DATE Nov 30 1960 SH. 1 OF 11 COMPILED BY DB	TMC SPECIFICATION NO. S516 D
APPROVED DB	TITLE: Test Procedure of TIS-3 JOB

TEST PROCEDURE

TIS-3

A. Test Equipment Used;

1. Square Wave Generator, Measurements Model 71
2. Counter, Model 550 Berkeley (200 Kc)
3. Scope, Tektronix Model 545A or Equivalent
4. Regulated Power Supply, Lambda Model 26 (105 to 125 Volts
5. Battery Supply, DC 0 to +20 Volts
6. Relay, C.P. Clare Model HG-1002
7. VTVM, Model V-7A Heathkit
8. Multi-meter, Simpson Model 260
9. Panoramic Analyzer Model LP-1A

DATE 8-22-62 SHEET 2 OF 11	TMC SPECIFICATION NO. S 516	D
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APPROVED	BLOCK DIAGRAM	

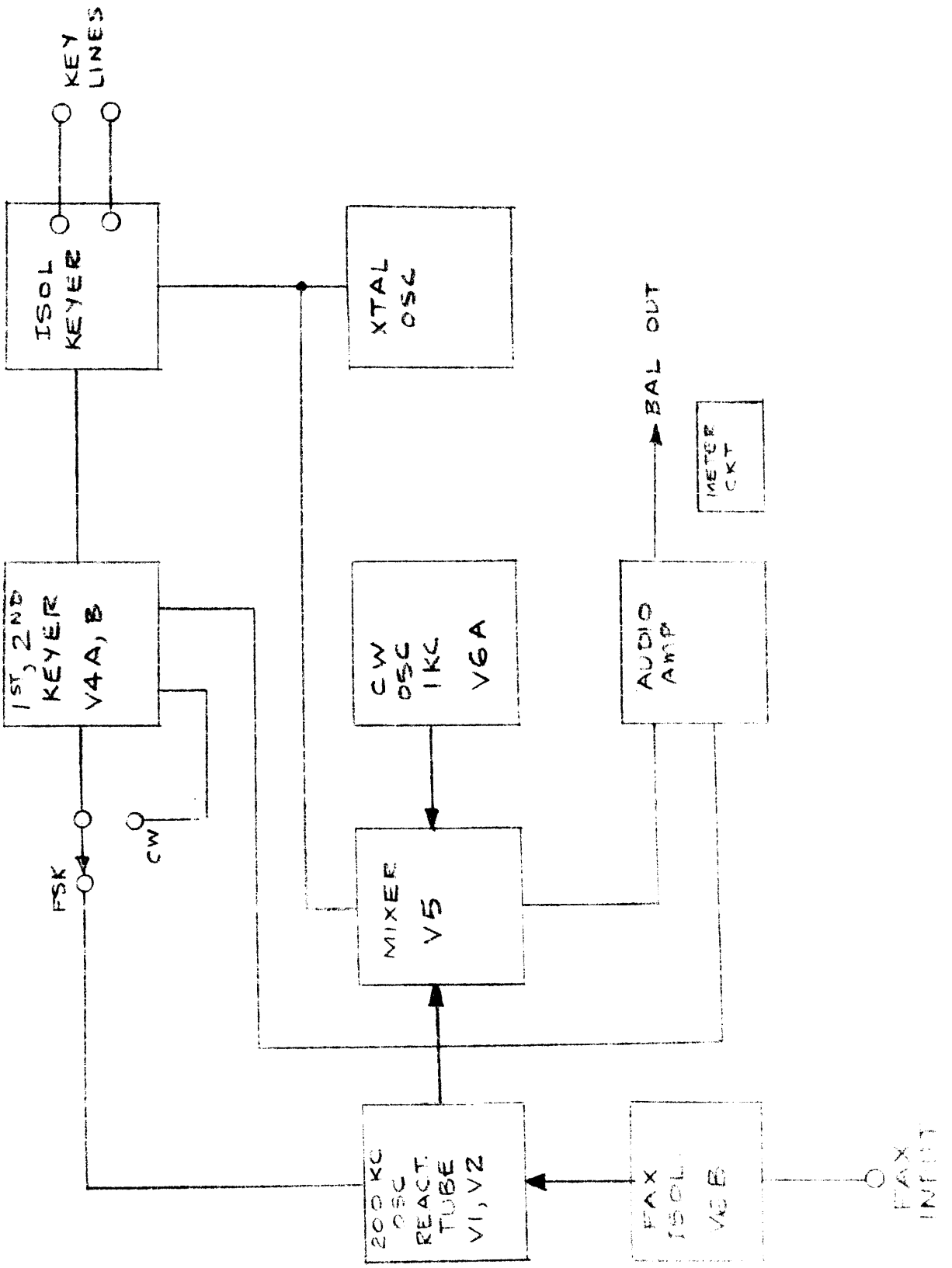

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FIGURE 1

FAX, REACTANCE TUBE TEST

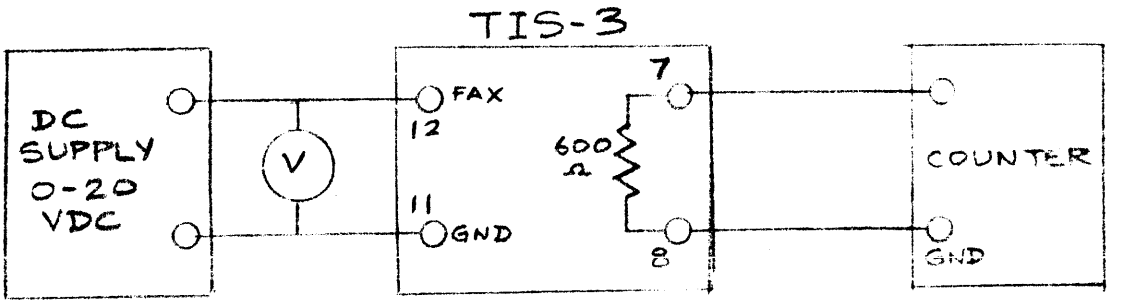

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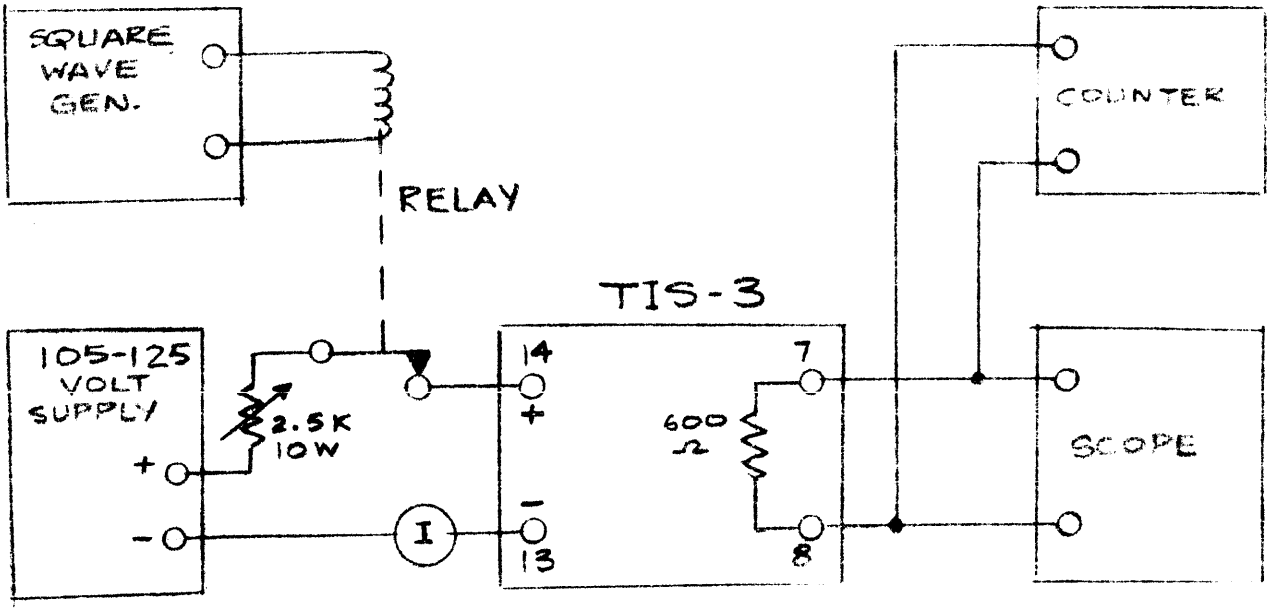
FIGURE 2

FSK CW KEYING TEST



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I PRELIMINARY TEST

A. Check unit for obvious wiring mistakes and poor solder connections.

B. Check with ohmmeter at terminal strip E1 for shorts.

E1	Approx. Resistance
1	0
2	0
3	INF.
4	INF.
5	20K
6	18K
7	30K
8	N.C.

C. Plug the unit into 110 volt AC and check the following voltages. Turn the STANDBY switch to B+.

E1	Volts Approx.
1 to GND	6.3 VAC
2 to GND	6.3 VAC
3 to 4	110 VAC
5	200 VDC*
6	+150 VDC*
7	-150 VDC*

*These voltages are removed by turning B+ switch to STANDBY.

D. Measure the following AC volts on E2.

E2	Volts Approx.
1 to 2	110 VAC
5 to 6	110 VAC

E. Oven light I2 should be on. The oven should reach operating temperature in approx. 15 minutes and the oven light should go out for start of oven cycle.

F. B+ - STANDBY switch should operate B+ light.

G. Make the following check with an ohmmeter on terminal strip E3.

1. With S4, S5 in the LINE position, the following lines should be shorted.

1	to	7	4	to	10
3	to	8	6	to	9

2. With S4, S5 in the CW, FAX, and FSK position there should be 70 ohms between 7,8 and 70 ohms between 9,10. The terminals 2,5,11 should read ground. Terminal 12 should read 50K ohms, terminal 13 INF, and terminal 14 INF.

II XTAL OSCILLATOR TEST V8

A. Check xtal oven Z1 for proper xtals. Y1, 198.100 kc; Y2, 198.000 kc and Z2 for Y3, 197.450 kc. The spare xtal position should also be checked out during this test by putting Y3 into spare holder.

B. Connect a scope and counter to the center top of L6 thru a 50 mmfd capacitor and tune for maximum voltage with S6 in position 3 (2550). This should be approximately 12.5 volts Peak to Peak (using scope). Check waveform for HUM.

C. Turn S6 to position 1 (1900) and adjust C35 if necessary to 198.100 kc.

D. Turn S6 to position 2 (2000) and adjust C36 if necessary to 198.000 kc.

E. Turn S6 to position 3 (2550) and adjust C37 if necessary to 197.450 kc.

III 200 KC OSCILLATOR AND REACTANCE TUBE

A. Set the following controls:

1. C3 to approx. one-third max. capacitance.
2. C46 to approx. mid capacitance.
3. R31 (shift cps) to a reading of 000.
4. R28 (shift cal.) to mid resistance.
5. R26 (shift bal.) to mid resistance.
6. S2 (test) to SPACE.

7. S6 (center frequency) to SPARE (position 4).
8. C18 to approx. 3/4 capacitance.
9. S1 (function) to FSK.

B. Connect the scope and counter to pin 2 of V5 (mixer tube).

C. Adjust C3 to within ±10 cycles of 200 kc and lock shaft. Now set to 200 kc by adjusting C46. Make sure shift ampl. R31 is set to 000. With a scope check the output which should be approx. 6 volts peak to peak. Also check the waveform for distortion and HUM.

D. Put VTVM on the center arm of R26 (shift bal.). Set meter on the 50 volt scale and adjust the meter to center scale with the zero adjust to read ± volts. By switching the Test switch to SPACE, set the pot to read approx. -12 volts. Now switch Test Switch to MARK and meter should read approx. +12 volts. Set R31 (shift cps) to 1000 and turn the Test Switch from MARK to SPACE. Shift should be ±500 cycles. If shift is not equal on both sides readjust R26 slightly so shift is equal.

E. With shift set to 1000 cps adjust R28 (shift cal.) for ±500 cycle shift. Adjust C18 for best linearity. Reset 200 kc Osc. to 200 kc after each adjustment.

SHIFT CPS (±5%)	COUNTER READING(EXAMPLE)	
	+	-
0	000	000
50	-25	+26
100	-50	+52
200	-98	+102
300	-152	+153
400	-205	+202
500	-254	+253
600	-303	+302
800	-401	+401
1000	-500	+500

F. At 1000 cycle shift, turn the test switch from SPACE to LINE. Shift must be the same. Make sure all controls are locked. This completes the test.

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IV MIXER AND AUDIO TEST

A. Set controls up for test in the following way:

1. Connect the counter, scope and 600 ohm load across pins 7 and 8 of E3 (channel 1).
2. Turn S4 (exciter channel 1) to the CW, FAX and FSK position.
3. Turn S6 (center frequency) to 1900 (position 1).
4. Set R49 (level adj.) to mid resistance.
5. Turn S2 (test) to MARK position.
6. Turn S1 (function) to FSK position.
7. Set R45 (audio bal.) to mid resistance.
8. Set R31 (shift cps) to a reading of 000.

B. The output level meter should be reading approx. 0 db. R49 (level adj.) should vary the output level meter reading from 0 to full scale. This indicates the mixer, audio and metering circuits are working properly.

C. With S6 (center frequency) in the following positions, the counter readings should be:

POSITION	COUNTER READING
1 (1900)	1900
2 (2000)	2000
3 (2550)	2550
4 (spare)	0

D. With R49 (level adj.) set to 0 db, the voltage on channel 1 should be approx. 1.8 volts peak to peak.

E. Set R31 (shift cps) to the following settings with S6 (center frequency) set to position 3(2550):

SHIFT CPS ±5%	OUTPUT FREQUENCY	
	space	mark
100	2500	2600
300	2400	2700
500	2300	2800
800	2150	2950
1000	2050	3050

V FAX TEST

A. Set controls up for test in the following way:

1. Switch S1 (function) to FAX (position 2).
2. Refer to Figure 1 for test set-up.
3. Set FAX input volts to 0 vdc.
4. Turn S6 (center frequency cps) to position 1 (1900) and adjust R44 (FAX BIAS) for output frequency of 2300 cps.
5. Set R66 (FAX ADJ.) to maximum resistance.
6. The following readings are typical for a unit operating properly:

+VDC	CPS ±5% (Center Frequency 1900 cps)
0	2300
.5	2260
1	2220
2	2140
5	1900
6	1820
8	1660
10	1500

If frequency is below 1500 cps at 10 vdc, adjust R66 (FAX ADJ.) for 1500 cps and repeat FAX test.

VI CW KEYING TEST

A. Refer to Figure 2 for Test Set-up.

1. Set S1 (Function) to CW (Position 3).
2. Set R27 (Threshold Ajd.) to mid resistance.
3. Set S3 (Key Mode) to 60 ma (Position 4).
4. Short-Out Contacts of Relay and adjust keying current to 60 ma.
5. Set square wave generator to 50 cycles.
6. Turn S6 (Center Frequency) to 2000 (Position 2).
7. Set S2 (Test) to Line (Position 1).
8. Adjust R49 (Level Adj.) for a reading of 0 db on output level meter.

B. Put counter on Pin 1 of V6A, CW Oscillator. Adjust L3 with Allen wrench for 1000 cps. This should be approximately 25 volts RMS.

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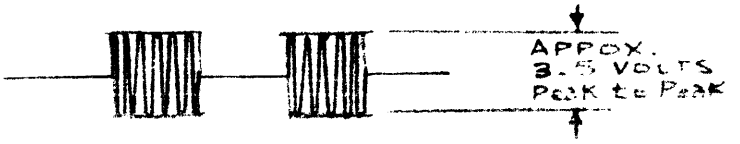
C. Adjust R27 (Threshold) and R64 (Audio balance) for best square wave of output waveform. R27 (Threshold) is adjusted to the point where unkeyed portion is at zero volts.



D. Short relay and measure output frequency. Ouput frequency should be 1000 cps.

E. Vary square wave generator from 5 cps to 200 cps, checking wave shape of output.

F. Disconnect key line and measure level in unkeyed state. Tone should be down at least 60 db.

G. Typical wave shapes and voltages with controls set as in CW Keying Test, Part A.

Pin 2 of V4 (1st Keyer)

Pin 3 of V4 (1st Keyer)

Pin 7 of V4 (1st Keyer)

Pin 2 of V3 (2nd Keyer)

Pin 8 of V3 (2nd Keyer)

H. Check output waveforms and voltages with S3 (Key Mode) in the 50 volt, 100 volt and 20 ma positions. Use the series potentiometer in test set-up to obtain these levels. These waveforms and voltages should be the same as shown in CW Keying Test, Part C.

VII FSK TEST

A. Set controls to following positions:

1. Turn S1,(FUNCTION)to FSK.

2. Set shift to 1000 cps.

Check shifted tone for envelope distortion from 0 to 1000 cps shift. The response should be flat within ±1 db.

VIII AUDIO DISTORTION TEST

A. Put analyzer on 600 ohm output (channel 1).

B. Set switches to FSK, 0 SHIFT, 2 kc TONE and test switch to LINE.

C. Set audio level meter to 0 db.

D. Adjust R67 (mixer balance) for minimum distortion and hum. This should be down at least 40 db.

REVISION SHEET

THE TECHNICAL MATERIEL CORP.
MAMARONECK NEW YORK

5516

MODEL TIS-3 PROJECT NO _____

DATE	REV.	PAGE	EMN#	DESCRIPTION	CHK.	APP.
11/ /62	A	4		STEP C, add "AC" to 110V readings		
		5		STEP B, chg. 60v to 6 v		
		5		STEP A of 200KC OSC.		
				ITEM 8, chg "mid" to 3/4		
		6		STEP C, chg 6 v to 2 v		
		6		STEP E, chg ±2% to ±5%,		
				add "to obtain --- etc",		
		7		STEP E, chg 2% to 5%		
		7		STEP A, item 2, chg Fig 2 to Fig 1		
		7		UNDER STEP A, add item 4		
		8		UNDER "CPS", chg 2% to 5%		
		9		On Waveforms,		
				chg 4 v to 3v, 16v to 6v,		
				90v to 22v, 50v to 12 v		
		10		chg. waveform volt. from 9 V to 4V		
	A	12		compl. revision of Test sheet		
4/1 /62	B	5	6638	On XTAL Osc. Test #8, letter "B": delete remark.		
				"This should be down approx. 60 db"		
		7		On fax test; add item 5, Adjust the fax adjust to		
				maximum resistance.		
		8		Chg. CPS column: From - 2250,2200,2100,1900,1800,1600,		
				1400, to - 2260,2220,2140,1900,1820,1660,1500.		
3/ /64	C	ALL		Completely Revised & Retyped		
7/ /65	D	11	8305	On Sect. VIII, letter D, Chg. 50 db to 40 db		

TMC FORM 61-A