram (002-XXXX-XX). The IPL may also contain the Final assembly or sub-assembly drawings.

The Assembly drawings reference their mechanical parts with a King Part Number (KPN). Electrical parts are referenced by their circuit designators (i.e. CR402, R908, etc.). Each Assembly parts list is assembled so that mechanical parts are first, in numerical part number order and electrical parts are second in circuit designation order.

The following unusual numbers may appear at times on the BOM and are for commentary purposes only.

Example 1:

CR401 999-9999-99 DO NOT USE

The component designator CR401 had been previously used on the assembly and then deleted; therefore, it cannot be reassigned.

Example 2:

CR401 999-9999-98 NOT USED

The component designator CR401 is available for future assignment and is not presently a part of the PC board/Final assembly.

Example 3:

CR401 999-9999-97 SEE NEXT ASSEMBLY

The component designator CR401 is used as part of the electrical circuit assembly but because of assembly or testing requirements may be part of another assembly.

CR401 999-9999-96 RESERVED

The component designator CR401 is reserved for future usage.

UNIT/BOARD VERSIONS

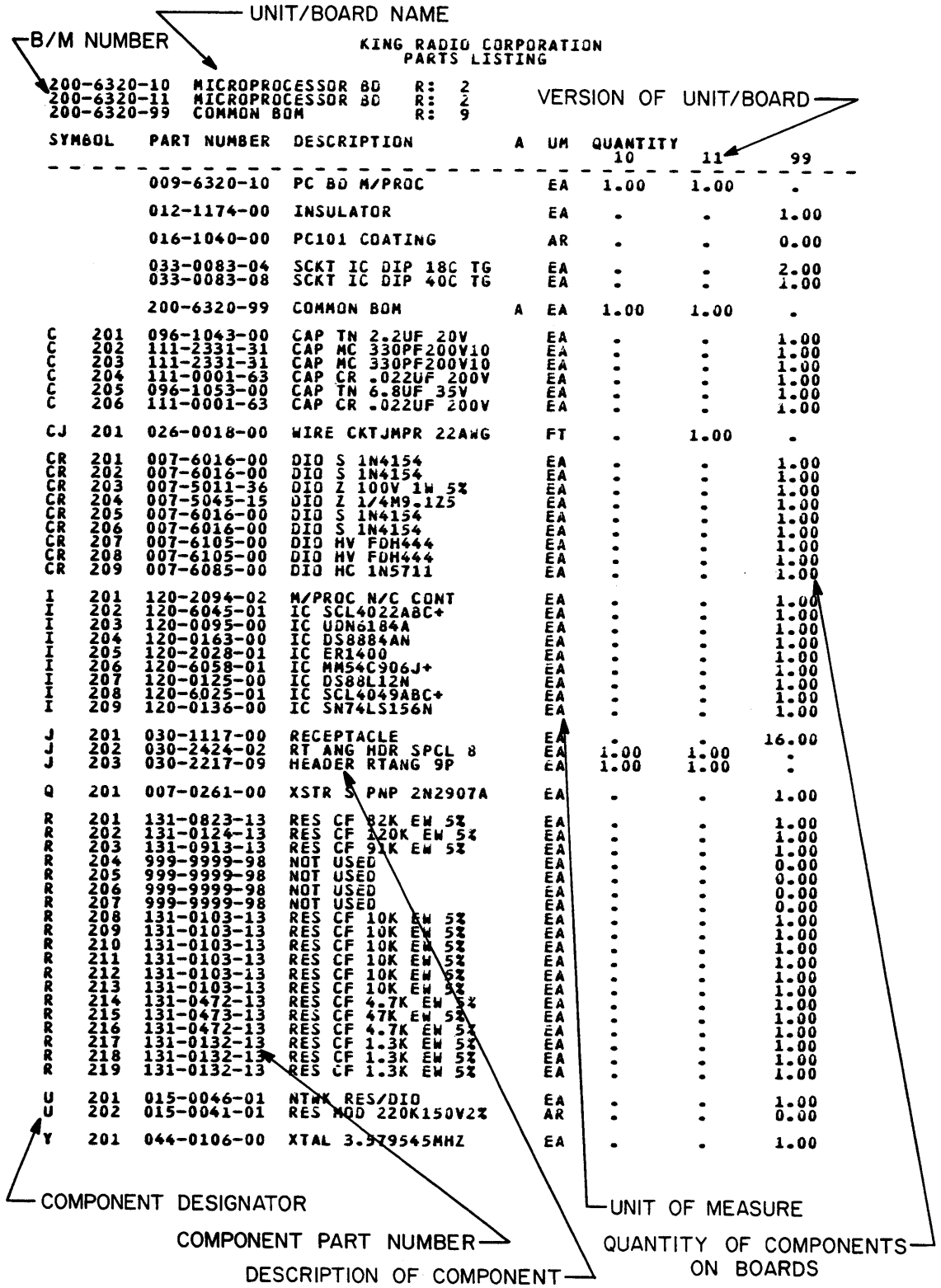
The BOM is arranged to show the Unit or Board version from left to right across the top of the BOM starting with the -00 column. One of the columns, either the -00 or -99 will be common to all versions. The common parts column will have numbers of parts or dashes. The number means the part is common to all versions and the dash means the part is not common to all versions. All parts required to build a unit will be the parts listed in the common version column plus the parts listed in the specific version column.

Example 1: Board Versions

Transmitter Board	-01	-02 or	-99 The common bill may be an -00 or a -99)
007-2050-01	1	-	- Part only on -01 board
007-2051-01	-	1	- Part only on -02 board
007-2052-01	-	-	1 Part on both -01 and -02 boards

Example 2: Unit Versions

Nav/Comm	-01	-02	-99 or -00	
200-1234-01 VOR BD	1	-	-	Bd only on -01 Version
200-1234-02 VOR BD	-	1	-	Bd only on -02 Version
200-4321-01 GS BD	1	-	-	Bd only on -01 Version
200-4321-02 GS BD	-	1	-	Bd only on -02 Version
200-2222-00 PWR SUP	-	-	1	Bd in both -01/-02 Versions
200-1111-00 CHS ASSY	-	-	1	Assy in both -01/02 Versions



KING RADIO CORPORATION
PARTS LISTING

200-6320-10 MICROPROCESSOR BD R: 2
200-6320-11 MICROPROCESSOR BD R: 2
200-6320-99 COMMON BOM R: 9

SYMBOL		PART NUMBER	DESCRIPTION	A	UM	QUANTITY 10	11	99
		009-6320-10	PC BD M/PROC		EA	1.00	1.00	.
		012-1174-00	INSULATOR		EA	.	.	1.00
		016-1040-00	PC101 COATING		AR	.	.	0.00
		033-0083-04	SCKT IC DIP 18C TG		EA	.	.	2.00
		033-0083-08	SCKT IC DIP 40C TG		EA	.	.	1.00
		200-6320-99	COMMON BOM	A	EA	1.00	1.00	.
C	201	096-1043-00	CAP TN 2.2UF 20V		EA	.	.	1.00
C	202	111-2331-31	CAP MC 330PF200V10		EA	.	.	1.00
C	203	111-2331-31	CAP MC 330PF200V10		EA	.	.	1.00
C	204	111-0001-63	CAP CR .022UF 200V		EA	.	.	1.00
C	205	096-1053-00	CAP TN 6.8UF 35V		EA	.	.	1.00
C	206	111-0001-63	CAP CR .022UF 200V		EA	.	.	1.00
CJ	201	026-0018-00	WIRE CKTJMPR 22AWG		FT	.	1.00	.
CR	201	007-6016-00	DIO S 1N4154		EA	.	.	1.00
CR	202	007-6016-00	DIO S 1N4154		EA	.	.	1.00
CR	203	007-5011-36	DIO Z 100V 1W 5%		EA	.	.	1.00
CR	204	007-5045-15	DIO Z 1/4M9.1Z5		EA	.	.	1.00
CR	205	007-6016-00	DIO S 1N4154		EA	.	.	1.00
CR	206	007-6016-00	DIO S 1N4154		EA	.	.	1.00
CR	207	007-6105-00	DIO HV FDH444		EA	.	.	1.00
CR	208	007-6105-00	DIO HV FDH444		EA	.	.	1.00
CR	209	007-6085-00	DIO HC 1N5711		EA	.	.	1.00
I	201	120-2094-02	M/PROC N/C CONT		EA	.	.	1.00
I	202	120-6045-01	IC SCL4022ABC+		EA	.	.	1.00
I	203	120-0095-00	IC UDN6184A		EA	.	.	1.00
I	204	120-0163-00	IC DS8884AN		EA	.	.	1.00
I	205	120-2028-01	IC ER1400		EA	.	.	1.00
I	206	120-6058-01	IC MM54C906J+		EA	.	.	1.00
I	207	120-0125-00	IC DS88L12N		EA	.	.	1.00
I	208	120-6025-01	IC SCL4049ABC+		EA	.	.	1.00
I	209	120-0136-00	IC SN74LS156N		EA	.	.	1.00
J	201	030-1117-00	RECEPTACLE		EA	.	.	16.00
J	202	030-2424-02	RT ANG HDR SPCL 8		EA	1.00	1.00	.
J	203	030-2217-09	HEADER RTANG 9P		EA	1.00	1.00	.
Q	201	007-0261-00	XSTR S PNP 2N2907A		EA	.	.	1.00
R	201	131-0823-13	RES CF 82K EW 5%		EA	.	.	1.00
R	202	131-0124-13	RES CF 120K EW 5%		EA	.	.	1.00
R	203	131-0913-13	RES CF 91K EW 5%		EA	.	.	1.00
R	204	999-9999-98	NOT USED		EA	.	.	0.00
R	205	999-9999-98	NOT USED		EA	.	.	0.00
R	206	999-9999-98	NOT USED		EA	.	.	0.00
R	207	999-9999-98	NOT USED		EA	.	.	0.00
R	208	131-0103-13	RES CF 10K EW 5%		EA	.	.	1.00
R	209	131-0103-13	RES CF 10K EW 5%		EA	.	.	1.00
R	210	131-0103-13	RES CF 10K EW 5%		EA	.	.	1.00
R	211	131-0103-13	RES CF 10K EW 5%		EA	.	.	1.00
R	212	131-0103-13	RES CF 10K EW 5%		EA	.	.	1.00
R	213	131-0103-13	RES CF 10K EW 5%		EA	.	.	1.00
R	214	131-0472-13	RES CF 4.7K EW 5%		EA	.	.	1.00
R	215	131-0473-13	RES CF 47K EW 5%		EA	.	.	1.00
R	216	131-0472-13	RES CF 4.7K EW 5%		EA	.	.	1.00
R	217	131-0132-13	RES CF 1.3K EW 5%		EA	.	.	1.00
R	218	131-0132-13	RES CF 1.3K EW 5%		EA	.	.	1.00
R	219	131-0132-13	RES CF 1.3K EW 5%		EA	.	.	1.00
U	201	015-0046-01	NTWK RES/DIO		EA	.	.	1.00
U	202	015-0041-01	RES MOD 220K150V2%		AR	.	.	0.00
Y	201	044-0106-00	XTAL 3.579545MHZ		EA	.	.	1.00

KING RADIO CORPORATION
PARTS LISTING

065-0050-00 PITCH SERVO R: 11
065-0050-01 PITCH SERVO ASSY R: 5
065-0050-04 PITCH SERVO ASSY R: 5
065-0050-06 PITCH SERVO ASSY R: 4
065-0050-07 PITCH SERVO ASSY R: 2
065-0050-08 PITCH SERVO ASSY R: 2
065-0050-09 PITCH SERVO ASSY R: 2
065-0050-10 PITCH SERVO ASSY R: 1

SYMBOL	PART NUMBER	DESCRIPTION	A	UM	QUANTITY 00	01	04	06	07	08	09	10
	016-1008-04	GLYPTAL 7526 BL		AR	0.00	.	.	.	.	.	.	.
	016-1016-00	MOLYKOTE G-N PASTE		AR	0.00	.	.	.	.	.	.	.
	025-0003-00	WIRE 22 BLK		FT	0.80	.	.	.	.	.	.	.
	025-0003-01	WIRE 22 BRN		FT	0.40	.	.	.	.	.	.	.
	025-0003-02	WIRE 22 RED		FT	0.80	.	.	.	.	.	.	.
	025-0018-31	WIRE 26 OR/BN		FT	0.40	.	.	.	.	.	.	.
	025-0018-33	WIRE 26 ORN		FT	0.40	.	.	.	.	.	.	.
	025-0018-34	WIRE 26 OR/YL		FT	0.40	.	.	.	.	.	.	.
	025-0018-36	WIRE 26 OR/BU		FT	0.40	.	.	.	.	.	.	.
	025-0018-40	WIRE 26 YL/BK		FT	0.40	.	.	.	.	.	.	.
	025-0018-42	WIRE 26 YL/RD		FT	0.40	.	.	.	.	.	.	.
	025-0018-44	WIRE 26 YEL		FT	0.40	.	.	.	.	.	.	.
	025-0018-45	WIRE 26 YL/GN		FT	0.80	.	.	.	.	.	.	.
	025-0018-52	WIRE 26 GN/RD		FT	0.40	.	.	.	.	.	.	.
	025-0018-53	WIRE 26 GN/OR		FT	0.40	.	.	.	.	.	.	.
	025-0018-62	WIRE 26 BU/RD		FT	0.40	.	.	.	.	.	.	.
	025-0018-68	WIRE 26 BU/GY		FT	0.40	.	.	.	.	.	.	.
	025-0018-77	WIRE 26 VIO		FT	0.40	.	.	.	.	.	.	.
	025-0018-79	WIRE 26 VI/WH		FT	0.40	.	.	.	.	.	.	.
	025-0018-96	WIRE 26 WH/BU		FT	0.40	.	.	.	.	.	.	.
	025-0029-00	WIRE 24 BLK		FT	0.40	.	.	.	.	.	.	.
	025-0029-02	WIRE 24 RED		FT	0.40	.	.	.	.	.	.	.
	025-0029-04	WIRE 24 YEL		FT	0.40	.	.	.	.	.	.	.
	025-0029-10	WIRE 24 BK/WH		FT	0.40	.	.	.	.	.	.	.
	025-0029-12	WIRE 24 RD/WH		FT	0.40	.	.	.	.	.	.	.
	025-0029-15	WIRE 24 GN/WH		FT	0.40	.	.	.	.	.	.	.
	025-0029-20	WIRE 24 GN/YL		FT	0.40	.	.	.	.	.	.	.
	025-0029-28	WIRE 24 RD/BK		FT	0.40	.	.	.	.	.	.	.
	025-0029-33	WIRE 24 WH/OR		FT	0.40	.	.	.	.	.	.	.
	029-0460-02	GEAR 63T64DP W/HUB	A	**	1.00	.	.	.	.	.	.	.
	029-0461-02	GEAR 69T64DP W/HUB	A	**	1.00	.	.	.	.	.	.	.
	047-5213-01	TACH MTG BRKT W/F		EA	1.00	.	.	.	.	.	.	.
	047-5513-02	STRN RLF BRKT W/H		EA	1.00	.	.	.	.	.	.	.
	047-6082-01	CABLE GUARD W/F		EA	.	1.00	.	1.00	1.00	1.00	1.00	1.00
	047-6083-02	PLT CA GUARD W/H-C	A	EA	.	1.00	.	1.00	1.00	1.00	1.00	1.00
	057-2378-00	S/N TAG		EA	1.00	.	.	.	.	.	.	.
	057-2439-00	WARNING TAG		EA	1.00	.	.	.	.	.	.	.
	065-0050-00	PITCH SERVO	A	EA	.	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	073-0430-03	MAIN PLATE W/HDW	A	EA	1.00	.	.	.	.	.	.	.
	073-0489-01	CABLE GUARD LONG		EA	.	.	2.00	.	.	.	.	.
	076-1235-01	SHAFT W/F	A	EA	.	1.00	.	1.00	1.00	1.00	1.00	1.00
	078-0118-00	RETURN SPRG-SLND		EA	1.00	.	.	.	.	.	.	.
	088-0919-00	DUST COVER 4.87		EA	1.00	.	.	.	.	.	.	.
	089-5436-03	SCR FHP 4-40X3/16		EA	2.00	.	.	.	.	.	.	.
	089-5853-04	SCR SET 2-56X1/8		EA	4.00	.	.	.	.	.	.	.
	089-5903-05	SCR PHP 4-40X5/16		EA	2.00	.	.	.	.	.	.	.
	089-5946-08	SCR PHP 6-20X1/2		EA	8.00	.	.	.	.	.	.	.
	089-6030-04	SCR SHC 8-32 1/4		EA	3.00	.	.	.	.	.	.	.
	089-6119-03	SCR PHP 2-56X3/16		EA	3.00	.	.	.	.	.	.	.
	089-6123-03	SCR PHP 4-40X3/16		EA	.	3.00	.	3.00	3.00	3.00	3.00	3.00
	089-6123-05	SCR PHP 4-40X5/16		EA	2.00	2.00	.	2.00	2.00	2.00	2.00	2.00
	089-6123-06	SCR MPH 5-44X3/8		**	2.00	.	.	.	.	.	.	.
	089-6129-04	SCR PHP 8-32X1/4		EA	1.00	.	.	.	.	.	.	.
	089-6344-04	SCR PHP 4-40X1/4		EA	2.00	.	.	.	.	.	.	.
	089-7021-00	METRIC SCREW		EA	2.00	.	.	.	.	.	.	.
	089-8017-37	WSHR INTL LK #8		EA	3.00	.	.	.	.	.	.	.

KING RADIO CORPORATION
PARTS LISTING

065-0050-XX

SYMBOL		PART NUMBER	DESCRIPTION	A	UM	QUANTITY 00	01	04	06	07	08	09	10
		089-8199-00	WSHR SHIM		AR	0.00	.	.	.	.	.	.	.
		089-8199-01	WSHR SHIM		AR	0.00	.	.	.	.	.	.	.
		089-8199-02	SHIM .015 T		EA	1.00	.	.	.	.	.	.	.
		089-8225-00	WSHR THRUST		EA	1.00	.	.	.	.	.	.	.
		089-8295-01	WASHER W/FINISH		AR	0.00	.	.	.	.	.	.	.
		089-8295-03	WASHER W/FINISH		AR	0.00	.	.	.	.	.	.	.
		089-8303-00	WASHER		EA	.	1.00	.	1.00	1.00	1.00	1.00	1.00
		089-8304-00	WASHER		EA	1.00	.	.	.	.	.	.	.
		090-0019-07	RING RTNR .438		EA	1.00	2.00	.	2.00	2.00	2.00	2.00	2.00
		091-0007-02	BSHG STRN RELIEF		EA	1.00	.	.	.	.	.	.	.
		091-0283-00	TO3 INSULATOR		EA	4.00	.	.	.	.	.	.	.
		091-0286-00	INSUL XSTR .437		EA	2.00	.	.	.	.	.	.	.
		200-2596-01	ENGAGE PLATE ASSY	A	EA	.	1.00	.	1.00	1.00	1.00	1.00	1.00
		200-2596-02	ENGAGE PLATE ASSY	A	EA	.	.	1.00	.	.	.	.	.
		200-2598-00	HARNESS ASSY	A	EA	1.00	.	.	.	.	.	.	.
		200-2731-00	SLIP CLUTCH ASSY	A	EA	.	1.00	.	1.00	1.00	1.00	1.00	1.00
		200-2793-00	SLIP CLUTCH ASSY	A	EA	.	.	1.00	.	.	.	.	.
		200-2841-00	SOLENOID ASSY	A	EA	1.00	.	.	.	.	.	.	.
		200-6304-00	CIRCUIT BOARD	A	EA	1.00	.	.	.	.	.	.	.
M	202	148-5011-00	MTR 6VDC		EA	1.00	.	.	.	.	.	.	.
Q	201	007-6127-00	XSTR S NPN 2N5632		EA	1.00	.	.	.	.	.	.	.
Q	202	007-6127-00	XSTR S NPN 2N5632		EA	1.00	.	.	.	.	.	.	.
Q	203	007-6128-00	XSTR DARL 2N6059		EA	1.00	.	.	.	.	.	.	.
Q	204	007-6128-00	XSTR DARL 2N6059		EA	1.00	.	.	.	.	.	.	.
R	117	026-0018-00	WIRE CKTJMPR 22AWG		EA	.	1.00	.	.	.	.	.	1.00
R	117	131-0152-13	RES CF 1.5K 1W 5%		EA	.	.	.	1.00	1.00	1.00	1.00	.
R	117	131-0622-13	RES CF 6.2K 1W 5%		EA	.	.	1.00	.	.	.	.	.
R	118	131-0103-13	RES CF 10K 1W 5%		EA	.	.	1.00	1.00	1.00	1.00	1.00	.
R	201	132-0103-02	RES WW 2 10W 10%		EA	1.00	.	.	.	.	.	.	.

KING
KS 177
PITCH SERVO

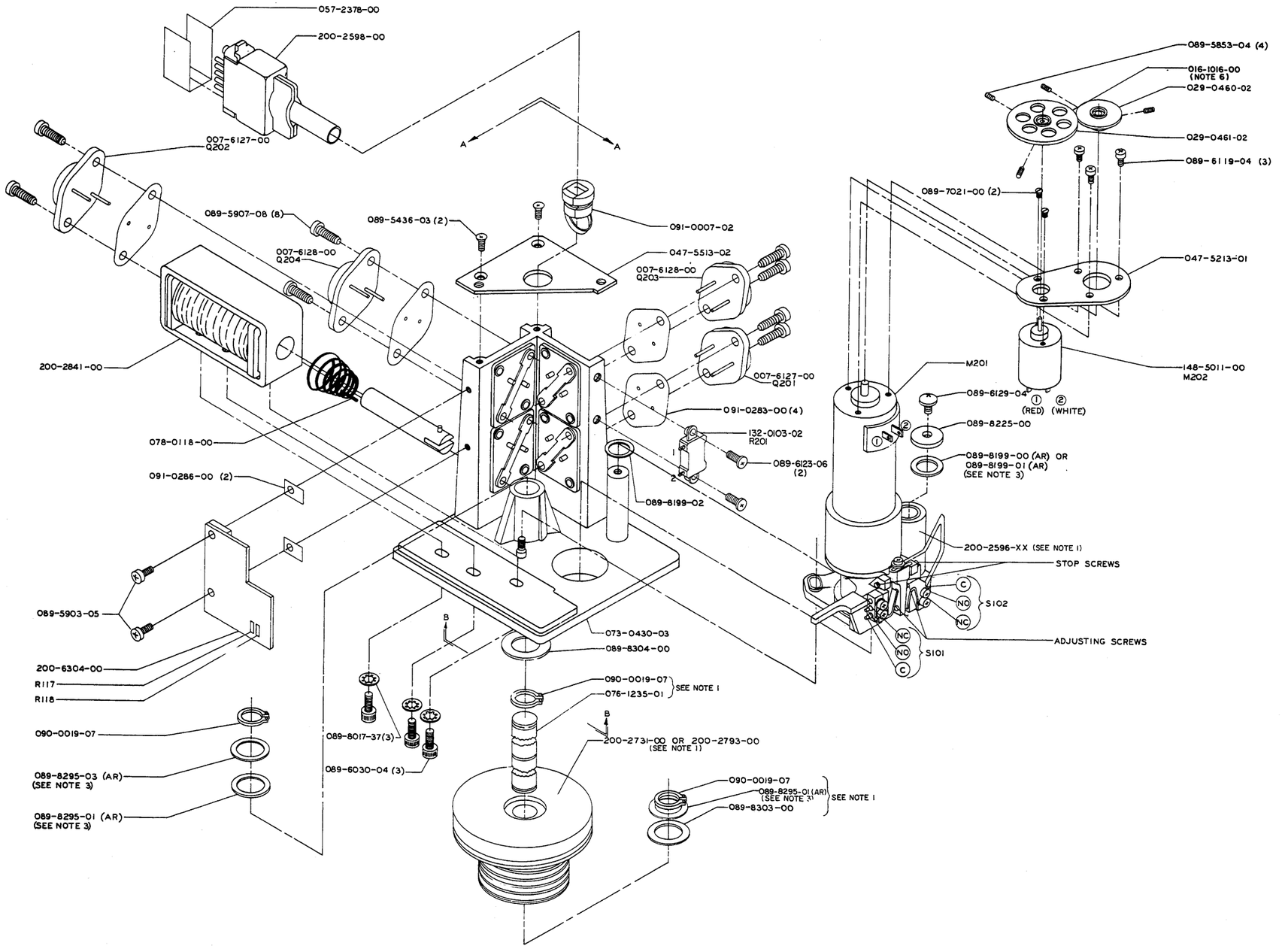


FIGURE 6-1 PITCH SERVO ASSEMBLY
(Dwg. No. 300-2605-00, R-13)
(Sheet 1 of 2)

KING
KS 177
PITCH SERVO

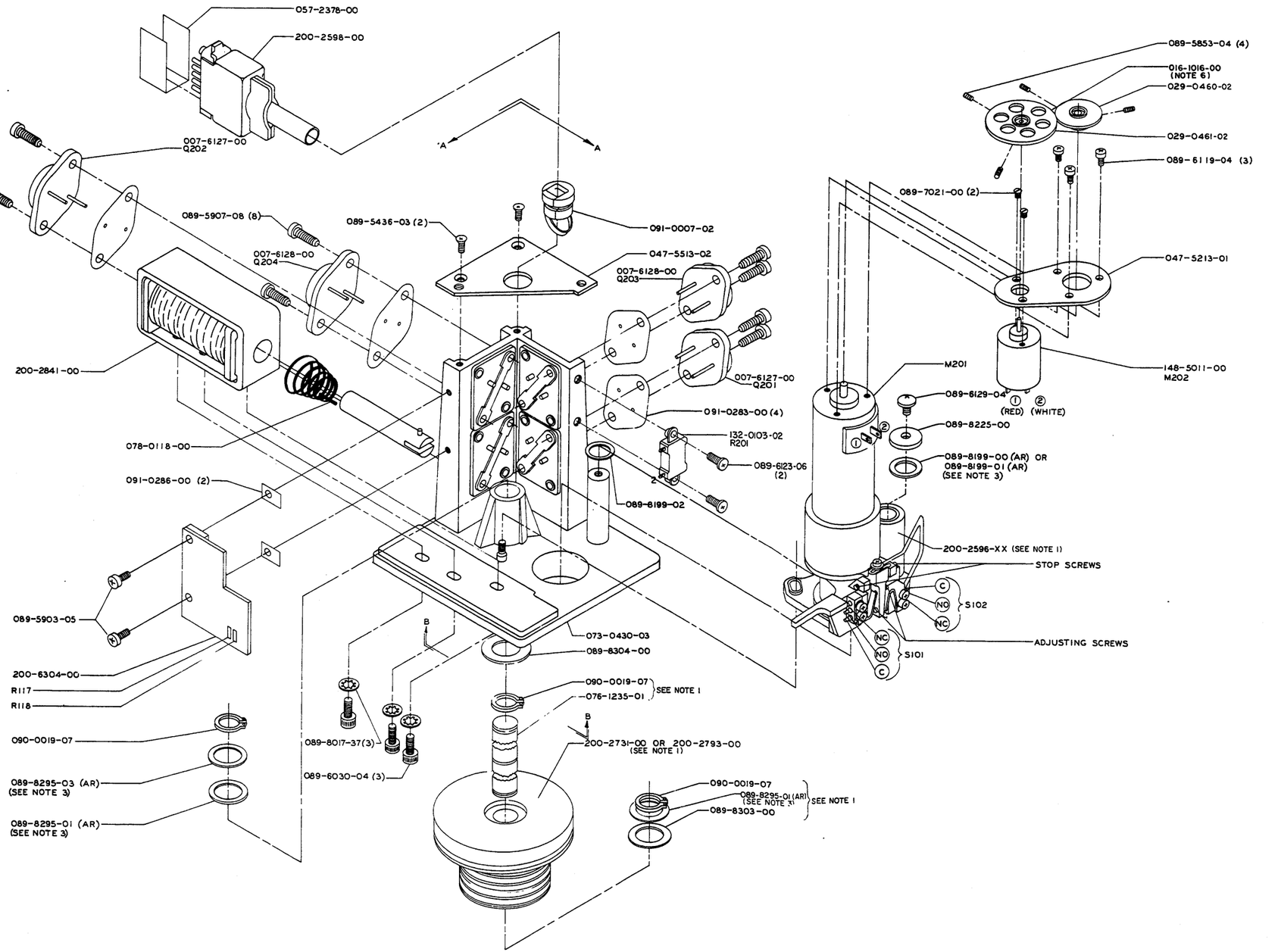
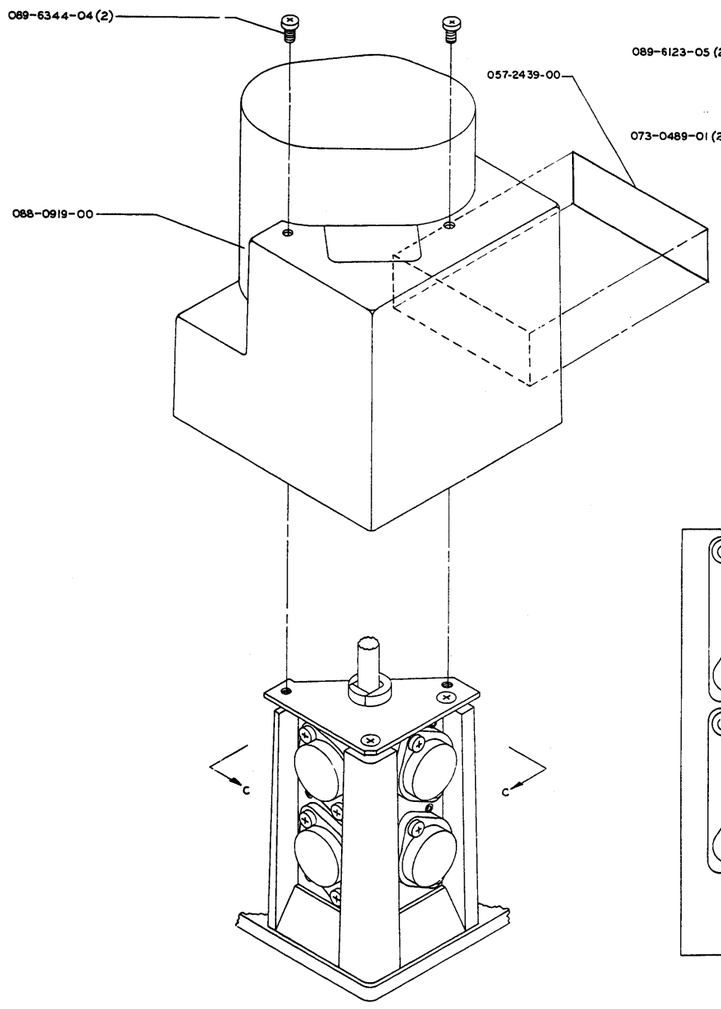
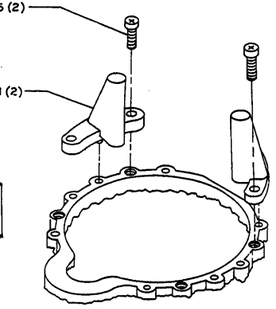


FIGURE 6-1 PITCH SERVO
(Dwg. No. 300-2605-00, R-11)
(Sheet 1 of 2)

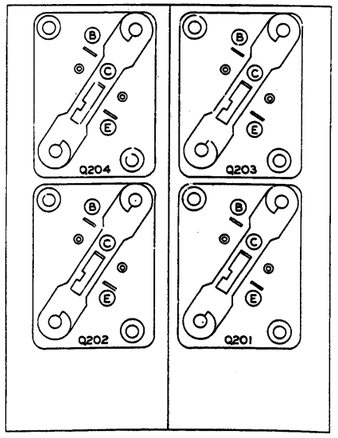
KING
KS 177
PITCH SERVO



VIEW A-A

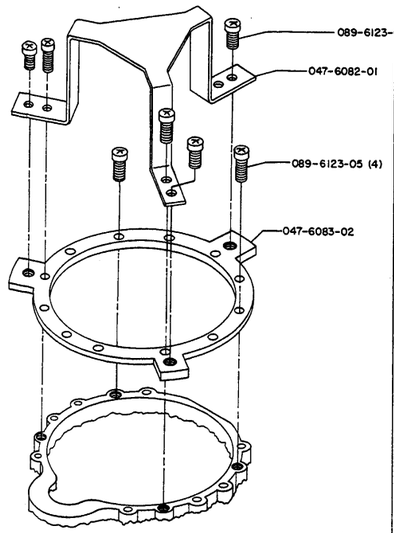


VIEW B-B
(SEE NOTE 1)



TRANSISTOR TERMINAL DESIGNATIONS

VIEW C-C



VIEW B-B
(SEE NOTE 1)

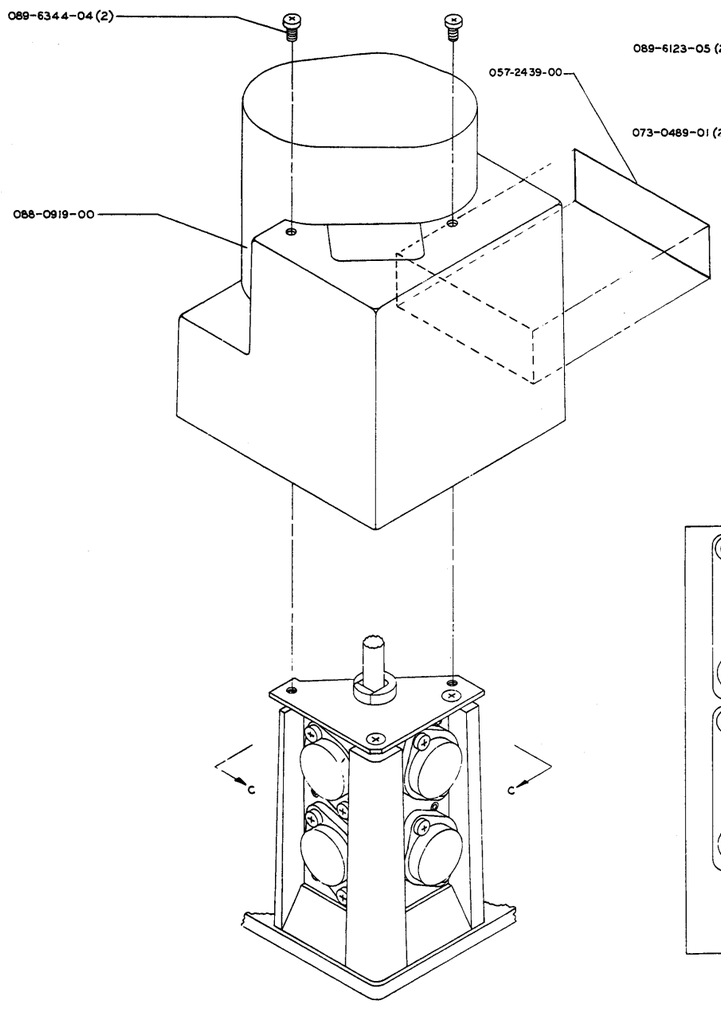
FROM	TO	COLOR	P/N	GA
P101-L	PCB101-11	GRN-RED	025-0018-52	26
P101-D	PCB101-19	GRN-ORN	025-0018-53	26
P101-P	PCB101-23	WHT-BLU	025-0018-96	26
P101-A	PCB101-21	BLU-GRA	025-0018-68	26
P101-N	PCB101-8	BRN	025-0003-01	22
P101-E	PCB101-1	YEL	025-0029-04	24
P101-M	PCB101-5	RED-WHT	025-0029-12	24
P101-B	PCB101-3	BLK-WHT	025-0029-10	24
P101-J	S101-NO	ORG-BRN	025-0018-31	26
P101-R	S102-NO	V10-WHT	025-0018-79	26
P101-H	Q201-C	RED	025-0003-02	22
P101-C	Q203-E	BLK	025-0003-00	22
PCB101-16	Q201-C	RED	025-0029-02	24
PCB101-12	Q204-E	BLK	025-0029-00	24
PCB101-10	Q201-B	ORG	025-0018-33	26
PCB101-13	Q202-B	ORG-YEL	025-0018-34	26
PCB101-15	Q201-E	YEL-BLK	025-0018-40	26
PCB101-9	Q203-B	YEL-RED	025-0018-42	26
PCB101-17	Q204-B	YEL	025-0018-44	26
PCB101-14	S101-C	YEL-GRN	025-0018-45	26
PCB101-2	SOL-WHT			
PCB101-4	SOL-RED			
PCB101-6	SOL-YEL			
PCB101-7	SOL-BLK			
S102-C	S101-C	YEL-GRN	025-0018-45	26
Q201-C	Q202-C	RED	025-0003-02	22
Q204-E	Q203-E	BLK	025-0003-00	22
Q203-C	Q202-E	BRN-YEL	025-0029-20	24
Q204-C	Q201-E	RED-BLK	025-0029-28	24
PCB101-18	Q202-E	ORG-BLU	025-0018-36	26
Q201-E	R201-1	GRN-WHT	025-0029-15	24

P/N.	FROM R201-2 025-0029-15 GRN-WHT 24 GA TO	FROM Q202-E 025-0029-33 WHT-ORG 24 GA TO	FROM PCB101-20 025-0018-62 BLU-RED 26 GA TO	FROM PCB101-22 025-0018-77 V10 26 GA TO	TRIM SWITCH LEVEL (LBF-IN)	SLIP CLUTCH TORQUE (LBF-IN)
-01	M201-2	M201-1	M202-2 (WHT)	M202-1(RED)	11 ± 1	20± 2
					6 ± 1/2	—
					6 ± 1/2	—
-04	M201-2	M201-1	M202-2 (WHT)	M202-1 (RED)	6 ± 1/2	21±2
					6 ± 1/2	—
-06	M201-2	M201-1	M202-2 (WHT)	M202-1 (RED)	11 ± 1	55±5
-07	M201-2	M201-1	M202-2 (WHT)	M202-1 (RED)	11± 1	42±4
-08	M201-2	M201-1	M202-2(WHT)	M202-1(RED)	11± 1	49±5
-09	M201-2	M201-1	M202-2(WHT)	M202-1(RED)	11± 1	45±4
-10	M201-2	M201-1	M202-2(WHT)	M202-1(RED)	6± 1/2	22±2

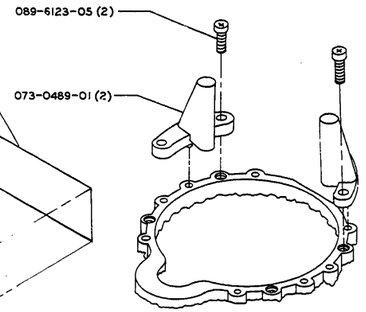
NOTES:
1. FOR COMPLETE ITEM DESCRIPTION SEE B/M 065-0050-XX.
2. AFTER SECURING APPLY GLYPTAL (016-1008-04) TO ALL SCREWS WITHOUT LOCKING DEVICE.
3. SHIM AS REQUIRED TO ACHEIVE .002-.008 END PLAY.
4. DELETED.
5. ADJUST SOLENOID ASSY.(200-2841-00) TO ACHEIVE .001-005 BACKLASH AT THE PITCH RADIUS OF THE MOTOR PINION AND THE CAPSTAN GEAR WITH SOLENOID IN ENGAGED POSITION.
6. APPLY A LIGHT COAT OF LUBE (016-1016-00) TO TACH GEAR TEETH (029-0442-01 AND 029-0443-01)

FIGURE 6-1 PITCH SERVO ASSEMBLY
(Dwg. No. 300-2605-00, R-13)
(Sheet 2 of 2)

KING
KS 177
PITCH SERVO



VIEW A-A



VIEW B-B
(SEE NOTE 1)

TRANSISTOR TERMINAL DESIGNATIONS

VIEW C-C

VIEW B-B
(SEE NOTE 1)

FROM	TO	COLOR	P/N	GA
P101-L	PCB101-11	GRN-RED	025-0018-52	26
P101-D	PCB101-19	GRN-ORN	025-0018-53	26
P101-P	PCB101-23	WHT-BLU	025-0018-96	26
P101-A	PCB101-21	BLU-GRA	025-0018-68	26
P101-N	PCB101-8	BRN	025-0003-01	22
P101-E	PCB101-1	YEL	025-0029-04	24
P101-M	PCB101-5	RED-WHT	025-0029-12	24
P101-B	PCB101-3	BLK-WHT	025-0029-10	24
P101-J	S101-NO	ORG-BRN	025-0018-31	26
P101-R	S102-NO	VIO-WHT	025-0018-79	26
P101-H	Q201-C	RED	025-0003-02	22
P101-C	Q203-E	BLK	025-0003-00	22
PCB101-16	Q201-C	RED	025-0029-02	24
PCB101-12	Q204-E	BLK	025-0029-00	24
PCB101-10	Q201-B	ORG	025-0018-33	26
PCB101-13	Q202-B	ORG-YEL	025-0018-34	26
PCB101-15	Q201-E	YEL-BLK	025-0018-40	26
PCB101-9	Q203-B	YEL-RED	025-0018-42	26
PCB101-17	Q204-B	YEL	025-0018-44	26
PCB101-14	S101-C	YEL-GRN	025-0018-45	26
PCB101-2	SOL-WHT			
PCB101-4	SOL-RED			
PCB101-6	SOL-YEL			
PCB101-7	SOL-BLK			
S102-C	S101-C	YEL-GRN	025-0018-45	26
Q201-C	Q202-C	RED	025-0003-02	22
Q204-E	Q203-E	BLK	025-0003-00	22
Q203-C	Q202-E	BRN-YEL	025-0029-20	24
Q204-C	Q201-E	RED-BLK	025-0029-28	24
PCB101-18	Q202-E	ORG-BLU	025-0018-36	26
Q201-E	R201-1	GRN-WHT	025-0029-15	24

P/N.	FROM R201-2 025-0029-15 GRN-WHT 24 GA TO	FROM Q202-E 025-0029-33 WHT-ORG 24 GA TO	FROM PCB101-20 025-0018-62 BLU-RED 26 GA TO	FROM PCB101-22 025-0018-77 VIO 26 GA TO	TRIM SWITCH LEVEL (LBF-IN)	SLIP CLUTCH TORQUE (LBF-IN)
-04	M201-2	M201-1	M202-2 (WHT)	M202-1 (RED)	6 ± 1/2	21±2
-06	M201-2	M201-1	M202-2 (WHT)	M202-1 (RED)	11 ± 1	55±5
-07	M201-2	M201-1	M202-2 (WHT)	M202-1 (RED)	11 ± 1	42±4
-08	M201-2	M201-1	M202-2 (WHT)	M202-1 (RED)	11 ± 1	49±5
-09	M201-2	M201-1	M202-2 (WHT)	M202-1 (RED)	11 ± 1	45±4

NOTES:
1. FOR COMPLETE ITEM DESCRIPTION SEE B/M 065-0050-XX.
2. AFTER SECURING APPLY GLYPTAL (016-1008-04) TO ALL SCREWS WITHOUT LOCKING DEVICE.
3. SHIM AS REQUIRED TO ACHEIVE .002-.008 END PLAY.
4. DELETED.
5. ADJUST SOLENOID ASSY.(200-2841-00) TO ACHEIVE .001-005 BACKLASH AT THE PITCH RADIUS OF THE MOTOR PINION AND THE CAPSTAN GEAR WITH SOLENOID IN ENGAGED POSITION.
6. APPLY A LIGHT COAT OF LUBE (016-1016-00) TO TACH GEAR TEETH (029-0442-01 AND 029-0443-01)

FIGURE 6-1 PITCH SERVO
(Dwg. No. 300-2605-00, R-11)
(Sheet 2 of 2)

200-2596-00 ENGAGE PLATE ASSY R: 5
200-2596-01 ENGAGE PLATE ASSY R: 0
200-2596-02 ENGAGE PLATE ASSY R: 0

SYMBOL		PART NUMBER	DESCRIPTION	A	UM	QUANTITY 00	01	02
		016-1007-05	LOCTITE 222-21 ADH		AR	0.00	.	.
		016-1007-07	LOCTITE 47-56 PMR		AR	0.00	.	.
		029-0361-01	PINION 10T 32DP	A	EA	1.00	1.00	1.00
		047-5621-01	SPRING RTNR W/F		EA	1.00	.	.
		047-5716-01	SPRING RTNR W/F		EA	1.00	.	.
		073-0437-03	ENGAGE PLATE		EA	1.00	.	.
		073-0481-02	SW ACTUATOR W/F	A	EA	1.00	.	.
		076-1241-00	BEARING RACE .6255		AR	0.00	.	.
		076-1241-01	BEARING RACE .6260		AR	0.00	.	.
		078-0124-00	TORQUE SPRG		EA	1.00	.	.
		089-6067-05	SCR FHP 4-40X5/16		EA	2.00	.	.
		089-6119-03	SCR PHP 2-56X3/16		EA	1.00	.	.
		089-6119-04	SCR PHP 2-56X1/4		EA	2.00	.	.
		089-6119-06	SCR PHP 2-56X3/8		EA	4.00	.	.
		089-6583-10	SET SCR 2-56X5/16		EA	4.00	.	.
		089-8282-02	WASHER		EA	1.00	.	.
		089-8293-00	WASHER		EA	1.00	.	.
		089-8294-01	WASHER		AR	0.00	.	.
		090-0019-09	RING RTNR .500		EA	1.00	.	.
		090-0052-17	ROLL PIN .312		EA	1.00	.	.
		147-5059-01	NEEDLE BNG W/LUB		EA	1.00	.	.
		200-2596-00	ENGAGE PLATE ASSY	A	EA	.	1.00	1.00
M	201	148-5058-00	DC MTR W/GEARHD		EA	.	1.00	.
M	201	148-5058-01	DC MTR W/GRHD		EA	.	.	1.00
S	101	031-0426-00	SWITCH INTGL LEVER		EA	1.00	.	.
S	102	031-0426-00	SWITCH INTGL LEVER		EA	1.00	.	.

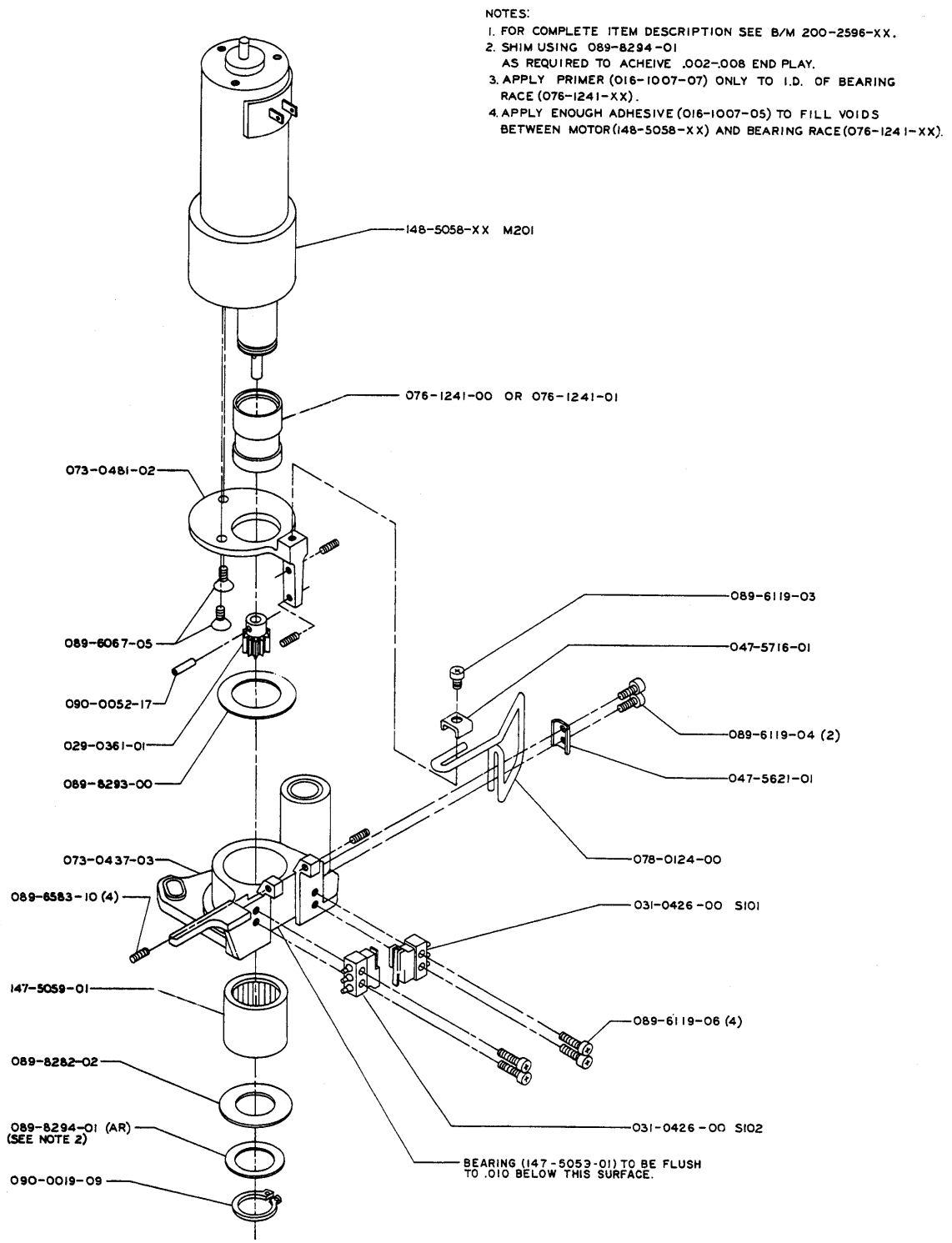


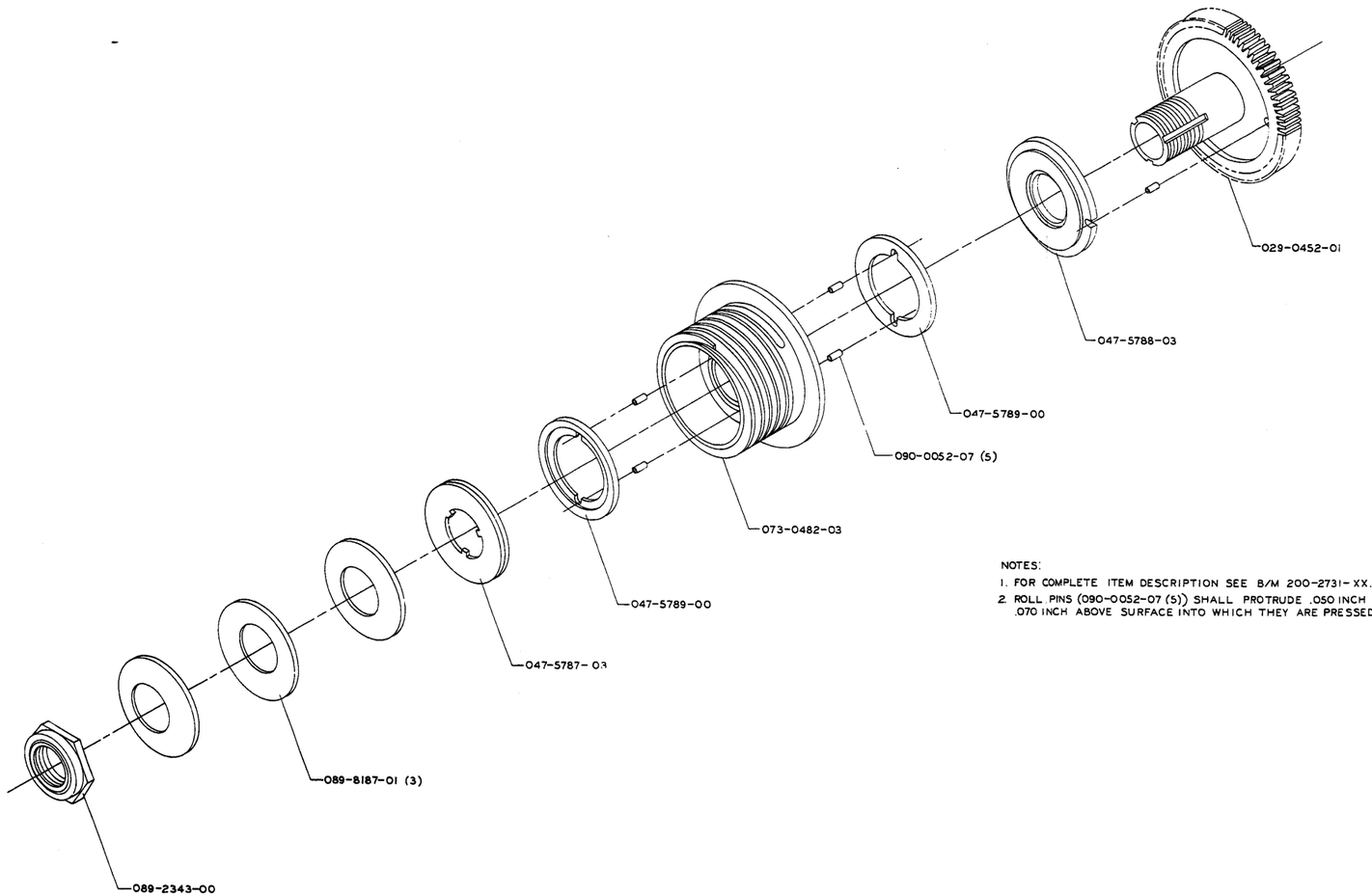
FIGURE 6-2 ENGAGE PLATE ASSEMBLY
(Dwg. No. 300-2596-00, R-3)

KING RADIO CORPORATION
PARTS LISTING

200-2731-00 SLIP CLUTCH ASSY R: 4 KS 0177

SYMBOL	PART NUMBER	DESCRIPTION	A	UM	QUANTITY 00
	029-0452-01	GEAR 77T MACH	A	EA	1.00
	047-5787-03	CLTCH PLT W/DSKMCH	A	EA	1.00
	047-5788-03	CLTCH PLT W/DSKMCH	A	EA	1.00
	047-5789-00	CLUTCH DISK		EA	2.00
	073-0482-03	CAPSTAN W/BUSHINGS	A	EA	1.00
	089-2343-00	NUT HEX LT 7.5-16		EA	1.00
	089-8187-01	WASHER 1.500		EA	3.00
	090-0052-07	PIN ROLLER .187		EA	5.00

KING
KS 177
PITCH SERVO



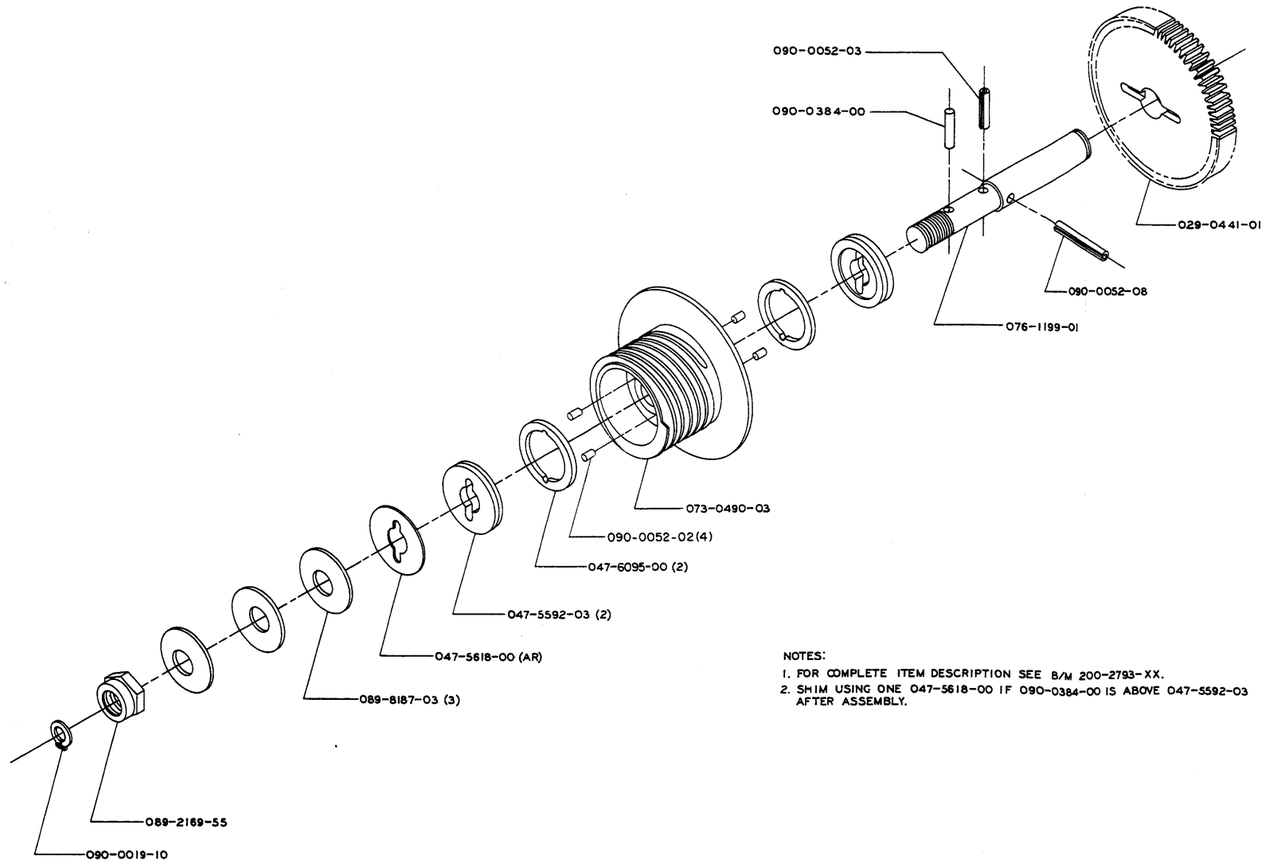
NOTES:
1. FOR COMPLETE ITEM DESCRIPTION SEE B/M 200-2731-XX.
2. ROLL PINS (090-0052-07 (5)) SHALL PROTRUDE .050 INCH TO .070 INCH ABOVE SURFACE INTO WHICH THEY ARE PRESSED.

FIGURE 6-3 SLIP CLUTCH ASSEMBLY
(Dwg. No. 300-2731-00, R-1)

200-2793-00 SLIP CLUTCH ASSY R: 3 KS 0177

SYMBOL	PART NUMBER	DESCRIPTION	A	UM	QUANTITY 00
	029-0441-01	GEAR 77T		EA	1.00
	047-5592-03	CLTCH PLT W/DSKMCH	A	EA	2.00
	047-5618-00	SHIM WASHER		AR	0.00
	047-6095-00	CLUTCH DISK		EA	2.00
	073-0490-03	CAPSTAN CSTG W/BUS	A	EA	1.00
	076-1199-01	SHAFT	A	EA	1.00
	089-2169-55	NUT HEX 3/8-24		EA	1.00
	089-8187-03	WASHER .950		EA	3.00
	090-0019-10	RING RTNR .312		EA	1.00
	090-0052-02	PIN ROLLER .250		EA	4.00
	090-0052-03	PIN ROLLER .500		EA	1.00
	090-0052-08	PIN ROLLER		EA	1.00
	090-0384-00	PIN .560 L		EA	1.00

KING
KS 177
PITCH SERVO

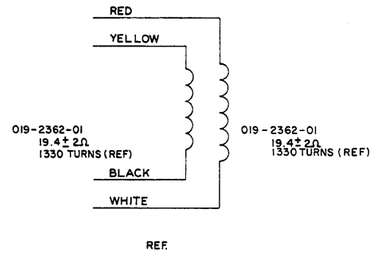


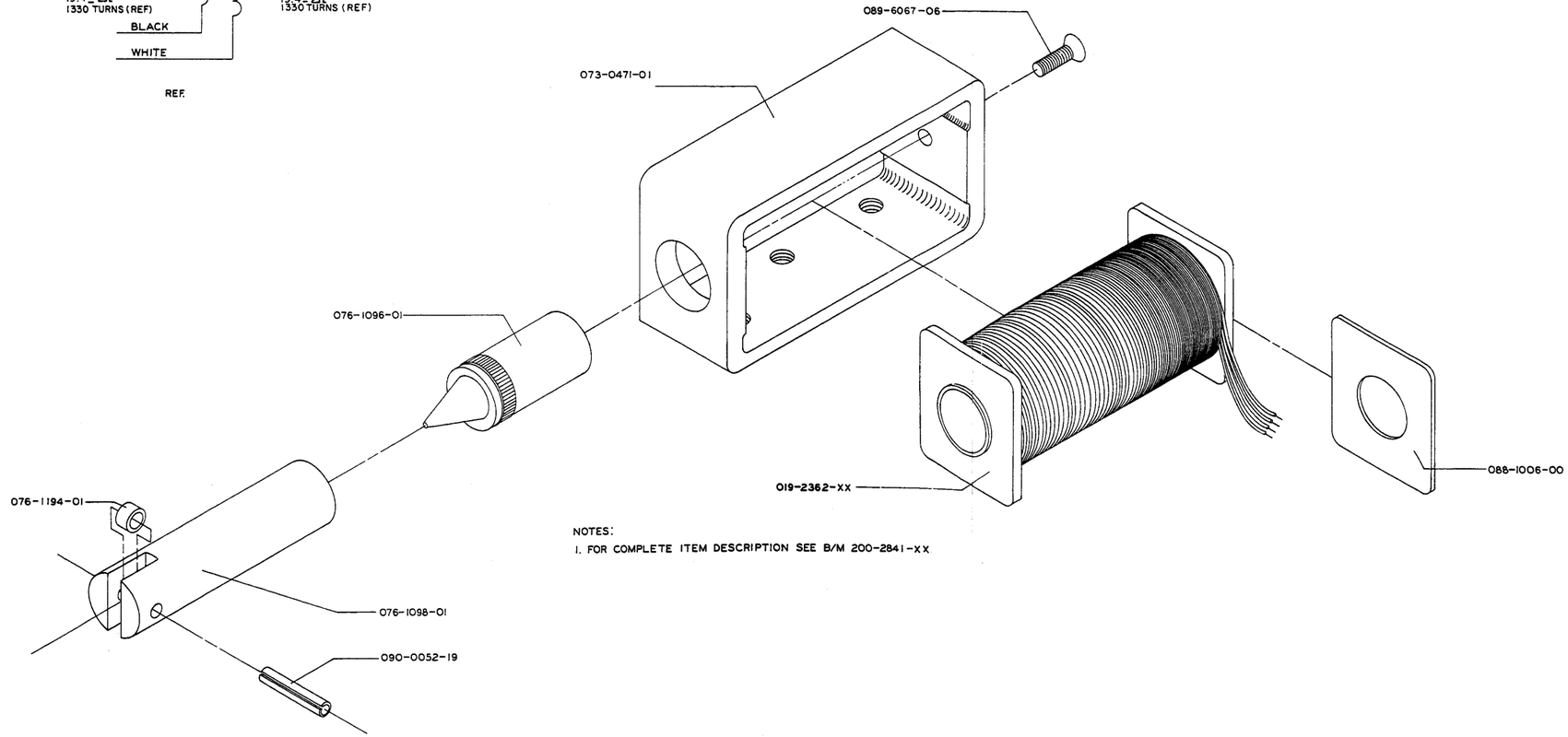
NOTES:
1. FOR COMPLETE ITEM DESCRIPTION SEE B/M 200-2793-XX.
2. SHIM USING ONE 047-5618-00 IF 090-0384-00 IS ABOVE 047-5592-03 AFTER ASSEMBLY.

FIGURE 6-4 SLIP CLUTCH ASSEMBLY
(Dwg. No. 300-2793-00, R-1)

200-2841-00 SOLENOID ASSY R: 3
200-2841-99 COMMON BOM R: 3

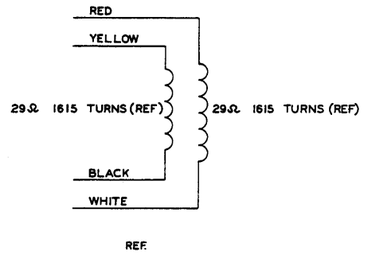
SYMBOL	PART NUMBER	DESCRIPTION	A	UM	QUANTITY 00	99
	019-2362-01	SOLENOID COIL		EA	.	1.00
	073-0471-01	FRAME SLND W/F	A	EA	1.00	.
	076-1096-01	PLUNGER STOP W/F	A	EA	.	1.00
	076-1098-01	SOL PLNGR		EA	.	1.00
	076-1194-01	ROLLER W/F		EA	.	1.00
	088-1006-00	SPACER		EA	.	1.00
	089-6067-06	SCR FHP 4-40X3/8		EA	.	1.00
	090-0052-19	ROLL PIN .625		EA	.	1.00
	150-0047-10	SHRNK TUBING NAT		FT	.	0.20
	200-2841-99	COMMON BOM	A	EA	1.00	.





NOTES:
1. FOR COMPLETE ITEM DESCRIPTION SEE B/M 200-2841-XX

FIGURE 6-5 SOLENOID ASSEMBLY
(Dwg. No. 300-2841-00, R-3)



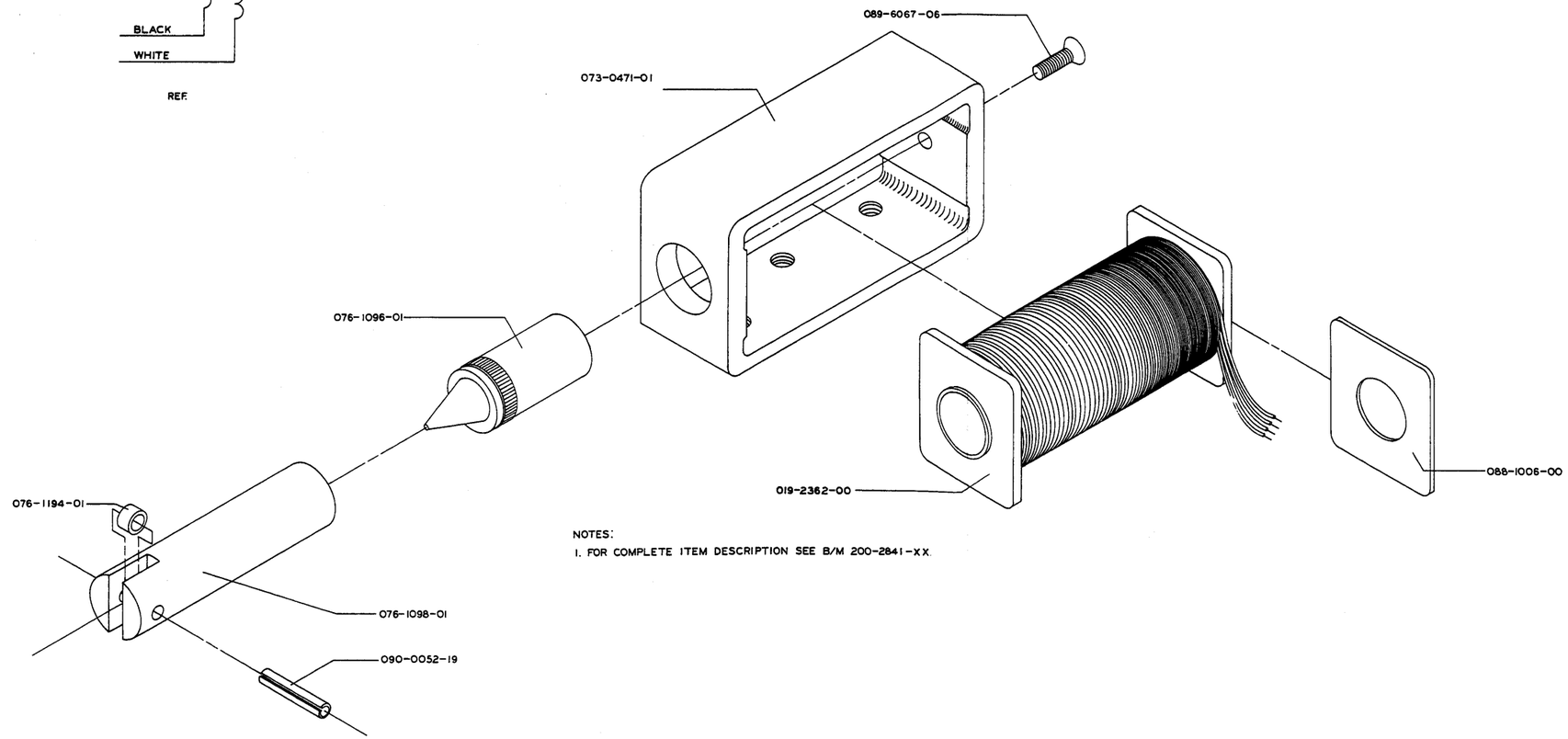
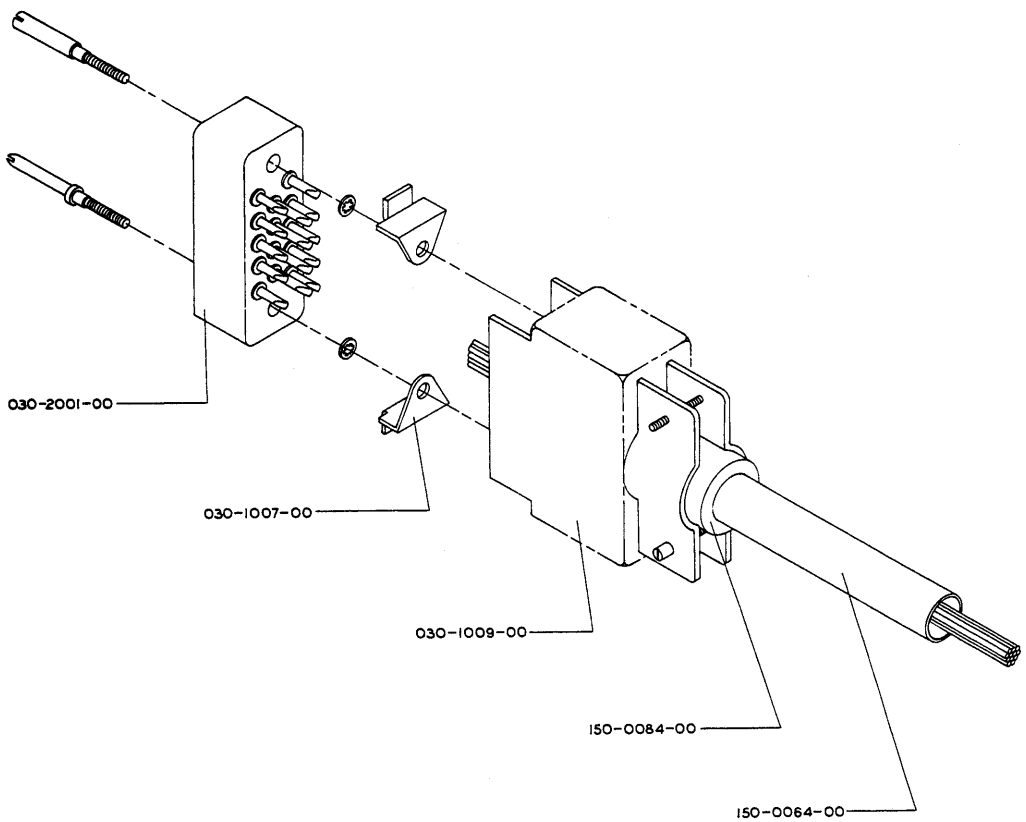


FIGURE 6-5 SOLENOID ASSEMBLY
(Dwg. No. 300-2841-00, R-2)

200-2598-00 HARNESS ASSY R: 2 KS 0177
200-2598-99 COMMON BOM R: 1 KS 0177

SYMBOL	PART NUMBER	DESCRIPTION	A	UM	QUANTITY 00	99
	025-0003-00	WIRE 22 BLK		FT	.	1.10
	025-0003-01	WIRE 22 BRN		FT	.	1.10
	025-0003-02	WIRE 22 RED		FT	.	1.10
	025-0018-31	WIRE 26 OR/BN		FT	1.10	.
	025-0018-52	WIRE 26 GN/RD		FT	.	1.10
	025-0018-53	WIRE 26 GN/OR		FT	.	1.10
	025-0018-68	WIRE 26 BU/GY		FT	.	1.10
	025-0018-79	WIRE 26 VI/WH		FT	1.10	.
	025-0018-96	WIRE 26 WH/BU		FT	.	1.10
	025-0029-04	WIRE 24 YEL		FT	.	1.10
	025-0029-10	WIRE 24 BK/WH		FT	.	1.10
	025-0029-12	WIRE 24 RD/WH		FT	.	1.10
	030-1007-00	TAB LOCKING		EA	.	2.00
	030-1009-00	HOOD CONN		EA	.	1.00
	030-2001-00	CONN 14 PIN MALE		EA	.	1.00
	150-0064-00	TUBING TFLN 2G BLK		FT	.	1.00
	150-0084-00	TUBING PLASTIC		EA	.	0.05
	200-2598-99	COMMON BOM	A	EA	1.00	.



WIRE NO.	FROM	COLOR	P/N	GA
1	P101-L	GRN-RED	025-0018-52	26
2	P101-H	RED	025-0003-02	22
3	P101-D	GRN-ORN	025-0018-53	26
4	P101-P	WHT-BLU	025-0018-96	26
5	P101-A	BLU-GRA	025-0018-68	26
6	P101-N	BRN	025-0003-01	22
7	P101-C	BLK	025-0003-00	22
8	P101-E	YEL	025-0029-04	24
9	P101-M	RED-WHT	025-0029-12	24
10	P101-B	BLK-WHT	025-0029-10	24
#11	P101-J	ORG-BRN	025-0018-31	26
#12	P101-R	VIO-WHT	025-0018-79	26

*NOT USED ON 200-2598-01

NOTES:

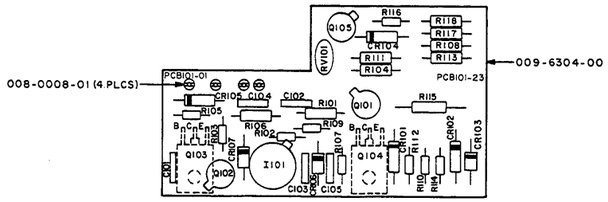
1. FOR COMPLETE ITEM DESCRIPTION SEE B/M 200-2598-XX
2. INSULATING TUBING 150-0064-00 SHALL EXTEND APROX. .45 INCH INTO CONNECTOR HOOD 030-1009-00
3. OVERALL LENGTH OF HARNESS ASSY CABLE 18 INCHES ±1 INCH.

FIGURE 6-6 HARNESS ASSEMBLY
(Dwg. No. 300-2598-00, R-1)

KING RADIO CORPORATION
PARTS LISTING

200-6304-00 CIRCUIT BOARD R: 3 KS 0177
200-6304-99 COMMON BOM R: 3 KS 0177

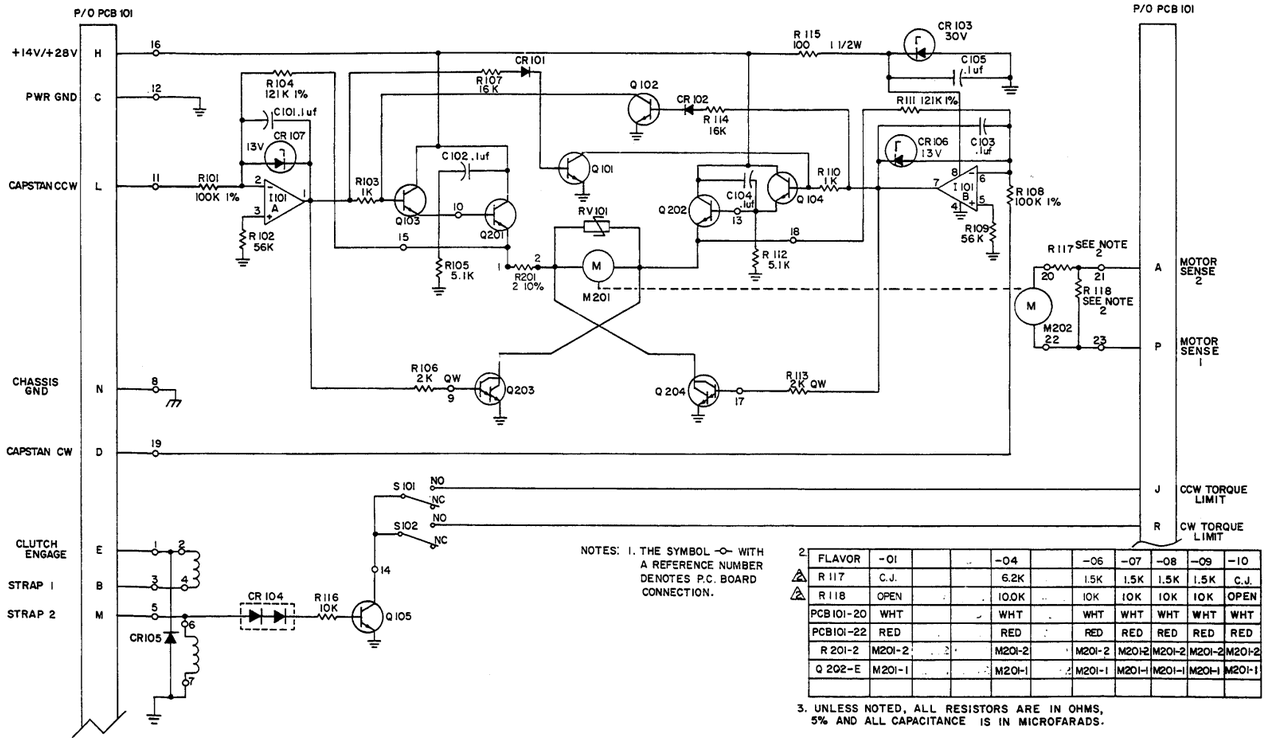
SYMBOL		PART NUMBER	DESCRIPTION	A	UM	QUANTITY 00	99
		009-6304-00	PC BD PITCH SERVO		EA	.	1.00
		016-1040-00	PC101 COATING		AR	.	0.00
		200-6304-99	COMMON BOM	A	EA	1.00	.
C	101	111-0001-22	CAP CR .1UF 100V		EA	.	1.00
C	102	111-0001-22	CAP CR .1UF 100V		EA	.	1.00
C	103	111-0001-22	CAP CR .1UF 100V		EA	.	1.00
C	104	111-0001-22	CAP CR .1UF 100V		EA	.	1.00
C	105	111-0001-22	CAP CR .1UF 100V		EA	.	1.00
CR	101	007-6033-00	DIO G 1N270		EA	.	1.00
CR	102	007-6033-00	DIO G 1N270		EA	.	1.00
CR	103	007-5011-23	DIO Z 30V 1W 5%		EA	.	1.00
CR	104	007-5021-00	DIO Z SZ13483		EA	1.00	.
CR	105	007-6047-00	DIO S 1N4005		EA	.	1.00
CR	106	007-5011-04	DIO Z 13V 1W 5%		EA	.	1.00
CR	107	007-5011-04	DIO Z 13V 1W 5%		EA	.	1.00
E	101	008-0008-01	TERM SPLIT TURR		EA	.	1.00
E	102	008-0008-01	TERM SPLIT TURR		EA	.	1.00
E	103	008-0008-01	TERM SPLIT TURR		EA	.	1.00
E	104	008-0008-01	TERM SPLIT TURR		EA	.	1.00
I	101	120-3053-01	IC LM158H		EA	.	1.00
Q	101	007-0383-50	XSTR 2N2222JAN		EA	.	1.00
Q	102	007-0383-50	XSTR 2N2222JAN		EA	.	1.00
Q	103	007-0164-00	XSTR S 2N4923		EA	.	1.00
Q	104	007-0164-00	XSTR S 2N4923		EA	.	1.00
Q	105	007-0383-50	XSTR 2N2222JAN		EA	1.00	.
R	101	136-1003-72	RES PF 100K EW 1%		EA	.	1.00
R	102	131-0563-13	RES CF 56K EW 5%		EA	.	1.00
R	103	131-0102-13	RES CF 1K EW 5%		EA	.	1.00
R	104	136-1213-72	RES PF 121K EW 1%		EA	.	1.00
R	105	131-0512-13	RES CF 5.1K EW 5%		EA	.	1.00
R	106	131-0202-23	RES CF 2K QW 5%		EA	.	1.00
R	107	131-0163-13	RES CF 16K EW 5%		EA	.	1.00
R	108	136-1003-72	RES PF 100K EW 1%		EA	.	1.00
R	109	131-0563-13	RES CF 56K EW 5%		EA	.	1.00
R	110	131-0102-13	RES CF 1K EW 5%		EA	.	1.00
R	111	136-1213-72	RES PF 121K EW 1%		EA	.	1.00
R	112	131-0512-13	RES CF 5.1K EW 5%		EA	.	1.00
R	113	131-0202-23	RES CF 2K QW 5%		EA	.	1.00
R	114	131-0163-13	RES CF 16K EW 5%		EA	.	1.00
R	115	132-0105-54	RES WW 100 1.5W 5%		EA	.	1.00
R	116	131-0103-13	RES CF 10K EW 5%		EA	1.00	.
RV	101	134-1026-01	VRSTR V39ZA1 39V		EA	.	1.00



Q101, Q102, Q105

NOTES:

1. PRIOR TO POST COATING BOTH SIDES OF P.C. BOARD WITH CLEAR URETHANE (016-1040-00), MASK OFF THE FOLLOWING: 008-0008-01 (4), PCB101-01 THRU PCB101-23.
2. R117 AND R118 VALUES ARE SHOWN ON 065-0050-00/XX OR 065-0051-00/XX.



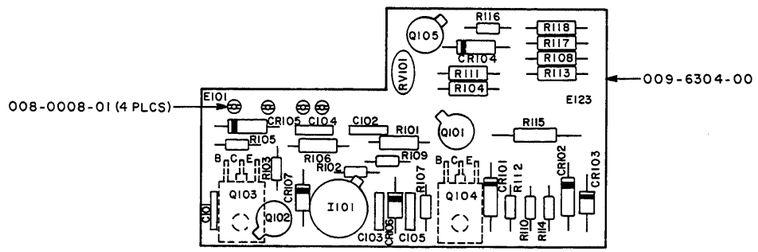
NOTES: 1. THE SYMBOL —o— WITH A REFERENCE NUMBER DENOTES P.C. BOARD CONNECTION.

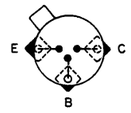
2

FLAVOR	-01			-04		-06	-07	-08	-09	-10
⚠3 R117	C.J.			6.2K		1.5K	1.5K	1.5K	1.5K	C.J.
⚠3 R118	OPEN			10.0K		10K	10K	10K	10K	OPEN
PCB101-20	WHT			WHT		WHT	WHT	WHT	WHT	WHT
PCB101-22	RED			RED		RED	RED	RED	RED	RED
R 201-2	M201-2			M201-2		M201-2	M201-2	M201-2	M201-2	M201-2
Q 202-E	M201-1			M201-1		M201-1	M201-1	M201-1	M201-1	M201-1

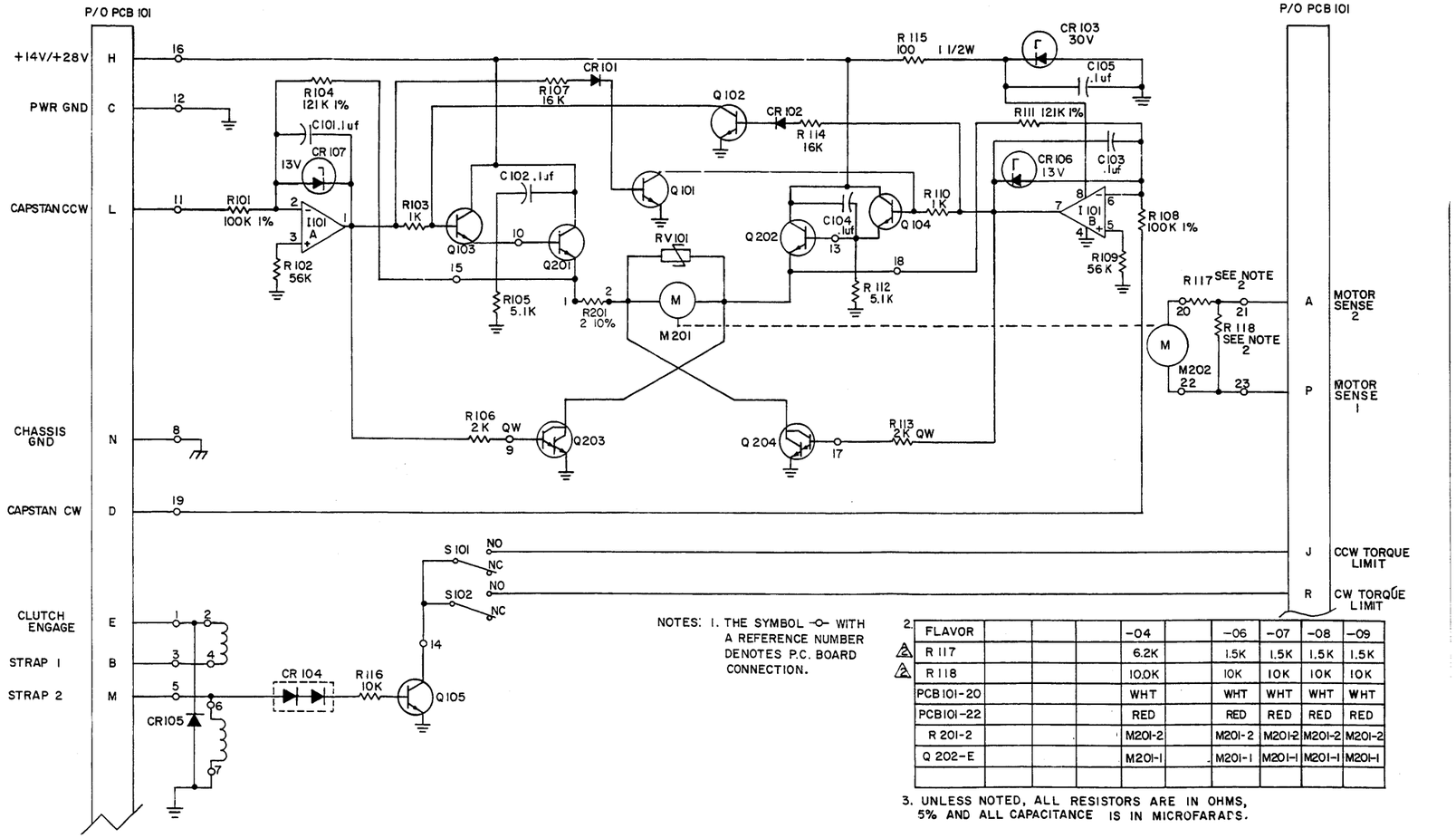
3. UNLESS NOTED, ALL RESISTORS ARE IN OHMS, 5% AND ALL CAPACITANCE IS IN MICROFARADS.

FIGURE 6-7 KS 177 PITCH SERVO PC BOARD ASSEMBLY AND SCHEMATIC
(Dwg. No. 300-6304-00, R-4)
(Dwg. No. 002-6304-00, R-7)





Q101, Q102, Q105



NOTES: 1. THE SYMBOL —o— WITH A REFERENCE NUMBER DENOTES P.C. BOARD CONNECTION.

2.

FLAVOR				-04		-06	-07	-08	-09
⚠2 R 117				6.2K		1.5K	1.5K	1.5K	1.5K
⚠2 R 118				10.0K		10K	10K	10K	10K
PCB 101-20				WHT		WHT	WHT	WHT	WHT
PCB101-22				RED		RED	RED	RED	RED
R 201-2				M201-2		M201-2	M201-2	M201-2	M201-2
Q 202-E				M201-1		M201-1	M201-1	M201-1	M201-1

3. UNLESS NOTED, ALL RESISTORS ARE IN OHMS, 5% AND ALL CAPACITANCE IS IN MICROFARADS.

NOTES:

1. PRIOR TO POST COATING BOTH SIDES OF P.C. BOARD WITH CLEAR URETHANE (016-1040-00), MASK OFF THE FOLLOWING: 008-0008-01 (4), E101 THRU E123.
2. R117 AND R118 VALUES ARE SHOWN ON 065-0050-00/XX

FIGURE 6-7 KS 177 PITCH SERVO PC BOARD ASSEMBLY AND SCHEMATIC
(Dwg. No. 300-6304-00, R-3)
(Dwg. No. 002-6304-00, R-6)

AlliedSignal

ELECTRONIC AND AVIONICS SYSTEMS

MAINTENANCE MANUAL

BENDIX/KING®

KS 178

PRIMARY SERVO

MANUAL NUMBER 006-05277-0003
REVISION 3 SEPTEMBER, 1983

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LIST OF ILLUSTRATIONS

SECTION IV
THEORY OF OPERATION

4.1 INTRODUCTION

This section contains the General and Detailed Theory of the KS 178 Primary Servo. The General Theory contains block diagram information on the overall operation of the unit. The Detailed Theory contains the circuit operation of the unit in detail. Information on alignment and troubleshooting can be found in Section V of this manual.

4.2 GENERAL CIRCUIT THEORY

The KS 178 Primary Servo (Figure 4-1) is an electrically driven servo that converts auto pilot electrical error signals into control surface position. The KS 178 is equipped with an adjustable overpower slip clutch that allows the pilot manual authority over the servo actuator.

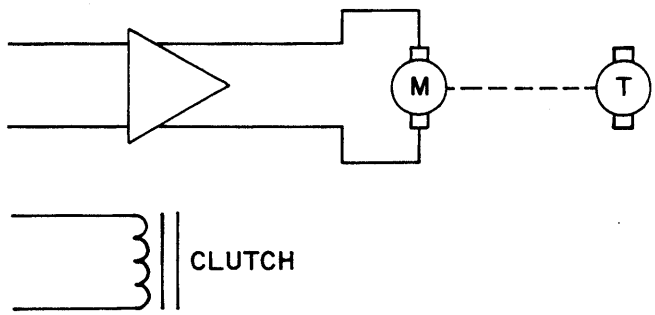

FIGURE 4-1 KS 178 PRIMARY SERVO, BLOCK DIAGRAM

4.2.1 ENGAGE SOLENOID

The Engage solenoid on the KS 178 operates from +14VDC or +28VDC depending upon the external strapping. When using the KS 178 in a +28 volt installation, pins B and M series connect two separate windings. The clutch engage signal (+28V) enters on pin E and current flows to ground through the series coils. Diode CR105 serves as an arc suppressor to shunt the negative field developed by the coils to ground as the solenoid is turned off.

The solenoid is converted to +14 volt operation by connecting pins M to E and B to C. This parallels the two coils. Engage operation is identical, with the +14 volt signal entering pin E.

4.2.2 MOTOR SPEED SENSING

Motor M202 is mechanically connected to the drive motor (M201) and sends a DC signal directly proportional to the speed of M201 to the KC 190/191/192. This signal is used to provide stability in the servo loop.

Certain versions of the KS 178 contain two resistors, R117 and R118, in the motor speed sensing lines which are used to scale the DC signal out at a level needed on certain aircraft.

4.2.3 SERVO VARIATIONS

Variations in the KS 178 servo include different motors, slip clutch setting and speed sense scaling resistors. The changes in the motor between the KS 178 flavors cause subsequent speed changes as measured at the capstan.

4.3 DETAILED CIRCUIT THEORY

KC 190/191/192 servo drive for counterclockwise rotation is applied to pin L through R101, then to I101A. I101A is operated in a non-linear mode until Q103 and Q201 are in the breakdown region. R103 provides current limiting between Q103 and I201. C102 provides for high frequency oscillations to be shunted. R105 provides for low current drift over a wide temperature range and prevents thermal runaway. When the output of Q201 exceeds 2.2 volts, Q103 and I101A go into their breakdown region and the gain of I101A becomes a gain of 1. R106 is also supplied through I101A, pin 1, to Q203. Q203 provides a pull down for M201 and provides a ground for the motor.

The emitter of Q201 supplies the high side and tracks I101A. The more voltage at the emitter of Q201, the faster M201 turns. RV101 provides arc suppression off the armature windings of the motor to prevent transistor burnout. R107, CR101, and Q101 provide servo protection in case pin L and pin D are both turned on at the same time. IF pin L and pin D both try to drive at the same time, Q101 shorts the base of Q104, and Q102 shorts the base of Q103. This prevents the servo from turning in any direction and it goes into a shutdown mode until either of the inputs goes low.

Clockwise rotation , at pin D, is applied through R108 to I101B. I101B is a non-linear amplifier until Q104 and Q202 reach their breakdown voltage and turn on, at which time I101B becomes a gain 1 amplifier. Voltage to Q104 is supplied through R110, and the emitter of Q104 supplies the base of Q202. The emitter of Q202 supplies the voltage to motor M201. C104 prevents high frequency oscillations as the motor runs through it's linear region. R112 prevents current runaway and provides temperature compensation of Darlington transistor Q202 in high temperature modes. R114, CR102, and Q102 are the other side of the turn-on to help keep the servo from burning out if both sides should turn on at once.

I101B, pin 7, also supplies Q204 through R113. Q204 provides the pull down to ground for M201. R115 and CR103, a 30 volt zener diode, provides a reference for I101A/B. If the 28 volt line goes above 30 volts it is clamped at 30 volts to prevent damage to I101A/B. C105 clamps any voltage spikes on the 28 volt line to prevent damage to the amplifiers or Q201, Q202, Q103, or Q104. M202 provides a tach feedback output through R117 and R118. These resistors provide the proper tach voltage output. The clutch engage solenoid in the 28 volt mode has its two windings connected in series; B is jumpered to M, and E is supplied with 28 volts. In the 14 volt configuration the two windings are connected in parallel; M is connected to E, and B is connected to ground.

When I101A/B receive a positive voltage on the input, the output is less than one volt, or at ground potential. This is due to the fact that I101A and I101B have a single supply. When they try to invert the positive voltage they drive it to ground.

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SECTION V
MAINTENANCE

5.1 INTRODUCTION

This section contains information on tests, alignment, inspection, cleaning, repair, and troubleshooting procedures for the KS 178 Primary Servo. Information concerning semiconductor and integrated circuit maintenance, along with specific operating characteristics can be found in Appendix A of this manual.

Basic digital logic theory can also be found in Appendix A. This information is provided to aid the technician in developing a working knowledge of commonly used devices and should not be interpreted as unit theory of operation.

5.2 TEST AND ALIGNMENT

5.2.1 TEST EQUIPMENT

The following test equipment or equivalent is required to properly align and test the KS 178. All test equipment must be calibrated before attempting alignment.

A. King KTS 158 Component Bench Tester:

   KPN 071-5064-00

B. Digital Multimeter:

   Fluke 8000A

C. Torque Wrench:

   SNAP-ON TEP-6FUA

D. Servo Torque Stand, KPN 047-4238-01, from KTS 151 Servo Test Kit 050-1603-00 as modified by Service Aid KTS 151-103.

5.2.2 DEFINITION OF STANDARD TEST TERMS AND CONDITIONS

A. Unless otherwise indicated, all voltage measurements are with respect to Pin C (Power Ground).

B. Clockwise (CW) and counterclockwise (CCW) rotation of the capstan is rotation as viewed from the capstan end of the unit.

C. Unless otherwise indicated, all specifications are for performance at ambient room temperature and humidity.

D. Slip clutch performance specifications apply to a new clutch or a clutch with new parts only after the run-in. The run-in shall consist of slipping the clutch into a load of 15 LBF-IN in a CW direction for at least 45 minutes and in a CCW direction for at least 45 minutes.

E. When vibration to minimize friction is required for a test, the unit shall be subjected to a vibration of .002 to .005 inch double amplitude at a frequency of 1500 to 2000 cycles per minute.

F. Test solenoid engage voltage and disengagement with the servo oriented so that the solenoid axis is horizontal.

KING
KS 178
PRIMARY SERVO

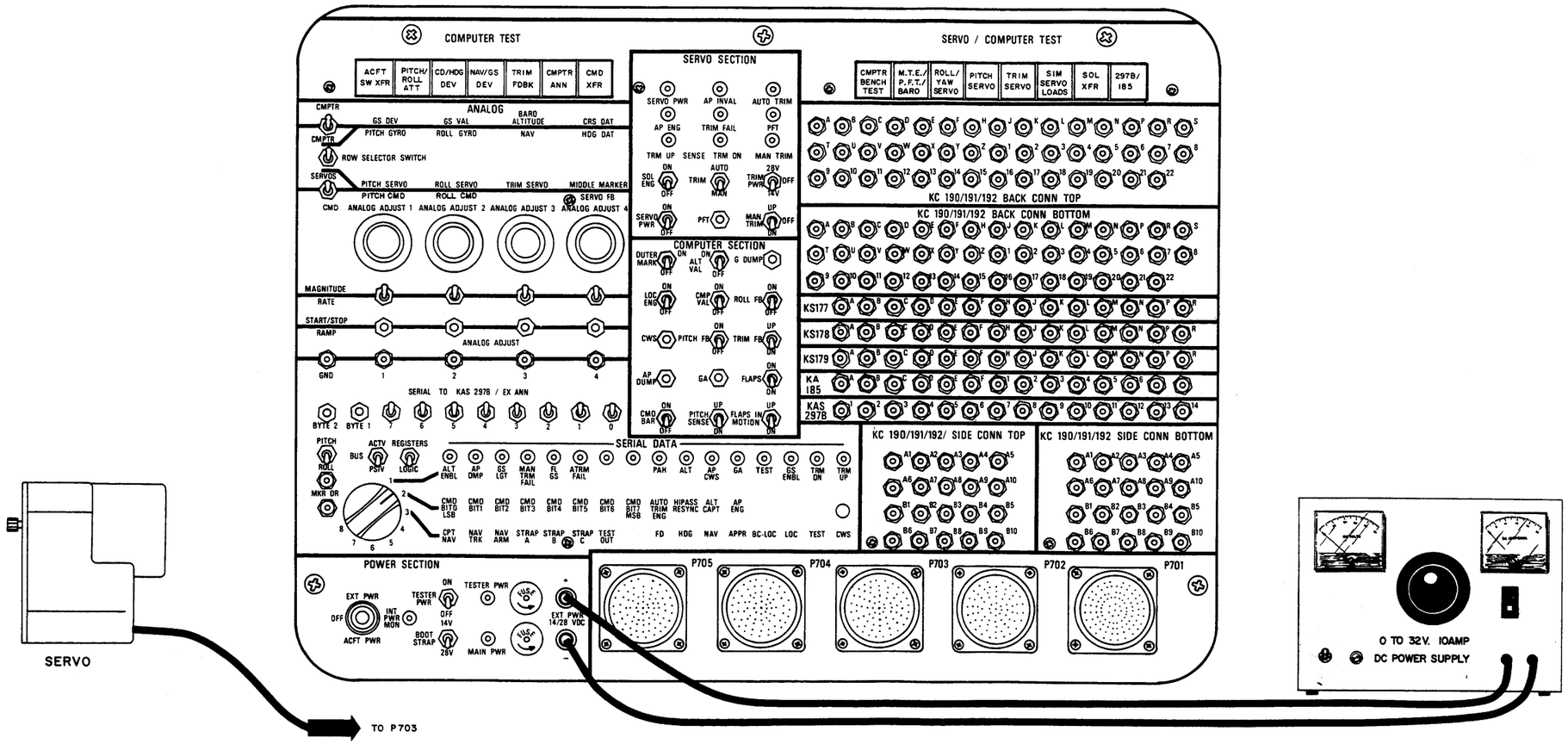


FIGURE 5-1 TEST SETUP
(Dwg. No. 696-3650-00, R-0)

5.2.3 FINAL TEST DATA SHEET

Connect test equipment and servo as shown in Figure 5-1.

NOTE

The term "OK" indicates that particular function is working properly.

5.2.3.1 Initialization

a. Switch the EXT PWR/ACFT PWR switch to OFF.

b. Connect P703 on the KTS 158 to the KS 178 under test.

c. Check the bus voltage of the aircraft that the KS 178 is installed in and test the KS 178 at that voltage. The KS 178 will operate on either 14VDC or 28VDC.

d. Connect the proper input voltage to the KTS 178 EXT PWR test jacks.

e. Set the switches on the KTS 158 as shown in Table 5-1.

CONTROL	LOCATION	POSITION
All switches	Computer Test Section	Out
ROLL/YAW SERVO switch	SERVO/COMPUTER TEST section	In
SOL XFR switch	SERVO/COMPUTER TEST section	In
All other switches	SERVO/COMPUTER TEST section	Out
SERVO PWR switch	SERVO SECTION	On
All other switches	SERVO SECTION	Off
All switches	COMPUTER SECTION	Off
ROW SELECTOR switch	ANALOG section	Down
SERVOS/CMD switch	ANALOG section	SERVOS
MAGNITUDE/RATE 2 switch	ANALOG section	MAGNITUDE
BOOT STRAP switch	POWER SECTION	Same as power bus
TESTER PWR switch	POWER SECTION	On
EXT PWR/ACFT PWR switch	POWER SECTION	EXT PWR

TABLE 5-1 INITIALIZE CONTROL SETTINGS

f. Connect voltmeter to Test Jack 2 and GND in ANALOG section.

g. Adjust ANALOG ADJUST 2 control for 0.0VDC on voltmeter.

NOTE

The instructions in paragraph 5.2.3.1 e, f, and g must be performed at the beginning of the tests in each of the following paragraphs.

5.2.3.2 Engage Clutch (28VDC Bus)

a. Install the KS 178 in the torque fixture (Figure 5-2).

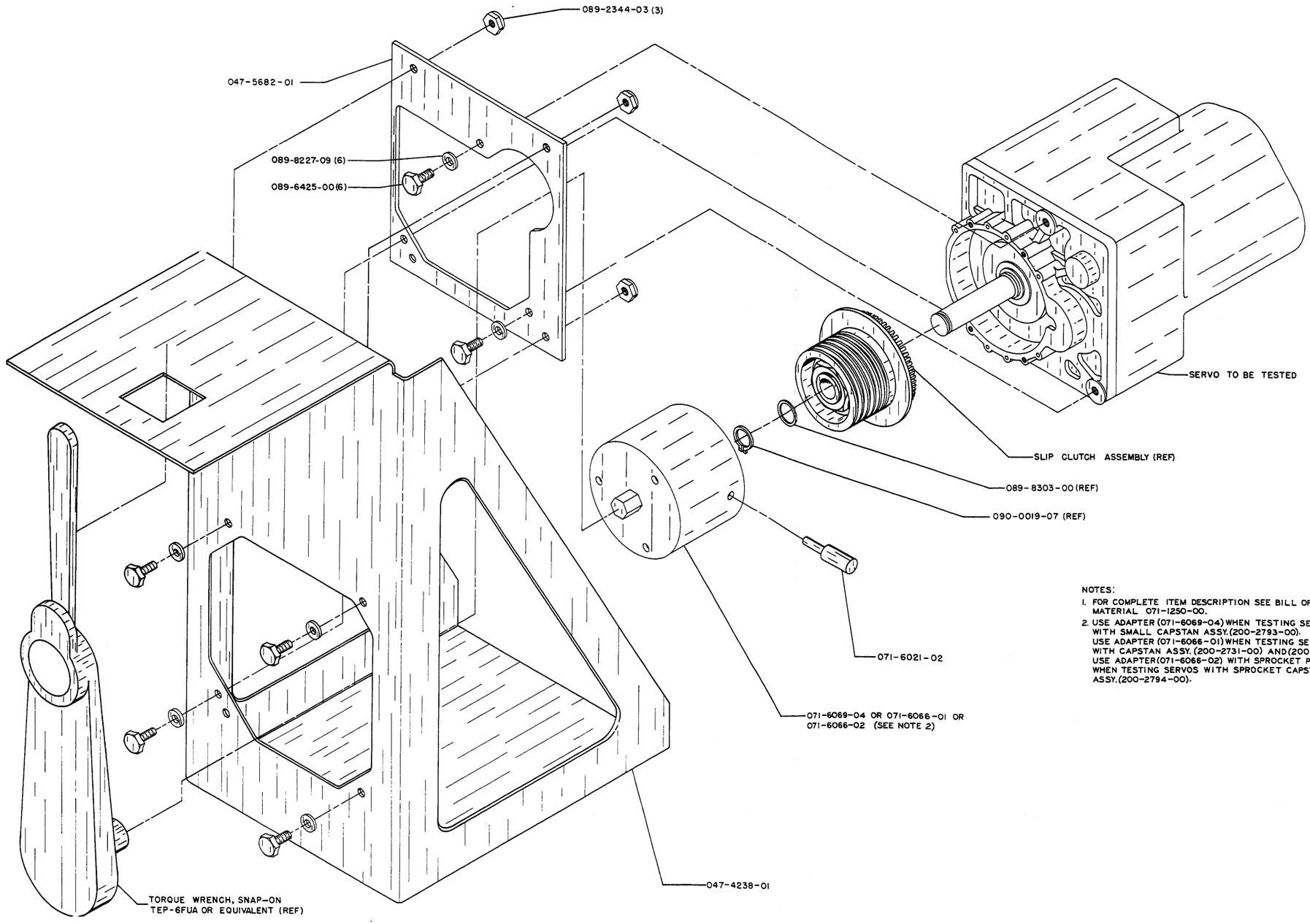
b. Perform the instructions in paragraph 5.2.3.1 e, f, and g.

c. Perform the procedures contained in Table 5-2.

STEP	CONTROL	LOCATION	POSITION	INDICATION	RESULT
1.	EXT PWR	Bench power supply	Adjust	+20VDC	
2.	SOL ENG switch	SERVO SECTION	On	KS 178 engage clutch engages without hesitation.	
3.	ANALOG ADJUST 2 (ROLL SERVO)	ANALOG	Adjust fully CCW	Slip clutch slips for greater than two revolutions without disengaging.	
4.	SOL ENG switch	SERVO SECTION	Off	KS 178 engage clutch disengages in less than 1 sec.	
5.	SOL ENG switch	SERVO SECTION	On	KS 178 engage clutch engages.	
6.	ANALOG ADJUST 2	ANALOG section	Adjust fully CW	KS 178 slip clutch shall slip for greater than two revolutions without disengaging.	
7.	SOL ENG switch	SERVO SECTION	Off	KS 178 engage clutch disengages.	
8.	EXT PWR	Bench power supply	Adjust	+28VDC	

TABLE 5-2 ENGAGE CLUTCH (28VDC)

KING
KS 178
PRIMARY SERVO



NOTES:

1. FOR COMPLETE ITEM DESCRIPTION SEE BILL OF MATERIAL 071-1250-00.
2. USE ADAPTER (071-6069-04) WHEN TESTING SERVOS WITH SMALL CAPSTAN ASSY.(200-2793-00).
   USE ADAPTER (071-6066-01) WHEN TESTING SERVOS WITH CAPSTAN ASSY. (200-2731-00) AND (200-2792-00).
   USE ADAPTER (071-6066-02) WITH SPROCKET PINS (071-6065-00) WHEN TESTING SERVOS WITH SPROCKET CAPSTAN ASSY.(200-2794-00).

FIGURE 5-2 KS 178 PRIMARY SERVO TEST KIT ASSEMBLY
(Dwg. No 300-2944-00, R-1)

5.2.3.3 Engage Clutch (14VDC Bus)

a. Install the KS 178 in the torque fixture (Figure 5-2).

b. Perform the instructions in paragraph 5.2.3.1 e, f, and g.

c. Perform the procedures contained in Table 5-3.

STEP	CONTROL	LOCATION	POSITION	INDICATION	RESULT
1.	EXT PWR switch	Bench Power Supply	Adjust	9 ± 0.1VDC	
2.	SOL ENG switch	SERVO SECTION	On	KS 178 engage clutch engages without hesitation.	
3.	ANALOG ADJUST 2 (ROLL SERVO)	ANALOG	Adjust fully CCW	The slip clutch shall slip greater than two revolutions without disengaging.	
4.	SOL ENG switch	SERVO SECTION	Off	KS 178 engage clutch disengages within less than 1 sec.	
5.	SOL ENG switch	SERVO SECTION	On	KS 178 engage clutch engages.	
6.	ANALOG ADJUST 2	ANALOG	Adjust fully CW	The slip clutch shall slip for greater than two revolutions.	
7.	SOL ENG switch	SERVO SECTION	Off	KS 178 engage clutch disengages in less than 1 sec.	
8.	EXT PWR	Bench Power Supply	Adjust	+14VDC	

TABLE 5-3 ENGAGE CLUTCH (14VDC)

5.2.3.4 Motor and Tach Performance

a. Perform the instructions in paragraph 5.2.3.1 e, f, and g.

b. Perform the procedures contained in Table 5-4.

STEP	CONTROL	LOCATION	POSITION	INDICATION	RESULT
1.	SOL ENG switch	SERVO SECTION	On	KS 178 engage clutch engaged.	
2.	Connect voltmeter to Test Jack D and Test Jack L in KS 178 section.				
3.	ANALOG ADJUST 2	ANALOG	Adjust	0.0 ± 0.5VDC	
4.	ANALOG ADJUST 2	ANALOG	Adjust slowly CCW	Until capstan just starts to rotate.	
5.	Connect voltmeter to Test Jack D and Test Jack C in KS 178 section. Ensure that value is more positive than -2.0VDC.				
6.	ANALOG ADJUST 2	ANALOG	Adjust	-10.0 ± 0.5VDC	
7.	KS 178 capstan shall rotate CW at a speed specified in Table 5-5 ± 15%.				
8.	Connect voltmeter to Test Jack A and Test Jack P in KS 178 section. Ensure that voltage is equal to motor speed measured in step eight, multiplied by the TACH multiplier given in Table 5-5 ± 15%. Ensure that voltage is negative.				
9.	Connect voltmeter to Test Jack L and Test Jack D.				
10.	ANALOG ADJUST 2	ANALOG	Adjust	0.0 ± 0.5VDC	
11.	ANALOG ADJUST 2	ANALOG	Adjust slowly CW	Until capstan just begins to rotate.	
12.	Connect voltmeter to Test Jack L and Test Jack C in KS 178 section. Ensure that voltage measures more positive than -2.0VDC.				
13.	ANALOG ADJUST 2	ANALOG	Adjust	-10. ± 0.02VDC	
14.	KS 178 capstan shall rotate CCW at a speed specified in Table 5-5 ± 15%.				

STEP	CONTROL	LOCATION	POSITION	INDICATION	RESULT
15.	Connect voltmeter to Test Jack A and Test Jack P. Record indication. Voltage shall be equal to motor speed measured in test 13 multiplied by TACH multiplier given in Table 5-5 ± 15%. Ensure that voltage is positive.				
16.	SOL ENG switch	SERVO SECTION	Off	----	
17.	Connect voltmeter to Test Jack 2 and Test Jack GND in ANALOG section.				
18.	ANALOG ADJUST 2	ANALOG	Adjust	0.0 ± 0.05VDC	

TABLE 5-4 MOTOR AND TACH PERFORMANCE

KS 178 P/N 065-0051-	Paragraphs 5.2.3.4-8, 5.2.3.4-15 Capstan No-load Speed (RPM)	Paragraphs 5.2.3.4-9, 5.2.3.4-16 Tach Multiplier	Paragraphs 5.2.3.5-2, 5.2.3.5-6 Breakout Torque (LBF-IN)	Paragraphs 5.2.3.5-3 5.2.3.5-7 Slip Clutch Torque (LBF-IN)
-01	4.07	.255	Slip Clutch Torque ± 15%	See Note 2
-02	2.68	.255	Slip Clutch Torque ± 15%	See Note 2
-04	2.68	.255	Slip Clutch Torque ± 15%	See Note 2
-06	4.07	.255	Slip Clutch Torque ± 15%	32 ± 3
-07	4.07	.255	Slip Clutch Torque ± 15%	25 ± 2
-08	4.07	.255	Slip Clutch Torque ± 15%	39 ± 4

NOTE

1. This table contains information on units that are currently released. As different part numbers units are released this table will automatically be updated.

2. The Slip Clutch Torque on most KS 178's is not preset from the factory and will vary from aircraft to aircraft. The Slip Clutch Torque is set during certification and the value can be obtained from the specific aircraft STC Installation Manual of the aircraft from which the KS 178 was removed.

TABLE 5-5 ALTERNATE VERSION DATA

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5.2.3.5 Slip Clutch Performance

a. Install the KS 178 in the torque fixture (Figure 5-2).

b. Perform the instructions contained in paragraph 5.2.3.1 e, f, and g.

c. Perform the procedures contained in Table 5-6.

STEP	CONTROL	LOCATION	POSITION	INDICATION	RESULT
1.	SOL ENG switch	SERVO SECTION	On	KS 178 engage clutch engaged	
2.	ANALOG ADJUST 2	ANALOG section	Adjust	While adjusting slowly CCW, observe clutch breakout point. Breakout torque shall be within the torque specified in Table 5-5.	
3.	ANALOG ADJUST 2	ANALOG section	Adjust fully CCW	Slip clutch torque given in Table 5-5.	
4.	Connect voltmeter to Test Jack D and Test Jack L on KS 178 section.				
5.	ANALOG ADJUST 2	ANALOG	Adjust	0.0±0.5VDC	
6.	ANALOG ADJUST 2	ANALOG	Adjust	While adjusting slowly CW, observe clutch breakout point. Breakout torque shall be within the torque specified in Table 5-5.	
7.	ANALOG ADJUST 2	ANALOG	Adjust fully CW	Slip clutch torque given in Table 5-5.	
8.	SOL ENG	SERVO SECTION	OFF	----	
9.	Connect voltmeter to Test Jack 2 and Test Jack GND in ANALOG section.				
10.	ANALOG ADJUST 2	ANALOG	Adjust	0.0 ± 0.05VDC	

TABLE 5-6 SLIP CLUTCH PERFORMANCE

5.2.3.6 Solenoid Performance

a. Install the KS 178 in the torque fixture (Figure 5-2).

b. Perform the instructions in paragraph 5.2.3.1 e, f, and g.

c. Perform the procedures contained in Table 5-7.

STEP	CONTROL	LOCATION	POSITION	INDICATION	RESULT
1.	SOL ENG switch	SERVO SECTION	ON	KS 178 engage clutch engaged.	
2.	Observe the position of the servo drive gear with respect to the large gear on the servo mount. The capstan should be able rotate one quarter of a degree to one eighth of a degree (Figure 5-3).				

TABLE 5-7 SOLENOID PERFORMANCE

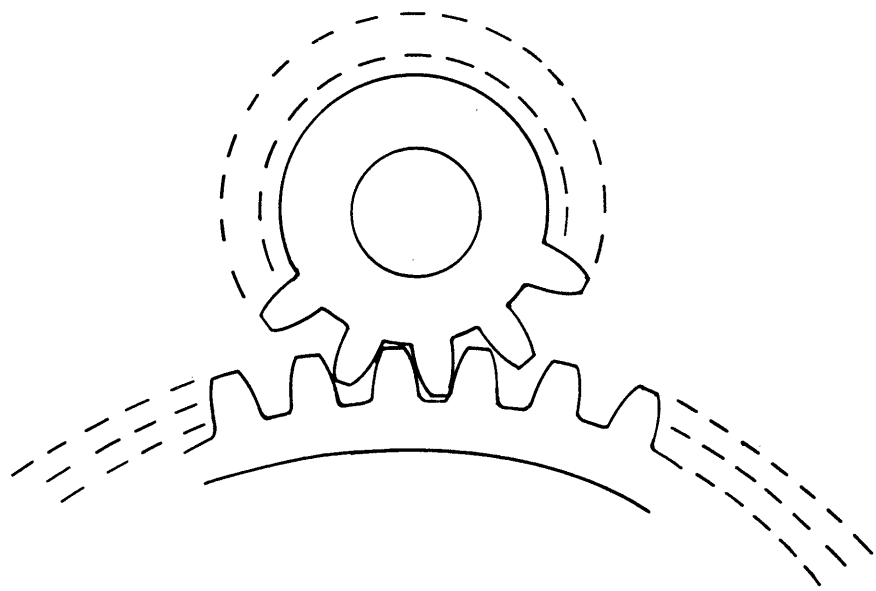


FIGURE 5-3 SERVO GEAR MESH

5.2.4 ALIGNMENT

Alignment procedures for the KS 178 Primary Servo are an integral part of the test and assembly procedures and should be performed as described in paragraphs 5.2.3.3a and 5.3.4.

5.2.4.1 Capstan Shaft and Capstan End Play Alignment

NOTE

THE MOTOR/ENGAGE PLATE ASSEMBLY MUST BE REMOVED TO FACILITATE CAPSTAN SHAFT INSTALLATION.

Drawing Reference - Figure 6-1, pages 6-3 and 6-5.

a. Install snap ring (090-0019-07) and washer (089-8304-00) onto center of shaft and slide shaft into the servo plate with the snap ring and washer on the capstan side of the plate.

b. Install washers (089-8295-01/03) as required and snap ring (090-0019-07). The "as required" washers are to achieve an end play of .002 to .008 inch.

c. Install capstan, washer (089-8303-00), shim washers (089-8295-01) as required, and snap ring (090-0019-07). The "as required" washers are to achieve an end play of .002 to .008 inch.

5.2.4.2 Motor Engage Plate End Play Alignment

NOTE

THE SOLENOID ASSEMBLY MUST BE REMOVED TO FACILITATE MOTOR ENGAGE PLATE INSTALLATION.

a. Carefully slide the engage plate assembly onto the main plate. Secure with screw (089-6129-04), washer (089-8225-00) and shims (089-8199-00/01) as required to achieve .002 to .008 inch end play.

b. Install PC board and solenoid per the assembly procedure.

5.2.4.3 Solenoid and Servo/Capstan Gear Alignment

a. Slide the solenoid onto the arm of the engage plate assembly and secure the solenoid with 3 screws (089-6030-04) and lock washers (089-8017-37).

b. With the 3 solenoid mount screws loose, slide the solenoid up or down to obtain .001 to .008 inches of backlash between the motor pinion and its capstan mounting gear.

Reference Figure 5-3, page 5-15 and Figure 6-1 on pages 6-3 and 6-5.

5.3 OVERHAUL

5.3.1 VISUAL INSPECTION

This section contains instructions to assist in determining the condition of the KS 178 assembly by inspection. Defects resulting from wear, physical damage, deterioration, or other causes can be found by these inspection procedures. To aid inspection, detailed procedures are arranged in alphabetical order.

A. Capacitors, Fixed

Inspect capacitors for case damage, body damage, and cracked, broken, or charred insulation. Check for loose, broken, or improperly soldered connections.

B. Chassis

Inspect the chassis for deformation, dents, punctures, badly worn surfaces, damaged connectors, damaged fastener devices, loose or missing hardware, component corrosion, and damage to finish.

C. Connectors

Inspect connector for broken parts, deformed shells or clamps, and other irregularities. Inspect for cracked or broken insulation and for contacts that are broken, deformed, or out of alignment. Also, check for corroded or damaged plating on contacts and for loose, improperly soldered, broken, or corroded terminal connections.

D. Covers and Shields

Inspect covers and shields for punctures, deep dents, and badly worn surfaces. Also, check for damaged fastener devices, corrosion, and damage to finish.

E. Insulators

Inspect all insulators for evidence of damage, such as broken or chipped edges, burned areas, and presence of foreign matter.

F. Resistors, Fixed

Inspect the fixed resistors for cracked, broken, blistered, or charred bodies and loose, broken, or improperly soldered connections.

G. Terminal Connections Soldered

1. Inspect for cold-soldered or resin joints. These joints present a porous or dull, rough appearance. Check for strength of bond using the points of a tool.

2. Examine the terminals for excess solder, protrusions from the joint, pieces adhering to adjacent insulation, and particles lodged between joints, conductors, or other components.

3. Inspect for insufficient solder and unsoldered strands of wire protruding from conductor at the terminal. Check for insulation that is stripped back too far from the terminal.

4. Inspect for corrosion at the terminal.

H. Wiring

Inspect open and laced wiring of chassis, subassembly chassis, and parts of equipment for breaks in insulation, conductor breaks, cut or broken lacing and improper dress in relation to adjacent wiring or chassis.

5.3.2 CLEANING

A. Using a clean, lint-free cloth lightly moistened with a mild cleaning detergent, remove all foreign matter from the equipment case. Wipe dry using a clean, lint-free cloth.

B. Using a hand controlled dry air jet (not more than 15psi), blow the dust from inaccessible areas. Care should be taken to prevent damage by the air blast.

C. Clean the receptacle and plugs with a hand controlled dry air jet (not more than 25psi) and a clean, lint-free cloth lightly moistened with an approved mild cleaning solvent. Wipe dry with a clean, dry, lint-free cloth.

5.3.3 REPAIR

This paragraph describes repair procedures, along with any special techniques for replacing damaged or defective components.

A. Connectors

When replacing a connector, refer to the appropriate PC board assembly drawing and follow notes to ensure correct mounting and mating of each connector.

B. Diodes

Diodes used are silicon and germanium; use long nose pliers as a heat sink under normal soldering conditions. Note the diode polarity before removal.

C. Integrated Circuits

Refer to Appendix "A" for removal and replacement instructions.

D. Wiring

When repairing a wire that has broken from its terminal, remove all old solder and pieces of wire from the terminal, restrip the wire to the necessary length and resolder the wire to the terminal. Replace a damaged wire with one of the same type, size, and length.

5.3.4 DISASSEMBLY/ASSEMBLY PROCEDURES

Refer to appropriate drawings in section VI.

5.3.4.1 Removal of the Dust Cover

a. To gain access to the components of the servo, remove two (2) screws, KPN 089-6344-04.

b. Slide the Dust Cover off and over the connector.

5.3.4.2 Removal of the Cable Guards

To remove the cable guards first remove mounting screws, KPN 089-6123-05.

5.3.4.3 Removal of the Tach Motor

a. Unsolder the wires which connect the Tach Motor to the wiring harness.

b. Remove the four (4) set screws, KPN 089-5853-04, that secure the drive gears.

c. Slide the gears off the shaft.

d. Remove the three (3) screws, KPN 089-6119-04, that secure the Tach Motor bracket to the drive motor.

e. Remove the two (2) screws, KPN 089-7021-00, that secure the Tach Motor to the bracket.

5.3.4.4 Removal of the Drive Motor/Engage Plate Assembly

a. Unsolder the wires which connect the drive Motor to the wiring harness.

b. Remove the three (3) screws, KPN 089-6030-04, and lockwashers, KPN 089-8017-37, that secure the soldenoid to the main plate, KPN 073-0430-XX.

c. Carefully slide the solenoid off the arm of the engage plate assembly.

d. Remove the return spring, KPN 078-0118-00, and the plunger, KPN 076-1098-01, from the solenoid. At the same time ensure that no wires are pulled from the harness.

e. Remove the two (2) screws, KPN 089-5903-05, that secure the PC board, KPN 200-6304-01, to the main plate. At the same time ensure that no wires are pulled from the harness.

f. Remove the one (1) screw, KPN 089-6129-04, washer and shims (if any) which secure the engage plate assembly to the main plate.

g. Carefully slide the engage plate assembly off the main plate.

5.3.4.5 Removal of the KS 178 Motor/Engage Plate Assembly

a. Remove the engage plate, KPN 073-0438-02 from the motor, KPN 148-5057-XX by removing the three screws, KPN 089-6067-05.

b. Drive the roll pin, KPN 090-0052-17, through the pinion gear, KPN 029-0361-00 and slide the gear off the motor shaft. Be sure to adequately support the pinion gear to prevent bending of the motor shaft.

5.3.4.6 Removal of the Capstan/Slip Clutch Assembly (Large Diameter Capstan)

a. Remove the snap ring, washer, and the shims (if any).

b. Slip the capstan/slip clutch assembly and washer off the shaft. Be careful to retain the proper number of shims to facilitate proper reassembly.

c. The shaft can be removed only after the motor has been removed.

d. Remove the snap ring, washers, and shims (if any).

e. Slide the shaft from the main plate.

f. Be careful to retain the proper number of shims to facilitate proper reassembly.

5.3.4.7 Disassembly of the Capstan/Slip Clutch Assembly (Large Diameter Capstan)

a. Remove the locknut that holds the entire assembly.

b. When removing the Belleville springs, observe their orientation. The first spring out has its cup facing the capstan; the second one has its cup facing out and the third one has its cup facing the capstan.

c. The assembly will then break down in the following order:

(1) Carbon-on-steel clutch plate.

(2) Copper clutch Disc

(3) Capstan

(4) Copper clutch Disc

(5) Carbon-on-steel clutch plate

5.3.4.8 Removal of Capstan/Slip clutch Assembly (Small Diameter Capstan)

a. The capstan/slip clutch assembly can only be removed the snap ring and shims (if any).

b. On the back side of the main plate, first remove the snap ring and shims (if any).

c. Pull the capstan from the main plate.

d. Slide the washer off the shaft. Retain the proper number of shims to facilitate proper assembly.

5.3.4.9 Disassembly of the Capstan/Slip Clutch Assembly (Small Diameter Capstan)

a. The capstan drive gear is pressed onto a roll pin and can be removed by carefully prying between the gear and capstan.

b. Slide the gear off the shaft.

c. To disassembly the slip clutch assembly, remove the snap ring and unscrew the locknut, which will in turn decompress the three (3) Belleville springs.

d. As the Belleville springs are removed, note their orientation. The first spring out has its cup facing the capstan, the second one has its cup facing out and the third one has its cup facing the capstan.

e. Next remove the following:

(1) Spacer

(2) Carbon-on-steel clutch plate

(3) Copper clutch disc

f. To remove the capstan, line up the small hole drilled into the groove in the capstan with the pin. The pin is a slip fit in the shaft and should easily drop through the hole.

g. Slide the capstan off the shaft being careful not to drop the copper clutch disc out from the rear of the capstan.

h. The carbon-on-steel clutch plate can now be pulled off the shaft. The amount of pull may seem more than usual since the plate is slightly press fitted onto the shaft.

5.3.4.10 Disassembly of the Solenoid Assembly

a. Unsolder or snip and mark the wires which connect the solenoid to the wiring harness.

b. Remove the roller from the plunger (removed during removal of the motor) by driving out the pin.

c. The entire assembly can be broken down into individual pieces by the removal of the screw.

d. The plunger stop can now be dropped out.

e. The solenoid coil and spacer can now be slid from the frame.

5.3.4.11 Transistor Removal

a. Power transistor replacement is easily accomplished without removal of the circuit module.

b. Remove the screw which fasten the transistors to the sockets. There is no need for unsoldering the leads.

5.4 TROUBLESHOOTING

The purpose of this section is to provide procedures and assistance in troubleshooting the KS 178 Primary Servo. The troubleshooting charts are written with all indications as they would appear when the KS 178 is connected to a full flight system. Throughout this section, it is assumed that the system problem has been thoroughly diagnosed as a KS 178 problem.

5.4.1 TROUBLESHOOTING ASSISTANCE

When replacing any of the power transistors in the KS 178, check the insulators for areas where particles beneath them may have punched through and would thus short the collector of the transistor to the chassis.

5.4.2 TROUBLESHOOTING CHART

SYMPTOM	PROBABLE CAUSE	TROUBLESHOOTING PROCEDURE
No CW servo movement during flight CCW movement satisfactory	CW side of amplifier open	Check operation of Q104, Q202, Q204
No CCW servo movement during flight CW movement satisfactory	CCW side of amplifier	Check operation of Q103, Q201, Q203
No servo movement during flight	Motor open	Check operation of M201
	Solenoid not engaging	Check operation of solenoid
	No power to servo	Check internal wiring
Roll movements "wallowing" during flight	Tach open or tach gear	Check operation of M202

CONTENTS

SECTION VI
ILLUSTRATED PARTS LIST

LIST OF ILLUSTRATIONS

ILLUSTRATED PARTS LIST INTRODUCTION

INTRODUCTION

The purpose of this parts list is for identification and requisition of parts. Part numbers listed in this Illustrated Parts List meet critical equipment design specification requirements. Use only those part numbers specified in this section for replacement of parts. Whenever a "caution" is posted concerning the use of a particular part, adherence to the appropriate replacement must be followed.

EXPLANATION OF ILLUSTRATED PARTS LIST

Terminology used on the parts list(s) is listed below.

1. Symbol-Denotes the component reference for both schematic diagrams and mechanical drawings. Example: CR401, whereas CR means Diode device and 401 is its assigned numerical code. The following designators are used by King Radio.

Circuit Designation	Component
C	Capacitor
F	Fuse
I	Integrated Circuit/IC
J	Fixed Connector
L	Inductor
Q	Transistor
P	Plug
R	Resistor
S	Switch
T	Transformer
U	Resistor/Capacitor Network
V	Photocell/tube
Y	Crystal
CJ	Circuit Jumper
CR	Diode
DS	Lamp
FL	Filter
TP	Test Point
WG	Waveguide

2. Part Number-The part number is assigned by King Radio Corporation. The first three digits denote the type of device. Example: 007-1200-00; the 007 denotes a discrete device. The following list are some of the prefixes commonly used by KRC.

Prefix	Component
007	Transistor/Diode
017	Filter
019	Transformer
019	Inductor
030	Connector
111/096/102/106	Capacitor
120	Integrated Circuit
13X	Resistor

3. Description-Defines minimum specification of the component/part. Example: XSTR S NPN SRF2325 is Transistor, Silicon, NPN and the vendor part number is SRF2325. Example: CAP EL 150UF 50V is Capacitor, Electrolytic, value is 150 microfarad and voltage rating is 50 volts. Following are some of the abbreviations used under Description.

Abbreviation	Word
AL	Aluminum
BIFLR	Bifilar
CC	Carbon Composite
CF	Carbon Film
CH	Choke
CAP	Capacitor
CAP CR	Ceramic
DC	Disk Ceramic
DIO	Diode
EL	Electrolytic
FC	Fixed Composition
FERR	Ferrite
FLTR	Filter
FT	Feed Thru
HV	High Voltage
HW	Half Watt
IC	Integrated Circuit
MC	Monolithic Ceramic
MY	Mylar
PC	Polycarbonate
PF	Precision Film
PP	Paper
PS	Polystrene
QW	Quarter Watt
RES	Resistor
S	Silicon
SCR	Screw
SM	Silver Mica
STDF	Standoff
SW	Switch
TERM	Terminal
TN	Tantalum
TST PT	Test Point
TW	Tenth Watt
VA	Variable
WW	Wire Wound
XFMR	Transformer
XSTR	Transistor
XTAL	Crystal

4. Code UM- Unit of measure, Example: EA for each. The following units are used through the Illustrated Parts List.

Abbreviation	Word
EA	Each
FT	Foot
AR	As Required

5. BOM- Bill of Material is a breakdown of units or parts used to assemble one item.

6. Assy No.- Assembly Number is the assigned number used to identify a mechanical drawing.

ILLUSTRATED PARTS LIST

The Illustrated Parts List (IPL) is organized basically in the following three divisions, Bill of Material (200-XXXX-XX), Parts Layout (300-XXXX-XX), and the Electrical Schematic Diagram (002-XXXX-XX). The IPL may also contain the Final assembly or sub-assembly drawings.

The Assembly drawings reference their mechanical parts with a King Part Number (KPN). Electrical parts are referenced by their circuit designators (i.e. CR402, R908, etc.). Each Assembly parts list is assembled so that mechanical parts are first, in numerical part number order and electrical parts are second in circuit designation order.

The following unusual numbers may appear at times on the BOM and are for commentary purposes only.

Example 1:

CR401 999-9999-99 DO NOT USE

The component designator CR401 had been previously used on the assembly and then deleted; therefore, it cannot be reassigned.

Example 2:

CR401 999-9999-98 NOT USED

The component designator CR401 is available for future assignment and is not presently a part of the PC board/Final assembly.

Example 3:

CR401 999-9999-97 SEE NEXT ASSEMBLY

The component designator CR401 is used as part of the electrical circuit assembly but because of assembly or testing requirements may be part of another assembly.

CR401 999-9999-96 RESERVED

The component designator CR401 is reserved for future usage.

UNIT/BOARD VERSIONS

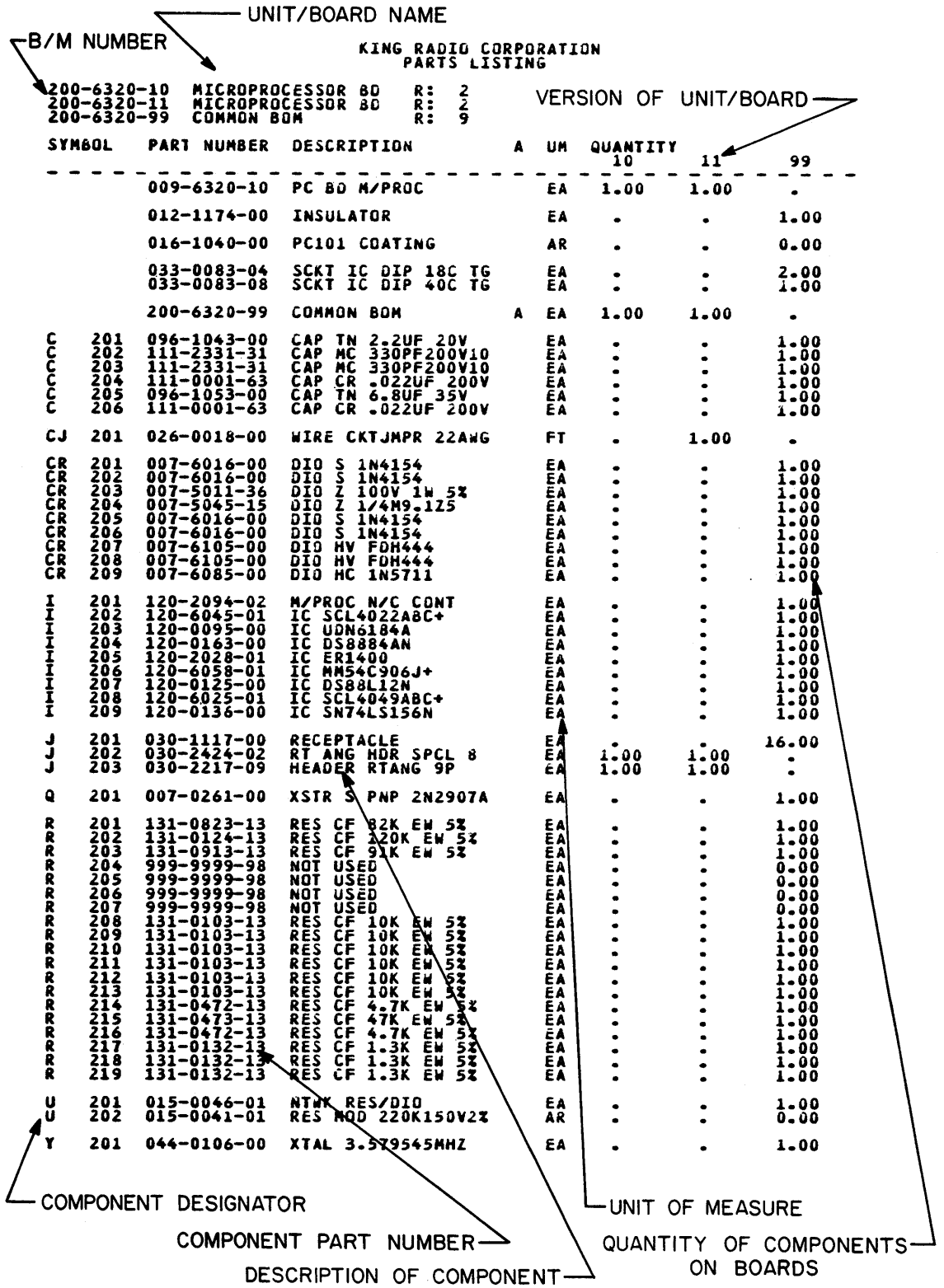
The BOM is arranged to show the Unit or Board version from left to right across the top of the BOM starting with the -00 column. One of the columns, either the -00 or -99 will be common to all versions. The common parts column will have numbers of parts or dashes. The number means the part is common to all versions and the dash means the part is not common to all versions. All parts required to build a unit will be the parts listed in the common version column plus the parts listed in the specific version column.

Example 1: Board Versions

Transmitter Board	-01	-02	-99 or -00 (the common bill may be -00 or -99)
007-2050-01	1	-	- Part only on -01 board
007-2051-01	-	1	- Part only on -02 board
007-2052-01	-	-	1 Part on both -01 and -02 boards

Example 2: Unit Versions

Nav/Comm	-00	-01	-99	
200-1234-01 VOR BD	1	-	-	Bd only on -00 Version
200-1234-02 VOR BD	-	1	-	Bd only on -01 Version
200-4321-01 GS BD	1	-	-	Bd only on -00 Version
200-4321-02 GS BD	-	1	-	Bd only on -01 Version
200-2222-00 PWR SUP	-	-	1	Bd in both -00/-01 Versions
200-1111-00 CHS ASSY	-	-	1	Assy in both -00/01 Versions


UNIT/BOARD NAME
B/M NUMBER
KING RADIO CORPORATION
PARTS LISTING
200-6320-10 MICROPROCESSOR BD R: 2
200-6320-11 MICROPROCESSOR BD R: 2
200-6320-99 COMMON BOM R: 9
VERSION OF UNIT/BOARD
SYMBOL PART NUMBER DESCRIPTION A UM QUANTITY 10 11 99
009-6320-10 PC BD M/PROC EA 1.00 1.00 .
012-1174-00 INSULATOR EA . . 1.00
016-1040-00 PC101 COATING AR . . 0.00
033-0083-04 SCKT IC DIP 18C TG EA . . 2.00
033-0083-08 SCKT IC DIP 40C TG EA . . 1.00
200-6320-99 COMMON BOM A EA 1.00 1.00 .
C 201 096-1043-00 CAP TN 2.2UF 20V EA . . 1.00
C 202 111-2331-31 CAP MC 330PF200V10 EA . . 1.00
C 203 111-2331-31 CAP MC 330PF200V10 EA . . 1.00
C 204 111-0001-63 CAP CR .022UF 200V EA . . 1.00
C 205 096-1053-00 CAP TN 6.8UF 35V EA . . 1.00
C 206 111-0001-63 CAP CR .022UF 200V EA . . 1.00
CJ 201 026-0018-00 WIRE CKTJMPR 22AWG FT . 1.00 .
CR 201 007-6016-00 DIO S 1N4154 EA . . 1.00
CR 202 007-6016-00 DIO S 1N4154 EA . . 1.00
CR 203 007-5011-36 DIO Z 100V 1W 5% EA . . 1.00
CR 204 007-5045-15 DIO Z 1/4M9.1Z5 EA . . 1.00
CR 205 007-6016-00 DIO S 1N4154 EA . . 1.00
CR 206 007-6016-00 DIO S 1N4154 EA . . 1.00
CR 207 007-6105-00 DIO HV FDH444 EA . . 1.00
CR 208 007-6105-00 DIO HV FDH444 EA . . 1.00
CR 209 007-6085-00 DIO HC 1N5711 EA . . 1.00
I 201 120-2094-02 M/PROC N/C CONT EA . . 1.00
I 202 120-6045-01 IC SCL4022ABC+ EA . . 1.00
I 203 120-0095-00 IC UDN6184A EA . . 1.00
I 204 120-0163-00 IC DS8884AN EA . . 1.00
I 205 120-2028-01 IC ER1400 EA . . 1.00
I 206 120-6058-01 IC MM54C906J+ EA . . 1.00
I 207 120-0125-00 IC DS88L12N EA . . 1.00
I 208 120-6025-01 IC SCL4049ABC+ EA . . 1.00
I 209 120-0136-00 IC SN74LS156N EA . . 1.00
J 201 030-1117-00 RECEPTACLE EA . . 16.00
J 202 030-2424-02 RT ANG HDR SPCL 8 EA 1.00 1.00 .
J 203 030-2217-09 HEADER RTANG 9P EA 1.00 1.00 .
Q 201 007-0261-00 XSTR S PNP 2N2907A EA . . 1.00
R 201 131-0823-13 RES CF 82K EW 5% EA . . 1.00
R 202 131-0124-13 RES CF 120K EW 5% EA . . 1.00
R 203 131-0913-13 RES CF 91K EW 5% EA . . 1.00
R 204 999-9999-98 NOT USED EA . . 0.00
R 205 999-9999-98 NOT USED EA . . 0.00
R 206 999-9999-98 NOT USED EA . . 0.00
R 207 999-9999-98 NOT USED EA . . 0.00
R 208 131-0103-13 RES CF 10K EW 5% EA . . 1.00
R 209 131-0103-13 RES CF 10K EW 5% EA . . 1.00
R 210 131-0103-13 RES CF 10K EW 5% EA . . 1.00
R 211 131-0103-13 RES CF 10K EW 5% EA . . 1.00
R 212 131-0103-13 RES CF 10K EW 5% EA . . 1.00
R 213 131-0103-13 RES CF 10K EW 5% EA . . 1.00
R 214 131-0472-13 RES CF 4.7K EW 5% EA . . 1.00
R 215 131-0473-13 RES CF 47K EW 5% EA . . 1.00
R 216 131-0472-13 RES CF 4.7K EW 5% EA . . 1.00
R 217 131-0132-13 RES CF 1.3K EW 5% EA . . 1.00
R 218 131-0132-13 RES CF 1.3K EW 5% EA . . 1.00
R 219 131-0132-13 RES CF 1.3K EW 5% EA . . 1.00
U 201 015-0046-01 NTWK RES/DIO EA . . 1.00
U 202 015-0041-01 RES NOD 220K150V2% AR . . 0.00
Y 201 044-0106-00 XTAL 3.579545MHZ EA . . 1.00
COMPONENT DESIGNATOR
COMPONENT PART NUMBER
DESCRIPTION OF COMPONENT
UNIT OF MEASURE
QUANTITY OF COMPONENTS ON BOARDS

KING RADIO CORPORATION
PARTS LISTING

065-0051-00 PRIMARY SERVO ASSY R: 11
065-0051-01 PRIMARY SERVO ASSY R: 4
065-0051-02 PRIMARY SERVO ASSY R: 6
065-0051-03 PRIMARY SERVO ASSY R: 4
065-0051-04 PRIMARY SERVO ASSY R: 4
065-0051-05 PRIMARY SERVO ASSY R: 2
065-0051-06 PRIMARY SERVO ASSY R: 5
065-0051-07 PRIMARY SERVO ASSY R: 2
065-0051-08 PRIMARY SERVO ASSY R: 2

SYMBOL	PART NUMBER	DESCRIPTION	A	UM	QUANTITY 00	01	02	03	04	05	06	07	08
	016-1008-04	GLYPTAL 7526 BL		AR	0.00	.	.	.	.	.	.	.	.
	016-1016-00	MOLYKOTE G-N PASTE		AR	0.00	.	.	.	.	.	.	.	.
	025-0003-00	WIRE 22 BLK		**	0.80	.	.	.	.	.	.	.	.
	025-0003-01	WIRE 22 BRN		FT	0.40	.	.	.	.	.	.	.	.
	025-0003-02	WIRE 22 RED		FT	0.80	.	.	.	.	.	.	.	.
	025-0018-33	WIRE 26 ORN		FT	0.40	.	.	.	.	.	.	.	.
	025-0018-34	WIRE 26 OR/YL		FT	0.40	.	.	.	.	.	.	.	.
	025-0018-36	WIRE 26 OR/BU		FT	0.40	.	.	.	.	.	.	.	.
	025-0018-40	WIRE 26 YL/BK		FT	0.40	.	.	.	.	.	.	.	.
	025-0018-42	WIRE 26 YL/RD		FT	0.40	.	.	.	.	.	.	.	.
	025-0018-44	WIRE 26 YEL		FT	0.40	.	.	.	.	.	.	.	.
	025-0018-52	WIRE 26 GN/RD		FT	0.40	.	.	.	.	.	.	.	.
	025-0018-53	WIRE 26 GN/OR		FT	0.40	.	.	.	.	.	.	.	.
	025-0018-62	WIRE 26 BU/RD		FT	0.40	.	.	.	.	.	.	.	.
	025-0018-68	WIRE 26 BU/GY		FT	0.40	.	.	.	.	.	.	.	.
	025-0018-77	WIRE 26 VIO		FT	0.40	.	.	.	.	.	.	.	.
	025-0018-96	WIRE 26 WH/BU		FT	0.40	.	.	.	.	.	.	.	.
	025-0029-00	WIRE 24 BLK		FT	0.40	.	.	.	.	.	.	.	.
	025-0029-02	WIRE 24 RED		FT	0.40	.	.	.	.	.	.	.	.
	025-0029-04	WIRE 24 YEL		FT	0.40	.	.	.	.	.	.	.	.
	025-0029-10	WIRE 24 BK/WH		FT	0.40	.	.	.	.	.	.	.	.
	025-0029-12	WIRE 24 RD/WH		FT	0.40	.	.	.	.	.	.	.	.
	025-0029-15	WIRE 24 GN/WH		FT	0.40	.	.	.	.	.	.	.	.
	025-0029-20	WIRE 24 GN/YL		FT	0.40	.	.	.	.	.	.	.	.
	025-0029-28	WIRE 24 RD/BK		FT	0.40	.	.	.	.	.	.	.	.
	025-0029-33	WIRE 24 WH/OR		FT	0.40	.	.	.	.	.	.	.	.
	029-0361-01	PINION 10T 32DP	A	EA	.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	029-0460-02	GEAR 63T64DP W/HUB	A	EA	1.00	.	.	.	.	.	.	.	.
	029-0461-02	GEAR 63T64DP W/HUB	A	EA	1.00	.	.	.	.	.	.	.	.
	047-5213-01	TACH MTG BRKT W/F		EA	1.00	.	.	.	.	.	.	.	.
	047-5513-02	STRN RLF BRKT W/H		EA	1.00	.	.	.	.	.	.	.	.
	047-6082-01	CABLE GUARD W/F		EA	.	.	.	.	.	.	1.00	1.00	1.00
	047-6083-02	FLT CA GUARD W/H-C	A	EA	.	.	.	.	1.00	.	1.00	1.00	1.00
	047-6161-01	CABLE GUARD W/F	A	EA	.	.	.	.	1.00	.	.	.	.
	057-2379-00	S/N TAG		EA	1.00	.	.	.	.	.	.	.	.
	057-2439-00	WARNING TAG		EA	1.00	.	.	.	.	.	.	.	.
	065-0051-00	PRIMARY SERVO ASSY	A	EA	.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	073-0430-03	MAIN PLATE W/HDW	A	EA	1.00	.	.	.	.	.	.	.	.
	073-0438-02	ENGAGE PLATE W/F	A	EA	1.00	.	.	.	.	.	.	.	.
	073-0485-01	CABLE GUARD SHORT		EA	.	2.00	2.00	2.00	.	.	.	.	.
	073-0489-01	CABLE GUARD LONG		EA	.	.	.	.	.	2.00	.	.	.
	076-1235-01	SHAFT W/F	A	EA	.	1.00	1.00	1.00	.	.	1.00	1.00	1.00
	078-0118-00	RETURN SPRG-SLND		EA	1.00	.	.	.	.	.	.	.	.
	088-0919-01	DUST COVER 4.05		EA	1.00	.	.	.	.	.	.	.	.
	089-5436-03	SCR FHP 4-40X3/16		EA	2.00	.	.	.	.	.	.	.	.
	089-5853-04	SCR SET 2-56X1/8		EA	4.00	.	.	.	.	.	.	.	.
	089-5903-05	SCR PHP 4-40X5/16		EA	2.00	.	.	.	.	.	.	.	.
	089-5948-08	SCR PHP 6-20X1/2		EA	8.00	.	.	.	.	.	.	.	.
	089-6030-04	SCR SHC 8-32 1/4		EA	3.00	.	.	.	.	.	.	.	.
	089-6067-05	SCR FHP 4-40X5/16		EA	3.00	.	.	.	.	.	.	.	.
	089-6119-03	SCR PHP 2-56X3/16		EA	3.00	.	.	.	.	.	.	.	.
	089-6123-03	SCR PHP 4-40X3/16		EA	.	.	.	.	3.00	.	3.00	3.00	3.00
	089-6123-05	SCR PHP 4-40X5/16		EA	2.00	.	.	.	2.00	.	2.00	2.00	2.00
	089-6123-06	SCR MPH 5-44X3/8		EA	2.00	.	.	.	.	.	.	.	.
	089-6129-04	SCR PHP 8-32X1/4		EA	1.00	.	.	.	.	.	.	.	.

KING RADIO CORPORATION
PARTS LISTING

065-0051-XX

SYMBOL		PART NUMBER	DESCRIPTION	A	UM	QUANTITY 00	01	02	03	04	05	06	07	08
		089-6344-04	SCR PHP 4-40X1/4		EA	2.00	.	.	.	.	.	.	.	.
		089-7021-00	METRIC SCREW		EA	2.00	.	.	.	.	.	.	.	.
		089-8017-37	WSHR INTL LK #6		EA	3.00	.	.	.	.	.	.	.	.
		089-8199-00	WSHR SHIM		AR	0.00	.	.	.	.	.	.	.	.
		089-8199-01	WSHR SHIM		AR	0.00	.	.	.	.	.	.	.	.
		089-8199-02	SHIM .015 T		EA	1.00	.	.	.	.	.	.	.	.
		089-8225-00	WSHR THRUST		EA	1.00	.	.	.	.	.	.	.	.
		089-8293-01	WASHER W/FINISH		AR	0.00	.	.	.	.	.	.	.	.
		089-8295-03	WASHER W/FINISH		AR	0.00	.	.	.	.	.	.	.	.
		089-8303-00	WASHER		EA	.	1.00	1.00	1.00	.	.	1.00	1.00	1.00
		089-8304-00	WASHER		EA	1.00	.	.	.	.	.	.	.	.
		090-0019-07	RING RTNR .438		EA	1.00	2.00	2.00	2.00	.	.	2.00	2.00	2.00
		090-0052-17	ROLL PIN .312		EA	1.00	.	.	.	.	.	.	.	.
		091-0007-02	BSHG STRN RELIEF		EA	1.00	.	.	.	.	.	.	.	.
		091-0283-00	TO3 INSULATOR		EA	4.00	.	.	.	.	.	.	.	.
		091-0286-00	INSUL XSTR .437		EA	2.00	.	.	.	.	.	.	.	.
		200-2598-01	HARNESS ASSY	A	EA	1.00	.	.	.	.	.	.	.	.
		200-2731-00	SLIP CLUTCH ASSY	A	EA	.	1.00	1.00	1.00	.	.	1.00	1.00	1.00
		200-2793-00	SLIP CLUTCH ASSY	A	EA	.	.	.	.	1.00	1.00	.	.	.
		200-2841-00	SOLENOID ASSY	A	EA	1.00	.	.	.	.	.	.	.	.
		200-6304-01	CIRCUIT BOARD	A	EA	1.00	.	.	.	.	.	.	.	.
M	201	148-5057-00	12DC MTG W/GRHD		EA	.	1.00	.	.	.	.	1.00	1.00	1.00
M	201	148-5057-01	19.1DC MTG W/GRHD		EA	.	.	1.00	.	1.00	.	.	.	.
M	201	148-5057-02	12DC MTG W/GRHD		EA	.	.	.	1.00	.	1.00	.	.	.
M	202	148-5011-00	MTR 6VDC		EA	1.00	.	.	.	.	.	.	.	.
Q	201	007-6127-00	XSTR S NPN 2N5632		EA	1.00	.	.	.	.	.	.	.	.
Q	202	007-6127-00	XSTR S NPN 2N5632		EA	1.00	.	.	.	.	.	.	.	.
Q	203	007-6128-00	XSTR DARL 2N6059		EA	1.00	.	.	.	.	.	.	.	.
Q	204	007-6128-00	XSTR DARL 2N6059		EA	1.00	.	.	.	.	.	.	.	.
R	117	026-0018-00	WIRE CKTJMPR 22AWG		EA	1.00	.	.	1.00	.	1.00	.	.	.
R	117	131-0822-13	RES CF 6.2K EW 5%		EA	.	1.00	1.00	.	1.00	.	1.00	1.00	1.00
R	118	131-0222-13	RES CF 2.2K EW 5%		EA	.	1.00	1.00	.	1.00	.	1.00	1.00	1.00
R	119	131-0512-13	RES CF 5.1K EW 5%		RF	X.	.	.	.	.	.	.	.	.
R	201	132-0103-02	RES WW 2 10W 10%		EA	1.00	.	.	.	.	.	.	.	.

KING
KS 178
PRIMARY SERVO

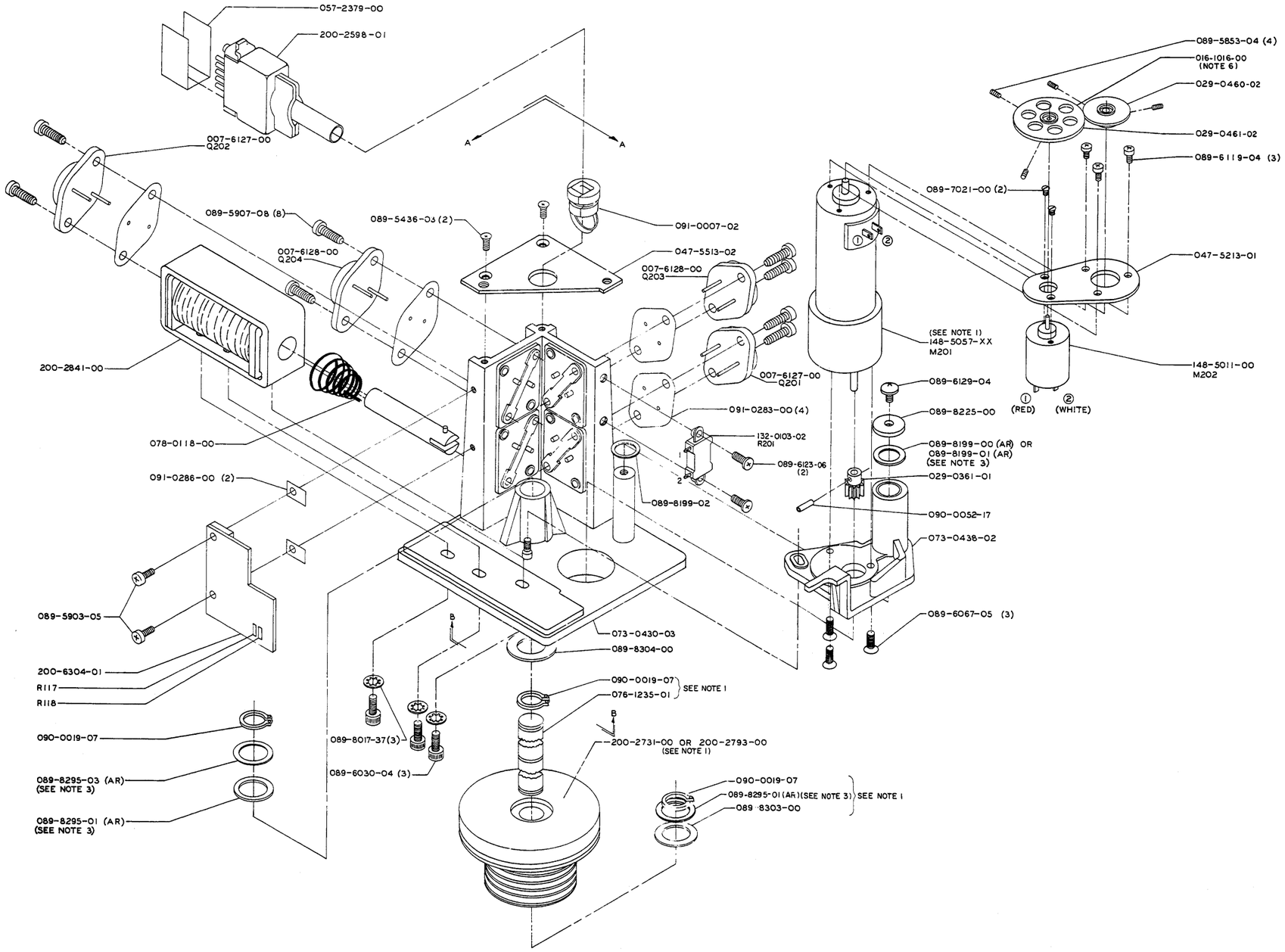


FIGURE 6-1 PRIMARY SERVO
(Dwg. No. 300-2606-00, R-12)
(Sheet 1 of 2)

KING
KS 178
PRIMARY SERVO

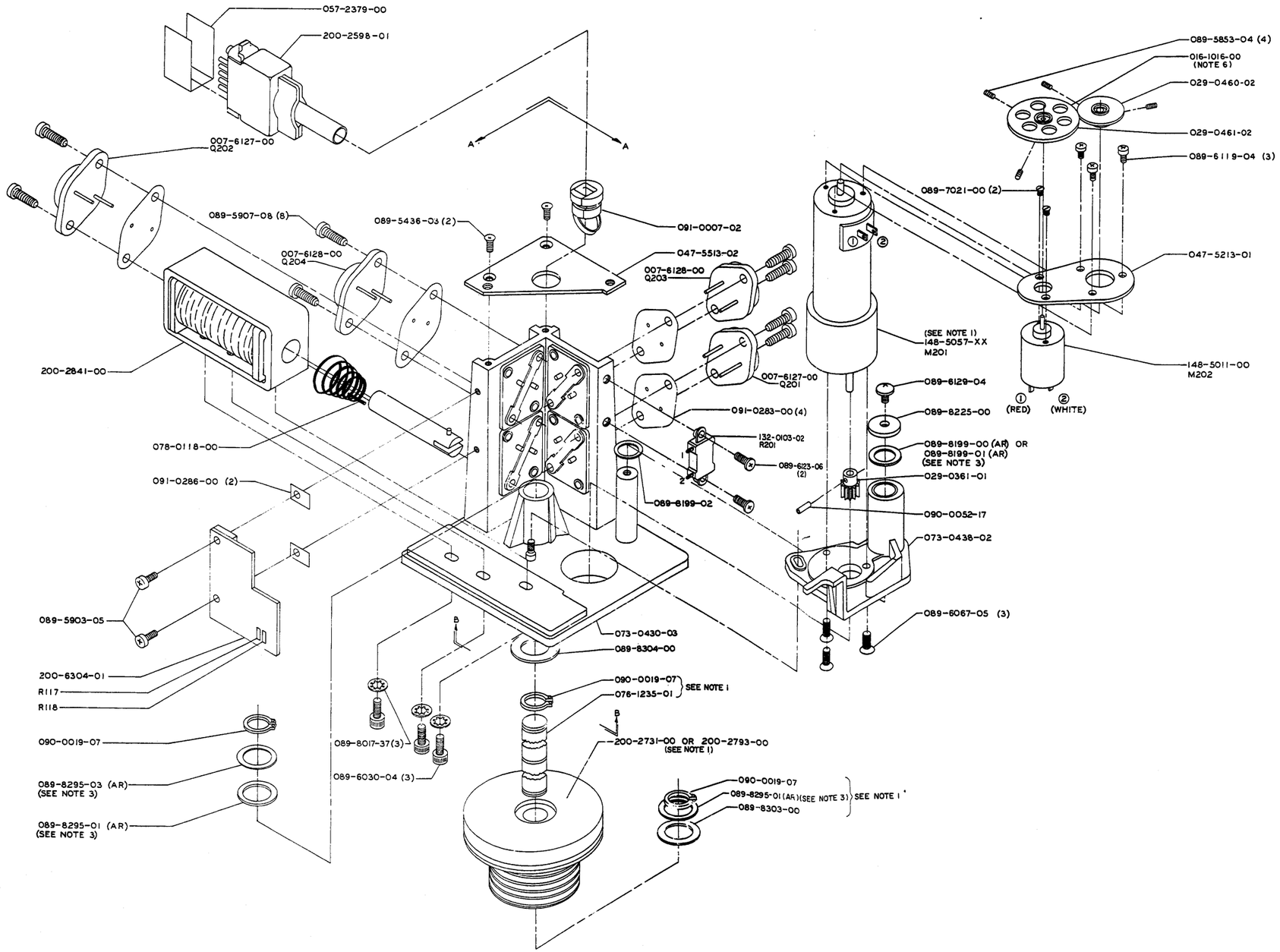
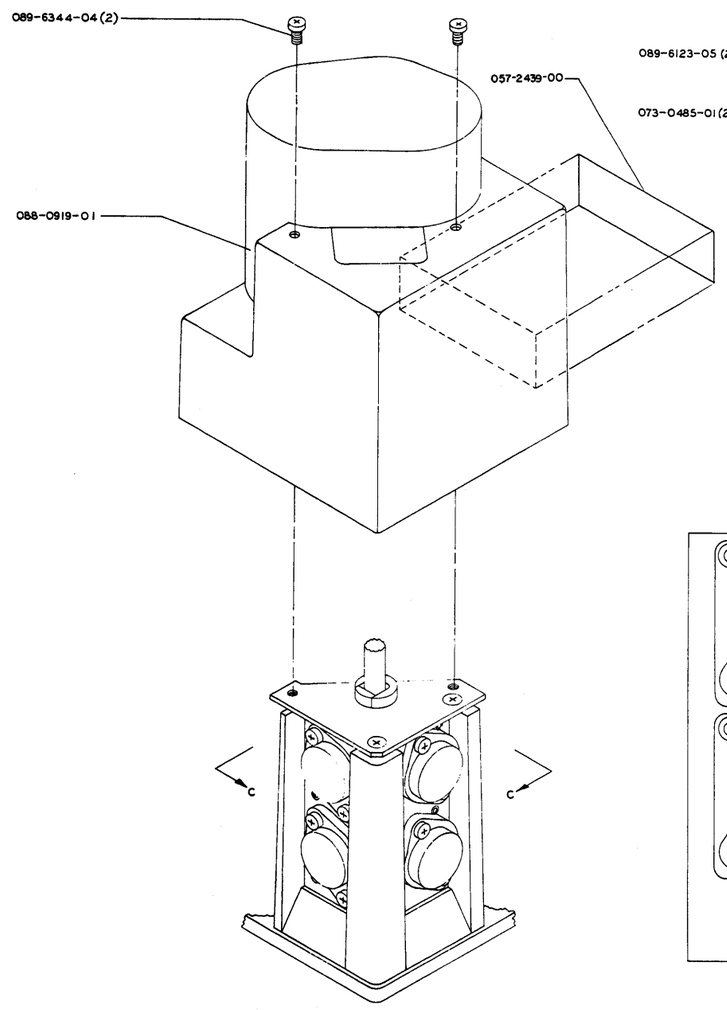
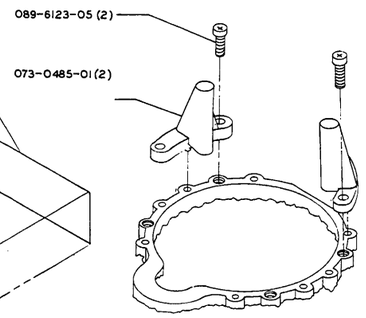


FIGURE 6-1 PRIMARY SERVO
(Dwg. No. 300-2606-00, R-11)
(Sheet 1 of 2)

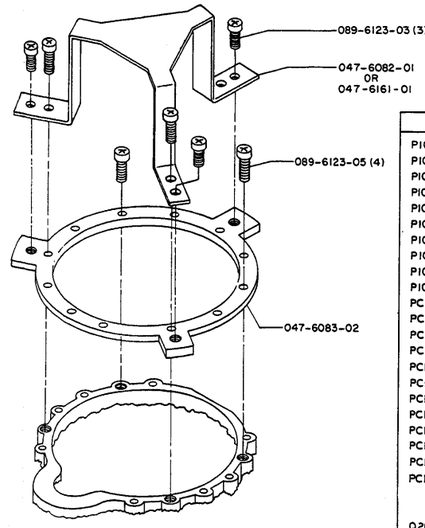
KING
KS 178
PRIMARY SERVO



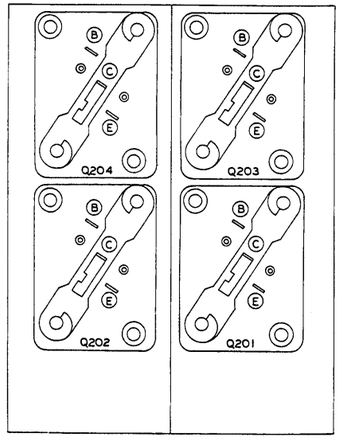
VIEW A-A



VIEW B-B
(SEE NOTE 1)



VIEW B-B
(SEE NOTE 1)



TRANSISTOR TERMINAL DESIGNATIONS

VIEW C-C

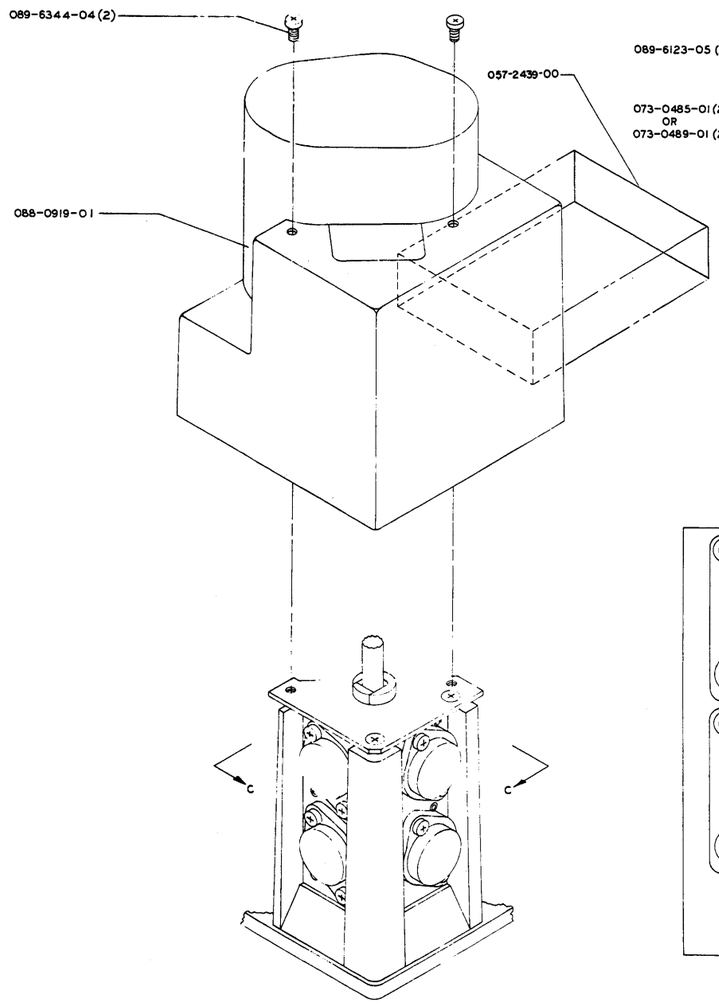
FROM	TO	COLOR	P/N	GA
P101-L	PCB101-11	GRN-RED	025-0018-52	26
P101-D	PCB101-19	GRN-ORN	025-0018-53	26
P101-P	PCB101-23	WHT-BLU	025-0018-96	26
P101-A	PCB101-21	BLU-GRA	025-0018-68	26
P101-N	PCB101-8	BRN	025-0003-01	22
P101-E	PCB101-1	YEL	025-0029-04	24
P101-M	PCB101-5	RED-WHT	025-0029-12	24
P101-B	PCB101-3	BLK-WHT	025-0029-10	24
P101-H	Q201-C	RED	025-0003-02	22
P101-C	Q203-E	BLK	025-0003-00	22
PCB101-16	Q201-C	RED	025-0029-02	24
PCB101-12	Q204-E	BLK	025-0029-00	24
PCB101-10	Q201-B	ORG	025-0018-33	26
PCB101-13	Q202-B	ORG-YEL	025-0018-34	26
PCB101-15	Q201-E	YEL-BLK	025-0018-40	26
PCB101-9	Q203-B	YEL-RED	025-0018-42	26
PCB101-17	Q204-B	YEL	025-0018-44	26
PCB101-18	Q202-E	ORG-BLU	025-0018-36	26
PCB101-2	SOL-WHT			
PCB101-4	SOL-RED			
PCB101-6	SOL-YEL			
PCB101-7	SOL-BLK			
Q204-E	Q203-E	BLK	025-0003-00	22
Q203-C	Q202-E	BRN-YEL	025-0029-20	24
Q204-C	Q201-E	RED-BLK	025-0029-28	24
Q201-C	Q202-C	RED	025-0003-02	22
Q201-E	R201-1	GRN-WHT	025-0029-15	24

P/N	FROM R201-2 025-0029-15 GRN-WHT 24 GA TO	FROM Q202-E 025-0029-33 WHT-ORG 24 GA TO	FROM PCB101-20 025-0018-62 BLU-RED 26 GA TO	FROM PCB101-22 025-0018-77 VIO 26 GA TO	SLIP CLUTCH TORQUE (LBF-IN)
-01	M201-2	M201-1	M202-2 (WHT)	M202-1 (RED)	21±2
-02	M201-2	M201-1	M202-2 (WHT)	M202-1 (RED)	23±2
-04	M201-2	M201-1	M202-2 (WHT)	M202-1 (RED)	45±5
-06	M201-2	M201-1	M202-2 (WHT)	M202-1 (RED)	32 ± 3
-07	M201-2	M201-1	M202-2 (WHT)	M202-1 (RED)	25±2
-08	M201-2	M201-1	M202-2 (WHT)	M202-1 (RED)	39 ± 3

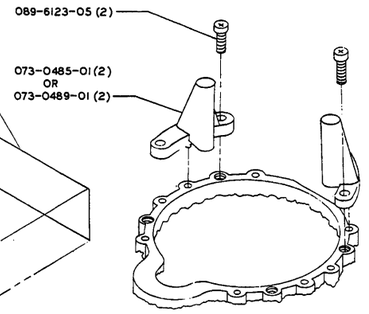
NOTES:
1. FOR COMPLETE ITEM DESCRIPTION SEE B/M 065-0051-XX.
2. AFTER SECURING APPLY GLYPTAL (016-1008-04) TO ALL SCREWS WITHOUT LOCKING DEVICE.
3. SHIM AS REQUIRED TO ACHEIVE .002-.008 END PLAY.
4. DELETED.
5. ADJUST SOLENOID ASSY. (200-2841-00) TO ACHEIVE .001-.005 BACKLASH AT THE PITCH RADIUS OF THE MOTOR PINION AND THE CAPSTAN GEAR WITH SOLENOID IN ENGAGED POSITION.
6. APPLY A LIGHT COAT OF LUBE (016-1016-00) TO TACH GEAR TEETH (029-0442-01 AND 029-0443-01).

FIGURE 6-1 PRIMARY SERVO
(Dwg. No. 300-2606-00, R-12)
(Sheet 2 of 2)

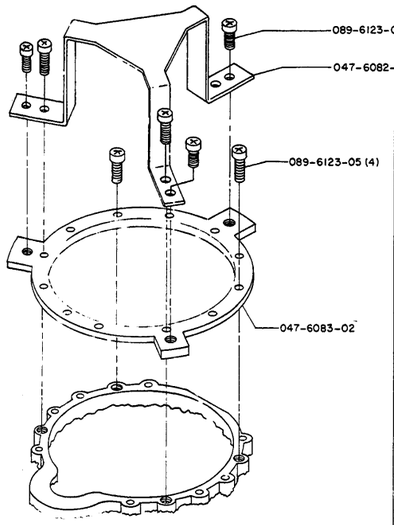
KING
KS 178
PRIMARY SERVO



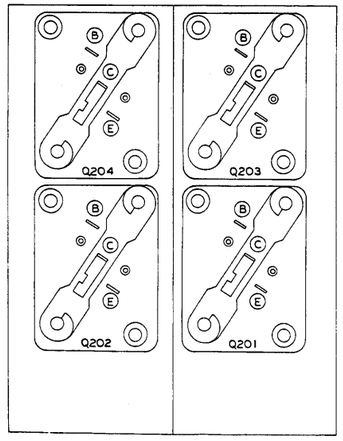
VIEW A-A



VIEW B-B
(SEE NOTE 1)



VIEW B-B
(SEE NOTE 1)



TRANSISTOR TERMINAL DESIGNATIONS

VIEW C-C

FROM	TO	COLOR	P/N	GA
P101-L	PCB101-11	GRN-RED	025-0018-52	26
P101-D	PCB101-19	GRN-ORN	025-0018-53	26
P101-P	PCB101-23	WHT-BLU	025-0018-96	26
P101-A	PCB101-21	BLU-GRA	025-0018-68	26
P101-N	PCB101-8	BRN	025-0003-01	22
P101-E	PCB101-1	YEL	025-0029-04	24
P101-M	PCB101-5	RED-WHT	025-0029-12	24
P101-B	PCB101-3	BLK-WHT	025-0029-10	24
P101-H	Q201-C	RED	025-0003-02	22
P101-C	Q203-E	BLK	025-0003-00	22
PCB101-16	Q201-C	RED	025-0029-02	24
PCB101-12	Q204-E	BLK	025-0029-00	24
PCB101-10	Q201-B	ORG	025-0018-33	26
PCB101-13	Q202-B	ORG-YEL	025-0018-34	26
PCB101-15	Q201-E	YEL-BLK	025-0018-40	26
PCB101-9	Q203-B	YEL-RED	025-0018-42	26
PCB101-17	Q204-B	YEL	025-0018-44	26
PCB101-18	Q202-E	ORG-BLU	025-0018-36	26
PCB101-2	SOL-WHT			
PCB101-4	SOL-RED			
PCB101-6	SOL-YEL			
PCB101-7	SOL-BLK			
Q204-E	Q203-E	BLK	025-0003-00	22
Q203-C	Q202-E	BRN-YEL	025-0029-20	24
Q204-C	Q201-E	RED-BLK	025-0029-28	24
Q201-C	Q202-C	RED	025-0003-02	22
Q201-E	R201-1	GRN-WHT	025-0029-15	24

P/N	FROM R201-2 025-0029-15 GRN-WHT 24 GA TO	FROM Q202-E 025-0029-33 WHT-ORG 24 GA TO	FROM PCB101-20 025-0018-62 BLU-RED 26 GA TO	FROM PCB101-22 025-0018-77 VIO 26 GA TO	SLIP CLUTCH TORQUE (LBF-IN)
-01	M201-2	M201-1	M202-2 (WHT)	M202-1 (RED)	21±2
-02	M201-2	M201-1	M202-2 (WHT)	M202-1 (RED)	
-06	M201-2	M201-1	M202-2 (WHT)	M202-1 (RED)	32±3
-07	M201-2	M201-1	M202-2 (WHT)	M202-1 (RED)	25±2
-08	M201-2	M201-1	M202-2 (WHT)	M202-1 (RED)	39±3

NOTES:
1. FOR COMPLETE ITEM DESCRIPTION SEE B/M 065-0051-XX.
2. AFTER SECURING APPLY GLYPTAL (016-1008-04) TO ALL SCREWS WITHOUT LOCKING DEVICE.
3. SHIM AS REQUIRED TO ACHEIVE .002-.008 END PLAY.
4. DELETED.
5. ADJUST SOLENOID ASSY. (200-2841-00) TO ACHEIVE .001-.005 BACKLASH AT THE PITCH RADIUS OF THE MOTOR PINION AND THE CAPSTAN GEAR WITH SOLENOID IN ENGAGED POSITION.
6. APPLY A LIGHT COAT OF LUBE (016-1016-00) TO TACH GEAR TEETH (029-0442-01 AND 029-0443-01).

FIGURE 6-1 PRIMARY SERVO
(Dwg. No. 300-2606-00, R-11)
(Sheet 2 of 2)

KING RADIO CORPORATION
PARTS LISTING

200-2731-00 SLIP CLUTCH ASSY R: 4

SYMBOL	PART NUMBER	DESCRIPTION	A	UM	QUANTITY 00
	029-0452-01	GEAR 77T MACH	A	EA	1.00
	047-5787-03	CLTCH PLT W/DSKMCH	A	EA	1.00
	047-5788-03	CLTCH PLT W/DSKMCH	A	EA	1.00
	047-5789-00	CLUTCH DISK		EA	2.00
	073-0482-03	CAPSTAN W/BUSHINGS	A	EA	1.00
	089-2343-00	NUT HEX LT 7.5-16		EA	1.00
	089-8187-01	WASHER 1.500		EA	3.00
	090-0052-07	PIN ROLLER .187		EA	5.00

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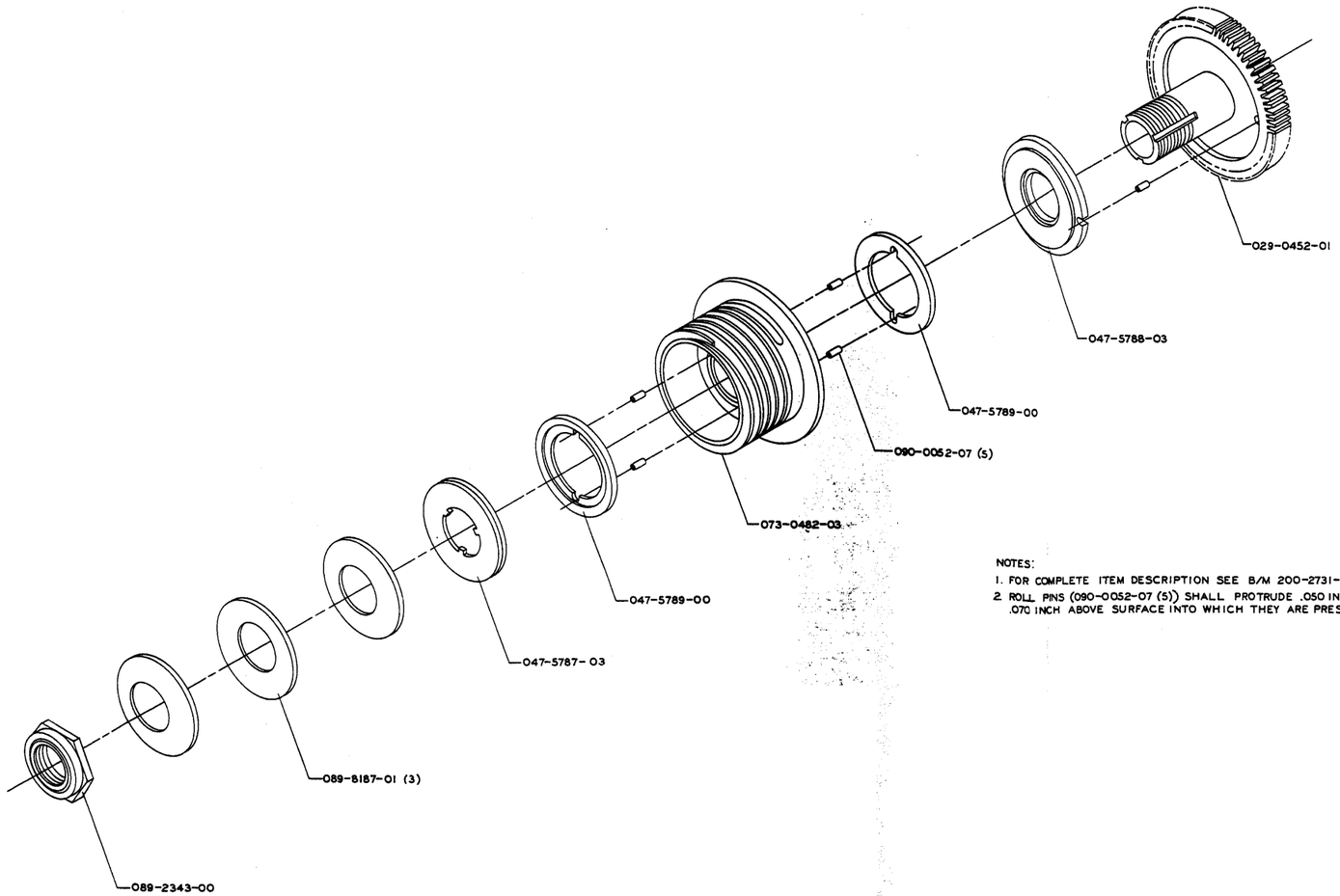
PRIMARY SERVO

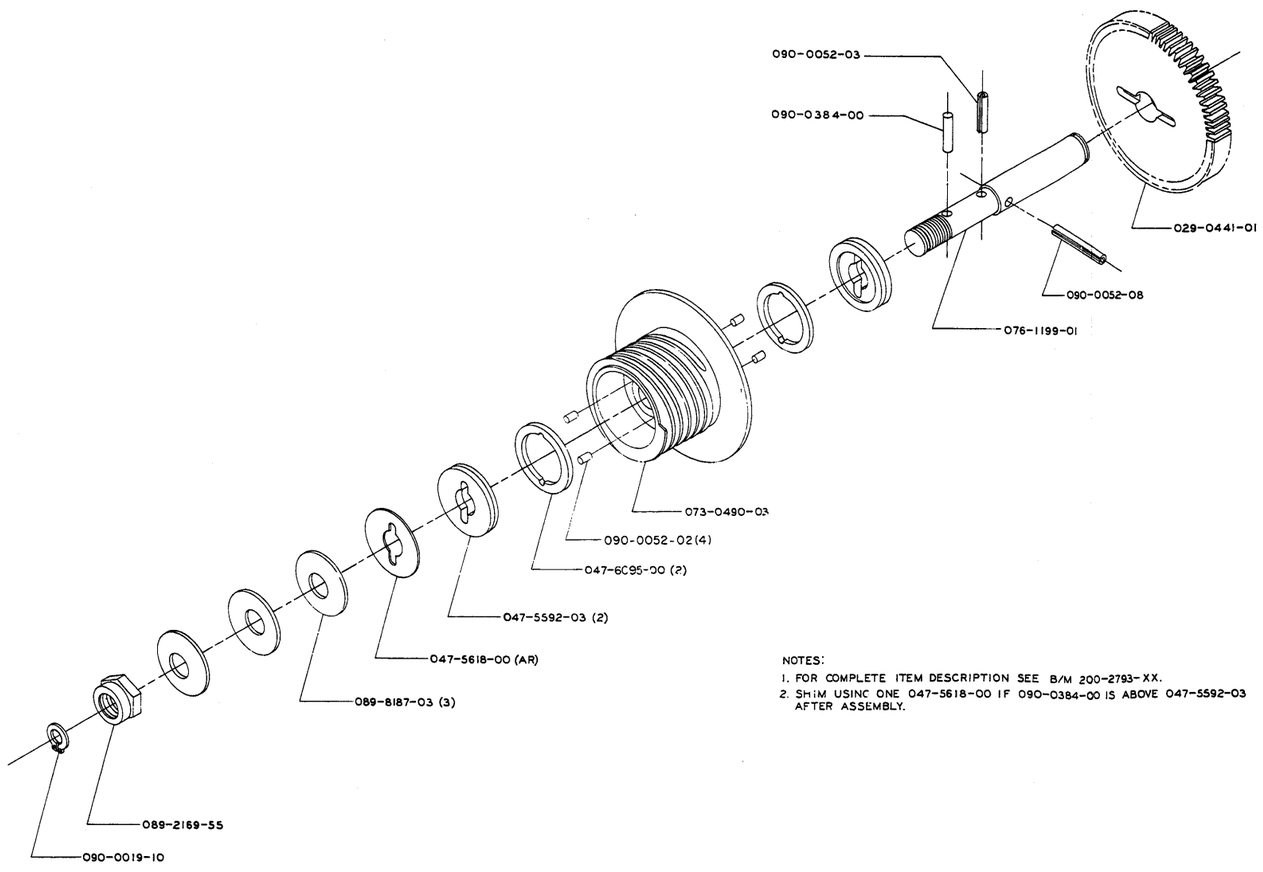


NOTES:
1. FOR COMPLETE ITEM DESCRIPTION SEE B/M 200-2731-XX.
2. ROLL PINS (090-0052-07 (5)) SHALL PROTRUDE .050 INCH TO .070 INCH ABOVE SURFACE INTO WHICH THEY ARE PRESSED.

FIGURE 6-2 SLIP CLUTCH ASSEMBLY
(Dwg. No. 300-2731-00, R-1)

200-2793-00 SLIP CLUTCH ASSY R: 3

SYMBOL	PART NUMBER	DESCRIPTION	A	UM	QUANTITY 00
	029-0441-01	GEAR 77T		EA	1.00
	047-5392-03	CLTCH PLT W/DSKMCH	A	EA	2.00
	047-5618-00	SHIM WASHER		AR	0.00
	047-6095-00	CLUTCH DISK		EA	2.00
	073-0490-03	CAPSTAN CSTG W/BUS	A	EA	1.00
	076-1199-01	SHAFT	A	EA	1.00
	089-2169-55	NUT HEX 3/8-24		EA	1.00
	089-8187-03	WASHER .950		EA	3.00
	090-0019-10	RING RTNR .312		EA	1.00
	090-0052-02	ROLL PIN .250		EA	4.00
	090-0052-05	ROLL PIN .500		EA	1.00
	090-0052-08	ROLL PIN .562		EA	1.00
	090-0384-00	PIN .560 L		EA	1.00

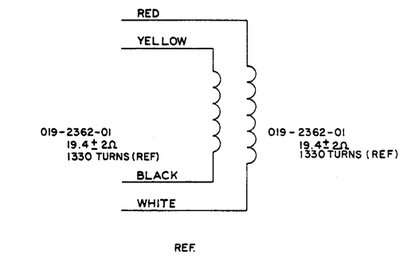


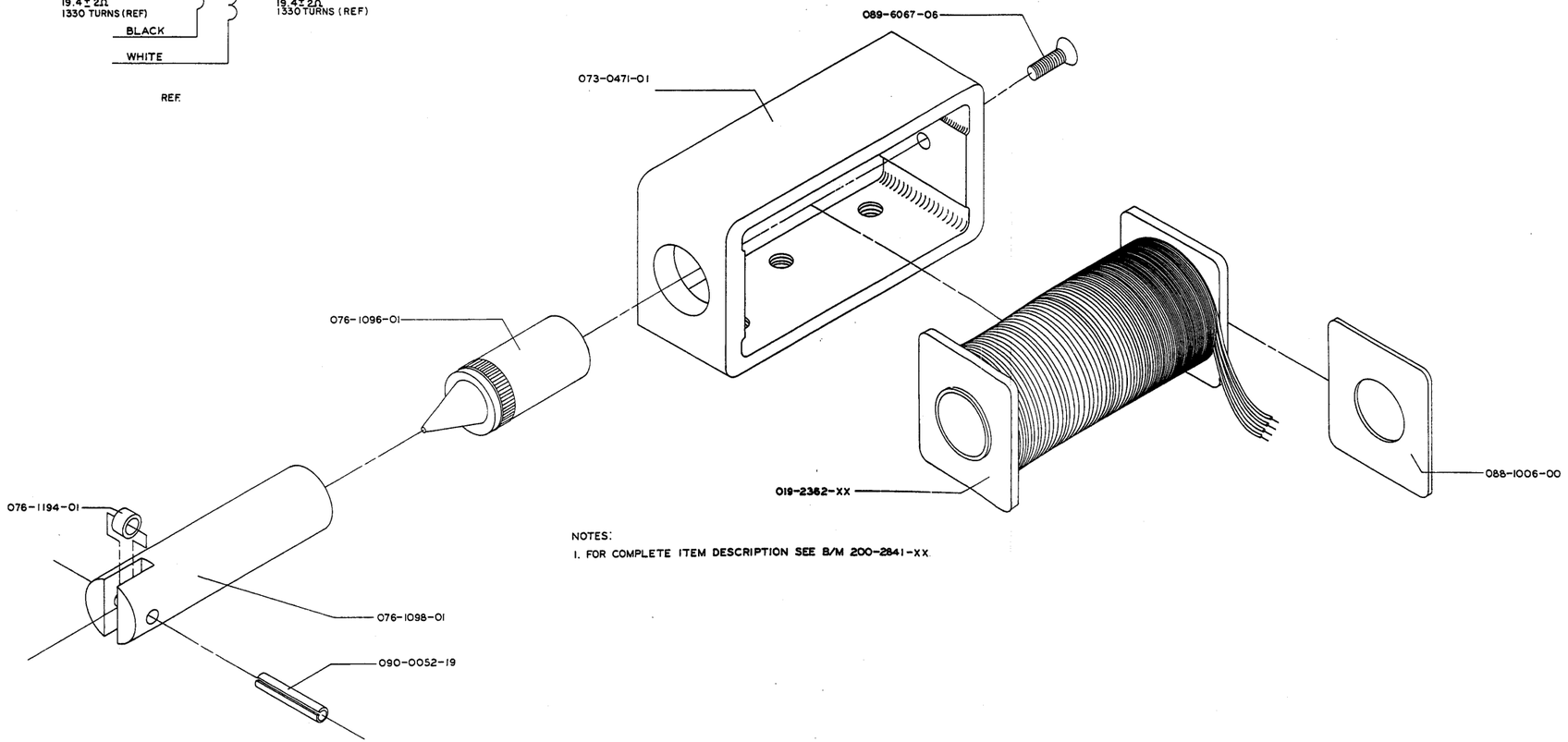
NOTES:
1. FOR COMPLETE ITEM DESCRIPTION SEE B/M 200-2793-XX.
2. SHIM USINC ONE 047-5618-00 IF 090-0384-00 IS ABOVE 047-5592-03 AFTER ASSEMBLY.

FIGURE 6-3 SLIP CLUTCH ASSEMBLY
(Dwg. No. 300-2793-00, R-1)

200-2841-00 SOLENOID ASSY R: 3
200-2841-99 COMMON BOM R: 3

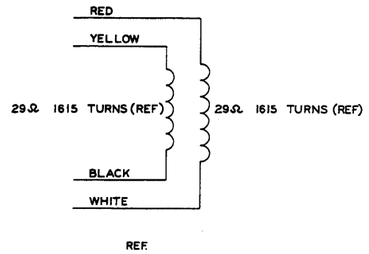
SYMBOL	PART NUMBER	DESCRIPTION	A	UM	QUANTITY 00	QUANTITY 99
	019-2362-01	SOLENOID COIL		EA	.	1.00
	073-0471-01	FRAME SLND W/F	A	EA	1.00	.
	076-1096-01	PLUNGER STOP W/F	A	EA	.	1.00
	076-1098-01	SOL PLNGR		EA	.	1.00
	076-1194-01	ROLLER W/F		EA	.	1.00
	088-1006-00	SPACER		EA	.	1.00
	089-6067-06	SCR FHP 4-40X3/8		EA	.	1.00
	090-0052-19	ROLL PIN .625		EA	.	1.00
	150-0047-10	SHRNK TUBING NAT		FT	.	0.20
	200-2841-99	COMMON BOM	A	EA	1.00	.

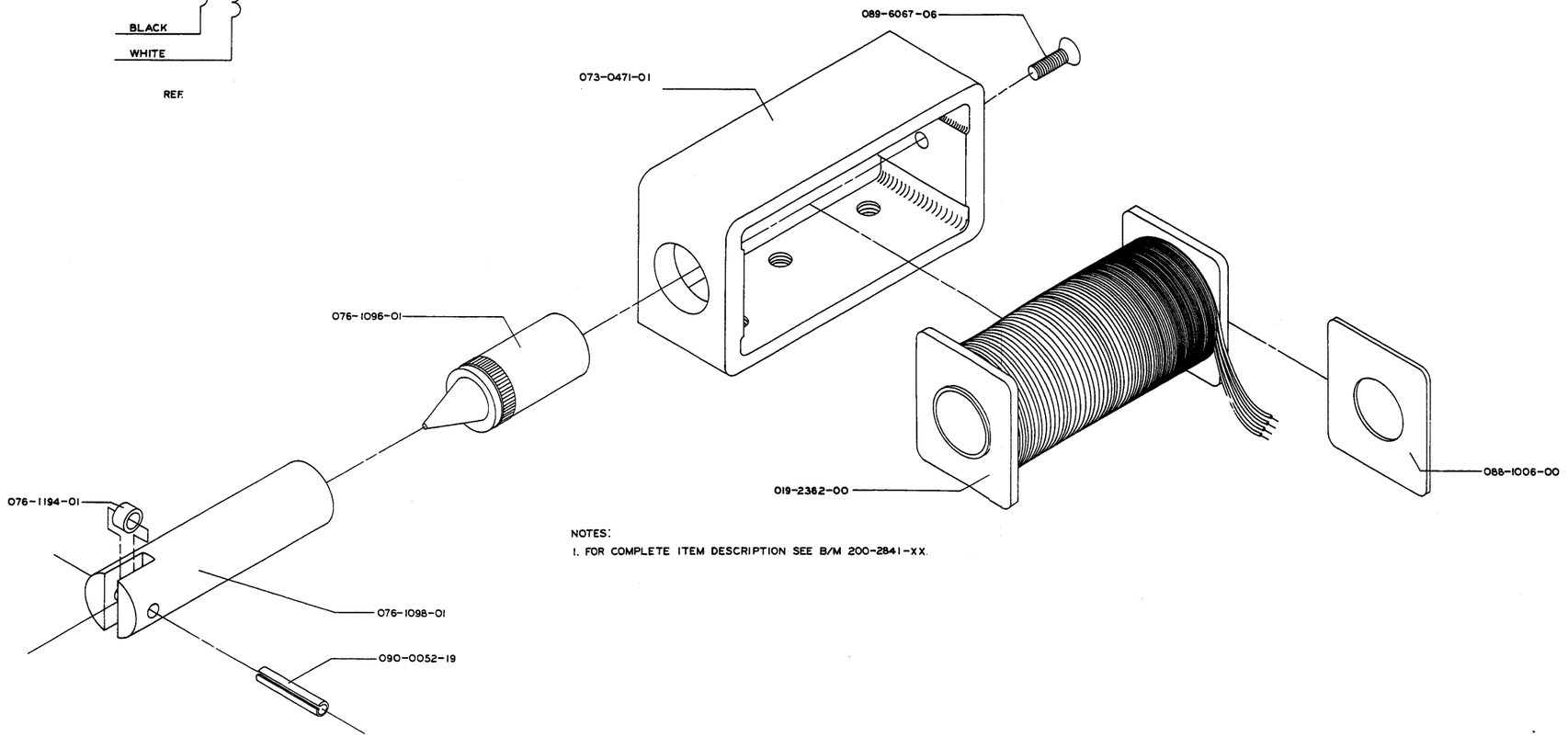




NOTES:
1. FOR COMPLETE ITEM DESCRIPTION SEE B/M 200-2841-XX.

FIGURE 6-4 SOLENOID ASSEMBLY
(Dwg. No. 300-2841-00, R-3)





NOTES:
1. FOR COMPLETE ITEM DESCRIPTION SEE B/M 200-2841-XX.

FIGURE 6-4 SOLENOID ASSEMBLY
(Dwg. No. 300-2841-00, R-2)

KING RADIO CORPORATION
PARTS LISTING

200-2598-01 HARNESS ASSY R: 2
200-2598-99 COMMON BOM R: 1

SYMBOL	PART NUMBER	DESCRIPTION	A	UM	QUANTITY 01	99
	025-0003-00	WIRE 22 BLK		FT	.	1.10
	025-0003-01	WIRE 22 BRN		FT	.	1.10
	025-0003-02	WIRE 22 RED		FT	.	1.10
	025-0018-52	WIRE 26 GN/RD		FT	.	1.10
	025-0018-53	WIRE 26 GN/OR		FT	.	1.10
	025-0018-68	WIRE 26 BU/GY		FT	.	1.10
	025-0018-96	WIRE 26 WH/BU		FT	.	1.10
	025-0029-04	WIRE 24 YEL		FT	.	1.10
	025-0029-10	WIRE 24 BK/WH		FT	.	1.10
	025-0029-12	WIRE 24 RD/WH		FT	.	1.10
	030-1007-00	TAB LOCKING		EA	.	2.00
	030-1009-00	HOOD CONN		EA	.	1.00
	030-2001-00	CONN 14 PIN MALE		EA	.	1.00
	150-0064-00	TUBING TFLN 26 BLK		FT	.	1.00
	150-0064-00	TUBING PLSTC .312		EA	0.05	0.05
	200-2598-99	COMMON BOM	A	EA	1.00	.

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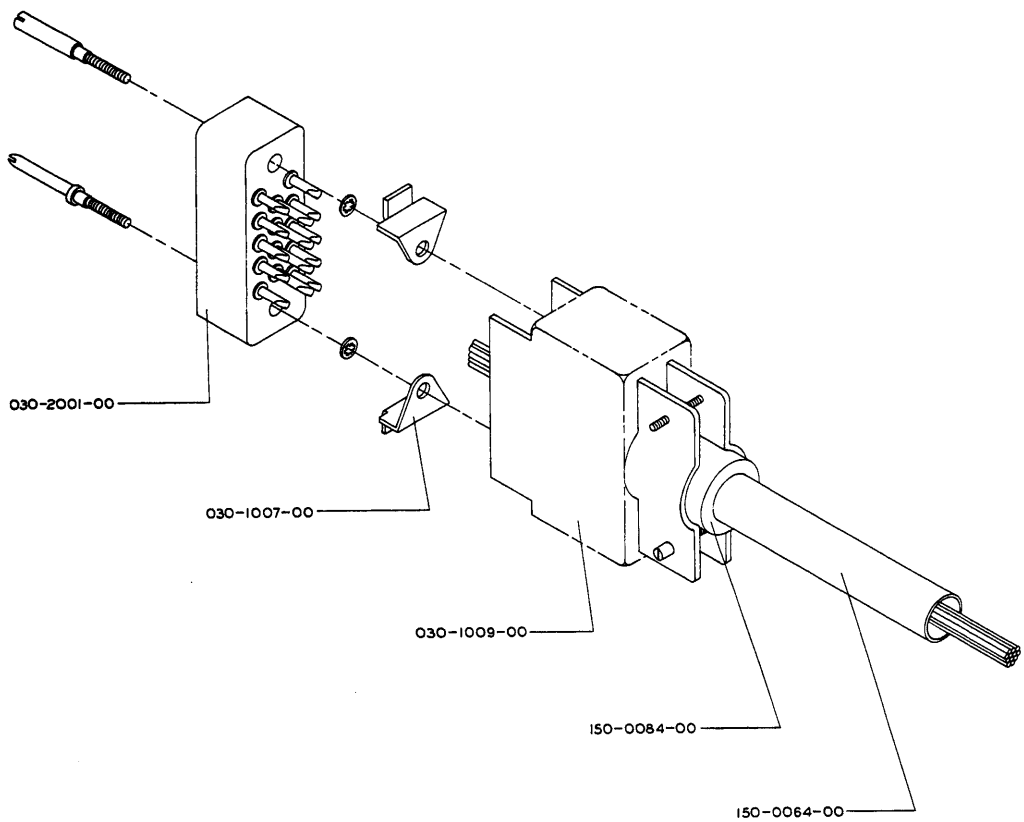
PRIMARY SERVO



WIRE NO.	FROM	COLOR	P/N	GA
1	P101-L	GRN-RED	025-0018-52	26
2	P101-H	RED	025-0003-02	22
3	P101-D	GRN-ORN	025-0018-53	26
4	P101-P	WHT-BLU	025-0018-96	26
5	P101-A	BLU-GRA	025-0018-68	26
6	P101-N	BRN	025-0003-01	22
7	P101-C	BLK	025-0003-00	22
8	P101-E	YEL	025-0029-04	24
9	P101-M	RED-WHT	025-0029-12	24
10	P101-B	BLK-WHT	025-0029-10	24
*11	P101-J	ORG-BRN	025-0018-31	26
*12	P101-R	VIO-WHT	025-0018-79	26

*NOT USED ON 200-2598-01

NOTES:
1. FOR COMPLETE ITEM DESCRIPTION SEE B/M 200-2598-XX
2. INSULATING TUBING 150-0064-00 SHALL EXTEND APROX. .45 INCH INTO CONNECTOR HOOD 030-1009-00
3. OVERALL LENGTH OF HARNESS ASSY CABLE 18 INCHES ±1 INCH.

FIGURE 6-5 HARNESS ASSEMBLY
(Dwg. No. 300-2598-00, R-1)

200-6304-01 CIRCUIT BOARD R: 3
200-6304-99 COMMON BOM R: 3

SYMBOL		PART NUMBER	DESCRIPTION	A	UM	QUANTITY 01	99
		009-6304-00	PC BD PITCH SERVO		EA	.	1.00
		016-1040-00	PC101 COATING		AR	.	0.00
		200-6304-99	COMMON BOM	A	EA	1.00	.
C	101	111-0001-22	CAP CR .1UF 100V		EA	.	1.00
C	102	111-0001-22	CAP CR .1UF 100V		EA	.	1.00
C	103	111-0001-22	CAP CR .1UF 100V		EA	.	1.00
C	104	111-0001-22	CAP CR .1UF 100V		EA	.	1.00
C	105	111-0001-22	CAP CR .1UF 100V		EA	.	1.00
CR	101	007-6033-00	DIO G 1N270		EA	.	1.00
CR	102	007-6033-00	DIO G 1N270		EA	.	1.00
CR	103	007-5011-23	DIO Z 30V 1W 5%		EA	.	1.00
CR	105	007-6047-00	DIO S 1N4005		EA	.	1.00
CR	106	007-5011-04	DIO Z 13V 1W 5%		EA	.	1.00
CR	107	007-5011-04	DIO Z 13V 1W 5%		EA	.	1.00
E	101	008-0008-01	TERM SPLIT TURR		EA	.	1.00
E	102	008-0008-01	TERM SPLIT TURR		EA	.	1.00
E	103	008-0008-01	TERM SPLIT TURR		EA	.	1.00
E	104	008-0008-01	TERM SPLIT TURR		EA	.	1.00
I	101	120-3053-01	IC LM158H		EA	.	1.00
Q	101	007-0383-50	XSTR 2N2222JAN		EA	.	1.00
Q	102	007-0383-50	XSTR 2N2222JAN		EA	.	1.00
Q	103	007-0164-00	XSTR S 2N4923		EA	.	1.00
Q	104	007-0164-00	XSTR S 2N4923		EA	.	1.00
R	101	136-1003-72	RES PF 100K QW 1%		EA	.	1.00
R	102	131-0563-13	RES CF 56K EW 5%		EA	.	1.00
R	103	131-0102-13	RES CF 1K EW 5%		EA	.	1.00
R	104	136-1213-72	RES PF 121K QW 1%		EA	.	1.00
R	105	131-0512-13	RES CF 5.1K EW 5%		EA	.	1.00
R	106	131-0202-23	RES CF 2K QW 5%		EA	.	1.00
R	107	131-0163-13	RES CF 16K EW 5%		EA	.	1.00
R	108	136-1003-72	RES PF 100K QW 1%		EA	.	1.00
R	109	131-0563-13	RES CF 56K EW 5%		EA	.	1.00
R	110	131-0102-13	RES CF 1K EW 5%		EA	.	1.00
R	111	136-1213-72	RES PF 121K QW 1%		EA	.	1.00
R	112	131-0512-13	RES CF 5.1K EW 5%		EA	.	1.00
R	113	131-0202-23	RES CF 2K QW 5%		EA	.	1.00
R	114	131-0163-13	RES CF 16K EW 5%		EA	.	1.00
R	115	132-0105-54	RES WW 100 1.5W 5%		EA	.	1.00
RV	101	134-1026-01	VRSTR V39ZA1 39V		EA	.	1.00

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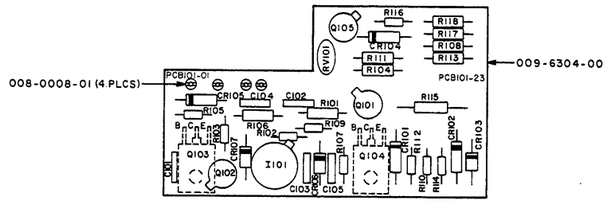
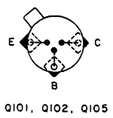
PRIMARY SERVO

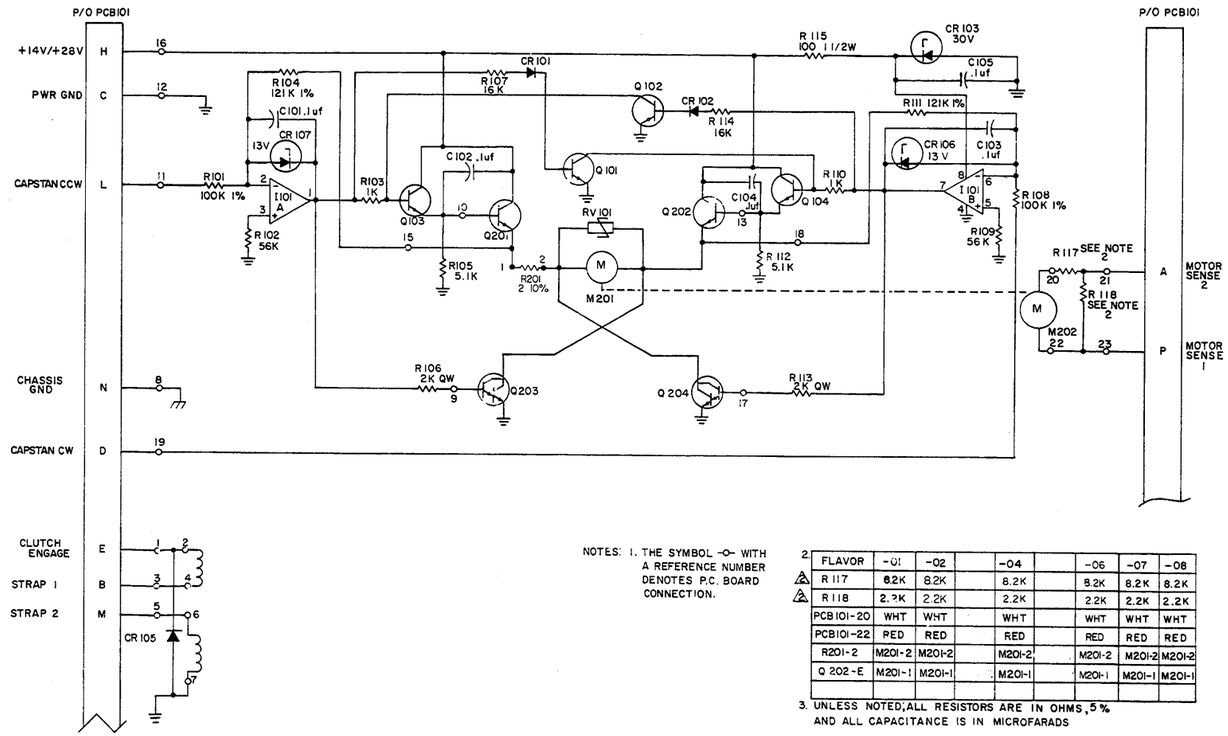




Q101, Q102, Q105

NOTES:

1. PRIOR TO POST COATING BOTH SIDES OF P.C. BOARD WITH CLEAR URETHANE (016-1040-00), MASK OFF THE FOLLOWING: 008-0008-01 (4), PCB101-01 THRU PCB101-23.
2. R117 AND R118 VALUES ARE SHOWN ON 065-0050-00/XX OR 065-0051-00/XX.



NOTES: 1. THE SYMBOL -o- WITH A REFERENCE NUMBER DENOTES P.C. BOARD CONNECTION.

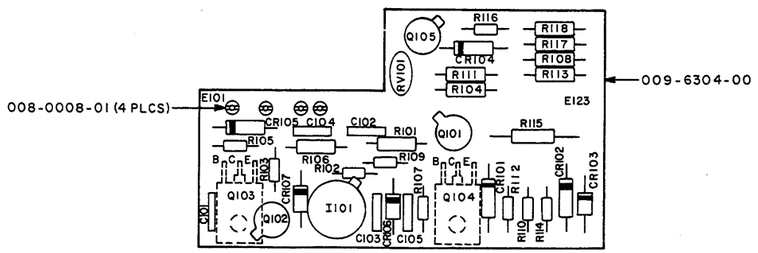
2.

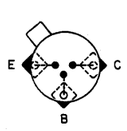
FLAVOR	-01	-02	-04	-06	-07	-08
R117	8.2K	8.2K	8.2K	8.2K	8.2K	8.2K
R118	2.2K	2.2K	2.2K	2.2K	2.2K	2.2K
PCB101-20	WHT	WHT	WHT	WHT	WHT	WHT
PCB101-22	RED	RED	RED	RED	RED	RED
R201-2	M201-2	M201-2	M201-2	M201-2	M201-2	M201-2
Q 202-E	M201-1	M201-1	M201-1	M201-1	M201-1	M201-1

3. UNLESS NOTED; ALL RESISTORS ARE IN OHMS, 5% AND ALL CAPACITANCE IS IN MICROFARADS

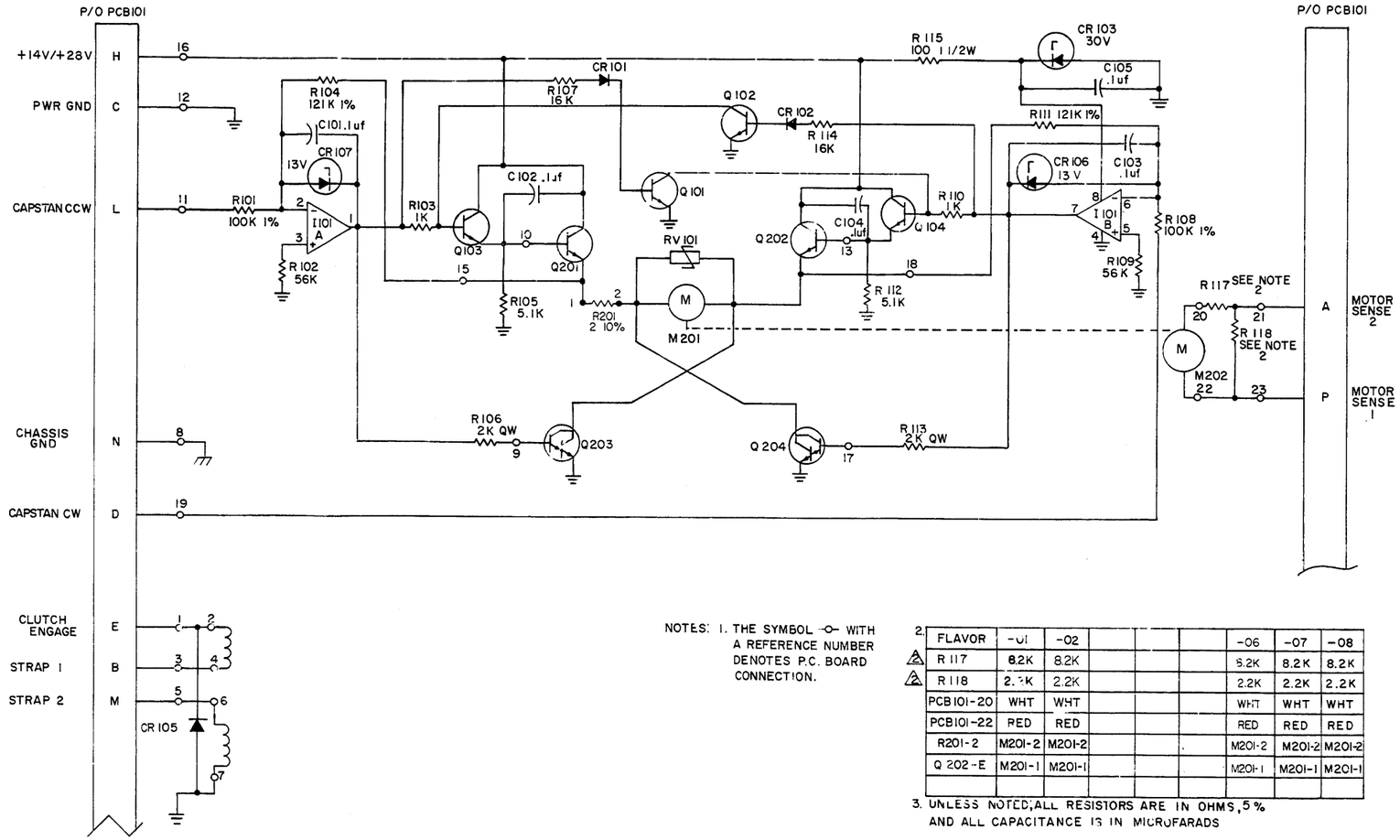
FIGURE 6-6 KS 178 PRIMARY SERVO P.C. BOARD ASSEMBLY AND SCHEMATIC
(Dwg. No. 300-6304-00, R-4)
(Dwg. No. 002-6304-01, R-7)

KING
KS 178
PRIMARY SERVO





Q101, Q102, Q105



NOTES:

1. PRIOR TO POST COATING BOTH SIDES OF P.C. BOARD WITH CLEAR URETHANE (016-1040-00), MASK OFF THE FOLLOWING: 008-0008-01 (4), E101 THRU E123.
2. R117 AND R118 VALUES ARE SHOWN ON 065-0051-00/XX.

NOTES: 1. THE SYMBOL —o— WITH A REFERENCE NUMBER DENOTES P.C. BOARD CONNECTION.

2.

FLAVOR	-01	-02				-06	-07	-08
⚠2 R117	8.2K	8.2K				8.2K	8.2K	8.2K
⚠2 R118	2.2K	2.2K				2.2K	2.2K	2.2K
PCB101-20	WHT	WHT				WHT	WHT	WHT
PCB101-22	RED	RED				RED	RED	RED
R201-2	M201-2	M201-2				M201-2	M201-2	M201-2
Q 202-E	M201-1	M201-1				M201-1	M201-1	M201-1

3. UNLESS NOTED; ALL RESISTORS ARE IN OHMS, 5%
AND ALL CAPACITANCE IS IN MICROFARADS

KS 178 SCH.

FIGURE 6-6 KS 178 PRIMARY SERVO P.C. BOARD ASSEMBLY
(Dwg. No. 300-6304-00, R-3)
(Dwg. No. 002-6304-01, R-6)

AlliedSignal

ELECTRONIC AND AVIONICS SYSTEMS

MAINTENANCE MANUAL

BENDIX/KING®

KS 179

PITCH TRIM SERVO

MANUAL NUMBER 006-05278-0003
REVISION 3 SEPTEMBER, 1983

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THEORY OF OPERATION

SECTION V
MAINTENANCE

TABLE OF CONTENTS
ILLUSTRATED PARTS LIST

LIST OF ILLUSTRATIONS

TABLES

SECTION IV
THEORY OF OPERATION

4.1 INTRODUCTION

This section contains the General and Detailed Theory of the KS 179 Pitch Trim Servo. The General Theory contains block diagram information of the overall operation of the unit. The Detailed Theory discusses the circuit operation of the unit in detail. Information on alignment and troubleshooting can be found in Section V of this manual.

4.2 GENERAL CIRCUIT THEORY

The KS 179 Pitch Trim Servo (Figure 4-1) is an electrically driven trim servo that converts electrical trim signals from either pilot or flight computer into elevator trim tab position. The KS 179 is equipped with an adjustable overpower slip clutch that allows the pilot manual authority over the servo actuator.

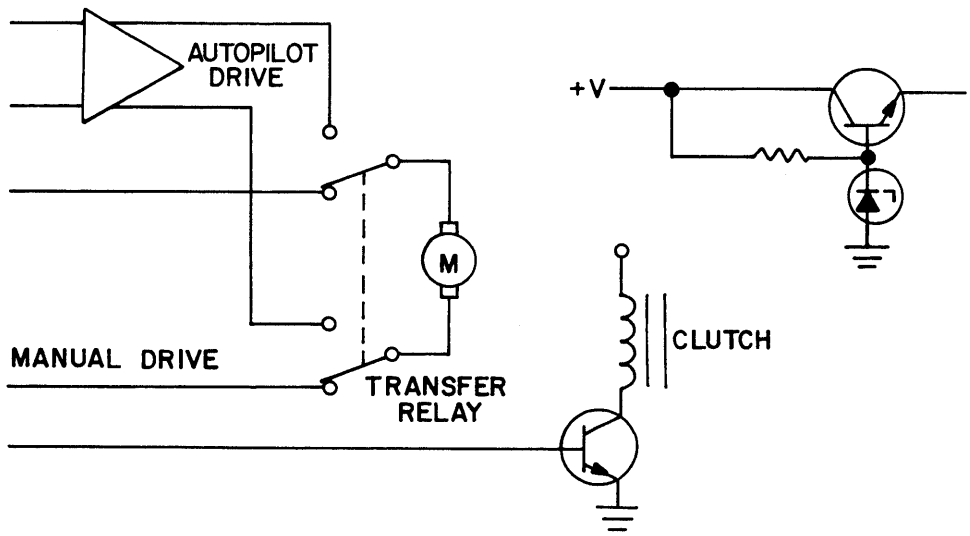


FIGURE 4-1 KS 179 PITCH TRIM SERVO BLOCK DIAGRAM

4.2.1 ENGAGE SOLENOID

The Engage solenoid on the KS 179 operates from +14VDC or +28VDC depending upon the servo type and internal wiring. Diode CR104 serves as an arc suppressor to shunt the negative field developed by the coils to ground as the solenoid is turned off.

4.3 DETAILED CIRCUIT THEORY

4.3.1 REGULATOR

The regulator consists of a medium power Darlingtion transistor, Q102, whose base is referenced to a resistor-zener diode network consisting of R105 and CR106. The regulated voltage is sent to pin A on the KS 179. R109, R110, Q103 and R202 make up an over current sensor which prevents Q102 from exceeding it's maximum current capability if Pin A should become shorted. C106 and C107 are used for noise decoupling.

The manual trim voltage from pin A is sent to the common leads of a two-pole double-throw switch located on the pilot control wheel. The normally open contacts of this switch are connected to the Manual Trim clockwise (CW) and counterclockwise (CCW) inputs of the KS 179. These lines in turn go through normally closed contacts of the transfer relay in the KS 179 to the motor connection of M201. Thus we see that in manual electric trim, the regulator voltage is placed directly across the motor windings.

Capacitors C103, C104, C105 have been added to the circuitry to keep noise interference from the servo at a minimum.

4.3.2 AUTO TRIM AMPLIFIER

The KC 191 or KC 192 computer produces positive going DC signals for auto trim drive commands in the KS 179. These signals enter the servo on pin K for clockwise capstan rotation and pin R for counterclockwise capstan rotation. The command signal through pin K turns on a Darlington power transistor, Q202, which has its emitter connected to one of the normally open contacts on the Auto Trim transfer relay.

A second path for the incoming signal at pin K is through R101 to the base of Q204, turning it on. The collector of Q204 is tied to the remaining normally open contact on the auto trim transfer relay. Transistors Q201 and Q203 work in an identical manner with R102 providing the current path for Q203. CR108 and CR109 have been added as protection diodes to shunt transient voltage spikes to the bus when the servo command changes directions. RV201 provides arc suppression off the armature windings of the motor to prevent transistor burnout.

An autopilot engage signal from the KC 191 or 192 computer provides the proper voltage on the auto trim transfer relay coil and causes the relay to energize. This transfers the amplifier drive signals previously discussed to the leads of M201. CR103 serves as an arc suppressor to short the negative field developed by the coil to ground as the relay is turned off.

4.3.3 SERVO VARIATIONS

To achieve the different speeds necessary, types of the KS 179 vary in the following components:

a. CR106 and R105 for various manual trim voltages.

b. Voltage values and motor gearheads of motor M201.

c. DC power requirements, either 14VDC or 28VDC.

SECTION V
MAINTENANCE

5.1 INTRODUCTION

This section contains information on tests, alignment, inspection, cleaning, repair, and troubleshooting procedures for the KS 179 Pitch Trim Servo. Information concerning semiconductor and integrated circuit maintenance, along with specific operating characteristics can be found in Appendix A of this manual.

Basic digital logic theory can also be found in Appendix A. This information is provided to aid the technician in developing a working knowledge of commonly used devices and should not be interpreted as unit theory of operation.

5.2 TEST AND ALIGNMENT

5.2.1 TEST EQUIPMENT

The following test equipment or equivalent is required to properly align and test the KS 179. All test equipment must be calibrated before attempting alignment.

A. King KTS 158 Component Bench Tester:

   KPN 071-5064-00

B. Digital Multimeter:

   Fluke 8000A

C. Torque Wrench:

   SNAP-ON TEP-6FUA

D. Servo Torque Stand:

   KPN 047-4238-01, from KTS 151 Servo Test Kit 050-1603-00 as modified by Service Aid KTS 151-103.

5.2.2 DEFINITION OF STANDARD TEST TERMS AND CONDITIONS

A. Unless otherwise indicated, all voltage measurements are with respect to Pin J (Power Ground).

B. Clockwise (CW) and counterclockwise (CCW) rotation of the capstan is rotation as viewed from the capstan end of the unit.

C. Solenoid engage voltage and disengagement shall be tested with the servo oriented so that the solenoid axis is horizontal.

D. Clutch performance specifications apply to a new clutch or a clutch with new parts only after the run-in. The run-in shall consist of slipping the clutch into a load of 15 LBF-IN in a CW direction for at least 45 minutes and in a CCW direction for at least 45 minutes.

KING
KS 179
PITCH TRIM SERVO

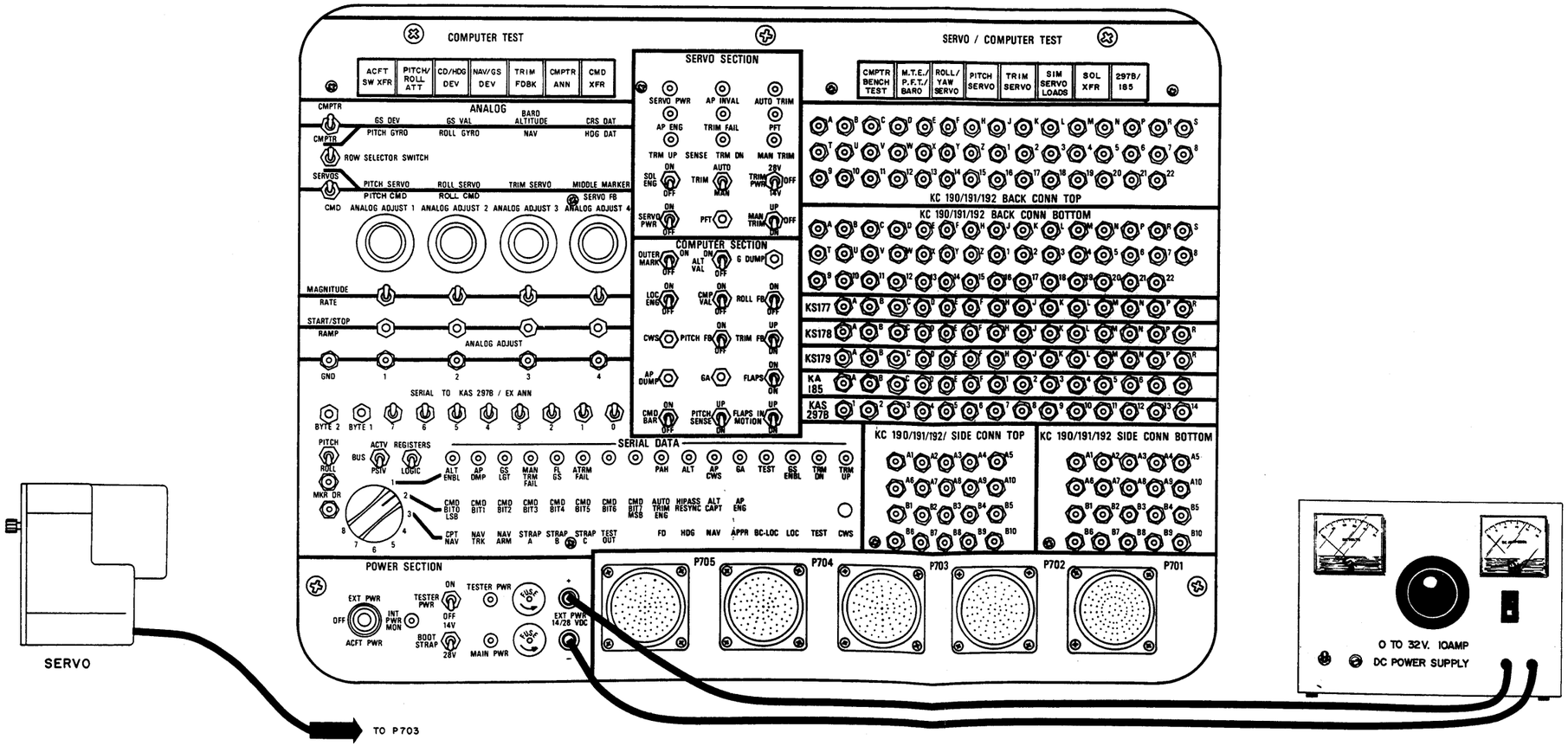


FIGURE 5-1 TEST SETUP
(Dwg. No. 696-3650-00, R-0)

5.2.3 FINAL TEST DATA SHEET

Connect test equipment and servo as shown in Figure 5-1.

NOTE

The term "OK" indicates that particular function is working properly.

5.2.3.1 Initialization

a. Switch the EXT PWR/ACFT PWR switch to OFF.

b. Connect P703 on the KTS 158 to the KS 179 under test.

c. Determine the standard aircraft bus voltage (28VDC or 14VDC).

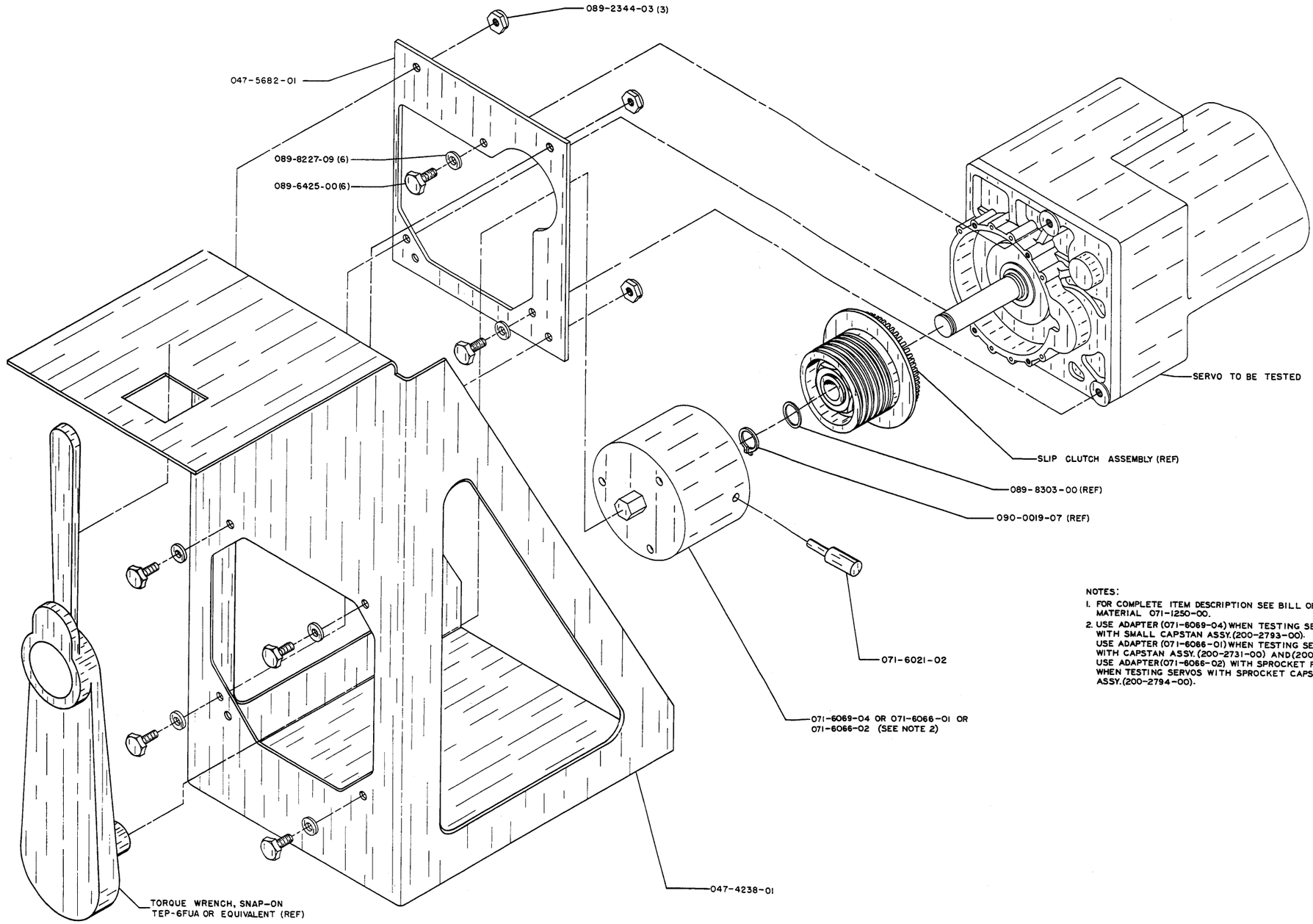
d. Connect the proper input voltage to the KTS 179 EXT PWR test jacks.

e. Set the switches on the KTS 158 as shown in Table 5-1.

CONTROL	LOCATION	POSITION
All switches	Computer Test Section	Out
TRIM SERVO switch	SERVO/COMPUTER TEST section	In
M.T.E/P.F.T./BARO switch	SERVO/COMPUTER TEST section	In
SOL XFR switch	SERVO/COMPUTER TEST section	In
All other switches	SERVO/COMPUTER TEST section	Out
TRIM PWR switch	SERVO SECTION	Same as power bus
All other switches	SERVO SECTION	Off
All switches	COMPUTER SECTION	Off
ROW SELECT switch	ANALOG section	Down
SERVOS/CMD switch	ANALOG section	Servos
MAGNITUDE/RATE 3 switch	ANALOG section	MAGNITUDE
BOOT STRAP switch	POWER SECTION	Same as power bus
TESTER PWR switch	POWER SECTION	On
EXT PWR/ACFT PWR switch	POWER SECTION	EXT PWR

TABLE 5-1 INITIALIZE CONTROL SETTINGS

KING
KS 179
PITCH TRIM SERVO



NOTES:

1. FOR COMPLETE ITEM DESCRIPTION SEE BILL OF MATERIAL 071-1250-00.
2. USE ADAPTER (071-6069-04) WHEN TESTING SERVOS WITH SMALL CAPSTAN ASSY.(200-2793-00). USE ADAPTER (071-6066-01) WHEN TESTING SERVOS WITH CAPSTAN ASSY. (200-2731-00) AND (200-2792-00). USE ADAPTER(071-6066-02) WITH SPROCKET PINS (071-6065-00) WHEN TESTING SERVOS WITH SPROCKET CAPSTAN ASSY.(200-2794-00).

FIGURE 5-2 KS 179 SERVO TEST SET ASSEMBLY
(Dwg. No. 300-2944-00, R-1)

f. Connect voltmeter to Test Jack 3 and GND in ANALOG section.

g. Adjust ANALOG ADJUST 3 control for 0.0VDC on voltmeter.

NOTE

The instructions in paragraph 5.2.3.1 e, f, and g must be performed at the beginning of the tests in each of the following paragraphs.

5.2.3.2 Manual Trim Perfomance

a. Install the KS 179 in the torque fixture (Figure 5-2).

b. Perform the instructions in paragraph 5.2.3.1 e, f, and g.

c. Perform the procedures contained in Table 5-2.

STEP	CONTROL	LOCATION	POSITION	INDICATION	RESULT
1.	Connect voltmeter to Test Jack A and Test Jack J in ANALOG section. Voltages read shall comply with those in Table 5-3.				
2.	TRIM switch	SERVO SECTION	MAN	KS 179 engage clutch engaged.	
3.	MAN TRIM switch	SERVO SECTION	Up	Capstan rotates CW at torque given in Table 5-3. Clutch torque at speed given in Table 5-3 (MAN TRIM SPEED).	
4.	MAN TRIM	SERVO SECTION	Down	Capstan rotates CCW at torque given in Table 5-3. Clutch torque at speed given in Table 5-3 (MAN TRIM SPEED).	
5.	MAN TRIM switch	SERVO SECTION	Off		

TABLE 5-2 MANUAL TRIM PERFORMANCE

KS 179 P/N 065-0052-	Paragraphs 5.2.3.2-1 Manual Trim Voltage (VDC)	Paragraphs 5.2.3.2-3 5.2.3.2-4 5.2.3.5-3 and 5.2.3.5-7 Clutch Torque (LBF-IN)	Paragraphs 5.2.3.2-3 5.2.3.2-6 Manual Trim Speed (RPM)	Paragraphs 5.2.3.5-2 5.2.3.5-6 Breakout Torque (LBF-IN)
-03	11 ± 1	20 ± 2	11.9 to 15.5	Slip Clutch Torque ± 15%
-04	12 + 1	20 ± 2	18.0 to 24.5	Slip Clutch Torque ± 15%
-05	9 ± 1	25 ± 3	16.0 to 22.6	Slip Clutch Torque ± 15%
-06	12 ± 1	21 ± 2	22.5 to 31.0	Slip Clutch Torque ± 15%
-07	15 ± 1	30 ± 3	2.55 to 3.80	Slip Clutch Torque ± 15%
-08	15 ± 1	40 ± 4	2.55 to 3.80	Slip Clutch Torque ± 15%
-09	8 ± 1	40 ± 4	2.55 to 3.80	Slip Clutch Torque ± 15%

NOTE

1. THIS TABLE CONTAINS INFORMATION ON UNITS THAT ARE CURRENTLY RELEASED. AS DIFFERENT PART NUMBER UNITS ARE RELEASED THIS TABLE WILL AUTOMATICALLY BE UPDATED.

2. THE SLIP CLUTCH TORQUE ON MOST KS 179'S IS NOT PRESET FROM THE FACTORY AND WILL VARY FROM AIRCRAFT TO AIRCRAFT. THE SLIP CLUTCH TORQUE IS SET DURING CERTIFICATION AND THE VALUE CAN BE OBTAINED FROM THE SPECIFIC AIRCRAFT STC INSTALLATION MANUAL OF THE AIRCRAFT FROM WHICH THE KS 179 WAS REMOVED.

TABLE 5-3 ALTERNATE VERSION DATA

5.2.3.3 Engage Clutch (28VDC)

a. Install the KS 179 in the torque fixture (Figure 5-2).

b. Perform the instructions in paragraph 5.2.3.1 e, f, and g.

c. Perform the procedures contained in Table 5-4.

STEP	CONTROL	LOCATION	POSITION	INDICATION	RESULT
1.	EXT PWR	Bench Power Supply	Adjust	+20.5VDC	
2.	TRIM switch	SERVO SECTION	AUTO	KS 179 engage clutch engages without hesitation.	
3.	ANALOG ADJUST 1 (PITCH SERVO)	ANALOG	Adjust fully CCW	The slip clutch shall slip greater than two revolutions without disengaging.	
4.	TRIM switch	SERVO SECTION	Off	KS 179 engage clutch disengages within less than 1 sec.	
5.	TRIM switch	SERVO SECTION	AUTO	KS 179 engage clutch engages.	
6.	ANALOG ADJUST 2	ANALOG	Adjust fully CW	The slip clutch shall slip for greater than two revolutions without disengaging.	
7.	TRIM switch	SERVO SECTION	Off	KS 179 engage clutch disengages in less than 1 sec.	
8.	EXT PWR	Bench Power Supply supply	Adjust	+28VDC	

TABLE 5-4 ENGAGE CLUTCH (28VDC)

5.2.3.4 Engage Clutch (14VDC)

a. Install the KS 179 in the torque fixture (Figure 5-2).

b. Perform the instructions in paragraph 5.2.3.1 e, f, and g.

c. Perform the procedures contained in Table 5-5.

STEP	CONTROL	LOCATION	POSITION	INDICATION	RESULT
1.	EXT PWR switch	Bench Power Supply	Adjust	9 $\pm$ 0.1VDC	

STEP	CONTROL	LOCATION	POSITION	INDICATION	RESULT
2.	TRIM switch	SERVO SECTION	AUTO	KS 179 engage clutch engages without hesitation.	
3.	ANALOG ADJUST 3 (TRIM SERVO)	ANALOG	Adjust fully CCW	The slip clutch shall slip greater than two revolutions without disengaging.	
4.	TRIM switch	SERVO SECTION	Off	KS 179 engage clutch disengage in less than 1 sec.	
5.	TRIM switch	SERVO SECTION	AUTO	KS 179 engage clutch engages.	
6.	ANALOG ADJUST 3	ANALOG	Adjust fully CW	The slip clutch shall slip for greater than two revolution without disengageing.	
7.	TRIM switch	SERVO SECTION	Off	KS 179 engage clutch disengages in less than 1 sec.	
8.	EXT PWR switch	Bench Power Supply	Adjust	+14VDC	

TABLE 5-5 ENGAGE CLUTCH (14VDC)

5.2.3.5 Auto Trim Performance

a. Install the KS 179 in the torque fixture (Figure 5-1).

b. Perform the instructions contained in paragraph 5.2.3.1 e, f, and g.

c. Perform the procedures contained in Table 5-6.

STEP	CONTROL	LOCATION	POSITION	INDICATION	RESULT
1.	TRIM switch	SERVO SECTION	AUTO	KS 179 engage clutch engaged.	
2.	ANALOG ADJUST 3	ANALOG SECTION	Adjust fully CCW	KX 179 capstan shall rotate CW	
3.	Connect voltmeter to Test Jack L and Test Jack F in KS 179 section. Ensure that voltage measured is positive.				

STEP	CONTROL	LOCATION	POSITION	INDICATION	RESULT
4.	ANALOG ADJUST 3	ANALOG	Adjust fully CW	KS 179 capstan shall rotate fully CCW.	
5.	Connect voltmeter to Test Jack L and Test Jack F in KS 179 section. Ensure that value is negative.				
6.	Connect voltmeter to Test Jack K and Test Jack R in KS 179 section. Measure voltage.				
7.	ANALOG ADJUST 3	ANALOG	Adjust 0.0 ± 0.05VDC.	KS 179 capstan does not rotate.	
8.	TRIM switch	SERVO SECTION	Off (center position)		

TABLE 5-6 AUTO TRIM PERFORMANCE

5.2.3.6 Slip Clutch Performance

a. Install the KS 179 in the torque fixture (Figure 5-2).

b. Perform the instructions in paragraph 5.2.3.1 e, f, and g.

c. Perform the procedures contained in Table 5-7.

STEP	CONTROL	LOCATION	POSITION	INDICATION	RESULT
1.	TRIM switch	SERVO SECTION	AUTO	KS 179 engage clutch engaged.	
2.	ANALOG ADJUST 3	ANALOG section	Adjust	While adjust slowly CCW, observe clutch breakout point. Breakout torque shall be within torque given in Table 5-3.	
3.	ANALOG ADJUST 3	ANALOG	Adjust fully CCW	Slip clutch torque given in Table 5-3.	
4.	Connect voltmeter to Test Jack R and Test Jack K in KS 179 section.				
5.	ANALOG ADJUST 3	ANALOG section	Adjust	0.0 ± 0.5VDC	

STEP	CONTROL	LOCATION	POSITION	INDICATION	RESULT
6.	ANALOG ADJUST 3	ANALOG	Adjust	While adjusting slowly CW, observe clutch breakout point. Breakout torque shall be within the torque given in Table 5-3.	
7.	ANALOG ADJUST 3	ANALOG section	Adjust fully CW	Slip clutch torque given in Table 5-3.	
8.	TRIM switch	SERVO SECTION	Off	----	
9.	Connect voltmeter to Test Jack R and Test Jack K in KS 179 section.				
10.	ANALOG ADJUST 3	ANALOG	ADJUST	0.0 ± 0.05VDC	

TABLE 5-7 SLIP CLUTCH PERFORMANCE

5.2.3.7 P.F.T. Performance

a. Perform the instructions in paragraph 5.2.3.1 e, f, and g.

b. Perform the procedurers contained in Table 5-8.

STEP	CONTROL	LOCATION	POSITION	INDICATION	RESULT
1.	ANALOG ADJUST 3	ANALOG section	Adjust fully CCW	----	
2.	Connect voltmeter to Test Jack L and Test Jack F in KS 179 section.				
3.	P.F.T. switch	SERVO SECTION	Depress and hold	A positive voltage.	
4.	P.F.T. switch	SERVO SECTION	Release	0.0 ±0.2VDC	

TABLE 5-8 P.F.T. PERFORMANCE

5.2.3.8 Solenoid Performance

a. Install the KS 179 in the torque fixture (Figure 5-2).

b. Perform the instructions in paragraph 5.2.3.1 e, f, and g.

c. Perform the procedures contained in Table 5-9.

STEP	CONTROL	LOCATION	POSITION	INDICATION	RESULT
1.	Connect voltmeter to Test Jack K and Test Jack R in KS 179 section. Ensure that voltage is 0 ± 0.2VDC.				
2.	ANALOG ADJUST 3	ANALOG section	Adjust	0 ± 0.2VDC	
3.	TRIM switch	SERVO SECTION	AUTO	KS 179 engage clutch engaged.	
4.	Observe the position of the servo drive gear with respect to the large gear on the servo mount. The capstan should be able rotate one quarter of a degree to one eighth of a degree (Figure 5-3).				
5.	TRIM switch	SERVO SECTION	OFF	Servo clutch dis-engages.	

TABLE 5-9 SOLENOID PERFORMANCE

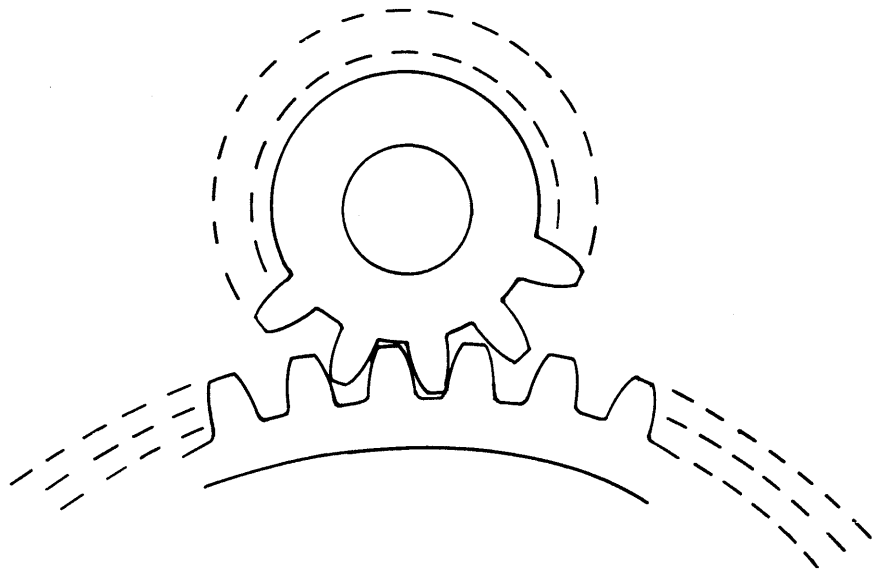


FIGURE 5-3 SERVO GEAR MESH

5.2.4 ALIGNMENT

The alignment procedures for the KS 179 Pitch Trim Servo are an integral part of the test and assembly procedures and may be found in this procedure and paragaraph 5.3.4.

5.2.4.1 Capstan Shaft and Capstan End Play Alignment

NOTE

THE MOTOR/ENGAGE PLATE ASSEMBLY MUST BE REMOVED TO FACILITATE CAPSTAN SHAFT INSTALLATION.

Drawing Reference - Figure 6-1, pages 6-3 and 6-5.

a. Install snap ring (090-0019-07) and washer (089-8304-00) onto center of shaft and slide shaft into the servo plate with the snap ring and washer on the capstan side of the plate.

b. Install washers (089-8295-01/03) as required and snap ring (090-0019-07). The "as required" washers are to achieve an end play of .002 to .008 inch.

c. Install capstan, washer (089-8303-00), shim washers (089-8295-01) as required, and snap ring (090-0019-07). The "as required" washers are to achieve an end play of .002 to .008 inch.

5.2.4.2 Motor Engage Plate End Play Alignment

NOTE

THE SOLENOID ASSEMBLY MUST BE REMOVED TO FACILITATE MOTOR ENGAGE PLATE INSTALLATION.

a. Carefully slide the engage plate assembly onto the main plate. Secure with screw (089-6129-04), washer (089-8225-00) and shims (089-8199-00/01) as required to achieve .002 to .008 inch end play.

b. Install PC board and solenoid per the assembly procedure.

5.2.4.3 Solenoid and Servo/Capstan Gear Alignment

a. Slide the solenoid onto the arm of the engage plate assembly and secure the solenoid with 3 screws (089-6030-04) and lock washers (089-8017-37).

b. With the 3 solenoid mount screws loose, slide the solenoid up or down to obtain .001 to .008 inches of backlash between the motor pinion and its capstan mounting gear.

Reference Figure 5-3, page 5-15, and Figure 6-1 on pages 6-3 and 6-5.

5.3 OVERHAUL

5.3.1 VISUAL INSPECTION

This section contains instructions to assist in determining the condition of the KS 179 assembly by inspection. Defects resulting from wear, physical damage, deterioration, or other causes can be found by these inspection procedures. To aid inspection, detailed procedures are arranged in alphabetical order.

A. Capacitors, Fixed

Inspect capacitors for case damage, body damage, and cracked, broken, or charred insulation. Check for loose, broken, or improperly soldered connections.

B. Chassis

Inspect the chassis for deformation, dents, punctures, badly worn surfaces, damaged connectors, damaged fastener devices, loose or missing hardware, component corrosion, and damage to finish.

C. Connectors

Inspect connector for broken parts, deformed shells or clamps, and other irregularities. Inspect for cracked or broken insulation and for contacts that are broken, deformed, or out of alignment. Also, check for corroded or damaged plating on contacts and for loose, improperly soldered, broken, or corroded terminal connections.

D. Covers and Shields

Inspect covers and shields for punctures, deep dents, and badly worn surfaces. Also, check for damaged fastener devices, corrosion, and damage to finish.

E. Insulators

Inspect all insulators for evidence of damage, such as broken or chipped edges, burned areas, and presence of foreign matter.

F. Resistors, Fixed

Inspect the fixed resistors for cracked, broken, blistered, or charred bodies and loose, broken, or improperly soldered connections.

G. Terminal Connections Soldered

1. Inspect for cold-soldered or resin joints. These joints present a porous or dull, rough appearance. Check for strength of bond using the points of a tool.

2. Examine the terminals for excess solder, protrusions from the joint, pieces adhering to adjacent insulation, and particles lodged between joints, conductors, or other components.

3. Inspect for insufficient solder and unsoldered strands of wire protruding from conductor at the terminal. Check for insulation that is stripped back too far from the terminal.

4. Inspect for corrosion at the terminal.

H. Wiring

Inspect open and laced wiring of chassis, subassembly chassis, and parts of equipment for breaks in insulation, conductor breaks, cut or broken lacing and improper dress in relation to adjacent wiring or chassis.

5.3.2 CLEANING

A. Using a clean, lint-free cloth lightly moistened with a mild cleaning detergent, remove all foreign matter from the equipment case. Wipe dry using a clean, lint-free cloth.

B. Using a hand controlled dry air jet (not more than 15psi), blow the dust from inaccessible areas. Care should be taken to prevent damage by the air blast.

C. Clean the receptacle and plugs with a hand controlled dry air jet (not more than 25psi) and a clean, lint-free cloth lightly moistened with an approved mild cleaning solvent. Wipe dry with a clean, dry, lint-free cloth.

5.3.3 REPAIR

This paragraph describes repair procedures, along with any special techniques for replacing damaged or defective components.

A. Connectors

When replacing a connector, refer to the appropriate PC board assembly drawing and follow notes to ensure correct mounting and mating of each connector.

B. Diodes

Diodes used are silicon and germanium; use long nose pliers as a heat sink under normal soldering conditions. Note the diode polarity before removal.

C. Integrated Circuits

Refer to Appendix "A" for removal and replacement instructions.

D. Wiring

When repairing a wire that has broken from its terminal, remove all old solder and pieces of wire from the terminal, restrip the wire to the necessary length and resolder the wire to the terminal. Replace a damaged wire with one of the same type, size and length.

5.3.4 DISASSEMBLY/ASSEMBLY PROCEDURES

Refer to appropriate drawings in section VI.

5.3.4.1 Removal of the Dust Cover

a. To gain access to the components of the servo, remove two (2) screws, KPN 089-6344-04.

b. Slide the Dust Cover off and over the connector.

5.3.4.2 Removal of the Cable Guards

To remove the cable guards first remove mounting screws, KPN 089-6123-05 or 089-6123-09.

5.3.4.3 Removal of the Drive Motor/Engage Plate Assembly

a. Unsolder the wires which connect the Drive Motor to the wiring harness.

b. Remove the three (3) screws, KPN 089-6030-04, and lockwashers that secure the solenoid to the mainplate.

c. Carefully slide the solenoid off the arm of the engage plate assembly.

d. Remove the return spring, KPN 078-0118-00, and the plunger, KPN 076-1098-01, from the solenoid. At the same time ensure that no wires are pulled from the harness.

e. Remove the two (2) screws, KPN 089-5903-05, that secure the PC board to the main plate. At the same time ensure that no wires are pulled from the harness.

f. Remove one (1) screw, KPN 089-6129-04, washer and shims (if any) which secures the engage plate assembly to the main plate.

g. Carefully slide the engage plate assembly off the main plate.

5.3.4.4 Disassembly of the Motor/Engage Plate Assembly

a. The engage plate and the motor can be separated easily by removing the three screws.

b. Drive the roll pin on through the pinion gear.

c. Slide the gear off the motor shaft.

5.3.4.5 Removal of the Capstan/Slip Clutch Assembly (Large Diameter Capstan)

a. Remove the snap ring, washer, and the shims (if any).

b. Slip the capstan/slip clutch assembly and washer off the shaft. Be careful to retain the proper number of shims to facilitate proper reassembly.

c. The shaft can be removed only after the motor has been removed.

d. Remove the snap ring, washers, and shims (if any).

e. Slide the shaft from the main plate.

f. Be careful to retain the proper number of shims to facilitate proper reassembly.

5.3.4.6 Disassembly of the Capstan/Slip Clutch Assembly (Large Diameter Capstan)

a. Remove the locknut that holds the entire assembly.

b. When removing the Belleville spring observe their orientation. The first spring out has its cup facing the capstan; the second one has its cup facing out and the third one has its cup facing the capstan.

c. The assembly will break down in the following order:

(1) Carbon-on-steel clutch plate.

(2) Copper clutch disc

(3) Capstan

(4) Copper clutch disc

(5) Carbon-on-steel clutch plate.

5.3.4.7 Removal of Capstan/Slip Clutch Assembly (Small Diameter Capstan)

a. The capstan/slip clutch assembly can only be removed if the motor has been removed first.

b. On the back side of the main plate, first remove the snap ring and shims (if any).

c. Pull the capstan from the main plate.

d. Slide the washer off the shaft. Retain the proper number of shims to facilitate proper assembly.

5.3.4.8 Disassembly of Capstan/Slip Clutch Assembly (Small Diameter Capstan)

a. The capstan drive gear is pressed onto a roll pin and can be removed by carefully prying between the gear and capstan.

b. Slide the gear off the shaft.

c. To disassemble the slip clutch assembly, remove the snap ring and unscrew the locknut which will in turn decompress the three (3) Belleville springs.

d. As the Belleville springs are removed, note their orientation. The first spring out has its cup facing the capstan, the second one has its cup facing out and the third one has its cup facing the capstan.

e. Next remove the following:

(1) Spacer

(2) Carbon-on-steel clutch plate.

(3) Copper clutch disc

f. To remove the capstan, the small hole drilled into the groove in the capstan must be lined up with the pin. The pin is a slip fit in the shaft and should easily drop through the hole.

g. Slide the capstan off the shaft, being careful not to drop the copper clutch disc out from the rear of the capstan.

h. The carbon-on-steel clutch plate can now be pulled off the shaft. The amount of pull may seem more than usual since the clutch is slightly press fitted onto the shaft.

5.3.4.9 Disassembly of the Solenoid Assembly

a. Unsolder or snip and mark the wires which connect the solenoid to the wiring harness.

b. The roller can be removed from the plunger (removed during removal of the motor) by driving out the pin.

c. The entire assembly can be broken down into individual pieces by the removal of the screw.

d. The plunger stop can now be dropped out.

e. The solenoid coil and spacer can now be slid from the frame.

5.3.4.10 Transistor Removal

a. Power transistor replacement is easily accomplished without removal of the circuit module.

b. Remove the screws which fasten the transistors to the sockets. There is no need for unsoldering the leads.

5.4 TROUBLESHOOTING

The purpose of this section is to provide procedures and assistance in troubleshooting the KS 179 Pitch Trim Servo. The troubleshooting charts are written with all indications as they would appear when the KS 179 is connected to a full flight system. Throughout this section, it is assumed that the system problem has been thoroughly diagnosed as a KS 179 problem.

5.4.1 TROUBLESHOOTING ASSISTANCE

When replacing any of the power transistors in the KS 179, check the insulators for areas where particles beneath them may have punched through and would thus short the collector of the transistor to the chassis.

5.4.2 TROUBLESHOOTING CHART

SYMPTOM	PROBABLE CAUSE	TROUBLESHOOTING PROCEDURE
Aircraft will not auto trim, trim self test does not work satisfactorily, manual trim operation	Open in trim servo amplifier	Check operation of Q201, Q202, Q203, Q204.
	Open in auto trim transfer relay	Check operation of transfer relay
	Solenoid not engaging engage solenoid	Check operation of Q101 and
Aircraft will not auto trim CW; CCW operation satisfactory	CW side of amplifier open	Check operation of Q202, Q204
Aircraft will not auto trim CCW; CW operation satisfactory	CCW side of amplifier open	Check operation of Q201, Q203
No auto or manual trim operation	Motor open	Check operation of M201
No manual trim operation auto trim operation satisfactory	Open in manual trim regulator	Check CR106 and Q102

ILLUSTRATED PARTS LIST INTRODUCTION

INTRODUCTION

The purpose of this parts list is for identification and requisition of parts. Part numbers listed in this Illustrated Parts List meet critical equipment design specification requirements. Use only those part numbers specified in this section for replacement of parts. Whenever a "caution" is posted concerning the use of a particular part, adherence to the appropriate replacement must be followed.

EXPLANATION OF ILLUSTRATED PARTS LIST

Terminology used on the parts list(s) is listed below.

1. Symbol-Denotes the component reference for both schematic diagrams and mechanical drawings. Example: CR401, whereas CR means Diode device and 401 is its assigned numerical code. The following designators are used by King Radio.

Circuit Designation	Component
C	Capacitor
F	Fuse
I	Integrated Circuit/IC
J	Fixed Connector
L	Inductor
Q	Transistor
P	Plug
R	Resistor
S	Switch
T	Transformer
U	Resistor/Capacitor Network
V	Photocell/tube
Y	Crystal
CJ	Circuit Jumper
CR	Diode
DS	Lamp
FL	Filter
TP	Test Point
WG	Waveguide

2. Part Number-The part number is assigned by King Radio Corporation. The first three digits denote the type of device. Example: 007-1200-00; the 007 denotes a discrete device. The following list are some of the prefixes commonly used by KRC.

Prefix	Component
007	Transistor/Diode
017	Filter
019	Transformer
019	Inductor
030	Connector
111/096/102/106	Capacitor
120	Integrated Circuit
13X	Resistor

3. Description-Defines minimum specification of the component/part. Example: XSTR S NPN SRF2325 is Transistor, Silicon, NPN and the vendor part number is SRF2325. Example: CAP EL 150UF 50V is Capacitor, Electrolytic, value is 150 microfarad and voltage rating is 50 volts. Following are some of the abbreviations used under Description.

Abbreviation	Word
AL	Aluminum
BIFLR	Bifilar
CC	Carbon Composite
CF	Carbon Film
CH	Choke
CAP	Capacitor
CAP CR	Ceramic
DC	Disk Ceramic
DIO	Diode
EL	Electrolytic
FC	Fixed Composition
FERR	Ferrite
FLTR	Filter
FT	Feed Thru
HV	High Voltage
HW	Half Watt
IC	Integrated Circuit
MC	Monolithic Ceramic
MY	Mylar
PC	Polycarbonate
PF	Precision Film
PP	Paper
PS	Polystrene
QW	Quarter Watt
RES	Resistor
S	Silicon
SCR	Screw
SM	Silver Mica
STDF	Standoff
SW	Switch
TERM	Terminal
TN	Tantalum
TST PT	Test Point
TW	Tenth Watt
VA	Variable
WW	Wire Wound
XFMR	Transformer
XSTR	Transistor
XTAL	Crystal

4. Code UM- Unit of measure, Example: EA for each. The following units are used through the Illustrated Parts List.

Abbreviation	Word
EA	Each
FT	Foot
AR	As Required

5. BOM- Bill of Material is a breakdown of units or parts used to assemble one item.

6. Assy No.- Assembly Number is the assigned number used to identify a mechanical drawing.

ILLUSTRATED PARTS LIST

The Illustrated Parts List (IPL) is organized basically in the following three divisions, Bill of Material (200-XXXX-XX), Parts Layout (300-XXXX-XX), and the Electrical Schematic Diagram (002-XXXX-XX). The IPL may also contain the Final assembly or sub-assembly drawings.

The Assembly drawings reference their mechanical parts with a King Part Number (KPN). Electrical parts are referenced by their circuit designators (i.e. CR402, R908, etc.). Each Assembly parts list is assembled so that mechanical parts are first, in numerical part number order and electrical parts are second in circuit designation order.

The following unusual numbers may appear at times on the BOM and are for commentary purposes only.

Example 1:

CR401 999-9999-99 DO NOT USE

The component designator CR401 had been previously used on the assembly and then deleted; therefore, it cannot be reassigned.

Example 2:

CR401 999-9999-98 NOT USED

The component designator CR401 is available for future assignment and is not presently a part of the PC board/Final assembly.

Example 3:

CR401 999-9999-97 SEE NEXT ASSEMBLY

The component designator CR401 is used as part of the electrical circuit assembly but because of assembly or testing requirements may be part of another assembly.

CR401 999-9999-96 RESERVED

The component designator CR401 is reserved for future usage.

UNIT/BOARD VERSIONS

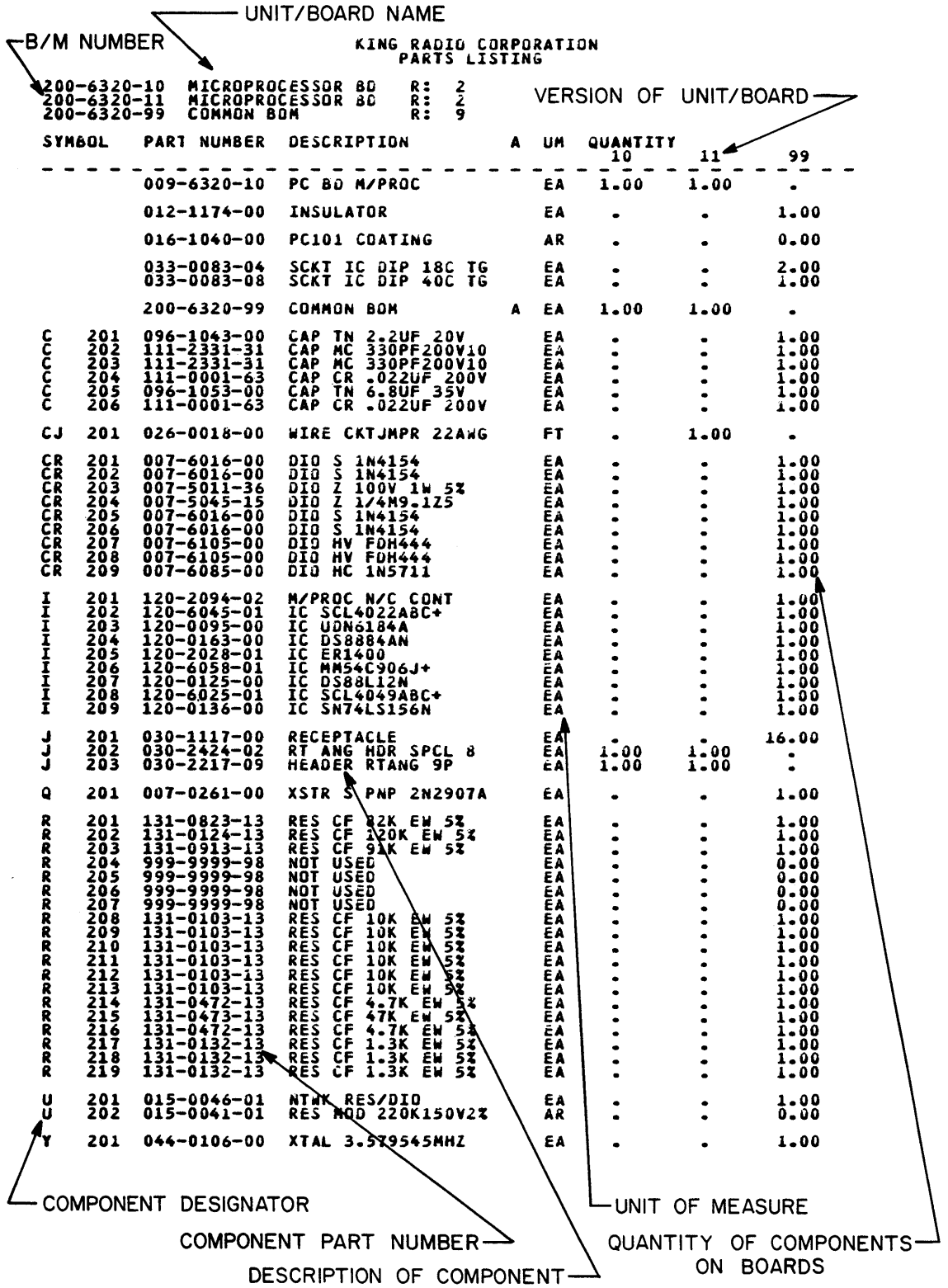
The BOM is arranged to show the Unit or Board version from left to right across the top of the BOM starting with the -00 column. One of the colums, either the -00 or -99 will be common to all versions. The common parts column will have numbers of parts or dashes. The number measn the part is common to all versions and the dash means the part is not common to all versions. All parts required to build a unit will be the parts listed in the common version column plus the parts listed in the specific version column.

Example 1: Board Versions

Transmitter Board	-01	-02	-99 or -00 (the common bill may be -00 or -99)
007-2050-01	1	-	- Part only on -01 board
007-2051-01	-	1	- Part only on -02 board
007-2052-01	-	-	1 Part on both -01 and -02 boards

Example 2: Unit Versions

Nav/Comm	-01	-02	-99 or -00	
200-1234-01 VOR BD	1	-	-	Bd only on -01 Version
200-1234-02 VOR BD	-	1	-	Bd only on -02 Version
200-4321-01 GS BD	1	-	-	Bd only on -01 Version
200-4321-02 GS BD	-	1	-	Bd only on -02 Version
200-2222-00 PWR SUP	-	-	1	Bd in both -01/-02 Versions
200-1111-00 CHS ASSY	-	-	1	Assy in both -01/02 Versions



KING RADIO CORPORATION
PARTS LISTING

200-6320-10 MICROPROCESSOR BD R: 2
200-6320-11 MICROPROCESSOR BD R: 2
200-6320-99 COMMON BOM R: 9

SYMBOL		PART NUMBER	DESCRIPTION	A	UM	QUANTITY 10	11	99
		009-6320-10	PC BD M/PROC		EA	1.00	1.00	.
		012-1174-00	INSULATOR		EA	.	.	1.00
		016-1040-00	PC101 COATING		AR	.	.	0.00
		033-0083-04	SCKT IC DIP 18C TG		EA	.	.	2.00
		033-0083-08	SCKT IC DIP 40C TG		EA	.	.	1.00
		200-6320-99	COMMON BOM	A	EA	1.00	1.00	.
C	201	096-1043-00	CAP TN 2.2UF 20V		EA	.	.	1.00
C	202	111-2331-31	CAP MC 330PF200V10		EA	.	.	1.00
C	203	111-2331-31	CAP MC 330PF200V10		EA	.	.	1.00
C	204	111-0001-63	CAP CR .022UF 200V		EA	.	.	1.00
C	205	096-1053-00	CAP TN 6.8UF 35V		EA	.	.	1.00
C	206	111-0001-63	CAP CR .022UF 200V		EA	.	.	1.00
CJ	201	026-0018-00	WIRE CKTJMPR 22AWG		FT	.	1.00	.
CR	201	007-6016-00	DIO S 1N4154		EA	.	.	1.00
CR	202	007-6016-00	DIO S 1N4154		EA	.	.	1.00
CR	203	007-5011-36	DIO Z 100V 1W 5%		EA	.	.	1.00
CR	204	007-5045-15	DIO Z 1/4M9.1Z5		EA	.	.	1.00
CR	205	007-6016-00	DIO S 1N4154		EA	.	.	1.00
CR	206	007-6016-00	DIO S 1N4154		EA	.	.	1.00
CR	207	007-6105-00	DIO HV FDH444		EA	.	.	1.00
CR	208	007-6105-00	DIO HV FDH444		EA	.	.	1.00
CR	209	007-6085-00	DIO HC 1N5711		EA	.	.	1.00
I	201	120-2094-02	M/PROC N/C CONT		EA	.	.	1.00
I	202	120-6045-01	IC SCL4022ABC+		EA	.	.	1.00
I	203	120-0095-00	IC UDN6184A		EA	.	.	1.00
I	204	120-0163-00	IC DS8884AN		EA	.	.	1.00
I	205	120-2028-01	IC ER1400		EA	.	.	1.00
I	206	120-6058-01	IC MM54C906J+		EA	.	.	1.00
I	207	120-0125-00	IC DS88L12N		EA	.	.	1.00
I	208	120-6025-01	IC SCL4049ABC+		EA	.	.	1.00
I	209	120-0136-00	IC SN74LS156N		EA	.	.	1.00
J	201	030-1117-00	RECEPTACLE		EA	.	.	16.00
J	202	030-2424-02	RT ANG HDR SPCL 8		EA	1.00	1.00	.
J	203	030-2217-09	HEADER RTANG 9P		EA	1.00	1.00	.
Q	201	007-0261-00	XSTR S PNP 2N2907A		EA	.	.	1.00
R	201	131-0823-13	RES CF 82K EW 5%		EA	.	.	1.00
R	202	131-0124-13	RES CF 120K EW 5%		EA	.	.	1.00
R	203	131-0913-13	RES CF 91K EW 5%		EA	.	.	1.00
R	204	999-9999-98	NOT USED		EA	.	.	0.00
R	205	999-9999-98	NOT USED		EA	.	.	0.00
R	206	999-9999-98	NOT USED		EA	.	.	0.00
R	207	999-9999-98	NOT USED		EA	.	.	0.00
R	208	131-0103-13	RES CF 10K EW 5%		EA	.	.	1.00
R	209	131-0103-13	RES CF 10K EW 5%		EA	.	.	1.00
R	210	131-0103-13	RES CF 10K EW 5%		EA	.	.	1.00
R	211	131-0103-13	RES CF 10K EW 5%		EA	.	.	1.00
R	212	131-0103-13	RES CF 10K EW 5%		EA	.	.	1.00
R	213	131-0103-13	RES CF 10K EW 5%		EA	.	.	1.00
R	214	131-0472-13	RES CF 4.7K EW 5%		EA	.	.	1.00
R	215	131-0473-13	RES CF 47K EW 5%		EA	.	.	1.00
R	216	131-0472-13	RES CF 4.7K EW 5%		EA	.	.	1.00
R	217	131-0132-13	RES CF 1.3K EW 5%		EA	.	.	1.00
R	218	131-0132-13	RES CF 1.3K EW 5%		EA	.	.	1.00
R	219	131-0132-13	RES CF 1.3K EW 5%		EA	.	.	1.00
U	201	015-0046-01	NTWK RES/DIO		EA	.	.	1.00
U	202	015-0041-01	RES NOD 220K150V2%		AR	.	.	0.00
Y	201	044-0106-00	XTAL 3.579545MHZ		EA	.	.	1.00

KING
KS 179
PITCH TRIM SERVO

065-0052-00	PITCH TRIM SERVO	R: 17
065-0052-01	PITCH TRIM SERVO	R: 12
065-0052-02	TWIN COMMANCHE	R: 3
065-0052-03	MOONEY MOD J	R: 9
065-0052-04	PITCH TRIM SERVO	R: 8
065-0052-05	PITCH TRIM SERVO	R: 9
065-0052-06	PITCH TRIM SERVO	R: 3
065-0052-07	PITCH TRIM SERVO	R: 2
065-0052-08	PITCH TRIM SERVO	R: 3
065-0052-09	PITCH TRIM SERVO	R: 1

SYMBOL	PART NUMBER	DESCRIPTION	A	UM	QUANTITY 00	01	02	03	04	05	06	07	08	09
	010-0019-92	TERM STDF WHT		EA	2.00	2.00	.	.	.	.	.	.	.	.
	025-0003-00	WIRE 22 BLK		IN	9.60	9.60	.	.	.	.	.	.	.	.
	025-0003-01	WIRE 22 BRN		IN	4.80	4.80	.	.	.	.	.	.	.	.
	025-0003-02	WIRE 22 RED		IN	4.80	4.80	.	.	.	.	.	.	.	.
	025-0003-05	WIRE 22 GRN		IN	4.80	4.80	.	.	.	.	.	.	.	.
	025-0003-06	WIRE 22 BLU		IN	4.80	4.80	.	.	.	.	.	.	.	.
	025-0003-09	WIRE 22 WHT		IN	4.80	4.80	.	.	.	.	.	.	.	.
	025-0003-17	WIRE 22 VI/WH		IN	4.80	4.80	.	.	.	.	.	.	.	.
	025-0003-22	WIRE 22 GN/YL		IN	4.80	4.80	.	.	.	.	.	.	.	.
	025-0003-52	WIRE 22 BR/GN		IN	4.80	4.80	.	.	.	.	.	.	.	.
	025-0003-67	WIRE 22 BU/RD		IN	9.60	9.60	.	.	.	.	.	.	.	.
	025-0003-75	WIRE 22 RD/BU		IN	9.60	9.60	.	.	.	.	.	.	.	.
	025-0018-33	WIRE 26 ORN		IN	9.60	9.60	.	.	.	.	.	.	.	.
	025-0018-41	WIRE 26 YL/BN		IN	4.80	4.80	.	.	.	.	.	.	.	.
	025-0018-44	WIRE 26 YEL		IN	9.60	9.60	.	.	.	.	.	.	.	.
	025-0018-52	WIRE 26 GN/RD		IN	9.60	9.60	.	.	.	.	.	.	.	.
	025-0018-53	WIRE 26 GN/OR		IN	9.60	9.60	.	.	.	.	.	.	.	.
	025-0018-55	WIRE 26 GRN		IN	4.80	4.80	.	.	.	.	.	.	.	.
	025-0018-56	WIRE 26 GN/BU		IN	4.80	4.80	.	.	.	.	.	.	.	.
	025-0018-66	WIRE 26 BLU		IN	4.80	4.80	.	.	.	.	.	.	.	.
	025-0018-92	WIRE 26 WH/RD		IN	4.80	4.80	.	.	.	.	.	.	.	.
	025-0029-00	WIRE 24 BLK		IN	9.60	9.60	.	.	.	.	.	.	.	.
	025-0029-02	WIRE 24 RED		IN	4.80	4.80	.	.	.	.	.	.	.	.
	025-0029-09	WIRE 24 WHT		IN	4.80	4.80	.	.	.	.	.	.	.	.
	025-0029-53	WIRE 24 BN/BU		IN	4.80	4.80	.	.	.	.	.	.	.	.
	025-0029-57	WIRE 24 OR/BU		IN	4.80	4.80	.	.	.	.	.	.	.	.
	025-0029-67	WIRE 24 BU/RD		IN	4.80	4.80	.	.	.	.	.	.	.	.
	025-0029-75	WIRE 24 RD/BU		IN	4.80	4.80	.	.	.	.	.	.	.	.
	029-0361-01	PINION 10T 32DP	A	EA	1.00	1.00	.	.	.	.	.	.	.	.
	047-5178-01	IDLR GD		EA	1.00	.	.	.	.	.	.	.	.	.
	047-5191-01	RELAY BRKT W/F		EA	1.00	1.00	.	.	.	.	.	.	.	.
	047-5513-01	STRN RLF BRKT W/F		EA	1.00	1.00	.	.	.	.	.	.	.	.
	047-5514-01	IDLER GUARD W/F		EA	1.00	.	.	.	.	.	.	.	.	.
	047-5969-01	GEAR GUARD W/F	A	EA	.	.	.	2.00	2.00	.	.	.	.	.
	047-6082-01	CABLE GUARD W/F		EA	.	.	.	.	.	.	.	.	1.00	1.00
	047-6083-02	PLT CA GUARD W/H-C	A	EA	.	.	.	.	.	.	.	.	1.00	1.00
	057-2380-00	S/N TAG		EA	1.00	1.00	.	.	.	.	.	.	.	.
	057-2439-00	WARNING TAG		EA	1.00	1.00	.	.	.	.	.	.	.	.
	065-0052-00	PITCH TRIM SERVO	A	EA	.	.	1.00	.	.	1.00	1.00	1.00	.	.
	065-0052-01	PITCH TRIM SERVO	A	EA	.	.	.	1.00	1.00	.	.	.	1.00	1.00
	073-0430-03	MAIN PLATE W/HDW	A	EA	.	1.00	.	.	.	.	.	.	.	.
	073-0430-04	MAIN PLATE W/HDW	A	EA	1.00	.	.	.	.	.	.	.	.	.
	073-0438-02	ENGAGE PLATE W/F	A	EA	1.00	1.00	.	.	.	.	.	.	.	.
	073-0439-03	IDLR PULLEY W/BUSH	A	EA	1.00	.	.	.	.	.	.	.	.	.
	073-0495-01	CABLE GUARD W/F	A	EA	.	.	.	2.00	2.00	.	.	.	.	.
	076-1235-01	SHAFT W/F	A	EA	1.00	1.00	.	.	.	.	.	.	.	.
	076-1329-01	CABLE GUARD W/F	A	EA	1.00	.	.	.	.	.	.	.	.	.
	078-0118-00	RETURN SPRG-SLND		EA	1.00	1.00	.	.	.	.	.	.	.	.
	088-0919-01	DUST COVER 4.05		EA	1.00	1.00	.	.	.	.	.	.	.	.
	089-2191-22	NUT HEX ESNA 6-32		EA	1.00	1.00	.	.	.	.	.	.	.	.
	089-5436-03	SCR FHP 4-40X3/16		EA	4.00	4.00	.	.	.	.	.	.	.	.
	089-5903-05	SCR PHP 4-40X5/16		EA	2.00	2.00	.	.	.	.	.	.	.	.
	089-5948-08	SCR PHP 6-20X1/2		EA	8.00	8.00	.	.	.	.	.	.	.	.
	089-6030-04	SCR SHC 8-32 1/4		EA	3.00	3.00	.	.	.	.	.	.	.	.

065-0052-XX

SYMBOL		PART NUMBER	DESCRIPTION	A	UM	QUANTITY 00	01	02	03	04	05	06	07	08	09
		089-6067-05	SCR PHP 4-40X5/16		EA	3.00	3.00	.	.	.	.	.	.	.	.
		089-6123-03	SCR PHP 4-40X3/16		EA	.	.	.	2.00	2.00	.	.	.	3.00	3.00
		089-6123-05	SCR PHP 4-40X5/16		EA	.	2.00	.	.	.	.	.	.	2.00	2.00
		089-6123-09	SCR PHP 4-40X9/16		EA	2.00	.	.	.	.	.	.	.	.	.
		089-6129-04	SCR PHP 8-32X1/4		EA	1.00	1.00	.	.	.	.	.	.	.	.
		089-6344-04	SCR PHP 4-40X1/4		EA	2.00	2.00	.	.	.	.	.	.	.	.
		089-7023-05	SCR SLKG 8-32X5/16		EA	1.00	.	.	.	.	.	.	.	.	.
		089-8017-37	WSHR INTL LK #8		EA	3.00	3.00	.	.	.	.	.	.	.	.
		089-8199-00	WSHR SHIM		AR	0.00	0.00	.	.	.	.	.	.	.	.
		089-8199-01	WSHR SHIM		AR	0.00	0.00	.	.	.	.	.	.	.	.
		089-8199-02	SHIM .015 T		EA	1.00	1.00	.	.	.	.	.	.	.	.
		089-8225-00	WSHR THRUST		EA	1.00	1.00	.	.	.	.	.	.	.	.
		089-8295-01	WASHER W/FINISH		AR	0.00	0.00	.	.	.	.	.	.	.	.
		089-8295-03	WASHER W/FINISH		AR	0.00	0.00	.	.	.	.	.	.	.	.
		089-8303-00	WASHER		EA	1.00	1.00	.	.	.	.	.	.	.	.
		089-8304-00	WASHER		EA	1.00	1.00	.	.	.	.	.	.	.	.
		090-0019-07	RING RTNR .438		EA	3.00	3.00	.	.	.	.	.	.	.	.
		090-0052-17	ROLL PIN .312		EA	1.00	1.00	.	.	.	.	.	.	.	.
		091-0007-02	SHG STRN RELIEF		EA	1.00	1.00	.	.	.	.	.	.	.	.
		091-0283-00	TO3 INSULATOR		EA	4.00	4.00	.	.	.	.	.	.	.	.
		091-0286-00	INSUL XSTR .437		EA	2.00	2.00	.	.	.	.	.	.	.	.
		200-2597-00	HARNESS ASSY	A	EA	.	.	1.00	1.00	1.00	1.00	1.00	.	.	1.00
		200-2597-01	HARNESS ASSY	A	EA	.	.	.	.	.	.	.	1.00	1.00	.
		200-2731-00	SLIP CLUTCH ASSY	A	EA	.	.	.	.	.	.	.	.	1.00	1.00
		200-2792-02	SLIP CLUTCH ASSY	A	EA	.	.	1.00	.	.	1.00	1.00	1.00	.	.
		200-2794-00	SLIP CLUTCH ASSY	A	EA	.	.	.	1.00	1.00	.	.	.	.	.
		200-2841-01	SOLENOID ASSY	A	EA	1.00	1.00	.	.	.	.	.	.	.	.
		200-6305-00	TRIM SERVO BOARD	A	EA	1.00	1.00	.	.	.	.	.	.	.	.
CR	106	007-5011-00	DIO Z 6.2V 1W 5%		AR	0.00	0.00	.	.	.	.	.	.	.	.
CR	106	007-5011-01	DIO Z 10V 1W 5%		AR	0.00	0.00	1.00	.	.	.	.	.	.	1.00
CR	106	007-5011-02	DIO Z 12V 1W 5%		AR	0.00	0.00	.	.	.	.	.	.	.	.
CR	106	007-5011-03	DIO Z 16V 1W 5%		AR	0.00	0.00	.	.	.	.	.	1.00	1.00	.
CR	106	007-5011-04	DIO Z 13V 1W 5%		AR	0.00	0.00	.	1.00	.	.	.	.	.	.
CR	106	007-5011-08	DIO Z Z3610		AR	0.00	0.00	.	.	.	.	.	.	.	.
CR	106	007-5011-10	DIO Z 22V 1W 5%		AR	0.00	0.00	.	.	.	.	.	.	.	.
CR	106	007-5011-14	DIO Z Z3616		AR	0.00	0.00	.	.	.	.	.	.	.	.
CR	106	007-5011-15	DIO Z 7.5V 1W 5%		AR	0.00	0.00	.	.	.	.	.	.	.	.
CR	106	007-5011-16	DIO Z 9.1V 1W 5%		AR	0.00	0.00	.	.	.	.	.	.	.	.
CR	106	007-5011-17	DIO Z 11V 1W 5%		AR	0.00	0.00	.	.	.	1.00	.	.	.	.
CR	106	007-5011-18	DIO Z 15V 1W 5%		AR	0.00	0.00	.	.	1.00	.	1.00	.	.	.
CR	106	007-5011-19	DIO Z 18V 1W 5%		AR	0.00	0.00	.	.	.	.	.	.	.	.
CR	106	007-5011-20	DIO Z 20V 1W 5%		AR	0.00	0.00	.	.	.	.	.	.	.	.
CR	106	007-5011-21	DIO Z 24V 1W 5%		AR	0.00	0.00	.	.	.	.	.	.	.	.
K	201	032-0029-00	RELAY 2PDT 12VDC		EA	.	.	1.00	1.00	1.00	1.00	1.00	.	.	1.00
K	201	032-0029-01	RELAY 2PDT 24VDC		EA	.	.	.	.	.	.	.	1.00	1.00	.
M	201	148-5057-00	12DC MTG W/GRHD		EA	.	.	.	.	.	.	.	.	.	1.00
M	201	148-5057-04	12DC MTG W/GRHD		EA	.	.	1.00	1.00	.	.	.	.	.	.
M	201	148-5057-06	24DC MTG W/GRHD		EA	.	.	.	.	.	.	.	1.00	1.00	.
M	201	148-5057-08	12DC MTR W/GRHD		EA	.	.	.	.	1.00	1.00	1.00	.	.	.
Q	201	007-6128-00	XSTR DARL 2N6059		EA	1.00	1.00	.	.	.	.	.	.	.	.
Q	202	007-6128-00	XSTR DARL 2N6059		EA	1.00	1.00	.	.	.	.	.	.	.	.
Q	203	007-6128-00	XSTR DARL 2N6059		EA	1.00	1.00	.	.	.	.	.	.	.	.
Q	204	007-6128-00	XSTR DARL 2N6059		EA	1.00	1.00	.	.	.	.	.	.	.	.
R	104	132-0107-61	RES WW 160 3.25W5%		EA	.	.	.	1.00	1.00	1.00	1.00	.	.	1.00
R	104	132-0107-80	RES WW 600 3.25W5%		EA	.	.	.	.	.	.	.	1.00	1.00	.
R	105	132-0106-61	RES WW 180 2.25W5%		EA	.	.	.	.	.	.	.	.	.	1.00
R	105	132-0106-70	RES WW 360 2.25W5%		EA	.	.	.	.	.	.	.	.	1.00	.
R	105	132-0107-57	RES WW 110 3.25W5%		EA	.	.	.	1.00	1.00	1.00	1.00	.	.	.
R	105	132-0107-59	RES WW 130 3.25W5%		EA	.	.	1.00	.	.	.	.	.	.	.
R	105	132-0107-77	RES WW 500 3.25W5%		EA	.	.	.	.	.	.	.	1.00	.	.
R	201	132-0051-00	RES WW 100 3W 10%		EA	.	.	.	1.00	1.00	1.00	1.00	1.00	1.00	1.00
R	202	132-0112-07	RES WW .33 5W 10%		EA	.	.	.	.	1.00	1.00	1.00	.	.	.
R	202	132-0112-09	RES WW .43 5W 10%		EA	.	.	1.00	1.00	.	.	.	.	.	.
R	202	132-0112-15	RES WW .75 5W 10%		EA	.	.	.	.	.	.	.	1.00	1.00	.
R	202	132-0116-06	RES WW .27 3W 10%		EA	.	.	.	.	.	.	.	.	.	1.00
RV	201	134-1026-00	VRSTR V39ZA1 31V		EA	.	.	1.00	1.00	1.00	1.00	1.00	.	.	1.00
RV	201	134-1026-01	VRSTR V39ZA1 39V		EA	.	.	.	.	.	.	.	1.00	1.00	.

KING
KS 179
PITCH TRIM SERVO

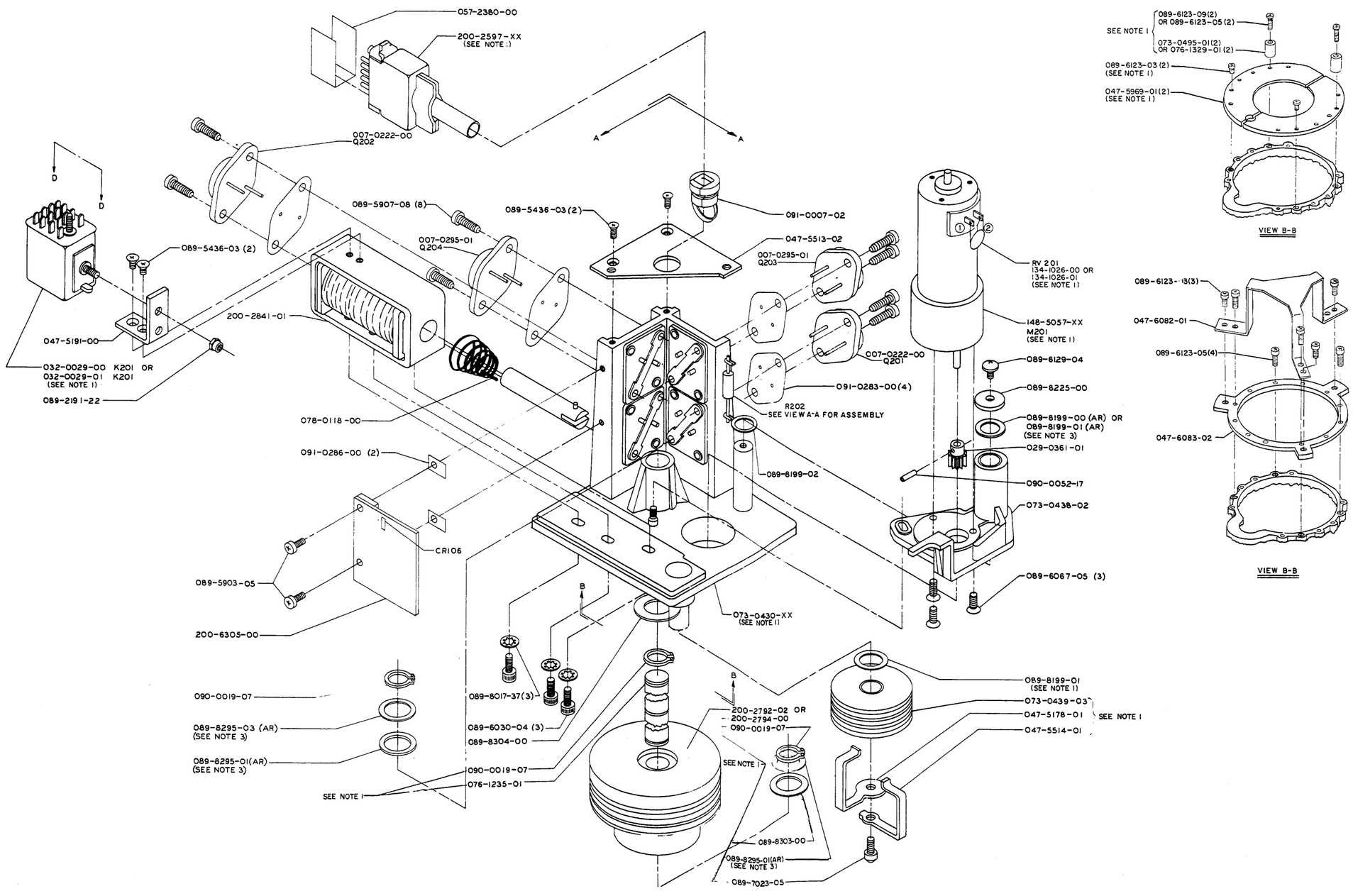
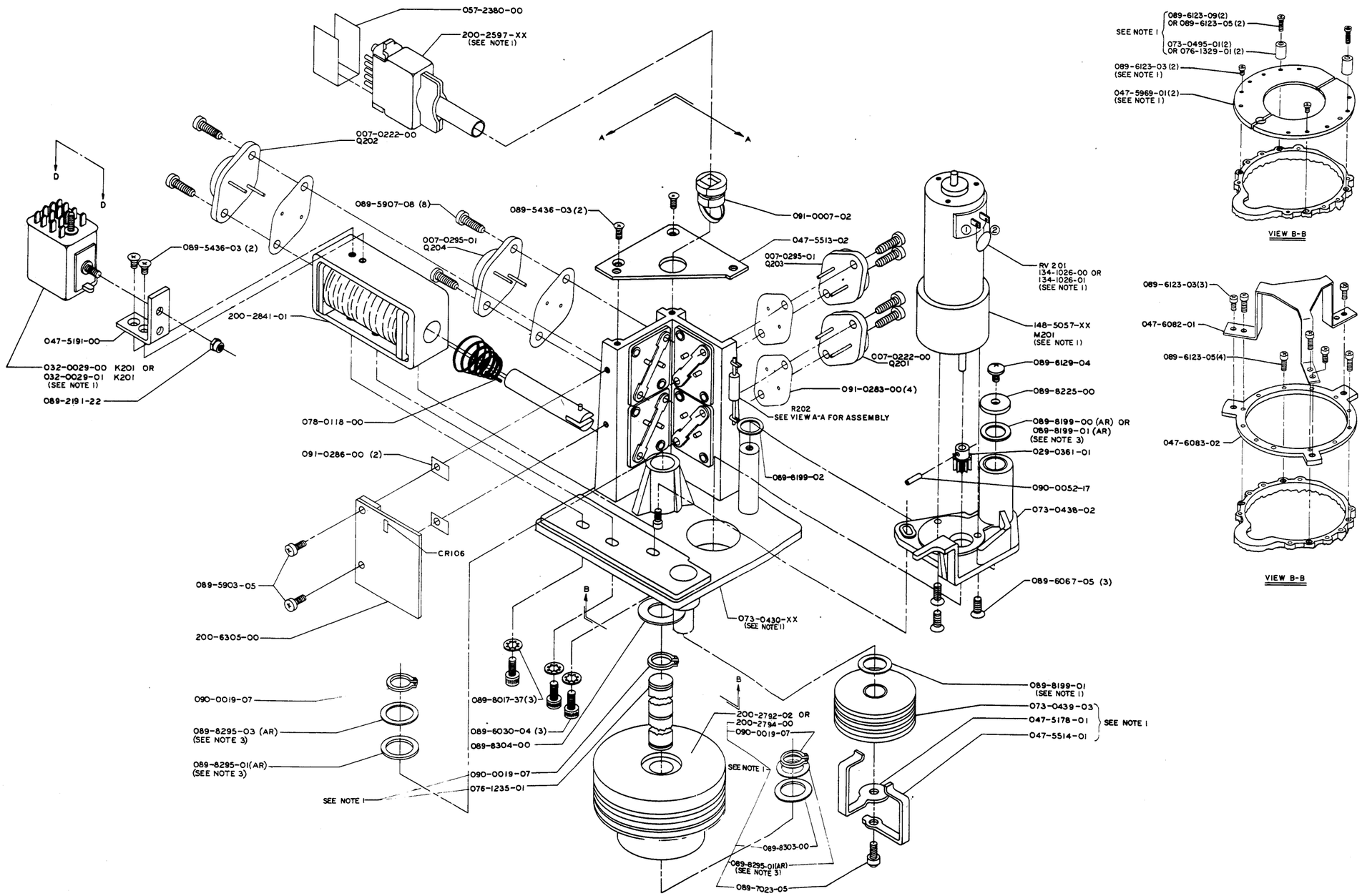


FIGURE 6-1 PITCH TRIM SERVO
(Dwg. No. 300-2607-00, R-20)
(Sheet 1 of 2)

KING
KS 179
PITCH TRIM SERVO



VIEW B-B

VIEW B-B

FIGURE 6-1 PITCH TRIM SERVO
(Dwg. No. 300-2607-00, R-19)
(Sheet 1 of 2)

KING
KS 179
PITCH TRIM SERVO

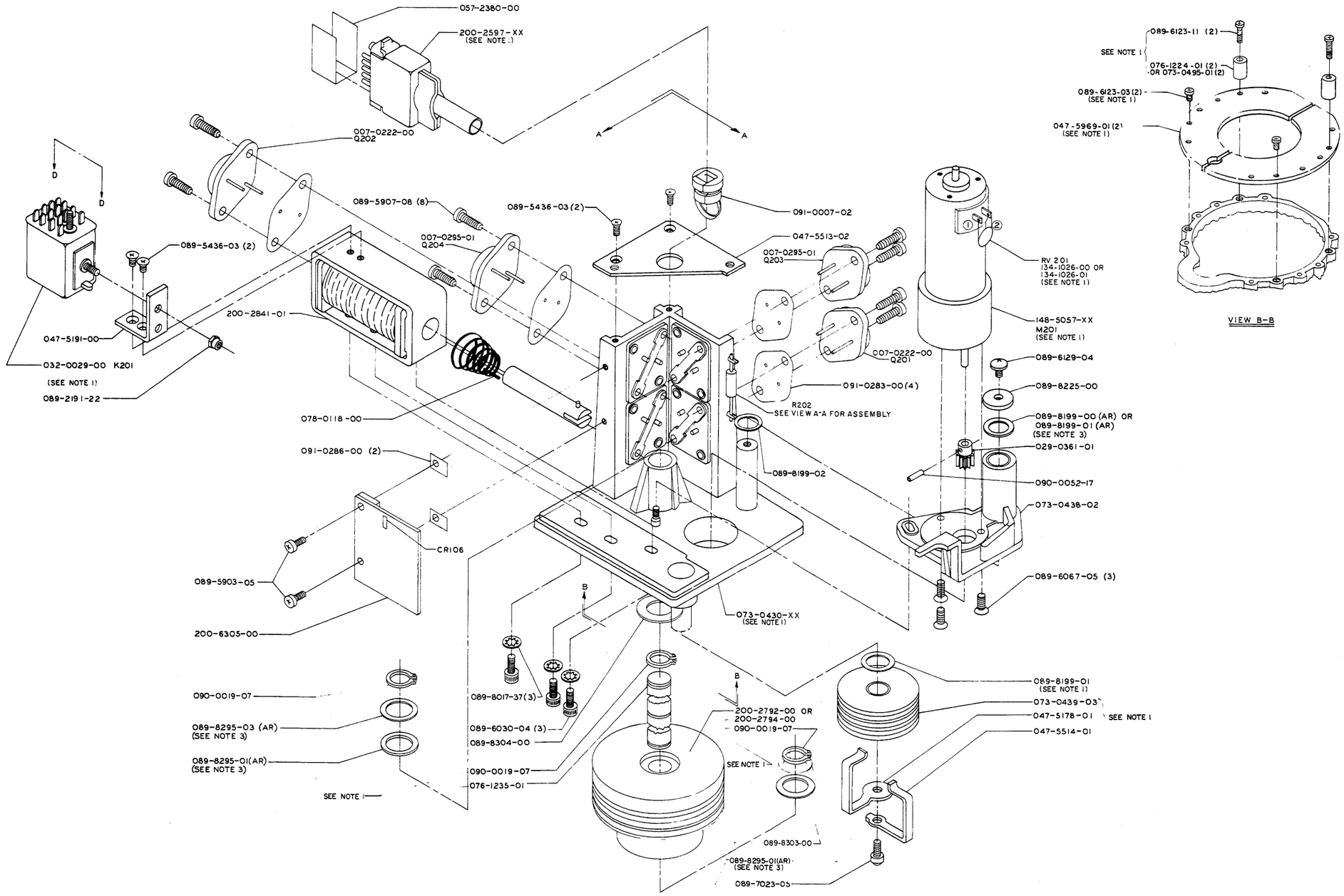
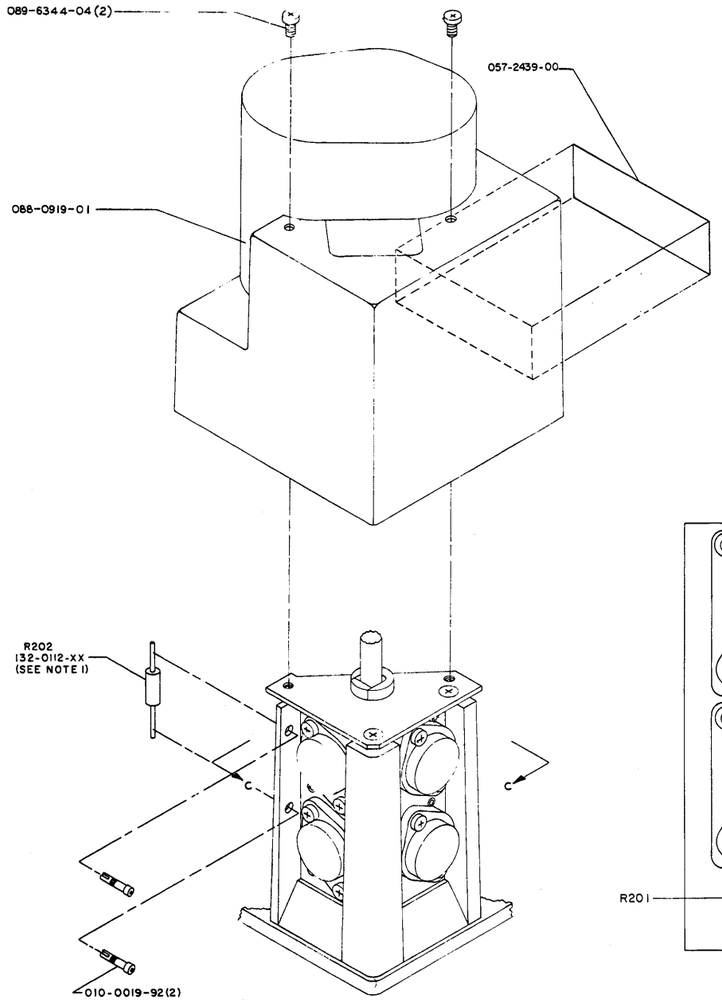
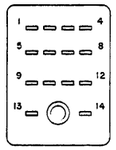


FIGURE 6-1 PITCH TRIM SERVO
(Dwg. No. 300-2607-00, R-15)
(Sheet 1 of 2)

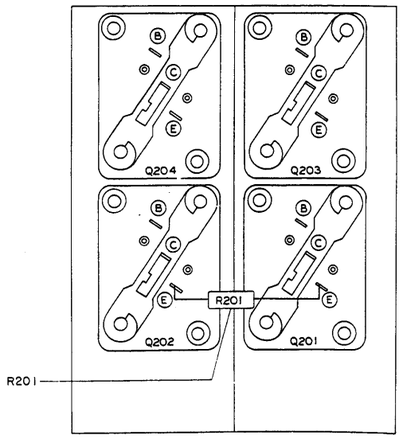
KING
KS 179
PITCH TRIM SERVO



VIEW A-A



VIEW D-D



TRANSISTOR TERMINAL DESIGNATIONS

VIEW C-C

FROM	TO	COLOR	P/N	GA
P101-K	Q202-B	GRN-RED	025-0018-52	26
P101-R	Q201-B	GRN-ORG	025-0018-53	26
P101-F	K201-9	BLUE	025-0018-66	26
P101-H	PCB101-1	BROWN	025-0003-01	22
P101-L	K201-12	GREEN	025-0018-55	26
P101-J	Q203-E	BLACK	025-0003-00	22
P101-P	K201-1	VIO-WHT	025-0003-17	22
P101-E	PCB101-3	WHT-RED	025-0018-92	26
P101-D	K201-4	GRN-YEL	025-0003-22	22
P101-A	PCB101-20	BRN-GRN	025-0003-52	22
P101-N	Q201-C	RED	025-0003-02	22
P101-M	Q202-C	WHITE	025-0003-09	22
P101-C	PCB101-4	YELLOW	025-0018-44	26
P101-B	PCB101-19	ORANGE	025-0018-33	26
Q201-C	PCB101-21	RED	025-0029-02	24
Q201-C	Q202-C	RED	025-0003-02	22
Q201-B	PCB101-7	GRN-ORN	025-0018-53	26
Q201-E	PCB101-8	RED-BLU	025-0029-75	24
Q201-E	K201-5	RED-BLU	025-0003-75	22
Q201-E	Q204-C	RED-BLU	025-0003-75	22
Q202-B	PCB101-23	GRN-RED	025-0018-52	26
Q202-E	PCB101-10	BLU-RED	025-0029-67	24
Q202-E	K201-8	BLU-RED	025-0003-67	22
Q202-E	Q203-C	BLU-RED	025-0003-67	22
Q203-B	PCB101-17	YEL-BRN	025-0018-41	26
Q203-E	Q204-E	BLACK	025-0003-00	22
Q204-B	PCB101-18	GRN-BLU	025-0018-56	26
Q204-E	PCB101-2	BLACK	025-0029-00	24
PCB101-5	K201-13	WHITE	025-0029-09	24
K201-14	Q204-E	BLACK	025-0029-00	24
PCB101-6	K201-1	BRN-BLU	025-0029-53	24
PCB101-9	K201-4	ORN-BLU	025-0029-57	24
E109	R202-1	YELLOW	025-0018-44	26
E110	R202-2	ORANGE	025-0018-33	26

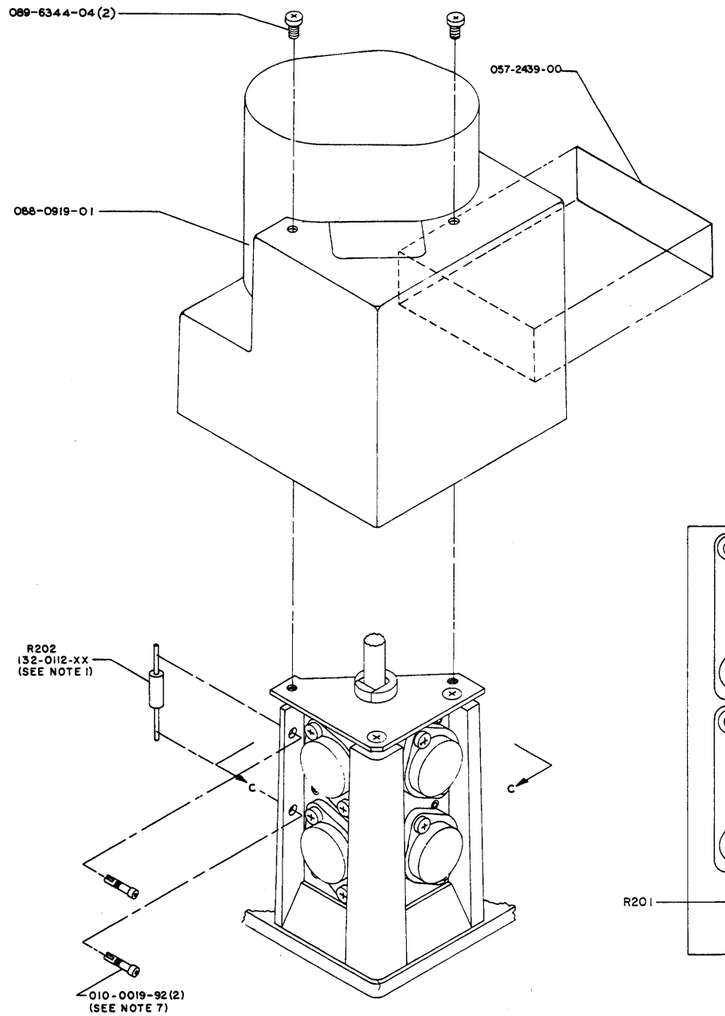
FLAVOR	-01	-02	-03	-04	-05	-06	-07	-08
K201-9 025-0003-06 BLU 22GA			M201 -1	M201 -1	M201 -1	M201 -1	M201 -2	M201 -2
K201-12 025-0003-05 GRN 22GA			M201 -2	M201 -2	M201 -2	M201 -2	M201 -1	M201 -1
SOL-RED			PCB 101-12	PCB 101-12	PCB 101-12	PCB 101-12	PCB 101-14	PCB 101-14
SOL-WHT			PCB 101-15	PCB 101-15	PCB 101-15	PCB 101-15	PCB 101-15	PCB 101-15
SOL-YEL			PCB 101-15	PCB 101-15	PCB 101-15	PCB 101-15	PCB 101-13	PCB 101-13
SOL-BLK			PCB 101-12	PCB 101-12	PCB 101-12	PCB 101-12	PCB 101-12	PCB 101-12
CLUTCH TORQUE (LBF-IN)			20±2	20±2	25±3	21±2	30±3	40±4
R201			100Ω	100Ω	100Ω	100Ω	100Ω	100Ω
R202			.43	.33	.33	.33	.75	.75

FLAVOR	-09
K201-9 025-0003-06 BLU 22GA	M201 -2
K201-12 025-0003-05 GRN 22GA	M201 -1
SOL-RED	PCB 101-12
SOL-WHT	PCB 101-15
SOL-YEL	PCB 101-15
SOL-BLK	PCB 101-12
CLUTCH TORQUE (LBF-IN)	40±4
R201	100Ω
R202	.27

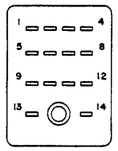
NOTES:
1. FOR COMPLETE ITEM DESCRIPTION SEE B/M 065-0052-XX.
2. AFTER SECURING APPLY GLYPTAL 016-1008-04 TO ALL SCREWS WITHOUT LOCKING DEVICE.
3. SHIM AS REQUIRED TO ACHIEVE .002-.008 END PLAY.
4. DELETED
5. ADJUST SOLENOID ASSY. 200-2841-01 TO ACHIEVE .001-.005 BACKLASH AT THE PITCH RADIUS OF THE MOTOR PINION AND THE CAPSTAN GEAR WITH SOLENOID IN ENGAGED POSITION.
6. BLACK OUT UNUSED VOLTAGE/CURRENT CALLOUT, ON TAG 057-2439-00, TO LEAVE PROPER VOLTAGE/CURRENT CALLOUT DISPLAYED.
7. TERMINAL POSTS ON TRANSISTOR SIDE OF INSULATED STANDOFFS TO BE CUT BACK FLUSH WITH STANDOFFS AFTER STANDOFFS HAVE BEEN SWAGED IN MAIN PLATE.

FIGURE 6-1 PITCH TRIM SERVO
(Dwg. No. 300-2607-00, R-20)
(Sheet 2 of 2)

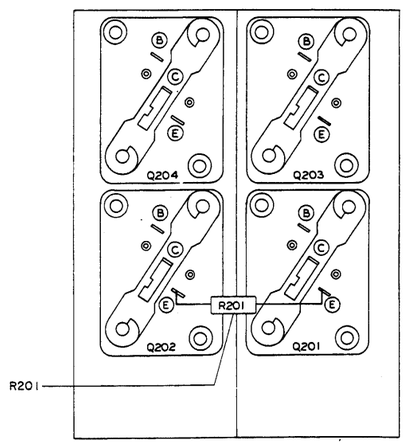
KING
KS 179
PITCH TRIM SERVO



VIEW A-A



VIEW D-D



TRANSISTOR TERMINAL DESIGNATIONS

VIEW C-C

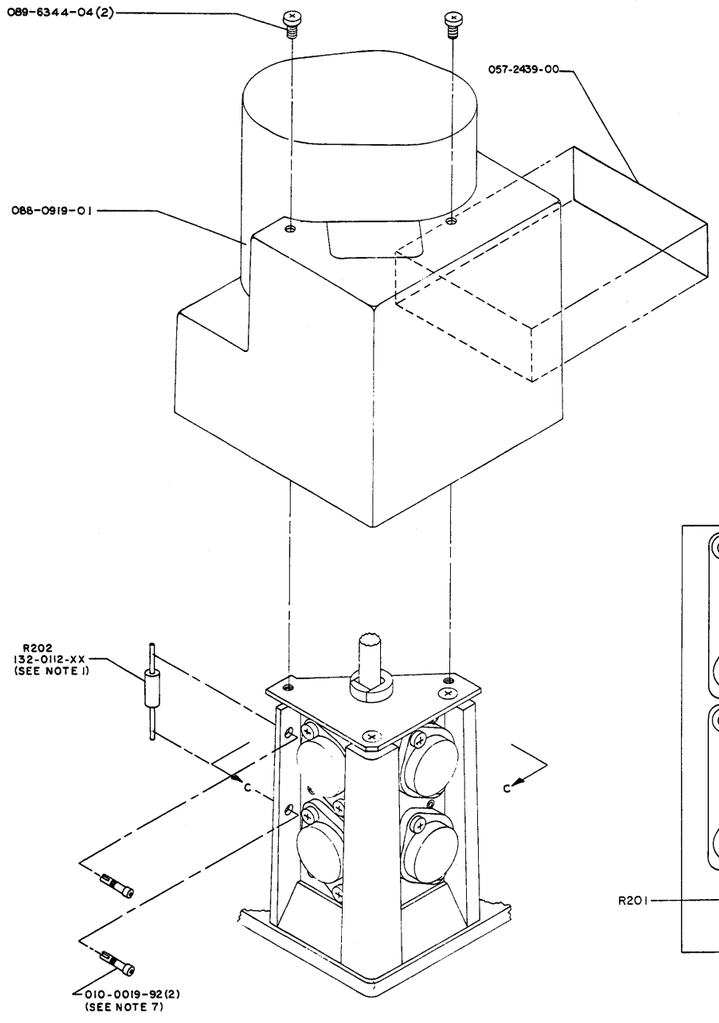
FROM	TO	COLOR	P/N	GA
P101-K	Q202-B	GRN-RED	025-0018-52	26
P101-R	Q201-B	GRN-ORG	025-0018-53	26
P101-F	K201-9	BLUE	025-0018-66	26
P101-H	PCB101-1	BROWN	025-0003-01	22
P101-L	K201-12	GREEN	025-0018-55	26
P101-J	Q203-E	BLACK	025-0003-00	22
P101-P	K201-1	VIO-WHT	025-0003-17	22
P101-E	PCB101-3	WHT-RED	025-0018-92	26
P101-D	K201-4	GRN-YEL	025-0003-22	22
P101-A	PCB101-20	BRN-GRN	025-0003-52	22
P101-N	Q201-C	RED	025-0003-02	22
P101-M	Q202-C	WHITE	025-0003-09	22
P101-C	PCB101-4	YELLOW	025-0018-44	26
P101-B	PCB101-19	ORANGE	025-0018-33	26
Q201-C	PCB101-21	RED	025-0029-02	24
Q201-C	Q202-C	RED	025-0003-02	22
Q201-B	PCB101-7	GRN-ORN	025-0018-53	26
Q201-E	PCB101-8	RED-BLU	025-0029-75	24
Q201-E	K201-5	RED-BLU	025-0003-75	22
Q201-E	Q204-C	RED-BLU	025-0003-75	22
Q202-B	PCB101-23	GRN-RED	025-0018-52	26
Q202-E	PCB101-10	BLU-RED	025-0029-67	24
Q202-E	K201-8	BLU-RED	025-0003-67	22
Q202-E	Q203-C	BLU-RED	025-0003-67	22
Q203-B	PCB101-17	YEL-BRN	025-0018-41	26
Q203-E	Q204-E	BLACK	025-0003-00	22
Q204-B	PCB101-18	GRN-BLU	025-0018-56	26
Q204-E	PCB101-2	BLACK	025-0029-00	24
PCB101-5	K201-13	WHITE	025-0029-09	24
K201-14	Q204-E	BLACK	025-0029-00	24
PCB101-6	K201-1	BRN-BLU	025-0029-53	24
PCB101-9	K201-4	ORN-BLU	025-0029-57	24
E109	R202-1	YELLOW	025-0018-44	26
E110	R202-2	ORANGE	025-0018-33	26

FLAVOR	-01	-02	-03	-04	-05	-06	-07	-08
K201-9 025-0003-06 BLU 22GA			M201 -1	M201 -1	M201 -1	M201 -1	M201 -2	M201 -2
K201-12 025-0003-05 GRN 22GA			M201 -2	M201 -2	M201 -2	M201 -2	M201 -1	M201 -1
SOL-RED			PCB 101-15	PCB 101-15	PCB 101-15	PCB 101-15	PCB 101-14	PCB 101-14
SOL-WHT			PCB 101-12	PCB 101-12	PCB 101-12	PCB 101-12	PCB 101-15	PCB 101-15
SOL-YEL			PCB 101-15	PCB 101-15	PCB 101-15	PCB 101-15	PCB 101-13	PCB 101-13
SOL-BLK			PCB 101-12	PCB 101-12	PCB 101-12	PCB 101-12	PCB 101-12	PCB 101-12
CLUTCH TORQUE (LBF-IN)			20±2	20±2	25±3	21±2	30±3	40±4
R201			100Ω	100Ω	100Ω	100Ω	100Ω	100Ω
R202			.43	.33	.33	.33	.75	.75

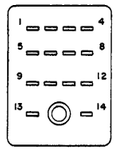
NOTES:
1. FOR COMPLETE ITEM DESCRIPTION SEE B/M 065-0052-XX.
2. AFTER SECURING APPLY GLYPTAL 016-1008-04 TO ALL SCREWS WITHOUT LOCKING DEVICE.
3. SHIM AS REQUIRED TO ACHIEVE .002-.008 END PLAY.
4. DELETED
5. ADJUST SOLENOID ASSY. 200-2841-01 TO ACHIEVE .001-.005 BACKLASH AT THE PITCH RADIUS OF THE MOTOR PINION AND THE CAPSTAN GEAR WITH SOLENOID IN ENGAGED POSITION.
6. BLACK OUT UNUSED VOLTAGE/CURRENT CALLOUT, ON TAG 057-2439-00, TO LEAVE PROPER VOLTAGE/CURRENT CALLOUT DISPLAYED.
7. TERMINAL POSTS ON TRANSISTOR SIDE OF INSULATED STANDOFFS TO BE CUT BACK FLUSH WITH STANDOFFS AFTER STANDOFFS HAVE BEEN SWAGED IN MAIN PLATE.

FIGURE 6-1 PITCH TRIM SERVO
(Dwg. No. 300-2607-00, R-19)
(Sheet 2 of 2)

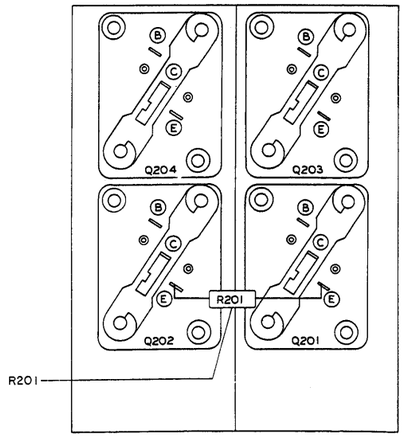
KING
KS 179
PITCH TRIM SERVO



VIEW A-A



VIEW D-D



TRANSISTOR TERMINAL DESIGNATIONS

VIEW C-C

FROM	TO	COLOR	P/N	GA
P101-K	Q202-B	GRN-RED	025-0018-52	26
P101-R	Q201-B	GRN-ORG	025-0018-53	26
P101-F	K201-9	BLUE	025-0018-66	26
P101-H	PCB101-1	BROWN	025-0003-01	22
P101-L	K201-12	GREEN	025-0018-55	26
P101-J	Q203-E	BLACK	025-0003-00	22
P101-P	K201-1	VIO-WHT	025-0003-17	22
P101-E	PCB101-3	WHT-RED	025-0018-92	26
P101-D	K201-4	GRN-YEL	025-0003-22	22
P101-A	PCB101-20	BRN-GRN	025-0003-52	22
P101-N	Q201-C	RED	025-0003-02	22
P101-M	Q202-C	WHITE	025-0003-09	22
P101-C	PCB101-4	YELLOW	025-0018-44	26
P101-B	PCB101-19	ORANGE	025-0018-33	26
Q201-C	PCB101-21	RED	025-0029-02	24
Q201-C	Q202-C	RED	025-0003-02	22
Q201-B	PCB101-7	GRN-ORN	025-0018-53	26
Q201-E	PCB101-8	RED-BLU	025-0029-75	24
Q201-E	K201-5	RED-BLU	025-0003-75	22
Q201-E	Q204-C	RED-BLU	025-0003-75	22
Q202-B	PCB101-23	GRN-RED	025-0018-52	26
Q202-E	PCB101-10	BLU-RED	025-0029-67	24
Q202-E	K201-8	BLU-RED	025-0003-67	22
Q202-E	Q203-C	BLU-RED	025-0003-67	22
Q203-B	PCB101-17	YEL-BRN	025-0018-41	26
Q203-E	Q204-E	BLACK	025-0003-00	22
Q204-B	PCB101-18	GRN-BLU	025-0018-56	26
Q204-E	PCB101-2	BLACK	025-0029-00	24
PCB101-5	K201-13	WHITE	025-0029-09	24
K201-14	Q204-E	BLACK	025-0029-00	24
PCB101-6	K201-1	BRN-BLU	025-0029-53	24
PCB101-9	K201-4	ORN-BLU	025-0029-57	24
E109	R202-1	YELLOW	025-0018-44	26
E110	R202-2	ORANGE	025-0018-33	26

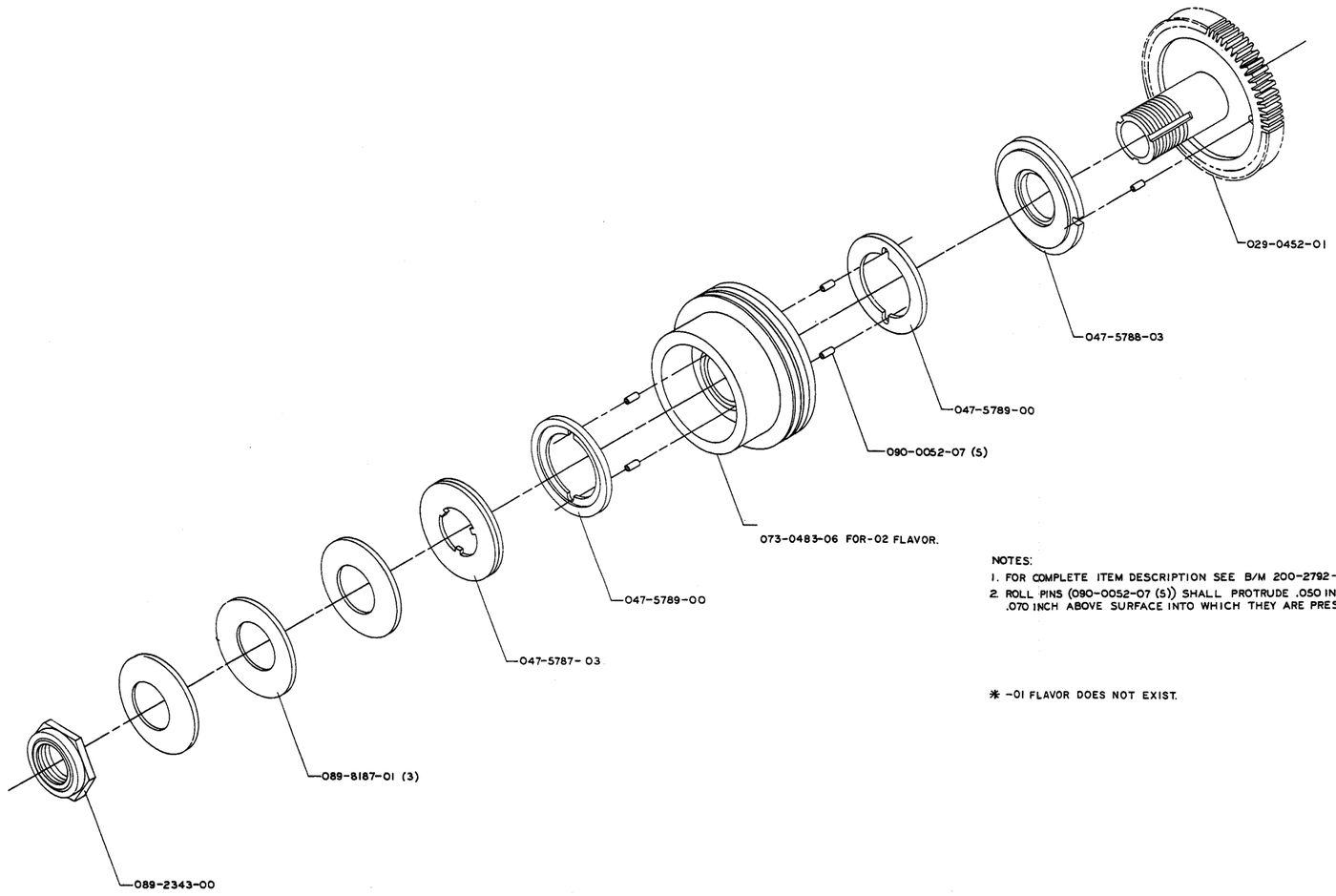
FLAVOR			-03	-04	-05	-06		
K201-9 025-0003-06 BLU 22GA			M201 -1	M201 -1	M201 -1	M201 -1		
K201-12 025-0003-05 GRN 22GA			M201 -2	M201 -2	M201 -2	M201 -2		
SOL-RED			PCB 101-15	PCB 101-15	PCB 101-15	PCB 101-15		
SOL-WHT			PCB 101-12	PCB 101-12	PCB 101-12	PCB 101-12		
SOL-YEL			PCB 101-15	PCB 101-15	PCB 101-15	PCB 101-15		
SOL-BLK			PCB 101-12	PCB 101-12	PCB 101-12	PCB 101-12		
CLUTCH TORQUE (LBF-IN)			20*2	21*2	25±3	18±2		
R201			100Ω	100Ω	100Ω	100Ω		
R202			.43	.43	.43	.43		

NOTES:
1. FOR COMPLETE ITEM DESCRIPTION SEE B/M 065-0052-XX.
2. AFTER SECURING APPLY GLYPTAL 016-1008-04 TO ALL SCREWS WITHOUT LOCKING DEVICE.
3. SHIM AS REQUIRED TO ACHEIVE .002-.008 END PLAY.
4. DELETED
5. ADJUST SOLENOID ASSY. 200-2841-01 TO ACHEIVE .001-.005 BACKLASH AT THE PITCH RADIUS OF THE MOTOR PINION AND THE CAPSTAN GEAR WITH SOLENOID IN ENGAGED POSITION.
6. BLACK OUT UNUSED VOLTAGE/CURRENT CALLOUT, ON TAG 057-2439-00, TO LEAVE PROPER VOLTAGE/CURRENT CALLOUT DISPLAYED.
7. TERMINAL POSTS ON TRANSISTOR SIDE OF INSULATED STANDOFFS TO BE CUT BACK FLUSH WITH STANDOFFS AFTER STANDOFFS HAVE BEEN SWAGED IN MAIN PLATE.

FIGURE 6-1 PITCH TRIM SERVO
(Dwg. No. 300-2607-00, R-15)
(Sheet 2 of 2)

200-2792-02 SLIP CLUTCH ASSY R: 1

SYMBOL	PART NUMBER	DESCRIPTION	A	UM	QUANTITY 02
	029-0452-01	GEAR 77T MACH	A	EA	1.00
	047-5787-03	CLTCH PLT W/DSKMCH	A	EA	1.00
	047-5788-03	CLTCH PLT W/DSKMCH	A	EA	1.00
	047-5789-00	CLUTCH DISK		EA	2.00
	073-0483-06	TRIM CPSTN W/BSHG	A	EA	1.00
	089-2343-00	NUT HEX LT 7.5-16		EA	1.00
	089-8187-01	WASHER 1.500		EA	3.00
	090-0052-07	ROLL PIN .187		EA	5.00

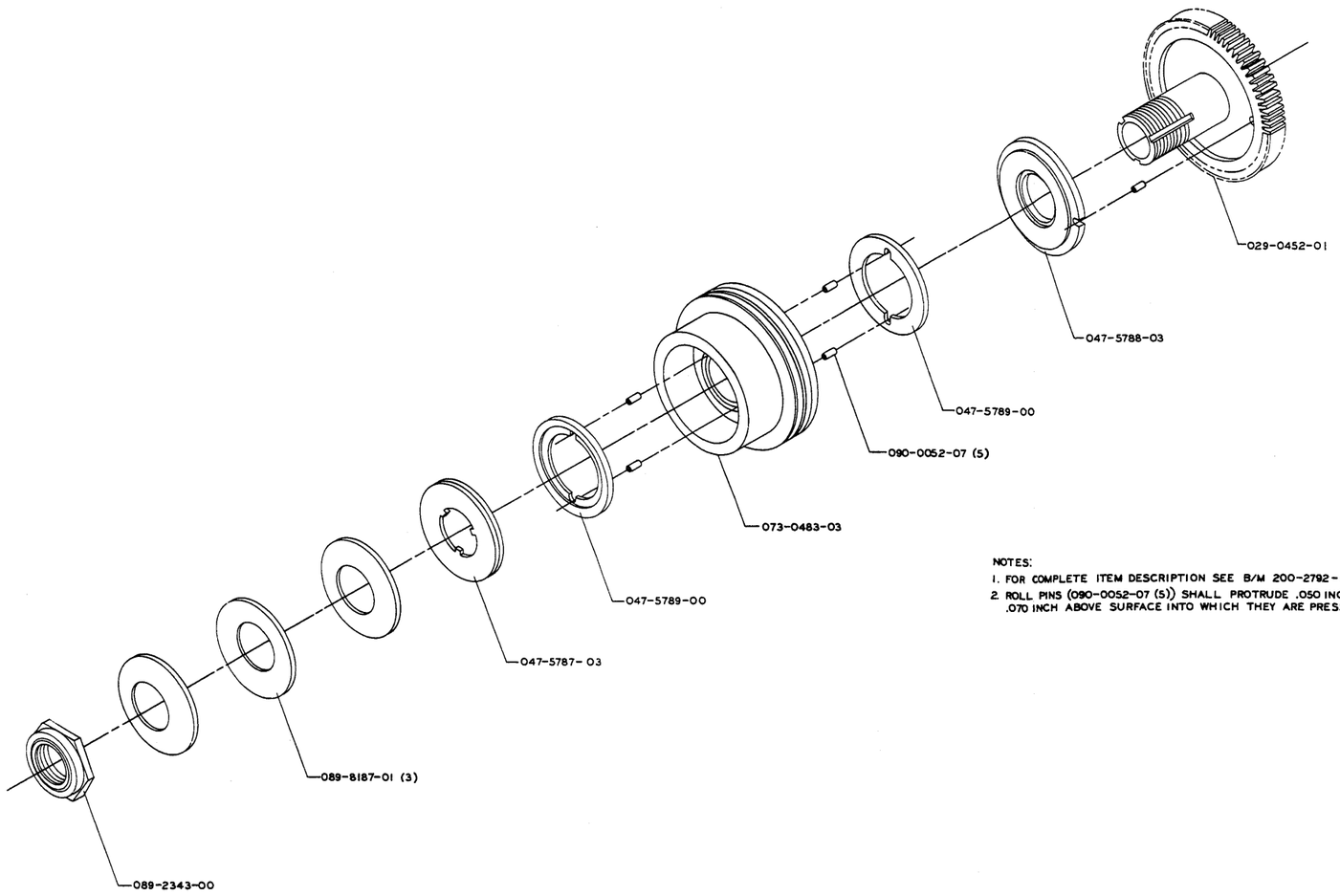


NOTES:
1. FOR COMPLETE ITEM DESCRIPTION SEE B/M 200-2792-XX.
2. ROLL PINS (090-0052-07 (5)) SHALL PROTRUDE .050 INCH TO .070 INCH ABOVE SURFACE INTO WHICH THEY ARE PRESSED.

* -01 FLAVOR DOES NOT EXIST.

FIGURE 6-2 SLIP CLUTCH ASSEMBLY
(Dwg. No. 300-2792-00/02, R-2)

KING
KS 179
PITCH TRIM SERVO

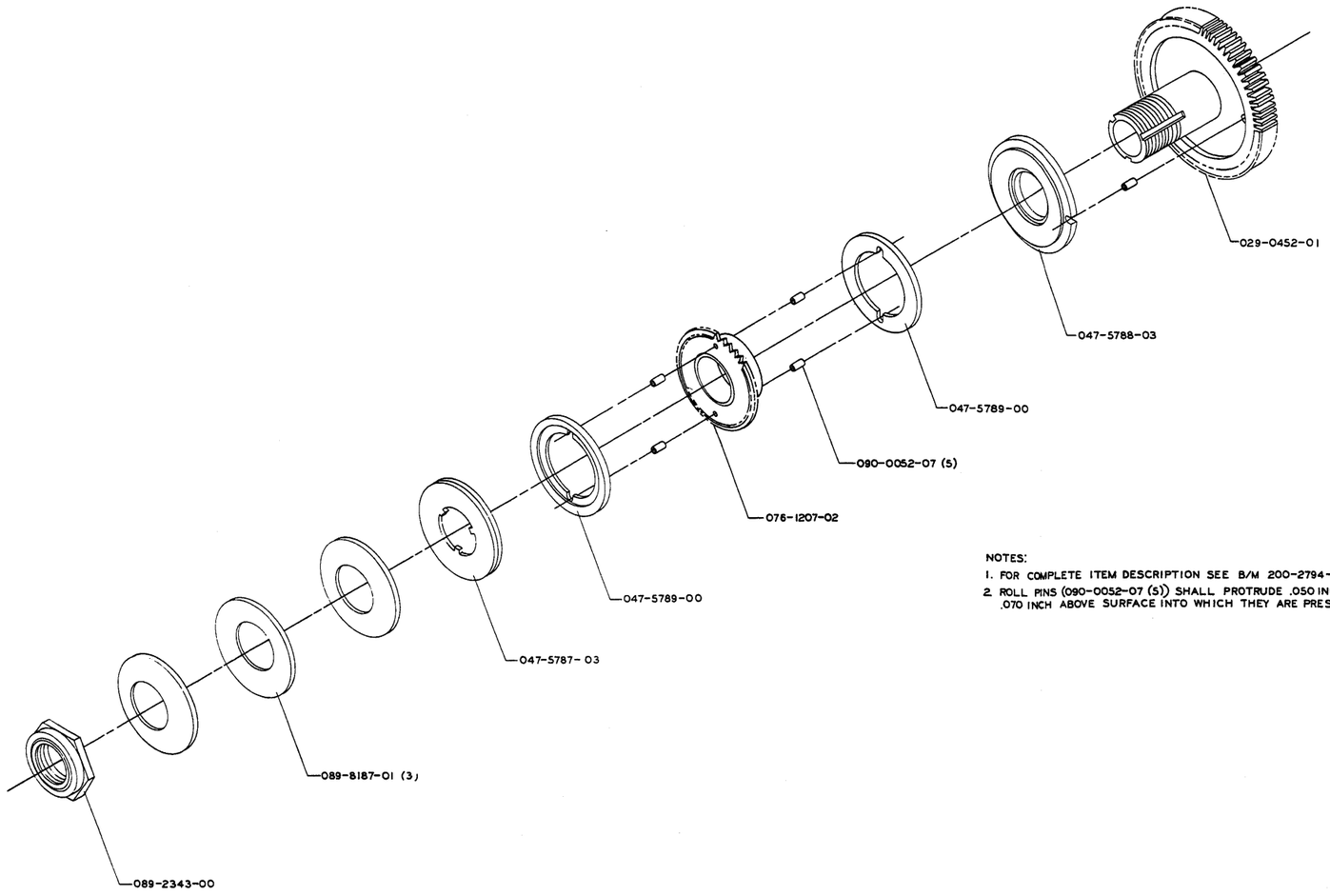


NOTES:
1. FOR COMPLETE ITEM DESCRIPTION SEE B/M 200-2792-XX.
2. ROLL PINS (090-0052-07 (5)) SHALL PROTRUDE .050 INCH TO .070 INCH ABOVE SURFACE INTO WHICH THEY ARE PRESSED.

FIGURE 6-2 SLIP CLUTCH ASSEMBLY
(Dwg. No. 300-2792-00, R-1)

200-2794-00 SLIP CLUTCH ASSY R: 4

SYMBOL	PART NUMBER	DESCRIPTION	A	UM	QUANTITY 00
	029-0452-01	GEAR 77T MACH	A	EA	1.00
	047-5787-03	CLTCH PLT W/DSKMCH	A	EA	1.00
	047-5788-03	CLTCH PLT W/DSKMCH	A	EA	1.00
	047-5789-00	CLUTCH DISK		EA	2.00
	076-1207-02	SPROCKET W/BUSHING	A	EA	1.00
	089-2343-00	NUT HEX LT 7.5-16		EA	1.00
	089-8187-01	WASHER 1.500		EA	3.00
	090-0052-07	ROLL PIN .187		EA	5.00



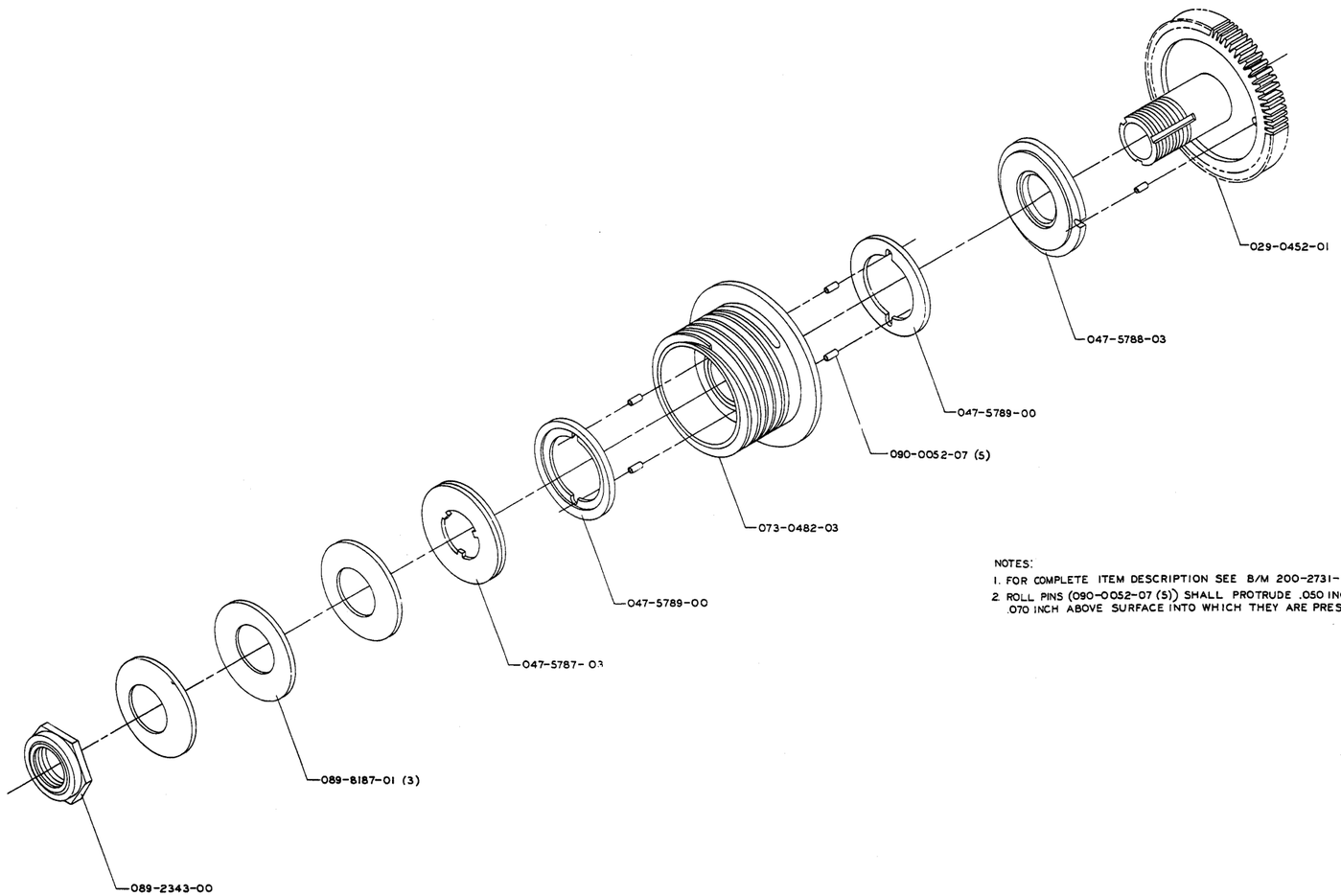
NOTES:
1. FOR COMPLETE ITEM DESCRIPTION SEE B/M 200-2794-XX.
2. ROLL PINS (090-0052-07 (5)) SHALL PROTRUDE .050 INCH TO .070 INCH ABOVE SURFACE INTO WHICH THEY ARE PRESSED.

FIGURE 6-3 SLIP CLUTCH ASSEMBLY
(Dwg. No. 300-2794-00, R-2)

200-2731-00 SLIP CLUTCH ASSY R: 4

SYMBOL	PART NUMBER	DESCRIPTION	A	UM	QUANTITY 00
	029-0452-01	GEAR 77T MACH	A	EA	1.00
	047-5787-03	CLTCH PLT W/DSKMCH	A	EA	1.00
	047-5788-03	CLTCH PLT W/DSKMCH	A	EA	1.00
	047-5789-00	CLUTCH DISK		EA	2.00
	073-0482-03	CAPSTAN W/BUSHINGS	A	EA	1.00
	089-2343-00	NUT HEX LT 7.5-16		EA	1.00
	089-8187-01	WASHER 1.500		EA	3.00
	090-0052-07	ROLL PIN .187		EA	5.00

KING
KS 179
PITCH TRIM SERVO



NOTES:
1. FOR COMPLETE ITEM DESCRIPTION SEE B/M 200-2731-XX.
2. ROLL PINS (090-0052-07 (5)) SHALL PROTRUDE .050 INCH TO .070 INCH ABOVE SURFACE INTO WHICH THEY ARE PRESSED.

FIGURE 6-4 SLIP CLUTCH ASSEMBLY
(Dwg. No. 300-2731-00, R-1)

KING RADIO CORPORATION
PARTS LISTING

200-2841-01 SOLENOID ASSY R: 3
200-2841-99 COMMON BOM R: 3

SYMBOL	PART NUMBER	DESCRIPTION	A	UM	QUANTITY 01	QUANTITY 99
	019-2362-01	SOLENOID COIL		EA	.	1.00
	073-0471-03	FRAME SLND W/H&W/F	A	EA	1.00	.
	076-1096-01	PLUNGER STOP W/F	A	EA	.	1.00
	076-1098-01	SOL PLNGR		EA	.	1.00
	076-1194-01	ROLLER W/F		EA	.	1.00
	088-1006-00	SPACER		EA	.	1.00
	089-6067-06	SCR FHP 4-40X3/8		EA	.	1.00
	090-0052-19	ROLL PIN .625		EA	.	1.00
	150-0047-10	SHRNK TUBING NAT		FT	.	0.20
	200-2841-99	COMMON BOM	A	EA	1.00	.

KING
KS 179
PITCH TRIM SERVO

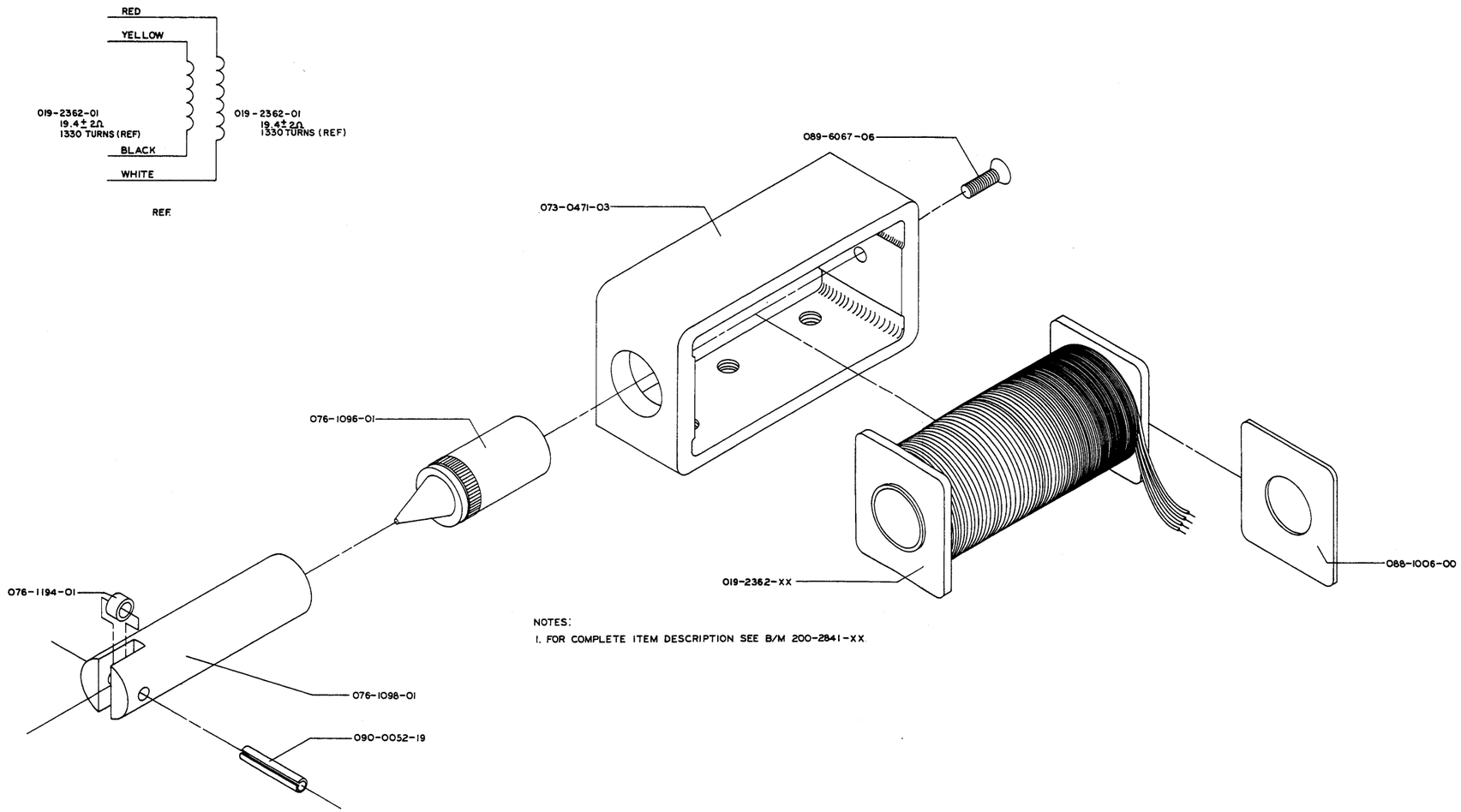
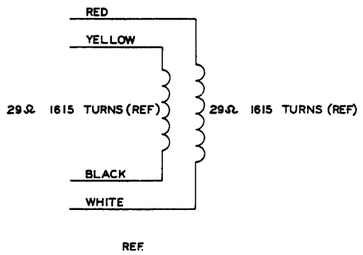
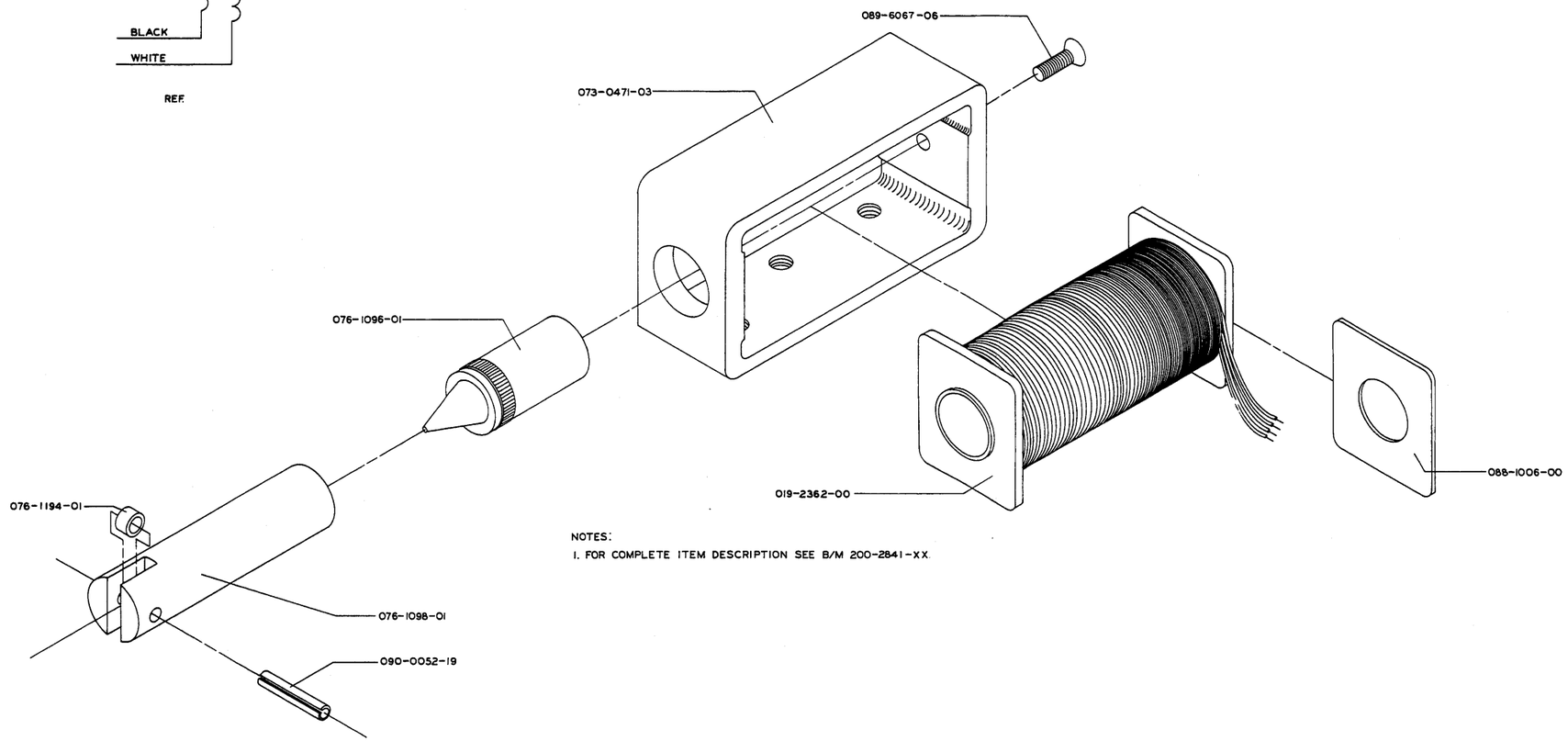


FIGURE 6-5 SOLENOID ASSEMBLY
(Dwg. No. 300-2841-00, R-3)

KING
KS 179
PITCH TRIM SERVO





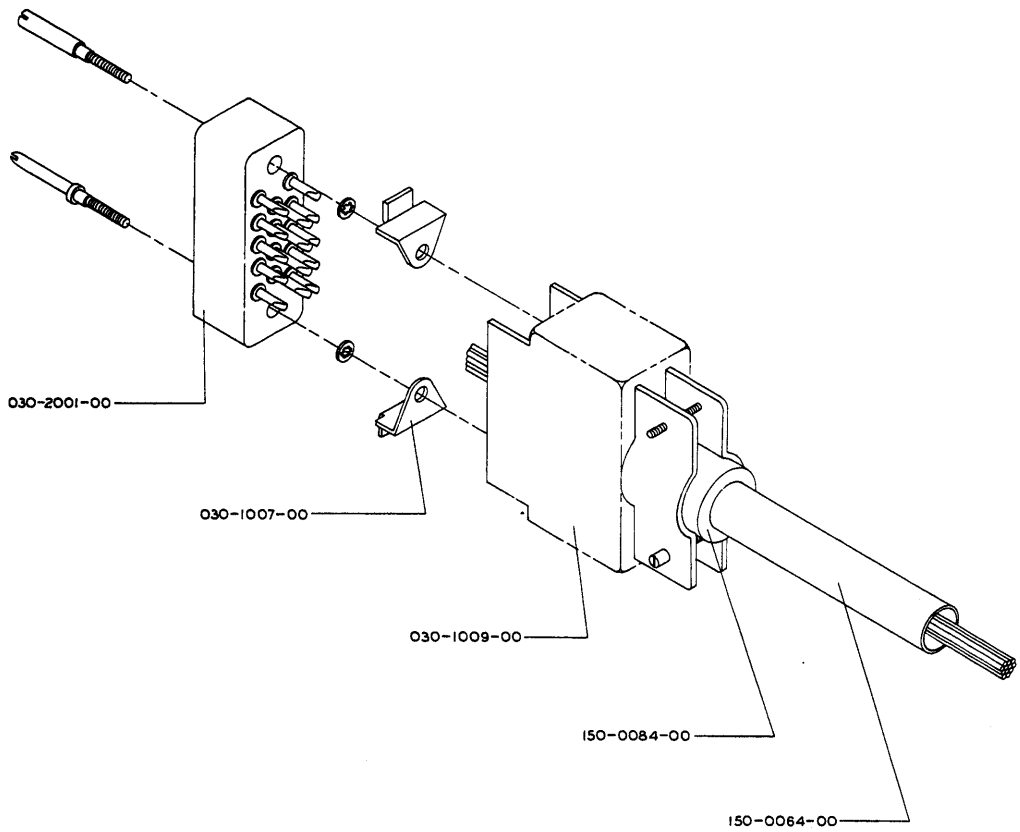
NOTES:
1. FOR COMPLETE ITEM DESCRIPTION SEE B/M 200-2841-XX.

FIGURE 6-5 SOLENOID ASSEMBLY
(Dwg. No. 300-2841-00, R-2)

200-2597-00 HARNESS ASSY R: 2
200-2597-01 HARNESS ASSY R: 3

SYMBOL	PART NUMBER	DESCRIPTION	A	UM	QUANTITY 00	QUANTITY 01
	025-0003-00	WIRE 22 BLK		FT	1.10	1.10
	025-0003-01	WIRE 22 BRN		FT	1.10	1.10
	025-0003-02	WIRE 22 RED		FT	1.10	.
	025-0003-09	WIRE 22 WHT		FT	.	1.10
	025-0003-17	WIRE 22 VI/WH		FT	1.10	1.10
	025-0003-22	WIRE 22 GN/YL		FT	1.10	1.10
	025-0003-52	WIRE 22 BR/GN		FT	1.10	1.10
	025-0018-33	WIRE 26 ORN		FT	1.10	1.10
	025-0018-44	WIRE 26 YEL		FT	1.10	1.10
	025-0018-52	WIRE 26 GN/RD		FT	1.10	1.10
	025-0018-53	WIRE 26 GN/OR		FT	1.10	1.10
	025-0018-55	WIRE 26 GRN		FT	1.10	1.10
	025-0018-66	WIRE 26 BLU		FT	1.10	1.10
	025-0018-92	WIRE 26 WH/RD		FT	1.10	1.10
	030-1007-00	TAB LOCKING		EA	2.00	2.00
	030-1009-00	HOOD CONN		EA	1.00	1.00
	030-2001-00	CONN 14 PIN MALE		EA	1.00	1.00
	150-0064-00	TUBING TFLN 26 BLK		FT	1.00	1.00
	150-0084-00	TUBING PLSTC .312		FT	0.10	0.10

KING
KS 179
PITCH TRIM SERVO



WIRE NO.	FROM	COLOR	P/N	GA
1	P101-K	GRN-RED	025-0018-52	26
2	P101-R	GRN-ORN	025-0018-53	26
3	P101-F	BLUE	025-0018-66	26
4	P101-H	BROWN	025-0003-01	22
5	P101-L	GREEN	025-0018-55	26
6	P101-J	BLACK	025-0003-00	22
7	P101-P	VIO-WHT	025-0003-17	22
8	P101-E	WHT-RED	025-0018-92	26
9	P101-D	GRN-YEL	025-0003-22	22
10	P101-A	BRN-GRN	025-0003-52	22
*11	P101-N	RED	025-0003-02	22
**12	P101-M	WHITE	025-0003-09	22
13	P101-C	YELLOW	025-0018-44	26
14	P101-B	ORANGE	025-0018-33	26

* NOT USED ON 200-2597-01
** NOT USED ON 200-2597-00

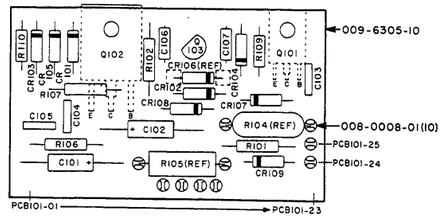
NOTES:
1. FOR COMPLETE ITEM DESCRIPTION SEE B/M 200-2597-XX
2. INSULATING TUBING 150-0064-00 SHALL EXTEND APROX. .45 INCH INTO CONNECTOR HOOD 030-1009-00
3. OVERALL LENGTH OF HARNESS ASSY CABLE 18 INCHES ± 1 INCH.

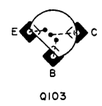
FIGURE 6-6 HARNESS ASSEMBLY
(Dwg. No. 300-2597-00, R-3)

200-6305-00 TRIM SERVO BOARD R: 5

SYMBOL		PART NUMBER	DESCRIPTION	A	UM	QUANTITY 00
		008-0008-01	TERM SPLIT TURR		EA	10.00
		009-6305-10	PC BD TRIM SERVO		EA	1.00
		016-1040-00	PC101 COATING		AR	0.00
C	101	096-1031-00	CAP TN 2.2UF 50V		EA	1.00
C	102	096-1031-00	CAP TN 2.2UF 50V		EA	1.00
C	103	111-0001-03	CAP CR .22UF 50V		EA	1.00
C	104	111-0001-03	CAP CR .22UF 50V		EA	1.00
C	105	111-0001-03	CAP CR .22UF 50V		EA	1.00
C	106	111-2103-41	CAP MC 10KPF50V10%		EA	1.00
C	107	111-2104-40	CAP MC 100KPF50V5%		EA	1.00
CR	101	007-6025-00	DIO S 1N4003		EA	1.00
CR	102	007-6025-00	DIO S 1N4003		EA	1.00
CR	103	007-6025-00	DIO S 1N4003		EA	1.00
CR	104	007-6025-00	DIO S 1N4003		EA	1.00
CR	105	007-6025-00	DIO S 1N4003		EA	1.00
CR	107	007-6025-00	DIO S 1N4003		EA	1.00
CR	108	007-6025-00	DIO S 1N4003		EA	1.00
CR	109	007-6025-00	DIO S 1N4003		EA	1.00
Q	101	007-0276-02	XSTR MJE181		EA	1.00
Q	102	007-0206-03	XSTR MJE1100		EA	1.00
Q	103	007-0078-02	XSTR S NPN 2N3416		EA	1.00
R	101	132-0105-92	RES WW 1.5K1.5W 5%		EA	1.00
R	102	132-0105-92	RES WW 1.5K1.5W 5%		EA	1.00
R	103	999-9999-98	NOT USED		EA	1.00
R	106	132-0105-92	RES WW 1.5K1.5W 5%		EA	1.00
R	107	132-0105-92	RES WW 1.5K1.5W 5%		EA	1.00
R	109	131-0101-23	RES CF 100 OW 5%		EA	1.00
R	110	131-0272-23	RES CF 2.7K OW 5%		EA	1.00

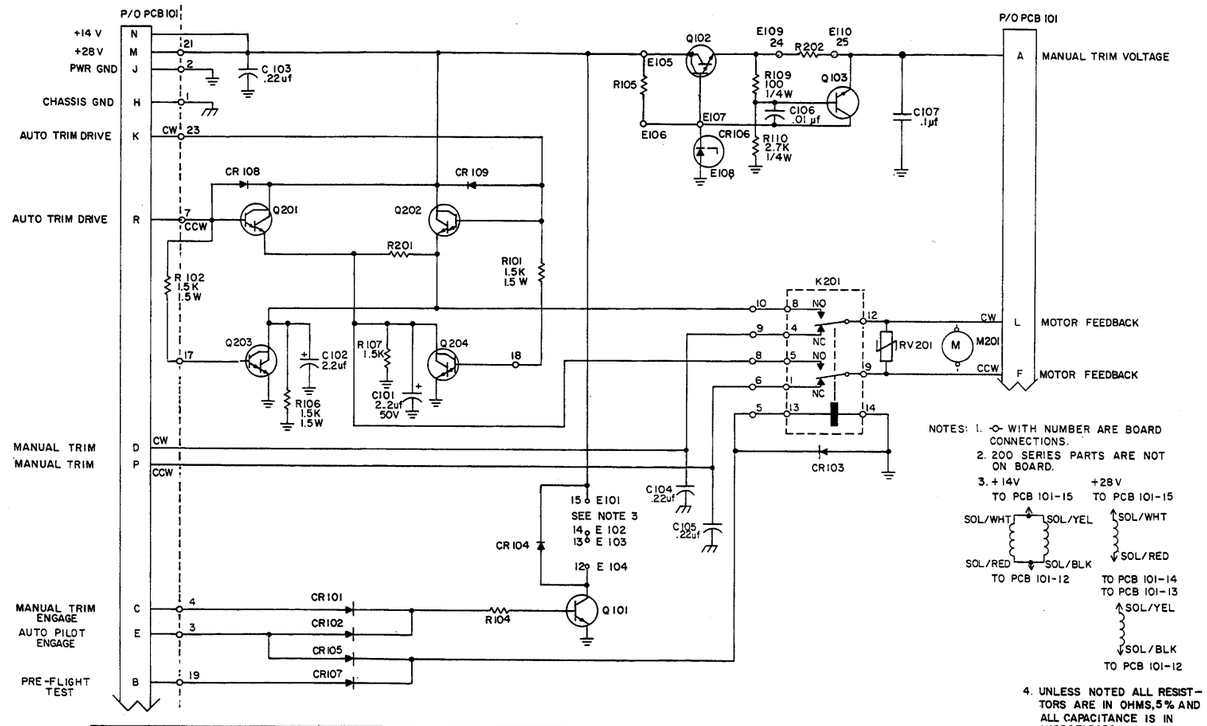
KING
KS 179
PITCH TRIM SERVO





NOTES:

1. PRIOR TO POST COATING BOTH SIDES OF P.C. BOARD WITH CLEAR URETHANE (016-1040-00), MASK OFF THE FOLLOWING: PCB101-01 THRU PCB101-25, 008-0008-01, DASHED-IN AREAS

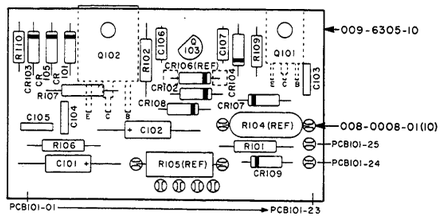


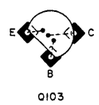
FLAVORS	-01	-02	-03	-04	-05	-06	-07	-08	-09	-10	-11	-12
R 104			160	160	160	160	600	600				
R 105			110	110	110	110	500	360				
CR106			13V	15 V	11V	15V	16V	16V				
R201			100	100	100	100	100	100				
SOLENOID			14 V	14 V	14V	14V	28V	28V				
K201-12			M201 -2	M201 -2	M201 -2	M201 -2	M201 -1	M201 -1				
K201-9			M201 -1	M201 -1	M201 -1	M201 -1	M201 -2	M201 -2				
R 202			.43	.33	.33	.33	.75	.75				

NOTES: 1. ◇ WITH NUMBER ARE BOARD CONNECTIONS.
2. 200 SERIES PARTS ARE NOT ON BOARD.
3. +14V TO PCB 101-15 +28V TO PCB 101-15
SOL/WHT SOL/YEL SOL/WHT SOL/RED SOL/BLK
SOL/WHT TO PCB 101-12
SOL/RED TO PCB 101-14
SOL/BLK TO PCB 101-13
SOL/YEL TO PCB 101-12
SOL/BLK TO PCB 101-12
4. UNLESS NOTED ALL RESISTORS ARE IN OHMS, 5% AND ALL CAPACITANCE IS IN MICROFARADS.

FIGURE 6-7 KS 179 PITCH TRIM SERVO PC BOARD ASSEMBLY AND SCHEMATIC
(Dwg. No. 300-6305-00, R-3)
(Dwg. No. 002 6305-00, R-12)

KING
KS 179
PITCH TRIM SERVO

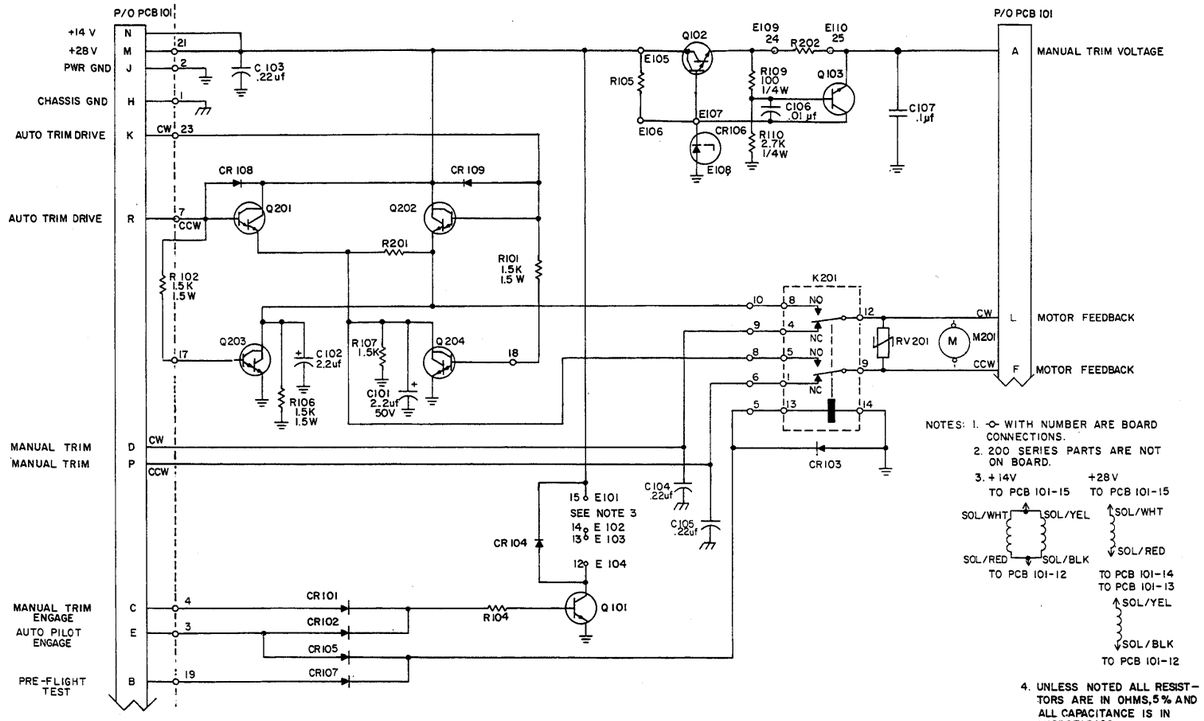




Q103

NOTES:

1. PRIOR TO POST COATING BOTH SIDES OF PC BOARD WITH CLEAR URETHANE (016-1040-00), MASK OFF THE FOLLOWING: PCB101-01 THRU PCB101-25, 008-0008-01, DASHED-IN AREAS



FLAVORS	-01	-02	-03	-04	-05	-06	-07	-08	-09	-10	-11	-12
R 104			160	160	160	160	600	600				
R 105			110	110	110	110	500	360				
CR106			13V	15V	11V	15V	16V	16V				
R201			100	100	100	100	100	100				
SOLENOID			14V	14V	14V	14V	28V	28V				
K201-12			M201 -2	M201 -2	M201 -2	M201 -2	M201 -1	M201 -1				
K201-9			M201 -1	M201 -1	M201 -1	M201 -1	M201 -2	M201 -2				
R 202			.43	.33	.33	.33	.75	.75				

NOTES: 1. ⊸ WITH NUMBER ARE BOARD CONNECTIONS.
2. 200 SERIES PARTS ARE NOT ON BOARD.
3. +14V TO PCB 101-15 +28V TO PCB 101-15
4. UNLESS NOTED ALL RESISTORS ARE IN OHMS, 5% AND ALL CAPACITANCE IS IN MICROFARADS.

FIGURE 6-7 KS 179 PITCH TRIM SERVO PC BOARD ASSEMBLY AND SCHEMATIC
(Dwg. No. 300-6305-00, R-3)
(Dwg. No. 002 6305-00, R-12)

KS 179 SCH.

TABLE OF CONTENTS

SEMICONDUCTOR AND INTEGRATED CIRCUIT DATA

1.1 GENERAL

Due to the wide utilization of semiconductors in this electronic equipment, somewhat different techniques are necessary in maintenance procedures. In solid state circuits the impedances and resistances encountered are of much lower values than those encountered in vacuum-tube circuits. Therefore, a few ohms discrepancy can greatly affect the performance of the equipment. Also, coupling and filter capacitors are of larger values and usually are of the tantalum type. Hence, when measuring values of capacitors, an instrument accurate in the high ranges must be employed. Capacitor polarity must be observed when measuring resistance. Usually more accurate measurements can be obtained if the semiconductors are removed or disconnected from the circuits.

1.1.1 SEMICONDUCTOR TEST EQUIPMENT

Damage to semiconductors by test equipment is usually the result of accidentally applying too much voltage to the elements. Common causes of damage from test equipment are discussed in the following paragraph.

A. Transformerless Power Supplies

Test equipment with transformerless power supplies is one source of high current. However, this type of test equipment can be used by employing an isolation transformer in the AC power line.

B. Line Filter

It is still possible to damage semiconductors from line current, even though the test equipment has a power transformer in the power supply, if the test equipment is provided with a line filter. This filter may function as a voltage divider and apply half voltage to the semiconductor. To eliminate this condition, connect a ground wire from the chassis of the test equipment to the chassis of the equipment under test before making any other connections.

C. Low-Sensitivity Multimeters

Another cause of semiconductor damage is a multimeter that requires excessive current to provide adequate indications. Multimeters with sensitivities of less than 20,000 ohms-per-volt should not be used on semiconductors. When in doubt as to the amount of current supplied by a multimeter, check the multimeter circuits on all scales with an external, low-resistance multimeter connected in series with the multimeter leads. If more than one milliampere is drawn on any range, this range cannot be safely used on small semiconductors.

D. Power Supply

When using a battery-type power supply, always use fresh batteries of the proper value. Make certain that the polarity of the power supply is correct for the equipment under test. Do not use power supplies having poor voltage regulation.

1.1.2 SEMICONDUCTOR VOLTAGE AND RESISTANCE MEASUREMENTS

When measuring voltage or resistance in circuits containing semiconductor devices, remember that these components are polarity and voltage conscious. Since the values of capacitors used in semiconductor circuits are usually large, time is required to charge these capacitors when they appear. Thus, any reading obtained is subject to error if sufficient time is not allowed for the capacitor to fully charge. When in doubt it may be best in some cases to isolate the components in question and measure them individually.

1.1.3 TESTING OF TRANSISTORS

A transistor checker should be used to properly evaluate transistors. If a transistor tester is not available, a good multimeter may be used. Make sure that the multimeter meets the requirements outlined in the preceding paragraph.

A. PNP Transistor

To check a PNP transistor, connect the positive lead of the multimeter to the base of transistor and the negative lead to the emitter or collector. Generally, a resistance reading of 50,000 ohms or more should be obtained. Reconnect the multimeter with the negative lead to the base. With the positive lead connected to the emitter or collector a resistance value of 500 ohms or less should be obtained.

B. NPN Transistor

Similar tests made on a NPN transistor should produce the following results:

With the negative lead of the multimeter connected to the base of the transistor the value of resistance between the base and the collector or emitter should be high. With the positive lead of the multimeter connected to the base, the value of resistance between the base and the collector or emitter should be low. If these results are not obtained, the transistor is probably defective and should be replaced.

CAUTION

IF A TRANSISTOR IS FOUND TO BE DEFECTIVE, MAKE CERTAIN THAT THE CIRCUIT IS IN GOOD OPERATING ORDER BEFORE INSTALLING A REPLACEMENT TRANSISTOR. IF A SHORT CIRCUIT EXISTS IN THE CIRCUIT, PUTTING IN ANOTHER TRANSISTOR WILL MOST LIKELY RESULT IN BURNING OUT THE NEW COMPONENT. DO NOT DEPEND UPON FUSES TO PROTECT TRANSISTORS.

1.1.4 REPLACING SEMICONDUCTORS

Never remove or replace a semiconductor with the supply voltage turned on. Transients thus produced may damage the semiconductor or others remaining in the circuit. If a semiconductor is to be evaluated in an external test circuit, be sure that no more voltage is applied to the semiconductor than normally is used in the circuit from which it came.

A. Use only a low heat soldering iron when installing or removing soldered-in semiconductors. Grasp the lead to which heat is applied between the solder joint and the semiconductor with long-nosed pliers.

This will dissipate some of the heat that would otherwise be conducted into the semiconductor from the soldering iron. Make certain that all wires soldered to semiconductor terminals have first been properly tinned so that the necessary connection can be made quickly. Excessive heat will permanently damage a semiconductor.

B. In some cases, power transistors are mounted on heat-sinks that are designed to dissipate heat away from them. In some power circuits, the transistor must also be insulated from ground. This insulating is accomplished by means of an insulating washer made of mica. When replacing transistors mounted in this manner, be sure that the insulating washers are replaced in proper order. After the transistor is mounted, and before making any connections, check from the case of the transistor to ground with a multimeter to see that the insulation is effective.

1.2 INTEGRATED CIRCUIT MAINTENANCE

1.2.1 GENERAL

A knowledge of integrated circuit fundamentals is as necessary in testing digital logic circuits involving IC's as a knowledge of rectification fundamentals is needed to test a power supply.

1.2.2 TERMINOLOGY

Several terms are used whenever logic circuits are discussed:

A. A logic state is defined as a high or low level voltage applied to the input or seen at the output of a device. A high level voltage is called a logic "1". A low level voltage is called a logic "0". Logic threshold voltage of a device is the input voltage required at an input to change the output state.

B. A truth table is a list of input logic states that will yield certain output logic states. A digital logic element should be thought of as a circuit element with its output level being either HI or LO as programmed by the levels present on its inputs.

   A logic element may be tested by verifying that it is performing per the Truth Table of that logic element.

C. Logic elements which have multiple inputs and a single output are known as gates. The OR gate produces a HI output when one or more of the inputs are HI. With all inputs LO, the output is LO. The AND gate produces a HI output only when all inputs are HI. When any input is LO the output is LO. A small circle at the output of a gate on the schematics indicates "negation", which means that the sense of the gate logic is reversed. An OR gate with negation is called a NOR gate and an AND gate with negation is called a NAND gate. A NOR gate produces a LO output when one or more of the inputs are HI and a NAND gate produces a LO output only when all inputs are HI.

D. The Flip-Flop logic element is the basic data storage element of digital logic. It has two outputs that are always at opposite logic levels. That is, when one output is HI the other is LO. The Flip-Flop will remain in a particular state until that state is changed by an input signal.

   The operation of these Flip-Flops is controlled by the signals on their inputs, and is best understood by a careful study of their Truth Tables. It should be kept in mind that a small circle on either the input or the output indicates negation. Also, a circle on a clock input indicates that a HI to LO transition causes the Flip-Flop to function.

E. Besides the gates and Flip-Flops, two other commonly used logic elements are inverters and expanders. Inverters are merely switching transistors such that if a logic "1" is the input to a device, a logic "0" will be the output and vice-versa. An expander is a set of parallel switching transistors that depends upon another resistor to provide their supply voltage. Generally, these devices are used to expand the number of inputs available to a standard gate.

1.2.3 INTEGRATED CIRCUIT TEST EQUIPMENT

As with semiconductors, damage to integrated circuits by test equipment is usually the result of applying too much current or voltage to the elements. The same precautions as discussed in Paragraph 1.1.1 apply here.

1.2.4 VOLTAGE MEASUREMENTS

Precise voltage measurements are not needed in testing digital IC's other than to see that the voltage is a HI or a LO level. An oscilloscope is needed where the input levels are of short duration, either HI or LO. For instance, if a 10 microsecond pulse going from LO to HI was applied to one input of a NOR gate, while the other input stayed LO, the output would go LO for 10 microseconds and then return HI. This, of course, could not be seen without an oscilloscope.

1.2.5 TESTING INTEGRATED CIRCUITS

The fully loaded guaranteed minimum high and maximum low for the digital logic output levels are:

TTL (V_{cc} = +5V)		ECL (V_{cc} = +5.2V)	
High	Low	High	Low
2.4	0.5	4.25	3.48

The minimum high and maximum low input levels which are guaranteed to be correctly interpreted are:

TTL (V_{cc} = +5V)		ECL (V_{cc} = +5.2V)	
High	Low	High	Low
2.0	0.8	4.06	3.75

When checking input and output levels of a logic element under question it should be remembered that an input or output may not agree with its truth table not because it has malfunctioned but because some other component connected to the same point has shorted to ground or to the supply voltage (V_{cc}). This is not common when an output on one element is connected to an input of another. A majority of digital IC failures can be grouped into three categories:

A. Input(s) or output shorted to ground pin of IC.

B. Input(s) or output shorted to V_{cc} pin of IC.

C. Open input(s) or output.

An input or output shorted to ground would be a constant LO and an input or output shorted to V_{cc} would be a constant HI.

Other failures common in digital IC's are:

A. Ground pin open.

B. V_{cc} pin open.

C. Inputs shorted together.

An open ground pin would not allow a LO on the output. An open V_{cc} pin would not allow a HI on the output. (Remember to isolate the device from other components connected to it). Two or more inputs shorted together can be checked by grounding one of the inputs under question. If the other input also goes to ground they are probably shorted.

CAUTION

IF AN IC IS FOUND TO BE DEFECTIVE, VERIFY THAT PROPER POWER SUPPLY VOLTAGES ARE PRESENT BEFORE INSTALLING A REPLACEMENT IC.

1.2.6 REPLACING INTEGRATED CIRCUITS

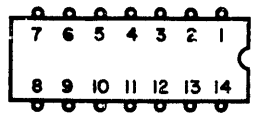
If an IC is known to be defective, the easiest way to remove it is to cut off each of its pins, remove the case, and then unsolder the remaining pins from the integrated circuit card one by one. This is preferrable over removing the IC intact because attempts to remove the IC intact may result in damage to the printed circuit board.

1.3 DATA SHEETS FOR INTEGRATED CIRCUITS

INTEGRATED CIRCUIT PIN LOCATION DIAGRAMS

(Viewed From TOP of IC)

(1)



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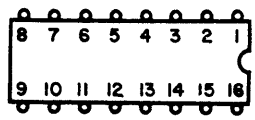

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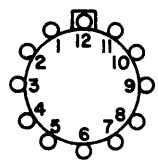

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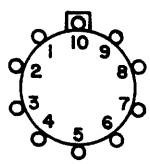

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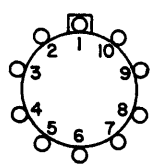
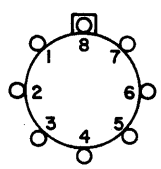


(6)



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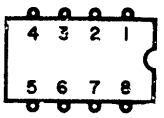


FIGURE 1. BUFFER

$Z = A$

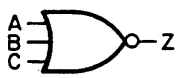
A	Z
0	0
1	1

FIGURE 2. INVERTER

$Z = \overline{A}$

A	Z
0	1
1	0

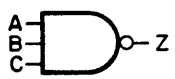
FIGURE 3. NOR GATE



$Z = \overline{A+B+C}$

A	B	C	Z
0	0	0	1
1	0	0	0
0	1	0	0
0	0	1	0
1	1	0	0
1	0	1	0
0	1	1	0
1	1	1	0

FIGURE 4. NAND GATE



$Z = \overline{ABC}$

A	B	C	Z
0	0	0	1
1	0	0	1
0	1	0	1
0	0	1	1
1	1	0	1
1	0	1	1
0	1	1	1
1	1	1	0

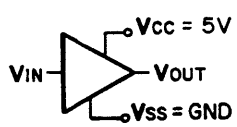
FIGURE 5. EXCLUSIVE OR GATE

$Z = A \oplus B$

A	B	Z
0	0	0
1	0	1
0	1	1
1	1	0

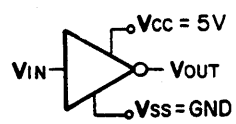
FIGURE 6. CMOSTO TTL VOLTAGE LEVEL TRANSLATORS

BUFFER



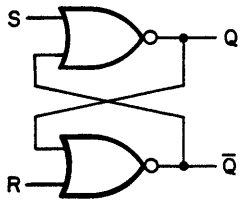
VIN	0V	10V
VOUT	0V	5V

INVERTER



VIN	0V	10V
VOUT	5V	0V

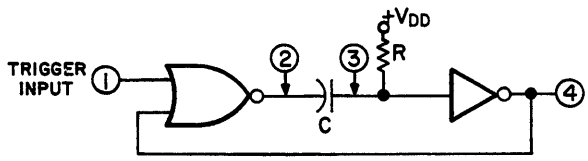
FIGURE 7. NOR GATE FLIP-FLOP



S	R	Next Q	$\overline{Q}$
1	1	0	0
0	1	1	0
0	0	NC	NC
1	0	0	1

NC = NO CHANGE

FIGURE 8. MONOSTABLE MULTIVIBRATOR (ONE-SHOT)



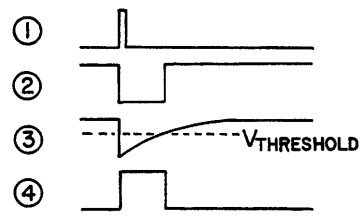
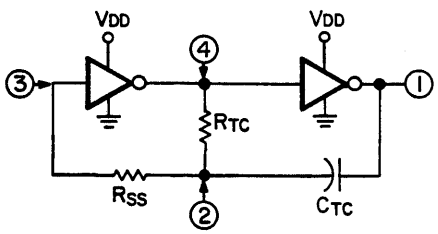
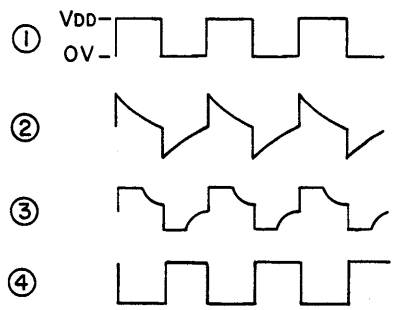


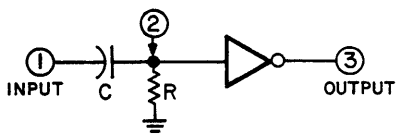
FIGURE 9. ASTABLE MULTIVIBRATOR (FREE-RUNNING)

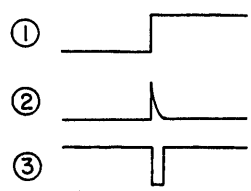




FREQUENCY OF OPERATION IS DETERMINED BY R_{TC} AND C_{TC}.
A NOR OR NAND GATE MAY BE USED IN PLACE OF THE FIRST INVERTER TO PERMIT GATING OF THE MULTIVIBRATOR.

FIGURE 10. DIFFERENTIATOR





OFTEN USED TO CHANGE A STEP SIGNAL TO A SHORT PULSE SIGNAL.

120-3053-00/01/02
LM358/158/258
DUAL OP-AMP

This device consists of two independent, high gain, internally frequency compenstated operational amplifiers which were designed specifically to operate from a single power supply over a wide range of voltages. Operation from split power supplies is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage.