

DESCRIPTION, SERVICING, AND ADJUSTMENTS FOR
303142 LOW LEVEL, POLAR LINE KEYS (PLK) WHEN
INSTALLED IN AN ELECTRICAL SERVICE ASSEMBLY
EQUIPPED FOR LOW LEVEL RFI (POLAR-EMC)
OPERATION AND USED WITH ASSOCIATED 321268
FILTER CARD IN 323644 OR 323645 SIGNAL GENERATOR

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1. DESCRIPTION

1.01 The 303142 polar line keyer (PLK) circuit card assembly (Figure 1) when installed (plugged) in an appropriate low level electrical service assembly (ESA) and used with its associated 321268 filter card assembly, is intended for radio frequency interference (rfi) suppression of transmitter operation in systems requiring low level rfi (Polar-EMC) kits.

1.02 For optimum rfi suppression, the 303142 PLK should be plugged into its special, shielded ESA and used with the 321268 filter card assembly and a 323644 or 323645 signal generator assembly.

1.03 The 303142 PLK is designed to operate into a high resistance load such as the 323810 selector magnet driver (SMD) described in Specification 50507S.

1.04 The PLK is designed to operate from one set of contacts. However, two signal generator outputs (filter card outputs) may be paralleled to drive one signal line from either one of two signal generators.

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1.05 The PLK unit requires an external power source which is mounted in its associated ESA. Each complete PLK assembly (not including filter card) is mounted on a single 4.25 by 2.488 inch, 15-pin plug-in card with a key slot located between pins J and K (Figures 1 and 2). All connections to the PLK are made through a 15-pin connector that is wired into an ESA. All connections to the filter card are made through a double shielded cable as described in the related modification kit specification.

1.06 When used as indicated in the preceding paragraphs, the 303142 PLK provides a low level interface of +6.0 volts marking and -6.0 volts spacing for Model 28 type transmitter distributors and keyboards for radio frequency interference (rfi) suppression.

1.07 The 303142 polar line keyer (PLK), with 321268 filter card, is adaptable to various types of Model 28 equipment through the use of special modification kits that are applicable in either field or factory installation. Each PLK, one or more, is a part of, or associated with, some electrical service assembly (ESA) with power supply. Each ESA is a part of some special modification kit. The quantity of PLKs and the associated equipment will depend upon which modification kit is used. For wiring diagrams and addition information, refer to Specification 50505S covering the electrical service assemblies.

2. TECHNICAL DATA

2.01 All low level polar line keyer (PLK) features given in the following paragraphs assume the use of the 321268 filter card assembly.

2.02 Maximum unloaded power consumption of the polar line keyer (PLK) should be less than 50 milliwatts.

2.03 The output of the 303142 polar line keyer (PLK) is +6.0 volts +1.0 corresponding to the marking state and -6.0 volts +1.0 corresponding to the spacing state.

2.04 The marking and spacing output voltages should be balanced to within 10 percent of each other.

2.05 The 303142 PLK operates from the spacing contacts (mark-contact open, space-contact closed) of the 323645 or 323644 signal generator assemblies.

- 2.06 The outputs from two 321268 filter card assemblies may be paralleled for parallel operation of either of two transmitters.
- 2.07 The nominal output resistance is 100 ohms.
- 2.08 The PLK operates at bit rates up to 75 baud.
- 2.09 Maximum short circuit output current should be 60 milliamperes.
- 2.10 The PLK operates into an output resistance (total load resistance) of 5000 ohms minimum.
- 2.11 The 303142 polar line keyer (PLK) and 321268 filter card assembly operates in a maximum free-air ambient temperature of 70°C (158°F). Storage temperature should not exceed 85°C (185°F).
- 2.12 The PLK operates from a power source delivering ± 7.8 volts dc ($\pm 10\%$) at nominally 25 milliwatts total input power.
- 2.13 The mark and space symmetry at zero volts (output waveform) is adjustable by means of the signal generator position adjustment.
- 2.14 The PLK is intended for use on signal lines less than 1000 feet in length. However, operation is possible with line lengths up to 5000 feet.

3. PRINCIPLES OF OPERATION

- 3.01 All circuit references in the following paragraphs are made with respect to the schematic wiring diagrams (Figures 3 and 4) and the 303142 low level, polar line keyer (PLK) circuit board assembly drawing (Figures 1 and 2).
- 3.02 The 303142 polar line keyer (PLK) is a neutral to polar converter which, by means of passive and active filtering, shapes the output waveform.
- 3.03 In the marking state the signal generator contact is open and Q1 conducts to a level established by resistors R1, R2, and R11. Transistor Q1 conducts sufficient current to saturate the collector of Q2 which rises to slightly less than the positive supply voltage. With Q2 conducting, Q4 and Q6 also conducts. Transistor Q4 base current (equal to the total output load current divided by the product of Q4 and Q6 gains) is small and consequently the voltage drops across R6, R10, and R7 are insignificant. Transistor Q6

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base current (equal to total output load current divided by the gain of Q6) is also small resulting in an insignificant voltage drop across R8. Thus, the output voltage is the power supply voltage minus the sum of Q2 voltage with collector-emitter saturated, Q4 base-emitter voltage and Q6 base-emitter voltage. The drop across R9 for normal output loads is insignificant.

3.04 In the spacing state the signal generator contact is closed. In this state R1 is shunted by the series combination of R13, R14, and R15 thus reducing Q1 base voltage below the emitter voltage established by the voltage divider R3, R11. With the emitter being at a higher potential than the base, Q1 is turned off. With Q1 off, Q2 is off and its collector voltage approaches the negative supply voltage. In this state Q3 and Q5 conduct. For the same reasons as in the marking state, the output voltage is primarily a function Q3 base-emitter voltage and Q5 base-emitter voltage. Diode CR1 is added to compensate for the unsymmetrical properties associated with the second stage.

3.05 During transistions, the nonsymmetric low-pass contact filter pre-filters the input to the keyer. In addition, common mode effects due to the unblanced stray capacitance of the contact assembly, are reduced. Capacitors C1 and C6 limit the high frequency response of stages 1 and 2 thus providing additional shaping.

3.06 Stage 3 (Q4 and Q3) is a low-pass active filter. By means of C2 charging and discharging through the feedback network consisting of R6, R10, R7, and C2, the rise and fall times are lengthened to produce an acceptable spectrum (from rfi standpoint). Capacitors C3, C4, and C5 provide additional shaping by bypassing undesirable frequency components generated in Q3, Q4, Q5, and Q6. C7 is a radio frequency bypass capacitor to decouple the power supply.

4. SERVICING

Note: Installation instructions are included in the specifications for the modification kit and electrical service assembly to be used (refer to Paragraph 1.07). The 303142 polar line keyer (PLK) is a circuit card assembly that needs only to be plugged into a properly keyed (polarizing key between pins J and K) 15-pin receptacle which is wired into an appropriate electrical service assembly (ESA).

4.01 It is recommended that any damaged 303142 polar line keyer (PLK) unit be replaced in the field and maintained in a repair center. The repair center should have equipment capable of simulating normal operating conditions.

4.02 It is also recommended that the PLK and associated 321268 filter card assembly be radio frequency interference (rfi) suppression tested after servicing and prior to final installation. Failures from this standpoint are not necessarily recognized by monitoring a typical communications operation.

4.03 The following information may be used as a guide for troubleshooting:

<u>Symptom</u>	<u>Probable Cause</u>
(a) Circuit always marking	(1) Q1 and/or Q2 shorted (2) Excessive signal generator contact resistance
(b) Circuit always spacing	(1) Q1 and/or Q2 open
(c) Mark - space bits detectable but will not go positive on mark	(1) Q4 and/or Q6 open
(d) Mark - space bits detectable but will not go negative on space	(1) Q3 and/or Q5 open

5. ADJUSTMENTS

Note: No mechanical or electrical adjustments are required on the 303142 polar line keyer (PLK) or its associated 321268 filter card. The adjustments given in this part apply to the contact box or signal generator and are for reference only.

5.01 This adjustment is made after the contact box is installed in the appropriate transmitter or keyboard and may be used in place of the adjustment in Paragraph 5.03.

(a) Remove the 325951 nut, 320043 outer cover, 325951 nut, 321273 inner cover, and, without unsoldering the leads to the filter card, remove the 321268 filter card assembly.

(b) With the contact box bracket mounting screw loosened friction tight, position the box by means of the eccentric, so that the marking and spacing gaps are equal when there is a maximum clearance between the contacts, as determined by engaging the clutch and rotating the main shaft. Tighten the mounting screws and recheck the adjustment.

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- (c) After completing the adjustment, replace all parts removed in Paragraph 5.01(a).

5.02 The following electromechanical adjustment pertains to the signal generator after installation of the 303142 polar line keyer and associated signal generator assembly and may be used in place of the adjustment in Paragraph 5.01.

5.03 If a test set is not available, use the following procedure:

- (a) Using an oscilloscope to view the output of the polar line keyer (transmitter sending repeated Y character), adjust the oscilloscope to trigger at zero volts on the keyer output waveform. Be sure to properly zero the vertical amplifier on the scope before beginning the adjustment.
- (b) Adjust the scope sweep rate so as to display one complete mark-space portion of the signal (Figure 6).
- (c) Adjust the position of the signal generator until the mark to space transition crosses zero volts at the center of the horizontal scale (Figure 6). When the signal generator is properly adjusted, the three points at which the waveform passes through zero volts will divide the horizontal axis into 2 equal segments.
- (d) After the adjustment is made, tighten the signal generator bracket screws securely.

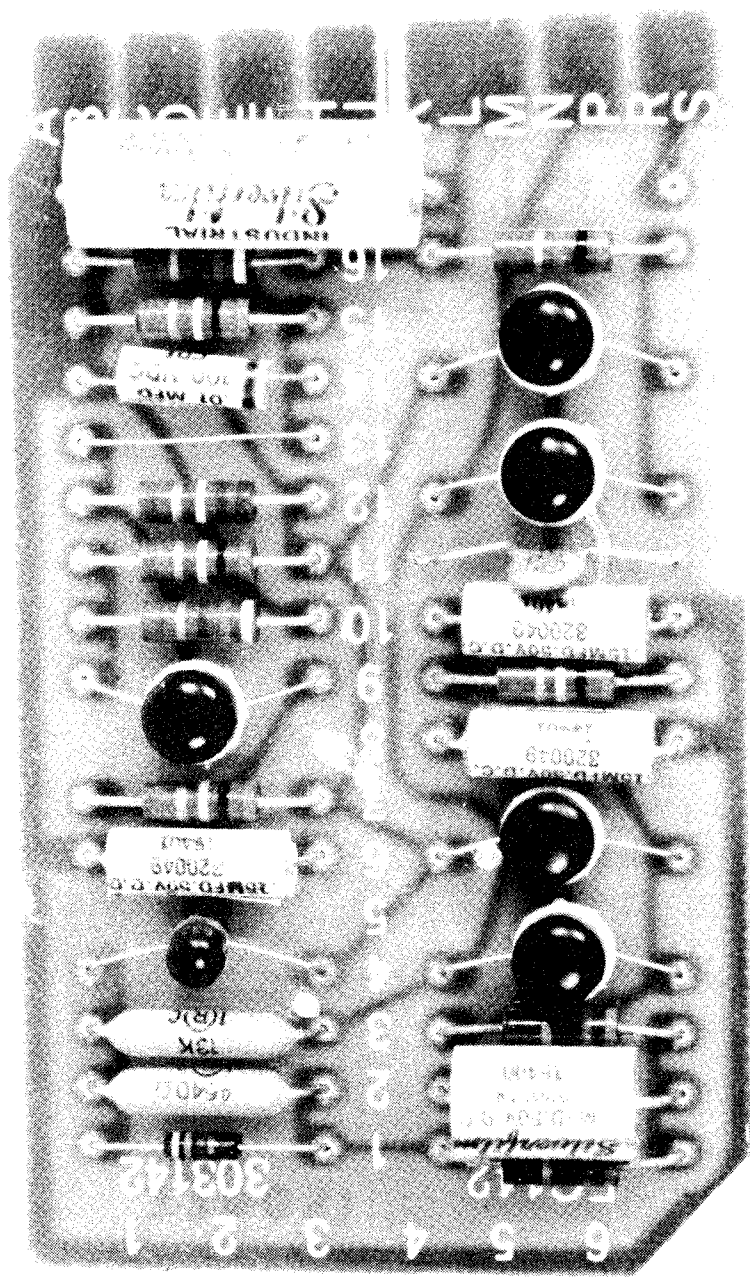
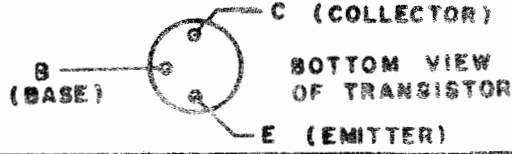
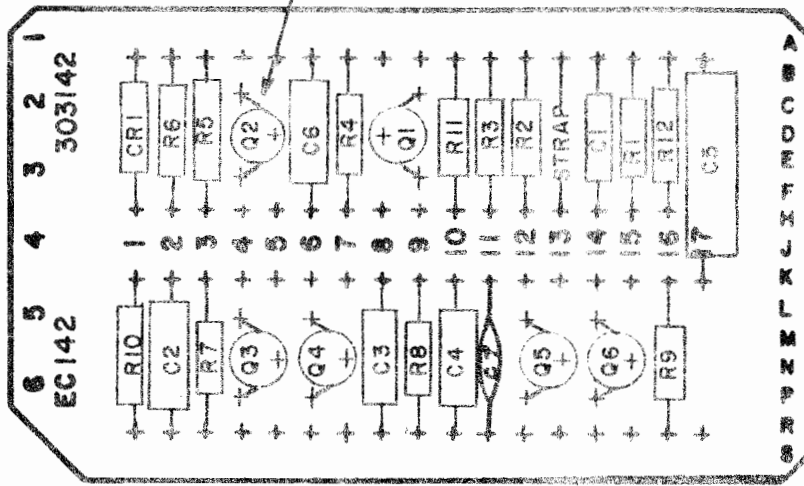


Figure 1 - Polar Line Keyer 303142

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324147 PAD UNDER Q2



NOTE

CARD CONNECTIONS ARE REPRESENTED BY LETTERS
TEST POINTS ARE REPRESENTED BY NUMBERS

STAMPING OR CIRCUIT DESIGN	NUMERICAL CONVERSION FOR 15 PT. CARDS WHEN USED WITH 36 PT. CONNECTOR	
	WHEN INSERTED IN UPPER HALF OF CONNECTOR	WHEN INSERTED IN LOWER HALF OF CONNECTOR
A	1	22
B	2	23
C	3	24
D	4	25
E	5	26
F	6	27
G	7	28
H	8	29
J	9	30
K	10	31
L	11	32
M	12	33
P	13	34
R	14	35
S	15	36

REF. DESIGN	TELETYPE PART NO.	TOTAL QTY.	NAME AND DESCRIPTION	LOCATING FUNCTION
R1	118720	2	RESISTOR 100K 5% 1/2 WATT	RC FILTER
R2	118178	1	RESISTOR 220K 5% 1/2 WATT	Q1 BASE BIAS
R3			RESISTOR SAME AS R1	Q1 EMITTER BIAS
R4	129854	2	RESISTOR 10K 5% 1/2 WATT	Q1 COLLECTOR BIAS
R5	321204	1	RESISTOR 13K 1% 1/2 WATT	Q2 COLLECTOR BIAS
R6	321203	1	RESISTOR 4640 1% 1/2 WATT	RC BIAS EQUALIZER
R7	118147	2	RESISTOR 6.8K 5% 1/2 WATT	Q3,4 BASE BIAS
R8			RESISTOR SAME AS R4	Q5,6 BASE BIAS
R9	137438	1	RESISTOR 100-0HMS 5% 1/2 WATT	RC FILTER
R10			RESISTOR SAME AS R7	Q3,4 BASE BIAS
R11	118146	2	RESISTOR 4.7K 5% 1/2 WATT	Q1 EMITTER BIAS
CR1	181619	1	DIODE 1N482	R6 SHUNT SWITCH
C1	321157	2	CAPACITOR 500 PpF	INPUT FILTER
C2	320048	1	CAPACITOR .5MFD	ACTIVE FILTER FEEDBACK
C3	320049	3	CAPACITOR .15MFD	ACTIVE FILTER INTEGRATOR
C4			CAPACITOR SAME AS C3	RC FILTER INTEGRATOR
C5	320047	1	CAPACITOR 2MFD	RC FILTER INTEGRATOR
Q1	315930	3	TRANSISTOR, 2N3568	1st AMPLIFIER
Q2	324144	1	TRANSISTOR 2N4121	2nd AMPLIFIER
Q3	315931	2	TRANSISTOR 2N3638	ACTIVE COMPLIMENTARY FILTER
Q4			TRANSISTOR SAME AS Q1	ACTIVE COMPLIMENTARY FILTER
Q5			TRANSISTOR SAME AS Q3	COMPLIMENTARY SYMMETRY
Q6			TRANSISTOR SAME AS Q1	EMITTER FOLLOWER AMPLIFIER
R12			RESISTOR SAME AS R11	OUTPUT LOAD
C6	181618	1	CAPACITOR .01MFD	RC FILTER
C7	321157		CAPACITOR - SAME AS C1	RF BY PASS
EC	320051	1	BOARD, ETCHED CIRCUIT	
		1	STRAP, BARE 24 AWG.	
	324147	1	PAD, TRANSISTOR	
	144495	5	PAD, TRANSISTOR	

Figure 2 - Arrangement and List of Polar Line Keyer 303142 Components

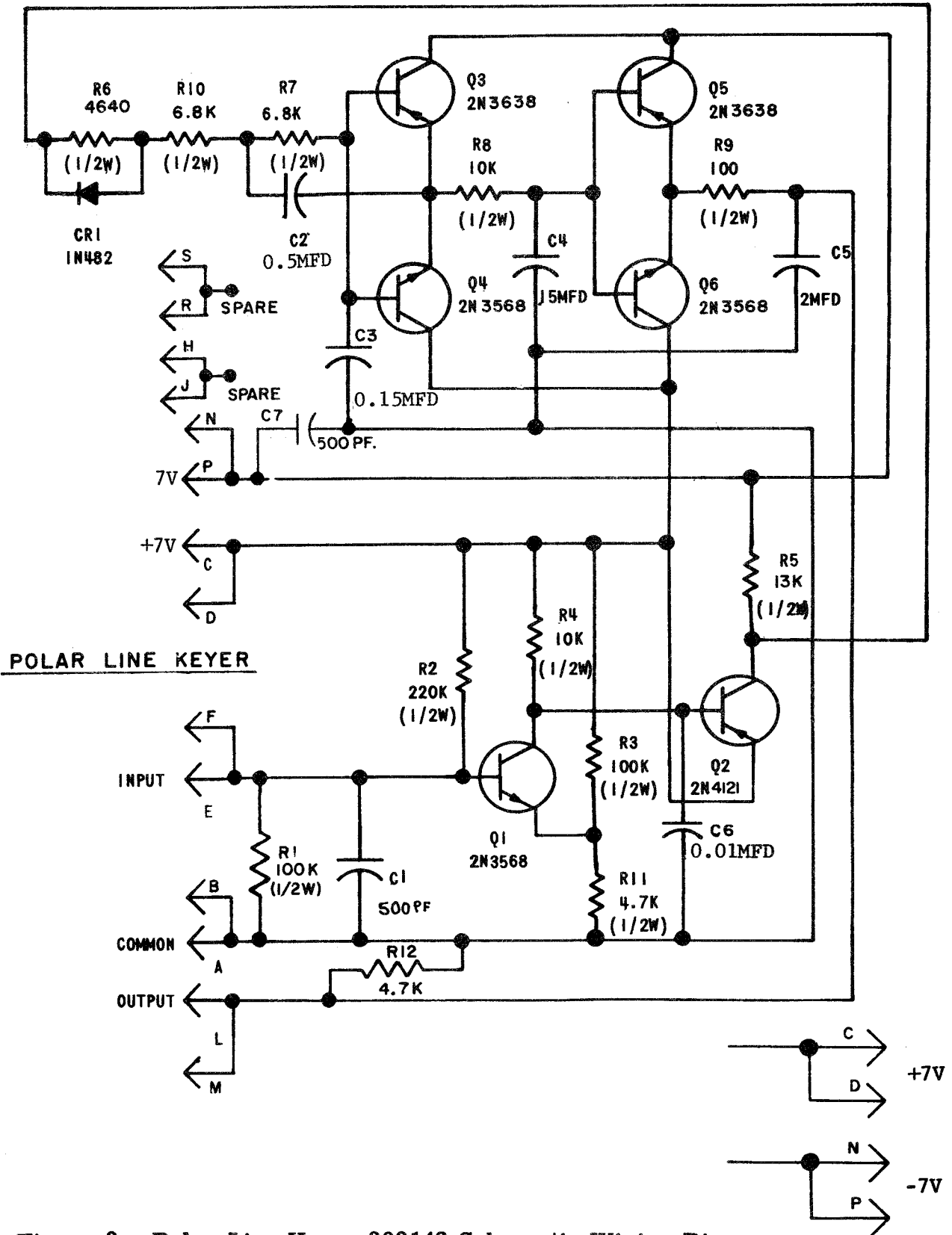
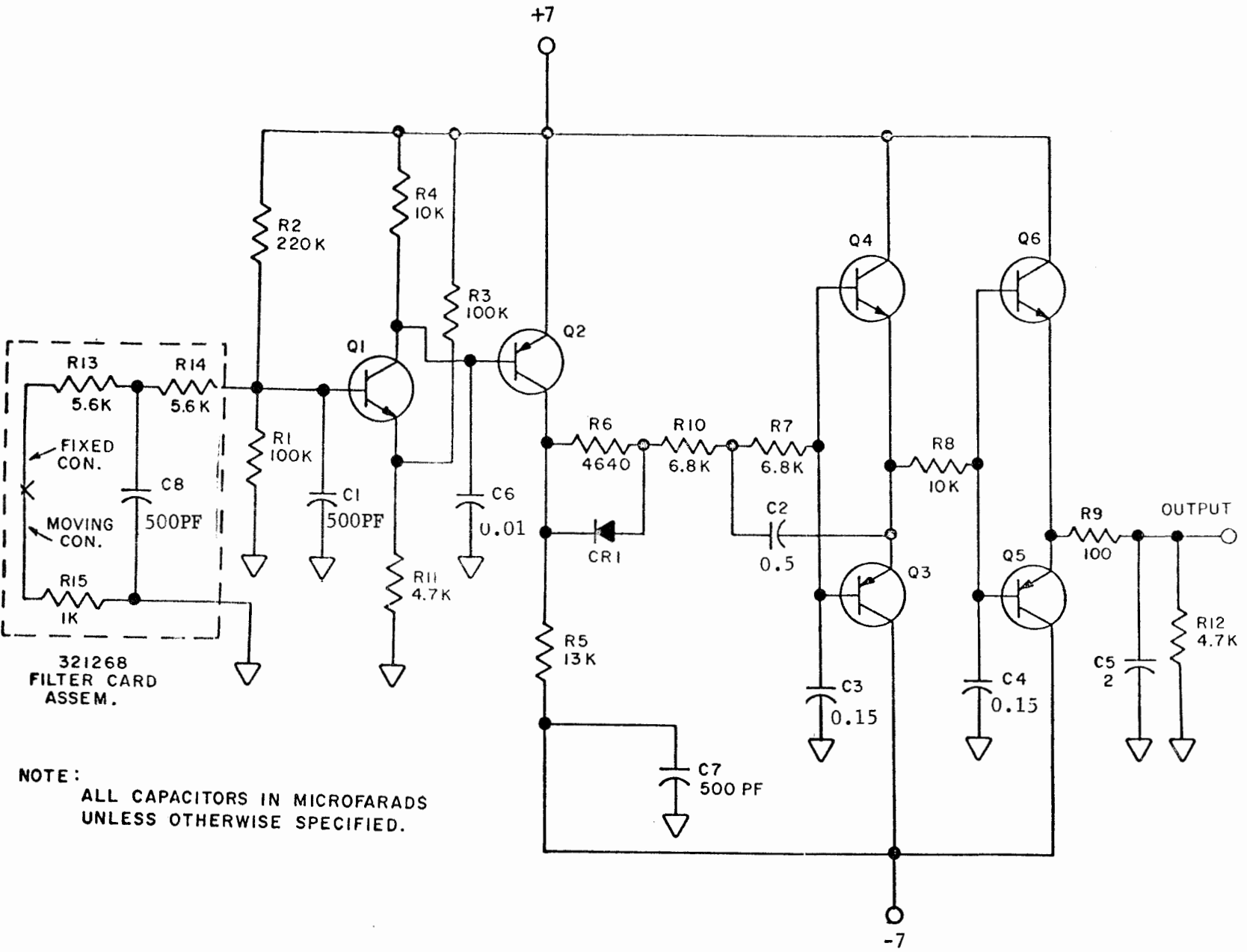


Figure 3 - Polar Line Keyer 303142 Schematic Wiring Diagram



NOTE:
ALL CAPACITORS IN MICROFARADS
UNLESS OTHERWISE SPECIFIED.

Figure 4 - Schematic Wiring Diagram of 303142 Polar Line Keyer and 321268 Filter Card Assemblies

REF. DESIGN	TELETYPE PART NO.	TOTAL QTY.	NAME AND DESCRIPTION	FUNCTION
R1	315960	2	RESISTOR, 5.6K 1/4 WATT	RC FILTER
R2	"		SAME AS R1	"
R3	321213	1	RESISTOR, 1000 Ω 1/4 WATT	"
C1	321157	1	CAPACITOR, 500 PFD	"
T1	137471	2	TERMINAL, SOLDER	
T2	"		"	
S1	194041	1	STUD, CONNECTOR	
S2	194042	1	"	

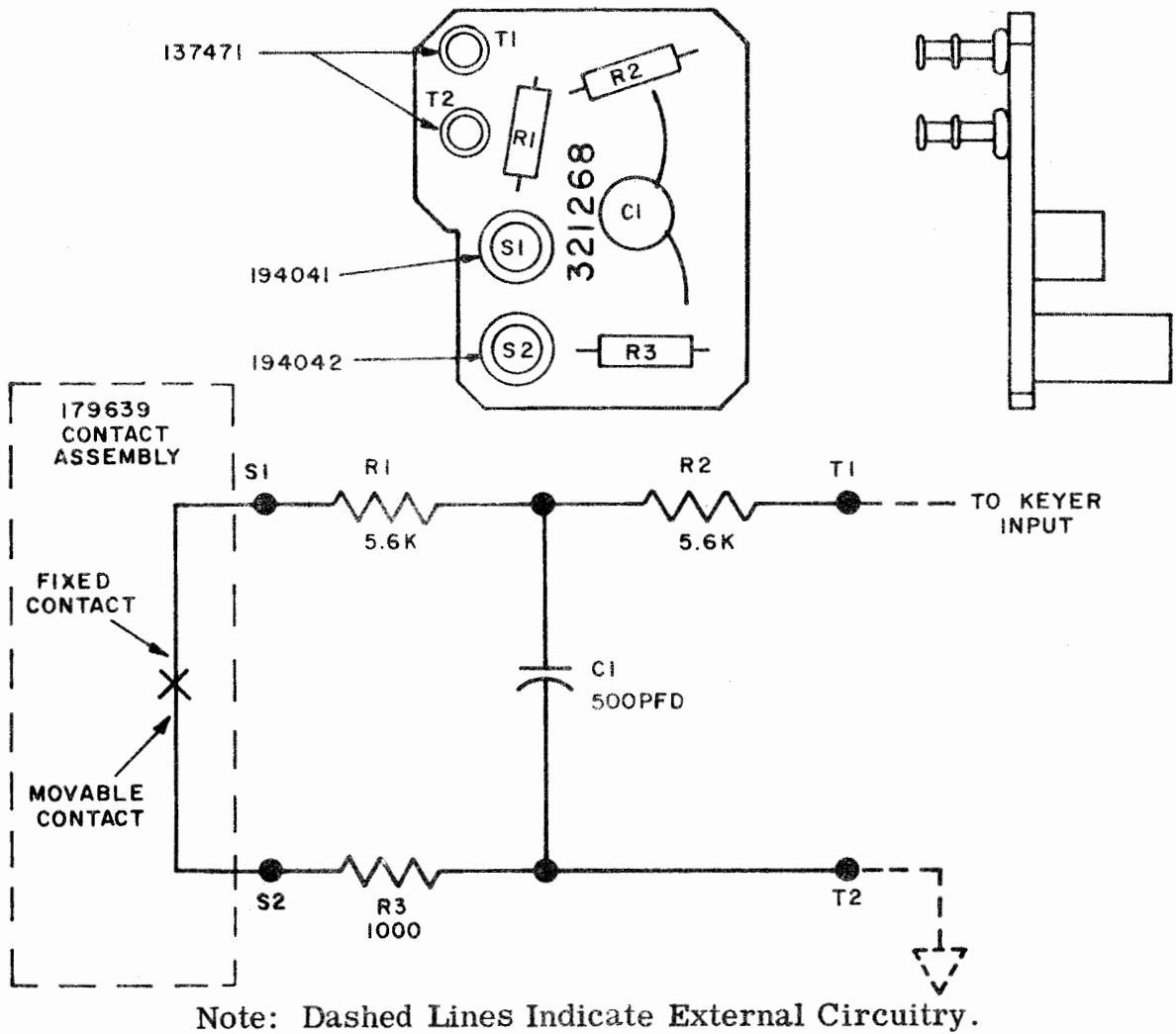
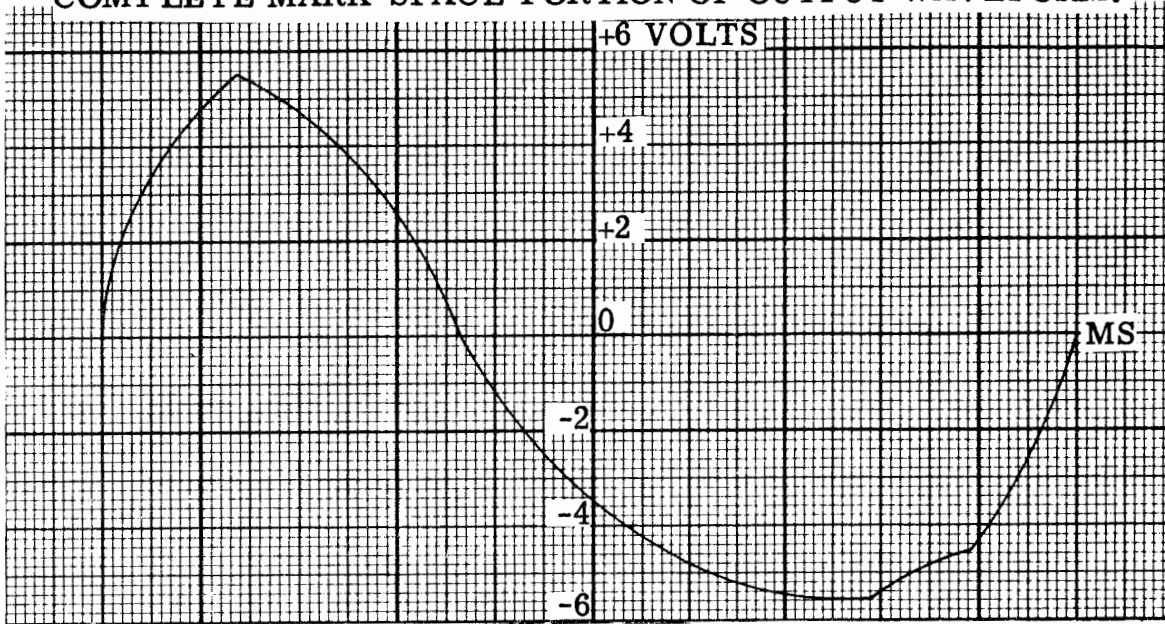
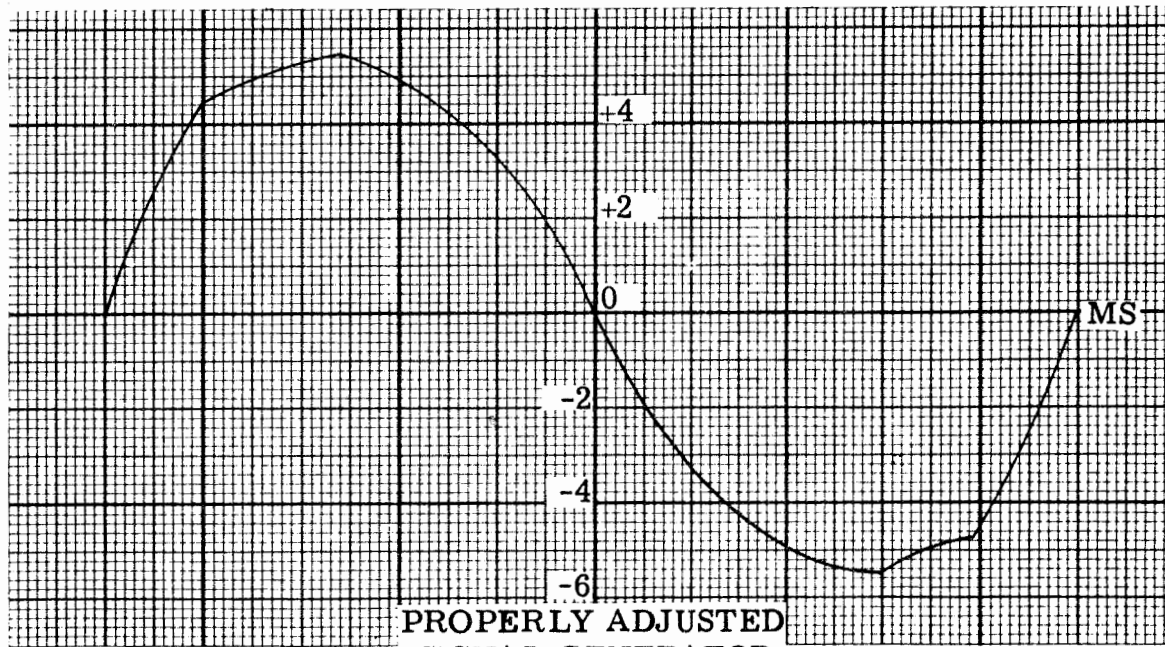


Figure 5 - Component List, Arrangement and Schematic Wiring Diagram of 321268 Filter for 303142 Polar Line Keyer

PROPERLY ADJUSTED OSCILLOSCOPE TO VIEW ONE COMPLETE MARK-SPACE PORTION OF OUTPUT WAVEFORM.



IMPROPERLY ADJUSTED SIGNAL GENERATOR



PROPERLY ADJUSTED SIGNAL GENERATOR

Figure 6 - Typical Oscilloscope Traces During Adjustment of Signal Generator 323644 or 323645 (Keyer Output)