TP177010 SELECTOR MAGNET DRIVER

SERVICING

CONTENTS PAGE

1. GENERAL

1.01 This section covers trouble shooting and repair of the TP 177010 selector magnet driver. General instructions appear in the following paragraphs. Tables 1 through 3 provide detailed information on locating trouble.

2. FIELD SERVICING

2.01 It is recommended that field servicing be limited to replacing the driver with a spare since it is probable that suitable tools and test equipment will not be available. Replace the device upon the absence of output signal when a known input test signal of proper polarity is applied. The mere absence of an output signal does not necessarily require replacement since the trouble may be in the signal or power circuits external to the driver. Therefore, these should be checked first.

3. REPAIRS

3.01 Repairs should be made at a properly-equipped maintenance center by qualified personnel. Testing and repair should preferably be handled by persons familiar with transistor circuits. The following equipment is required:

(a) A suitable source of dc teletypewriter signals such as a Distortion Test Set or a transmitter distributor.

(b) An oscilloscope with differential preamp for observing current waveforms.*

(c) A 0-5-50 20,000 ohm-per-volt dc voltmeter.

(d) A 0-150 5,000 ohm-per-volt ac voltmeter.

(e) A 0-100 dc milliammeter.

(f) A selector-magnet assembly to receive driver's output.

(g) A 1-ohm resistor in series with selector-magnet assembly to monitor selector's current waveform.

4. TROUBLE SHOOTING SEQUENCE

4.01 To locate a trouble, proceed as follows:

(a) Check input signals for quality and correct polarity (see Tables 1 and 2).

(b) Check output signal for absence or distortion (see Tables 1 and 2).

(c) Check power supply's dc voltage (approx -40 v).

(d) Using some sort of repetitive signal as an input, check collector of each transistor to see if it is switching, ie, changing each time input signal changes (see Tables 1 and 2). This should locate general circuit that has the trouble.

(e) Use Table 3 to determine component causing trouble.

5. REPLACEMENT OF PARTS

(a) Resistors may be replaced by those obtained from local electronic suppliers. On the other hand, to ensure obtaining proper parts, diodes, transistors, etc should be ordered by TP number (see appropriate parts

* Oscilloscope must be isolated from ground.

Prepared for American Telephone and Telegraph Company by Teletype Corporation

section). In an emergency, a 2N1008B transistor may be used as a replacement for any transistor on the driver. Do not substitute diodes.

(b) When parts are replaced, do not overheat leads of transistors or diodes, or card itself. Excessive heat will damage components and cause printed circuits to lift from board. Use a small soldering iron with a relatively low operating temperature.

CAUTION: IF CIRCUIT CARD IS REMOVED, WHEN REPLACING IT, PLACE TP195177 INSULATING WASHER BETWEEN CARD AND TP152426 NUT (SEE PARTS SECTION). OTHERWISE, NUT WILL CONTACT PRINTED CIRCUIT AND WILL CAUSE DAMAGE TO DRIVER.

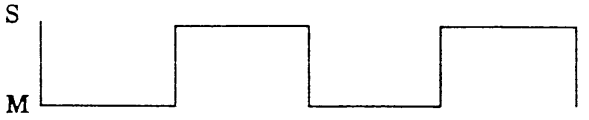
TABLE 1
CIRCUIT VOLTAGES

Location	Test Point	Input Line Condition	
		Mark	Space
Negative Signal Line	TP1	2.9 v	0.85 v
Q1 Base		2.7 v	0.85 v
Q1 Emitter	TP7 or Terminal Post #3	2.2 v	2.2 v
Q1 Collector	Terminal Post #5	2.2 v	3.4 v
Junction R4 - R5		4.3 v	10.9 v
Q2 Base	Terminal Post #6	2.2 v	3.4 v
Q2 Emitter		2.95 v	2.95 v
Q2 Collector	TP4	9.2 v	3.0 v
Q3 Base		4.15 v	3.4 v
Q3 Emitter		3.65 v	3.6 v
Q3 Collector	TP8	3.8 v	10.9 v
CR10 Cathode	TP5	4.6 v	3.0 v
Q4 Base		9.7 v	3.4 v
Q4 Emitter	TP4	9.2 v	3.0 v
Q4 Collector - Q5 Base	TP3	9.3 v	3.1 v
Junction R7 - R8		36.0 v	35.0 v
Q5 Emitter		9.85 v	3.65 v
Q5 Collector	TP2	39.5 v	39.0 v

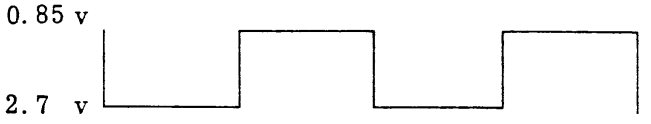
NOTES: All voltages negative with respect to TP6.
Nominal Power supply voltage (TP2 to TP6): 39.5 v.
Voltage readings may vary ± 15% from above values.

TABLE 2
WAVEFORMS

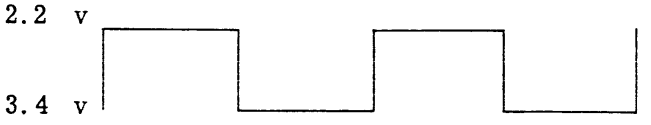
Input Signal - 100 wpm
0.0135 Sec. Bit Rate



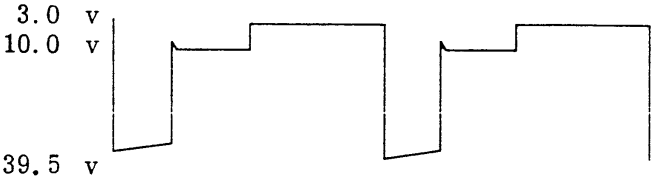
Q1 Base



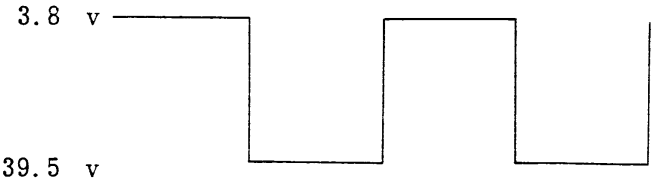
Q1 Collector



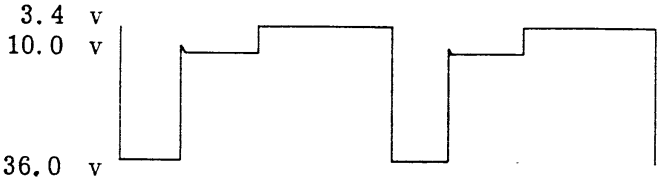
Q2 Collector



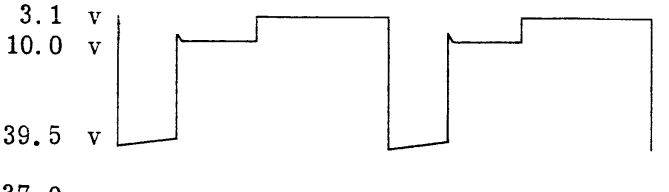
Q3 Collector



Q4 Base



Q4 Collector



Q5 Collector

Selector Magnet
Current

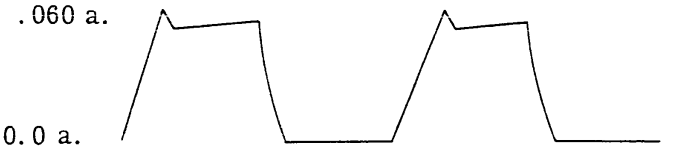


TABLE 3
GENERAL TROUBLE ANALYSIS CHART

Symptom	Possible Trouble [1]	Confirmation [2]
Output remains marking despite changes in input signal.	Q1 Shorted	Q1 Collector: -2.2 v with spacing input.
	Q2 Open	Q2 Collector: -9.3 v with spacing input.
	Q3 Shorted	Q3 Collector: -3.6 v with spacing input.
	CR10 Shorted	TP4: -8.5 v with marking input.
Output remains spacing despite changes in input signal.	Q1 Open	Q1 Collector: -3.4 v with marking input.
	Q2 Shorted	Q2 Collector: -3.0 v with marking input.
	Q3 Open	Q2 or Q3 Collector: -44 v with marking input.
	Transformer Open	TP2: nominal d c voltage outside rated limits of 39.5 v ±5 v.
	Transformer Shorted	TP2: nominal d c voltage outside rated limits of 39.5 v ±5 v.
	C1 Shorted	Q4 and Q2 or Q3 inoperative, probably destroyed.
	C2 Open	D c output voltage drops to approximately 32 v 'scope across TP2-TP6 shows pulsating d c (no filtering).
	C2 Shorted	TP2: d c output voltage drops to 0 v. Transformer, and diodes CR14, CR15 may be damaged.
	CR9 Shorted, Reversed or Open	Q3 inoperative, probably destroyed.
	CR14 or CR15 Shorted	TP2: d c output voltage drops very low, oscilloscope shows a c.
	CR14, CR15 Open	TP2: d c voltage -35 v with one diode open. 0 v with both diodes open.
	CR11 Shorted	TP4: -5.1 v with marking input.
	CR11 Reversed	TP4: -5.1 v with marking input.
	CR10 Open	TP4 and TP5: -44 v with marking input.
	CR10 Reversed	TP4 and TP5: -44 v with marking input.
	Q4 Open	Q5, Q2 and/or Q3 inoperative, probably destroyed.
	Q5 Shorted	Q2, Q3 and Q4 inoperative, probably destroyed.

1 "Shorted" refers to short-circuit between emitter and collector.
"Open" refers to any pair or all three terminals open.
2 Voltages shown are measured with respect to TP6.

TABLE 3 (Continued)

Symptom	Possible Trouble [1]	Confirmation [2]
Garbling or loss of range	Q5 Open	Delayed current rise time in selector magnet coils. 0.010 to 0.012 sec to reach 0.060 a. level. No overshoot current (see Table 2). Poor margin on spacing bias distortion.
	CR13 Open	Q5 emitter -39.5 v with marking or spacing input. Also symptoms of Q5 open.
	Q4 Shorted	Delayed current rise time in selector magnet coils. 0.010 to 0.012 sec to reach 0.060 a. level. No overshoot current (see Table 2). Poor margin on spacing bias distortion.
	CR8 Open	R4-R5 junction: -10.3 v with marking input. Vary input current above and below 0.030 a. trigger lever. Oscillations observed when 'scope connected across one ohm sampling resistor in series with selector magnet coils. Transistors Q1 through Q5 may be damaged by this trouble condition.
	CR8 Shorted	Delayed current fall time in selector magnet coils. Approx. 0.007 sec to reach 0 current level. Printer has poor range on marking bias signal.
	CR8 Reversed	Delayed current fall time as described above (CR8 shorted). Also, as above (CR8 open) oscillations observed.
	CR11 Open	Q3 Collector: -3.8 v with spacing input. Delayed current fall time in selector magnet coils. 0.030 sec to reach zero current level. Poor range on marking bias distortion.
	CR12 Open	Delayed current rise time in selector magnet coils. 0.012 sec to rise to 0.060 a. level; no overshoot current (see Table 2). Poor margin on spacing bias signals.
	CR12 Shorted	Delayed current rise time in selector magnet coils; 0.012 sec to reach 0.060 a. level; no overshoot current (see Table 2). Poor range on spacing bias distortion. Maximum selector magnet current 0.100 a.
	CR12 Reversed	Delayed current rise time in selector magnet coils; 0.012 sec to reach 0.060 a. level; no overshoot current (see Table 2). Poor range on spacing bias signals. Maximum selector magnet current 0.100 a.
	CR14 or CR15 Open	D c voltage at TP2 decreases below 39.5 v -15%. Maximum selector magnet current approximately 0.040 a. Poor range on spacing bias signals.
	C2 Open	TP2: Low d c output volts; high ripple voltage; poor overall range.

1 "Shorted" refers to short-circuit between emitter and collector.
"Open" refers to any pair or all three terminals open.
2 Voltages shown are measured with respect to TP6.