DATASPEED TAPE SENDER AND RECEIVER

TESTS, ADJUSTMENTS AND

TROUBLE-SHOOTING GUIDES

1. INTRODUCTION

1.01 This section covers steps and procedures for tests, adjustments, and isolation of trouble in DATASPEED tape senders and receivers. It describes the preliminary tests to be performed by the data test center handling the trouble report and includes trouble-shooting tables to serve as a guide in locating and clearing troubles on DATASPEED equipment.

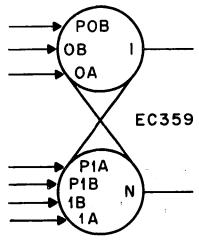
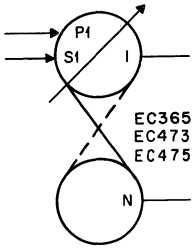
1.02 This section is reissued to include information pertaining to type 2 DATASPEED equipment, and to change the title.

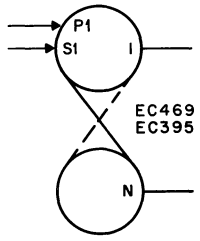
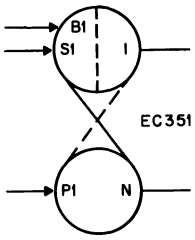
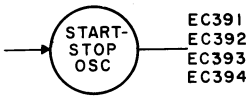
1.03 Special tools and instruments required are listed and described in Section 592-800-500.

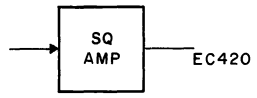
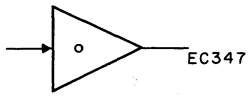
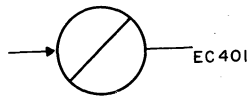
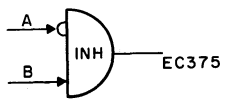
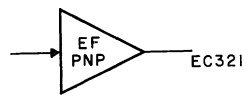
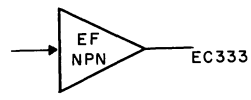
1.04 Also included is a description of the logic elements used in DATASPEED equipment. These elements include circuit symbols, functions, and input and output characteristics along with a theory of operation of each circuit. Fig. 1 and 2 describe electronic circuitry in block diagram form.

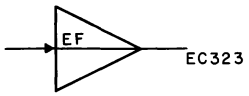
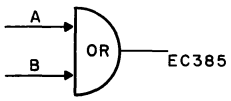
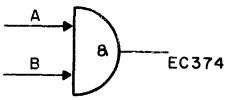
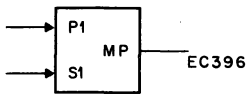
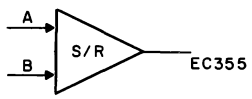
1.05 The trouble-shooting tables contain necessary information required for using a DATASPEED test point signal monitor or a general purpose oscilloscope.

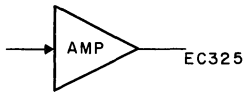
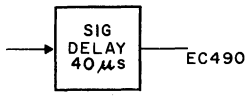
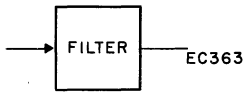
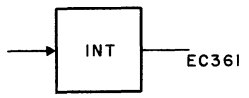
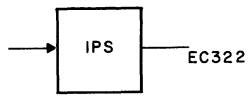
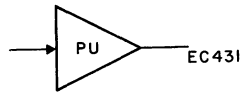
2. DESCRIPTION OF LOGIC ELEMENTS USED IN DATASPEED TAPE SENDERS AND RECEIVERS

Symbol and Circuit No.	Function	Input	Output
 FLIP-FLOP	Acts as binary switch, frequency division, storage element, binary counter.	To "Set 0" lead −6 to 0 volt pulse or to step function OA or OB, prime input POB must be at ground or +1.5 volts, POA internally primed. To "Set 1" lead −6 to 0 volt pulse or square wave must be on OB or 1B input. Respective primes must be at ground or +1.5 volts to trigger output.	"Set 0" lead inverted output I must be at +0.8 volt. When switched to "Set 1" condition, square-wave output must be +0.8 to −6 volts. Conversely N (normal output) switches −6 to +0.8 volt in less that 5 microseconds. "Set 0" lead opposite above inputs.
 ONE-SHOT, VARIABLE	Generates a pulse of adjustable duration with fast rise times. Used for delay purposes.	S1 input is a −6 to 0 volt pulse or square wave. Prime input, P1, must be at ground or 1.5 volts.	Inverted output I is at +0.8 to −6 volts for adjusted duration. N (normal output) is −6 to 0.8 volts for adjusted duration.

Symbol and Circuit No.	Function	Input	Output
 ONE-SHOT, FIXED	Generates a pulse of fixed duration with fast rise times. Used for delay purposes.	Same as variable one-shot inputs.	Same as variable one-shot output except that duration of pulse is fixed.
 VARIABLE PULSE DELAY	Generates a pulse of variable duration depending on condition of biasing input. Used for delay purposes.	S1 input is a −6 to 0 volt pulse or square wave. Prime input P1 must be at ground or +1.5 volts. Bias input B1 can be at −6 volts or ground.	Inverted output I goes from +0.8 to −6 volts for shortest duration when B1 input is at −6 volts and will time out its longest duration when B1 is at ground or slightly positive. Pulse duration may vary between shortest and longest duration depending on condition of B1.
 START-STOP OSCILLATOR	A sine wave oscillator of fixed audio frequency used to generate electronic clock which determines bit rate of system.	For ON condition input should be at ground or slightly positive. OFF condition input should be at −6 volts.	ON condition sine wave output is 1050 cps. Output swings from −1 volt to approximately −10 volts (8 to 9 volts peak to peak [pp]). In OFF condition, output is at steady state and about −5.5 volts.

Symbol and Circuit No.	Function	Input	Output
 SQUARING AMPLIFIER	Used in conjunction with start-stop oscillator. Shapes sine-wave input to positive pulses, one for each cycle of sine wave. Used as advance pulse generator (electronic clock pulses).	Sine wave −1 to −10 volts (8 to 9 volts pp).	Pulses are about 10 msec or less duration −6 to 0 volt, one pulse for each negative transition of sine wave. Steady state output at −6 volts.
 PULSE AMPLIFIER	Reshapes square wave input to standard narrow pulse. Used as isolation amplifier.	Square wave input +0 to −6 volts transition.	Narrow pulse is −6 to 0 volt transition with a less than 5-msec rise time for duration of 10 msec or less.
 INVERTOR	A dc-coupled amplifier used to invert input signal.	A −6 to 0 volt or 0 to +6 volts for each square wave or pulse input.	Same as input except that wave form is inverted.
 INHIBIT GATE	Controls gating of signals. A presence of signal on one input inhibits output.	Square wave of pulse on either input. If B is at 0 volt, a negative signal on A will produce an output.	A pulse or square signal −6 to 0 volt for the duration of pulse.
 EMITTER FOLLOWER (PNP)	An isolation amplifier used to drive diode gates with fast fall time output.	Square wave or pulse input −6 to 0 volt transitions.	Follows input −6 to 0 volt.
 EMITTER FOLLOWER (NPN)	An isolation amplifier used to drive gates with fast rise time output.	Square wave or pulse input −6 to 0 volt transitions.	Follows input −6 to 0 volt.

Symbol and Circuit No.	Function	Input	Output
 SYMMETRICAL EMITTER FOLLOWER	Same as above. Provides isolation where output must have fast rise times for both positive and negative transitions.	Square wave or pulse input −6 to 0 volt transitions.	Follows input −6 to 0 volt.
 "OR" GATE	Used for gating two inputs. If signal appears on A or B, there will be a corresponding signal on the output lead.	Square wave or pulse input −6 to 0 volt.	Output is coincident with input −6 to 0 volt transition. Output will assume most positive value.
 "AND" GATE	Used for gating coincidence signals on A and B.	For an output both inputs A and B must be at 0 volt square wave or pulse input −6 to 0 volt.	Output a square wave or pulse input coincident with input. Output will assume most negative value.
 MAGNETIC PULSER	A regenerative amplifier used to drive selector magnets. A load consisting of coil and resistor is shunted by a diode output signal of adjustable duration.	To trigger circuit, prime input P1 must be at 0 volt or slightly positive and a −6 to 0 volt pulse or square wave must appear on S1.	−28 to 0 volt signal of adjustable duration between 3.5 msec to 7 msec.
 SIGNAL IN AMPLIFIER	Converts polar output of data set to neutral signals.	−3 to −25 volts for mark input, +3 to +25 volts for space input on A. At B input signal is blinded at −6 to 0 volt and unblinded at −6 volts.	Mark is approximately +1.5 volts and space is −6 volts. When B is at 0 volt, output is at 0 volt.

Symbol and Circuit No.	Function	Input	Output
 SIGNAL OUT AMPLIFIER	Converts a neutral signal to a polar signal capable of driving data set.	0 volt for mark and −6 volts for space.	Polar signal output −6 volts for mark signal and +6 volts for space signal.
 SIGNAL DELAY	Provides approximately 40-usec delay of signal input for gating purposes.	Signal input −6 to 0 volt transitions.	Same as input except delayed approximately 40 usec.
 FILTER	Rejects high-frequency noise from voltage source.	To filter following voltage inputs in modules: +1.5, +6, −6, and −12 volts.	Same as input. High-frequency noise eliminated.
 INTEGRATOR	Integrates input signal and prevents noise due to contact bounce.	Input signal of 0 to −28 volts.	Integrated output (slow rise time) 0 to −10 volts or less depending on input.
 INTEGRATED PULSE SHAPER	Reshapes input signal so that output signal has fast rise time capable of driving standard circuit such as flip-flop.	0 to −6 volts input of slow rise time.	−6 to 0 volt transition of 8 usec or less.
 PICKUP AMPLIFIER	Converts pickup pulse generated by magnetic (sinusoidal signal) to a standard output signal.	Input is 40 volts pp around a −6 volt dc level. Minimum input 6 volts pp (−3 to −9 volts). Switches on positive transition of pickup signal.	Output is −6 to 0 volt transition for a duration of about 300 msec or less depending on speed and amplitude of input.

3. CALIBRATING DATASPEED TEST POINT SIGNAL MONITOR

3.01 Before using the test point signal monitor, check and calibrate as follows:

1. Plug power cord into ac convenience outlet provided on front panel of power module.
2. Turn power switch to ON and observe that power indicator lamps light. Allow approximately 5-minute warmup time.
3. Set SELECTOR switch to TEST.
4. Set trigger switch to INT +.
5. When test signal appears on screen, adjust V (vertical) knob until signal fills the six vertical divisions.
6. Adjust H (horizontal) knob until four sine waves fill the ten horizontal divisions of the screen and are of equal amplitude.

Note: Two screw-type adjustments H and V are provided as fine adjustments for Steps 5 and 6.

7. Adjust BEAM and FOCUS control knobs to obtain a clear sharp signal.

Note: A lever, located under center bottom of screen, is provided for screen illumination.

4. PRELIMINARY TESTS

4.01 When trouble is reported on DATASPEED service, it will be handled by the data test center. Test center will perform necessary tests to determine which terminal, sending or receiving, is the cause of the failure. Sections 314-825-500, 314-825-501, and 314-825-502 describe testing procedures for DATASPEED service that will be performed by the data test center.

4.02 This list of figures and tables will aid in locating trouble in DATASPEED equipment.

- Block diagrams Figs. 3 and 4, will aid in sectionalizing and isolating troubles.
- Logic diagrams, Fig. 5 and 6, provide an over-all picture of electronic circuitry.
- Trouble-shooting tables provide scope settings and scope displays for testing circuit elements.

4.03 Tables A and B are to be used for tests and adjustments of electronic circuitry.

4.04 There are two trouble-shooting procedures in this section: one for tape sender (Tables C, D, E, and F) and one for tape receiver (Tables G, H, J and K).

4.05 These tables are divided into types of trouble in order that unnecessary steps may be eliminated. These steps fall into the following categories:

Tape Sender	Table
1. Complete Failure	C
2. No Signal Output	D
3. Level Failure	E
4. Garbled Message	F

Tape Receiver	
1. Complete Failure	G
2. Not Punching Tape	H
3. Garbled Message	J
4. Dropping or Addition of Marks and Tape Feed Failure	K

4.06 Testing instructions for the data sets are contained in other Plant Series practices. Trouble proved in the data set may require its replacement.

4.07 A plastic carrying case with complete set of circuit cards and a pretested data set should be readily available at all times to handle trouble calls.

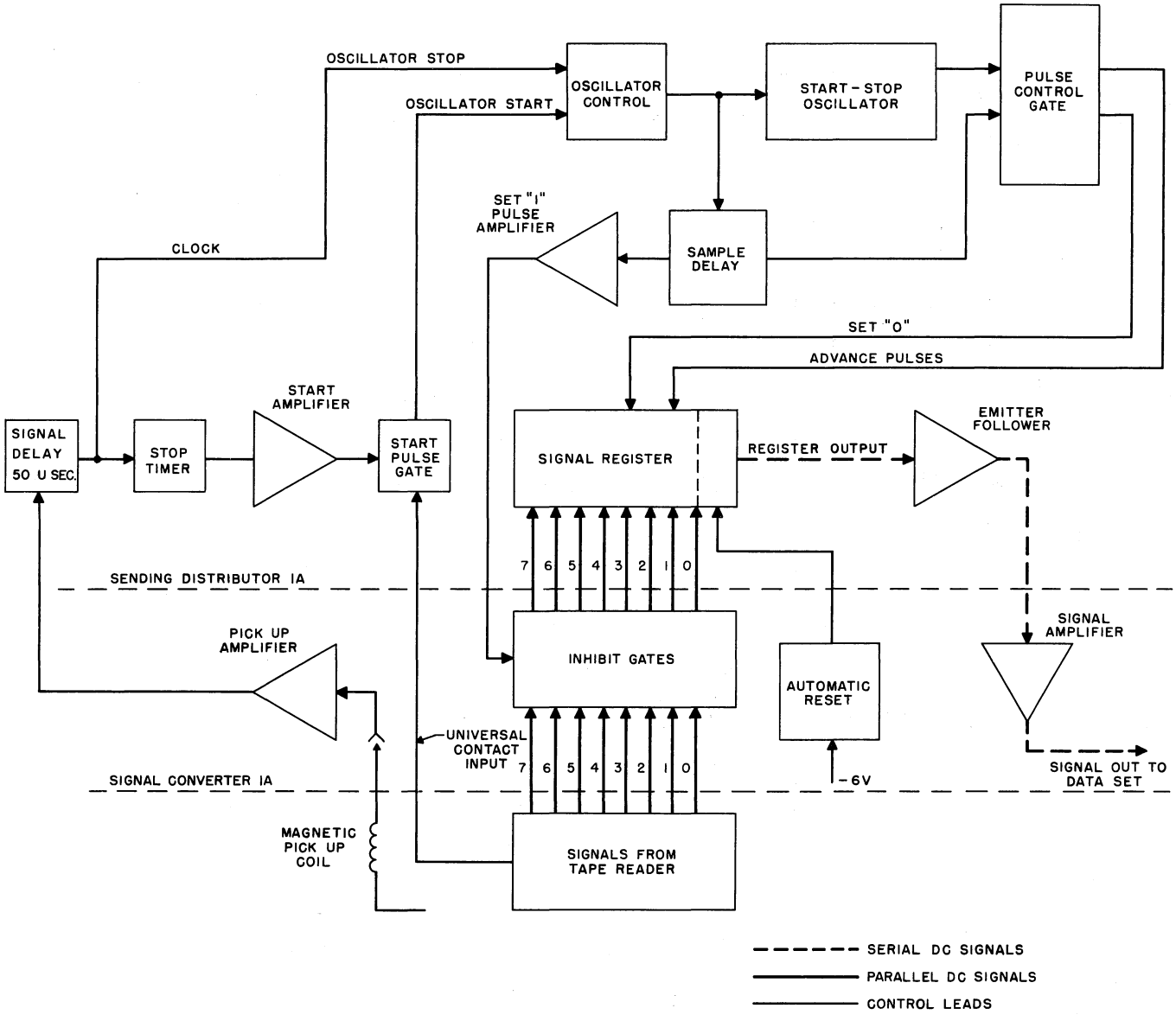


Fig. 1 — Block Diagram of Tape Sender Electronic Circuitry

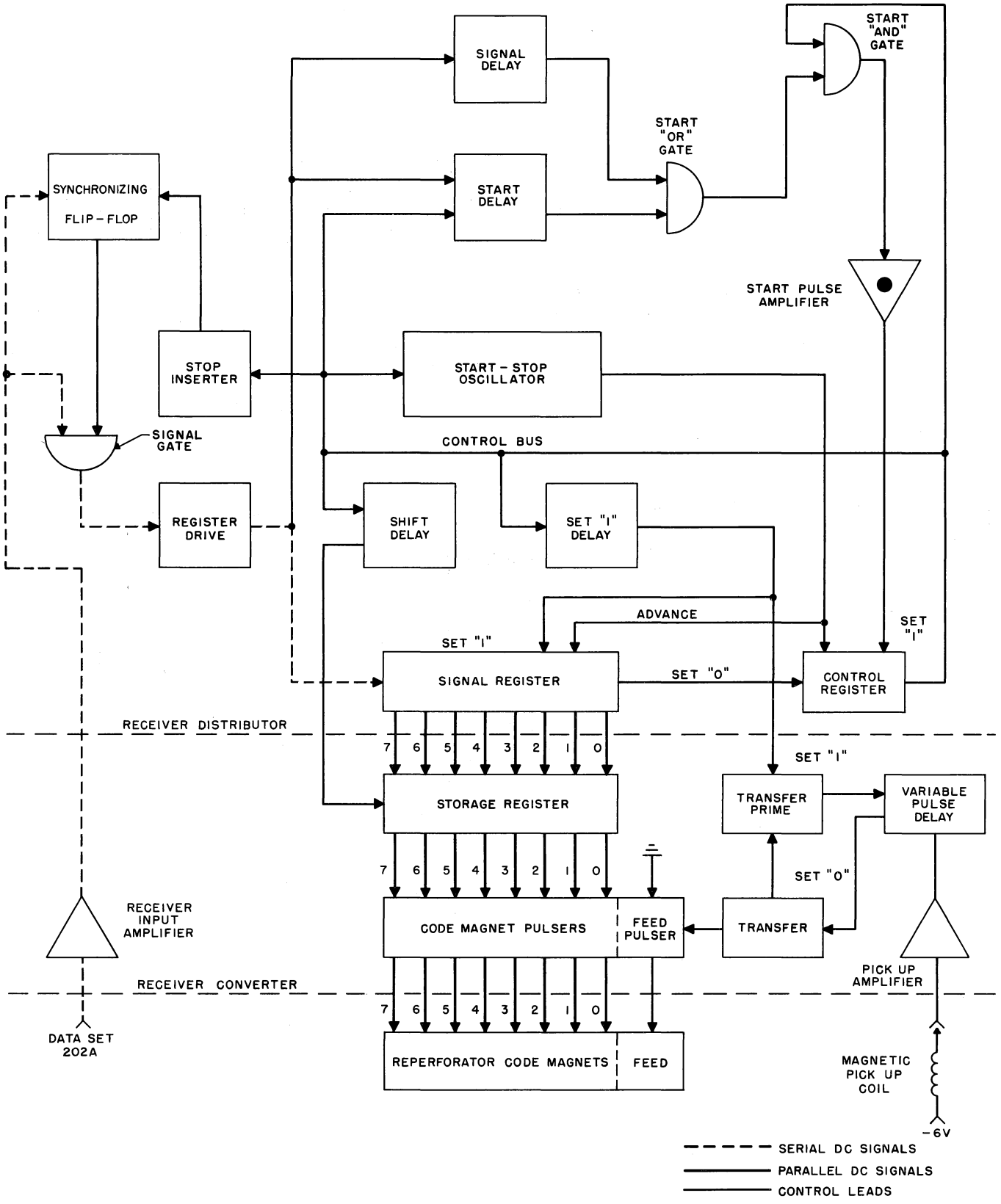
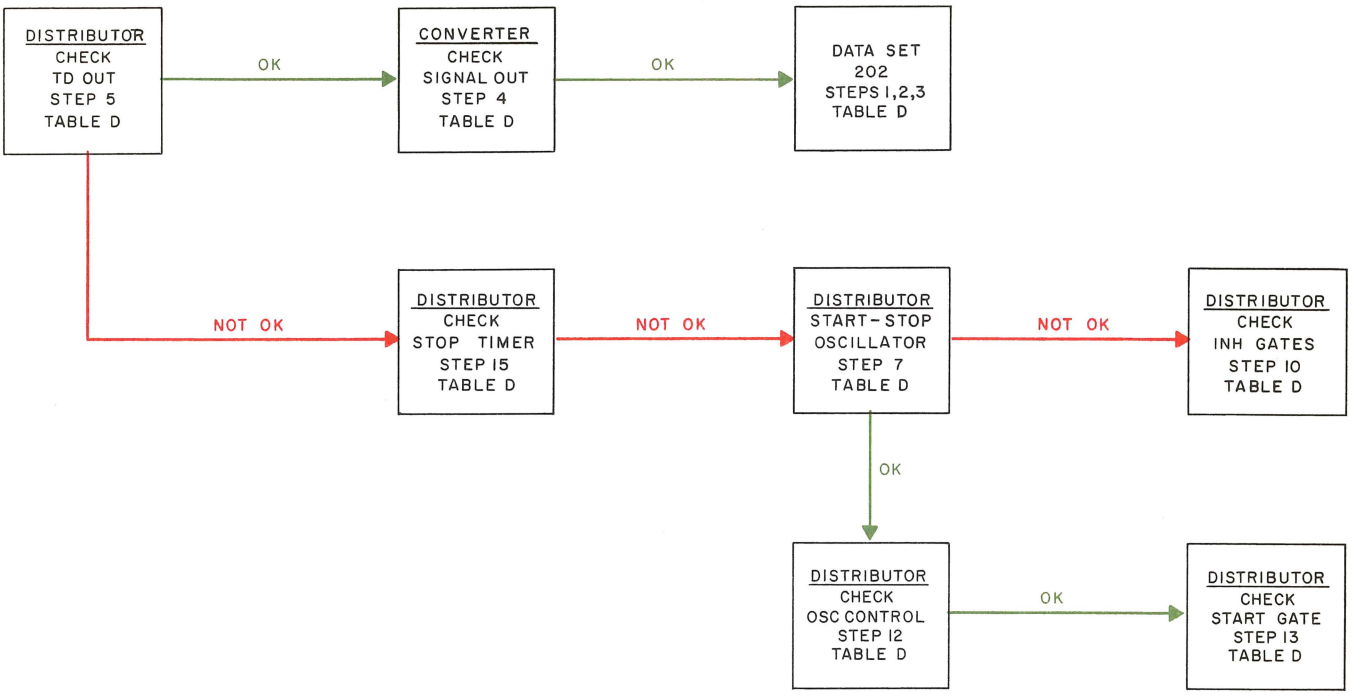
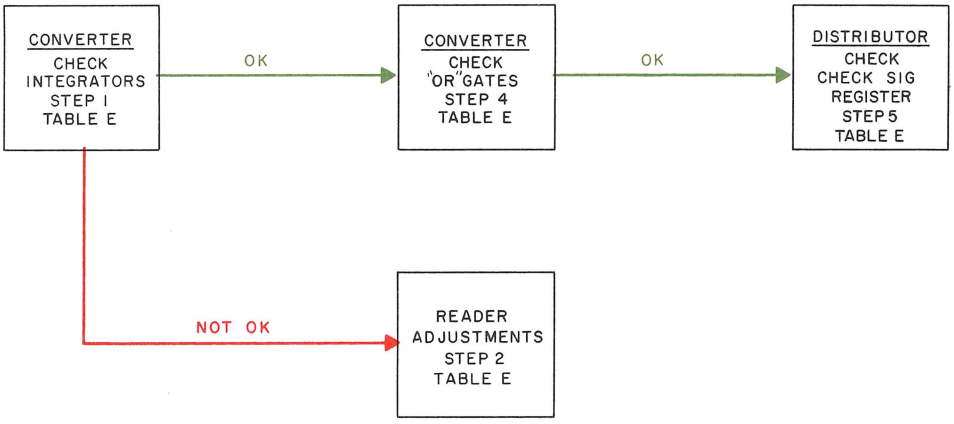


Fig. 2 — Block Diagram of Tape Receiver Electronic Circuitry



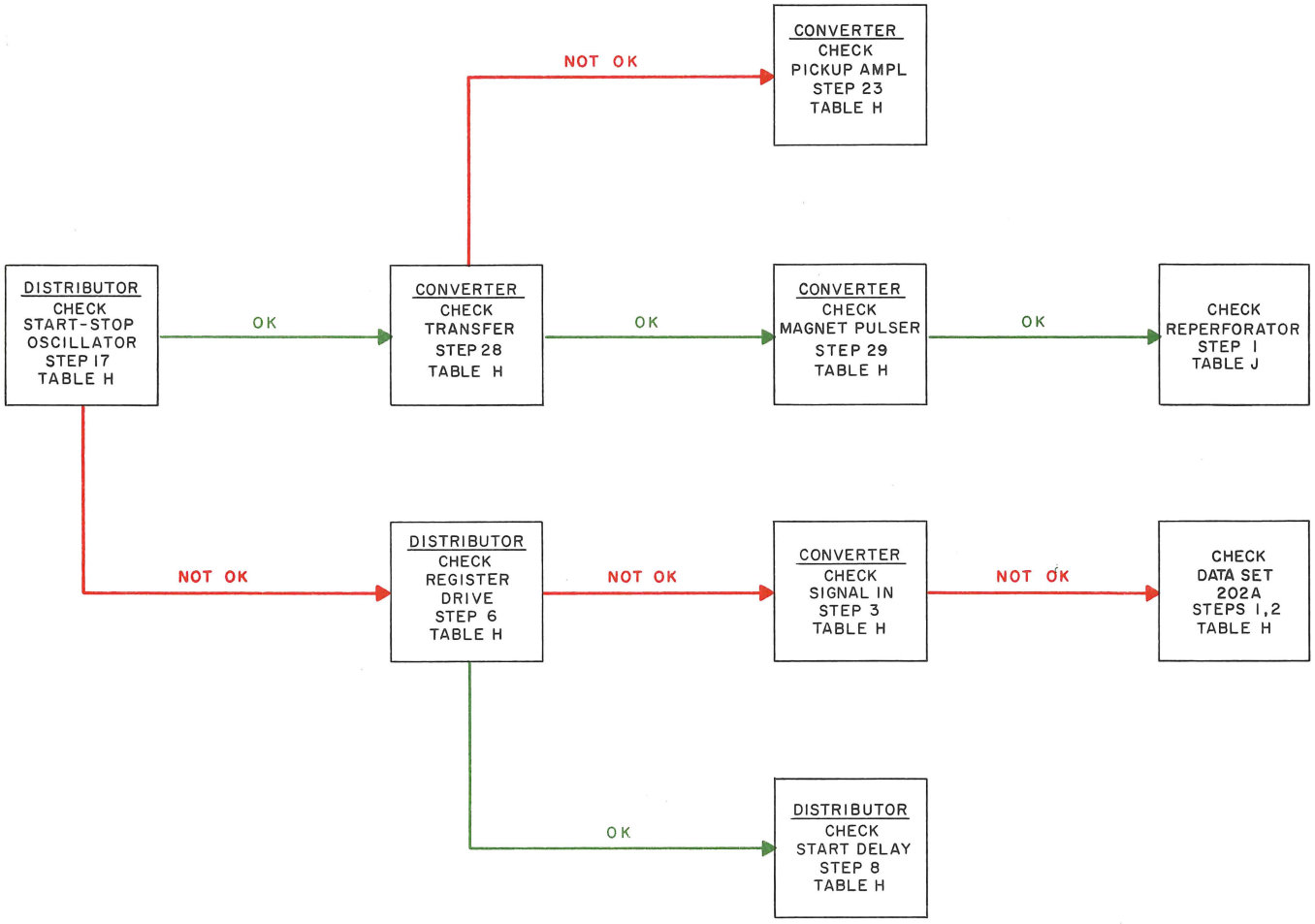
COMPLETE FAILURE OR GARBLE MESSAGE



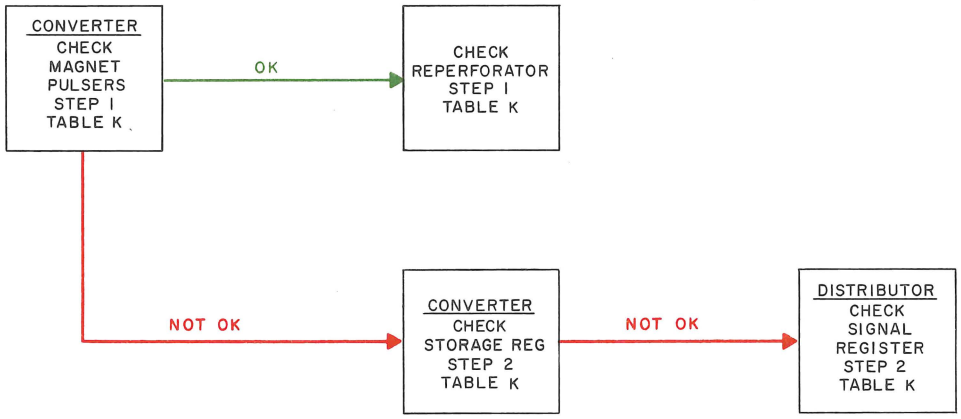
LEVEL FAILURE

TRANSMITTER

Fig. 3 — Block Diagram to Aid in Isolating Trouble



COMPLETE FAILURE OR GARBLED MESSAGE



LEVEL AND FEED FAILURE

RECEIVER

Fig. 4 — Block Diagram to Aid in Isolating Trouble

TABLE A

DATASPEED Tape Sender-Tests and Adjustments of Electronic Circuitry

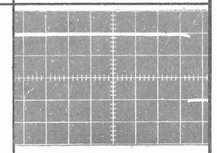
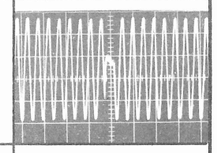
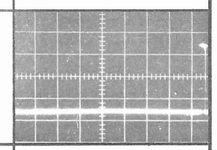
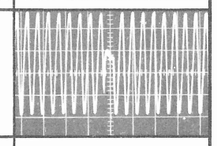
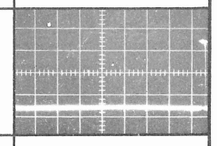
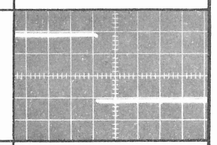
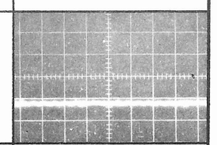
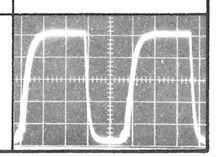
Test No.	Signal Monitor Selector Switch Setting	TRIGGER Setting for Scopes	General Purpose Oscilloscope Setting		Signal Test Points in DATASPEED Sender		Trigger Test Points in DATASPEED Sender		Requirements	Adjustments	Scope Displays
			H	V	Sending Distributor	Signal Converter	Sending Distributor	Signal Converter			
1	4	EXT +	100 usec/D	2 V/D	BD-1		BD-1		Time out is between 850 to 900 usec.	Adjust stop timer by variable resistor R11 on card BD(EC365).	
2	7	EXT +	2 msec/D	2 V/D	BQ-2		BD-1		1. Last cycle over shoots to about 1/2 to 3/4 down on negative cycle. 2. All cycles of operation are equal in amplitude.	1. Make rough adjustment of oscillator by variable resistor R11 on card BD(EC365). 2. Adjust feedback resistor R6 on card BQ(EC394).	
3	4	INT +	100 usec/D	2 V/D	BN-2				Jitter of last advance pulse occurs on both sides of steady advance pulse.	Adjust frequency of oscillator by adjusting variable inductor L1 on card BQ(EC394) until the observed wave form appears as shown. It may be necessary to operate EXT switch several times to catch jitter. Jitter may not be present if frequency is off.	
4	7	EXT +	2 msec/D	2 V/D	BQ-2		BD-1		Same as test 2-1.	Make fine adjustment of stop timer by variable resistor R11 on card BD(EC365). Recheck Step 1.	
5	4	INT +	100 usec/D	2 V/D	BN-2				Second advance pulse is centered to jitter.	Touch up frequency by variable inductor L1 on card BQ(EC394).	
6	4	EXT +	100 usec/D	2 V/D	BF-1		BF-1		Time-out should be 475 ± 100 usec.	Rough adjustment of timing resistor R11 on card BF(EC473).	
7	6	EXT +	2 msec/D	2 V/D		BR-2		BR-2	Second pulse coincides with midpoint of scope.	Set wave form by adjusting horizontal position on scope. Proceed to Step 8 without further horizontal adjustment.	
8	6	EXT +	2 msec/D	2 V/D		CR-4		BR-2	The approximate midpoint of the contact closure should coincide with midpoint of wave form.	To adjust, loosen pickup coil mounting screws on tape reader and position the pick-up coil until this condition is met.	

TABLE B

DATASPEED Tape Receivers-Tests and Adjustments of Electronic Circuitry

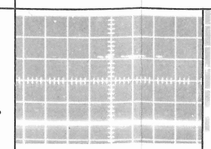
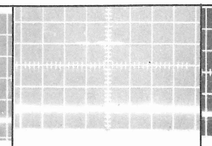
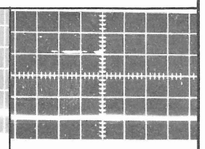
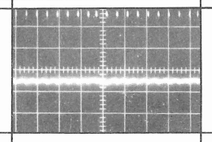
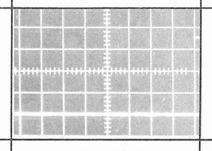
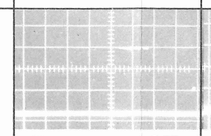
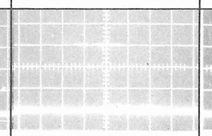
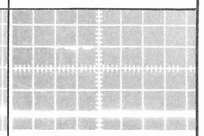
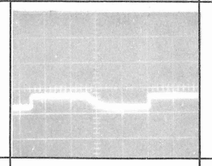
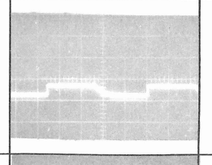
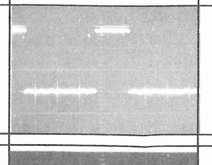
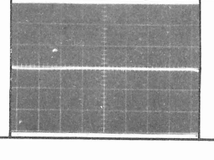
Test No.	Signal Monitor Selector Switch Setting	TRIGGER Setting for Scope	General Purpose Oscilloscope Setting		Signal Test Points in DATASPEED Receiver		Trigger Test Points in DATASPEED Receiver		Requirements	Adjustments	Scope Displays		
			H	V	Receiving Distributor	Signal Converter	Receiving Distributor	Signal Converter					
1	4	EXT +	100 usec/D	2 V/D	CF-2		CP-1		Receiving reversals consisting of (0, 2, 4, 6) marking adjust oscillator to 1050 cps ±0.3% frequency	Adjust frequency by variable inductor L1 on card CH(EC394). Note: Due to data set jitter the adjustment should center jitter pulses around steady pulse.	 Frequency Too Low	 Frequency OK	 Frequency Too High
2	7	EXT +	2 msec/D	2 V/D	CH-3		CL-2		All cycles of operation equal in amplitude.	Adjust feedback resistor of oscillator R6 on card CH (EC394). Recheck Test 1.			
3	4	EXT -	100 usec/D	2 V/D	CP-1		CP-1		Proceed to Step 4 without changing scope setup.	Adjust using horizontal control on scope.			
4	4	EXT -	100 usec/D	2 V/D	CF-2		CP-1		Pulse occurs midpoint of bit.	Adjust start delay resistor R11 on card CM(EC473).	 Frequency OK Start Delay Too Long	 Frequency OK Start Delay OK	 Frequency OK Start Delay Too Short
5	6	EXT +	2 msec/D	5 V/D		CM 4 CN 4 CP 4 CQ 4 CR 4		CH-2	The reperforator motor must be on. Magnet pulsers should have respective time-outs of 5 ±0.2 msec. Slight jitter is normal.	Adjust feedback resistor R5 on cards CM, CN, CP, CQ, and CR(EC396).			
6	6	EXT +	2 msec/D	5 V/D		CJ-4		CH-2	The reperforator motor must be on. Feed magnet pulser should have time-out of 5.5 ±0.2 msec. Slight jitter is normal.	Adjust feedback resistor R5 on card CJ(EC396).			
	6	INT +	2 msec/D	2 V/D	CN-1				Type 1 - Stop inserter should have time-out of 2.9 msec ±0.1 msec.	Adjust resistor R11 on card CN(EC365).			
7	4	INT +	100 usec/D	2 V/D	CN-1				Type 2 - Time-out 950 msec ±100 msec.				

TABLE C

DATASPEED Tape Sender-Complete Failure

Symptom	Step	Action	Normal Indication and Procedure	Abnormal Indication and Procedure	
Power failure	1	Check power lamp (yellow) on control panel.	Should be on. Proceed to 2.	Proceed to Step 2 or check modular power supply. Should be on. Check -28 volt dc supply.	
	2	Check if reader and winder motor will operate when their respective switches are closed.	If motor operates, proceed to 3.	Proceed to 3. Check reset button on motor.	
	3	With receiver off hook, place data set in data mode.	DATA lamp should light. Proceed to Step 9.	Check line fuses in cabinet. Proceed to 4. Check fuses in data set 202A.	
	4	If Steps 1, 2, and 3 fail, check the following: Check for loose power connections.	All plugs should be in place. Proceed to Step 5.	Place plugs in proper receptacles and recheck Steps 1 through 3.	
	5	With power removed, check loose or broken wires and possible short circuits using VOM. Refer to drawing.	If these check out, proceed to Step 6.	Correct and recheck Steps 1 through 3.	
	6	Visual check of modular power supply. Check all dc voltages by operating voltage selector switch located on the power supply. Read the respective voltages on meter.	If all voltages are present, proceed to Step 7.	Zero indication signifies blown fuses. If -6R volt fuse is blown, this may indicate -8 volts on meter. Replace blown fuses and recheck.	
Reader or line break failure (when provided)	7	Place tape in the reader. Place AUTO-MANUAL switch on MANUAL. Place start-stop lever in RUN position. Depress READER, button. Operate toggle switch located on automatic answer package in TEST position.	Tape reader should operate and sense tape. Proceed to Step 8.	Indicates no direct current to operating magnet. Check operating magnet circuit and associated relays and contacts. Also inspect for possible mechanical failure or maladjustment of tape reader.	
Check of line break signal (when provided)	8	Call Data Test Center. With test tape in reader, depress READER and DATA buttons. Wait a moment and place start-stop lever in RUN. Request test center to call back.	When test center comes back on line and is in data mode, reader should start automatically. Place reader lever in STOP. Alarm should go off. Upon disconnect from test center, LINE BREAK alarm and indicator lamp should go on and stop reader.	Check data set line break signal using VOM or signal monitor. Disconnect input to data set, ground test instrument on terminal 1 and place probe on line break output. Place call to test center and request test center data set to be in data mode. Line break output voltage should be +8±1 volt for ON, -8±1 volt for OFF, or break condition. If normal, recheck with load applied (data set connector plugged in) and test instrument connected to signal ground or power supply and probe on test point 6 of automatic answer circuit card. Reading should be same as above.	

TABLE C (Continued)

DATASPEED Tape Sender-Complete Failure

Sympton	Step	Action	Normal Indication and Procedure	Abnormal Indication and Procedure	
Failure of motors to start when in automatic condition. Note: Omit Steps 3 and 4 if unattended answering is not included in DATASPEED equipment.	9	Place MANUAL-AUTOMATIC switch in AUTOMATIC. Place OPERATE-TEST switch in TEST.	Motors should start. Proceed to Step 11.	Visual A. Check motor start relay K to see if it is operating. B. Substitute circuit card and recheck Step 8. C. Check wiring and relay. D. Check dc supply voltage.	
	10	Check relay driver amplifier. Disconnect interface on data set. VOM or scope can be used. 1. Voltmeter - Connect positive lead to A8 and negative lead to B4 of connector from power module. 2. Test point signal monitor - connect as above. Set SYNC for INT +. Set selector switch to position 8: H to 2 msec per division (msec/D). V to 2 volts per division (V/D).	Should read -28 volts dc when test switch is in OPERATE, 0 volt when in TEST. Should see - 28 to 0 volt transition as switch is moved from OPERATE to TEST.		
	11	Check of automatic motor start in conjunction with data set 202A. 1. MANUAL - AUTOMATIC switch in AUTOMATIC. 2. Data set in AUTO. 3. TEST - OPERATE in OPERATE and data set interface connected.	Motor should start.	Proceed to Step 12.	
	12	Disconnect data set interface and using VOM or scope check interlock output of pin 6 of data set connector. Ground test equipment to pin 1. Using a nearby telephone, call data line number in the normal manner. Answer call and press DATA button. Note output. If scope is used, place controls on INT +, selector switch to Pos. 8: H - 2 msec/D, V - 10V/D.	$+8 \pm 1$ volts for ON. 0 ± 1 volt for OFF. When switching from TALK to DATA, a 0 to 8 ± 1 volt transition should occur.	Check data set and if in trouble, replace.	

TABLE D

DATASPEED Tape Sender 1-No Signal Output

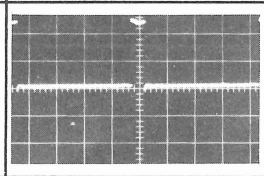
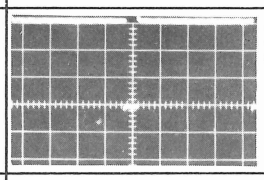
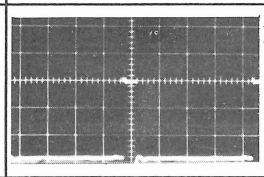
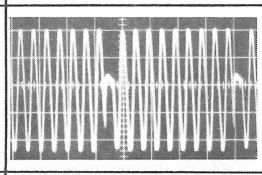
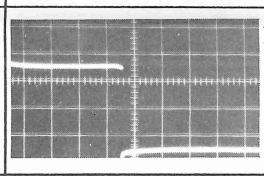
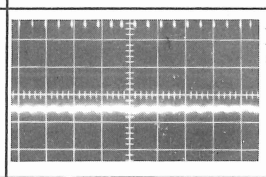
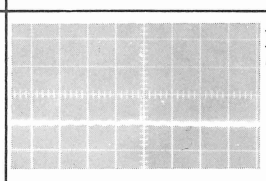
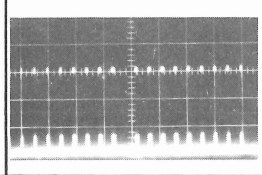
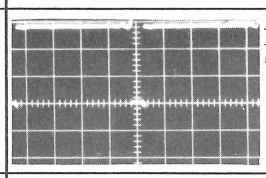
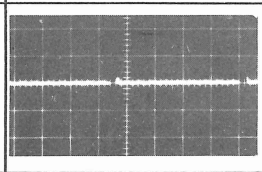
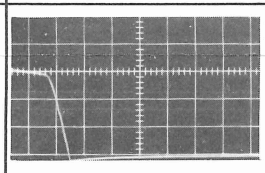
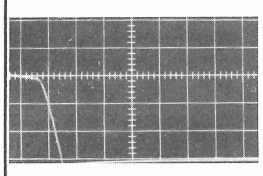
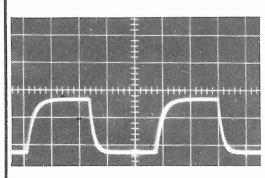
Symptom	Step	Action	Normal Indication and Procedure	Abnormal Indication and Procedure	Scope Displays and Settings
Data set 202A failure	1	With handset off hook, depress DATA button.	DATA lamp should light and stay lighted. Proceed to Step 2.	Check fuse in data set 202A. Replace if necessary and recheck. Proceed to Step 2.	
	2	Using a nearby telephone, call data line number in the normal manner. Answer call and press DATA button.	A mark tone of 1200 cps should be heard in receiver of calling telephone. Proceed to Step 3.	Check or replace data set, if necessary, following test instructions in Section 592-013-500.	
Data set operating. No modulated signal.	3	Check power supply voltages.	All voltages should read nominal voltage ±10 percent. Proceed to Step 4.	Replace any blown fuses and recheck. Readjust voltage levels per requirements.	
Electronic failure	4	With reader sending all marks, check signal converter output lead on test point CM6.	See scope display. If correct, check wiring to data set.	Proceed to Step 5.	 Pos-6 TP-CM6 H-2msec/D V-5V/D T-EXT + BM3
	5	With reader sending all marks, check distributor output at test point CN2.	See scope display. If correct, proceed to Step 6.	Proceed to Step 7.	 Pos-6 TP-CN2 H-2msec/D V-2V/D T-EXT + BM3
	6	Check signal converter test point CN3.	See scope display. If correct, replace Z212, card CM and recheck Step 5.	If incorrect, replace Z211, card CN and recheck. Inspect wiring between distributor and signal converter.	 Pos-6 TP-CN3 H-2msec/D V-2V/D T-EXT + BM3
	7	Check start-stop oscillator in distributor at test point BQ2.	If scope display is correct, proceed to Step 8.	Proceed to Step 12.	 Pos-7 TP-BQ2 H-2msec/D V-2V/D T-EXT + BM3
	8	Check sample delay in distributor at test point BF1.	If scope display is correct, proceed to Step 9.	If incorrect, replace Z105, card BF. Recheck Step 7.	 Pos-4 TP-BF1 H-100usec/D V-2V/D T-INT +
	9	Check squaring amplifier in distributor at test point BN2.	If scope display is correct, proceed to Step 10.	If incorrect, replace Z109, card BN and recheck Step 8.	 Pos-6 TP-BN2 H-2msec/D V-2V/D T-EXT + BE3
	10	Check inhibit gate in distributor at test points BG3 and BG4.	If scope display is correct, proceed to Step 11.	If incorrect, replace Z106, card BG and recheck Step 9.	 Pos-2 TP-BG3 H-2msec/D V-2V/D T-INT +  Pos-6 TP-BG4 H-2msec/D V-2V/D T-EXT + BG3
	11	Check register elements in distributor at test points CF2, CG2, CH2, CJ2, and CK2.	If scope display is correct, proceed to Step 13.	If incorrect, replace defected card(s).	 Pos-6 TP-CF2-CK2 H-2msec/D V-2V/D T-EXT + BF1
	12	Check oscillator control in distributor at test point BM3.	If scope display is correct, replace Z108, card BQ and readjust.	Proceed to Step 13.	 Pos-6 TP-BM3 H-2msec/D V-2V/D T-EXT + BD1
	13	Check the following in sequence: Inh. gate in distributor at test points BH4 and BH5. Terminal D on card BH.	If scope display at BH4 is correct, replace Z104, card BM and recheck Step 12.	If BH5 is normal and input on terminal D is abnormal, proceed to Step 18. If both are normal, replace Z103, card BH and recheck. If both are present, the trouble may be a timing problem. If signal is present on terminal D and not on BH5, proceed to Step 14.	 Pos-2 TP-BH4 H-2usec/D V-2V/D T-EXT + BE3  Pos-2 TP-BH5 H-2usec/D V-2V/D T-EXT + BE3  Pos-8 TP-BHD H-2msec/D V-5V/D T-EXT + BR2

TABLE D (Continued)

DATASPEED Tape Sender 1-No Signal Output

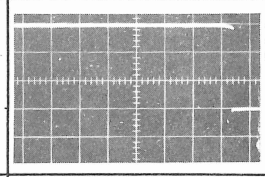
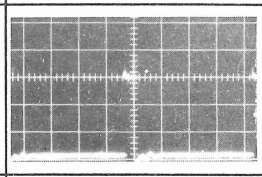
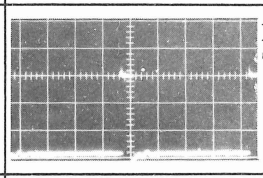
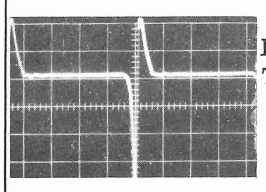
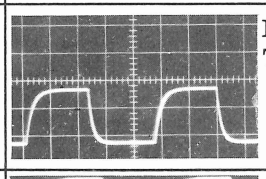
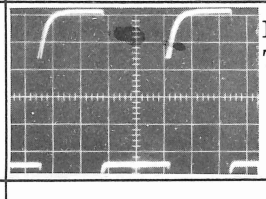
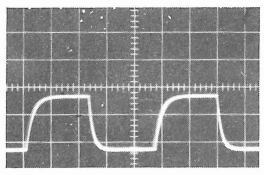
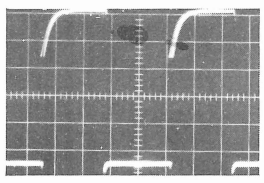
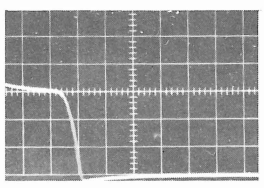
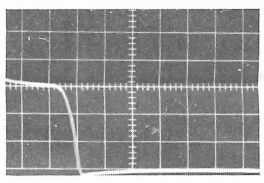
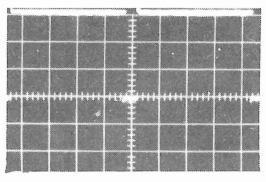
Sympton	Step	Action	Normal Indication and Procedure	Abnormal Indication and Procedure	Scope Displays and Settings
Electronic failure (continued)	14	Check stop timer in distributor at test point BD1.	If scope display is correct, replace Z102, card BE in distributor.	Proceed to Step 15.	 Pos-4 TP-BD1 H-100usec/D V-2V/D T-EXT + BD1
	15	Check signal delay in distributor at test point BB3.	If scope display is correct, replace Z101, card BD in distributor, and adjust.	Proceed to Step 16.	 Pos-6 TP-BB3 H-2msec/D V-2V/D T-INT +
	16	Check pickup amplifier in converter at test point CPJ.	If scope display is correct, replace Z121, card BB in distributor.	Proceed to Step 17.	 Pos-6 TP-CPJ H-2msec/D V-2V/D T-INT +
	17	Check pickup in converter at test point CPA.	If scope display is correct, replace Z209, card CP in converter and recheck Step 16. Check wiring with power off, check dc resistance between -6 volts and terminal A. Should be 800 to 900 ohms.	Proceed to Step 18.	 Pos-8 TP-CPA H-2msec/D V-5V/D T-INT -
	18	Check universal contact in converter at test point CR4.	If scope display is correct, check wiring between distributor and converter.	Proceed to Step 19.	 Pos-8 TP-CR4 H-2msec/D V-10V/D T-EXT + BR2
	19	Check universal contacts in converter at test point CRE.		If abnormal signal, check and adjust contacts. If no signal, check wiring to tape reader.	 Pos-8 TP-CRE H-2msec/D V-5V/D T-EXT + BR2

TABLE E

DATASPEED Tape Sender-Level Failure

Symptom	Step	Action	Normal Indication and Procedure	Abnormal Indication and Procedure	Scope Displays and Settings
Reader contact failure *	1	With reader sending all marks, check integrators in converter test points CQ1 to 5 or CR1 to 3, whichever level is failing. CQ1 to CQ5 are levels 0 to 4, CR1 to CR3 are levels 5 to 7.	If scope display is correct, proceed to Step 3.	If incorrect, proceed to Step 2.	 Pos-8 TP-CQ1-5, CR1-3 H-2msec/D V-5V/D T-EXT + BR2
	2	Interchange Z201, card CQ and Z202, card CR. Recheck	If level failure moves to corresponding level of interchanged card, replace that card and recheck Steps 1 and 2.	If trouble is same level, check input terminal to respective cards. See scope display. Make mechanical adjustments to reader if necessary. If there is no signal input, visually check reader contact sensing pins, etc., and wiring from tape reader to converter.	 Pos-8 TP-CQA-E, CRB-D H-2msec/D V-5V/D T-EXT + BR2
Electronic circuit failure *	3	With reader sending all marks, check respective card in which level failure occurs. Test Points Level Z203 BR3, 4 Q, 1 Z204 BQ3, 4 2, 3 Z205 BP3, 4 4, 5 Z206 BN3, 4 6, 7	See scope display. If correct, proceed to Step 4.	Interchange card that is failing with working card and recheck. Replace defective card	 Pos-2 TP-† H-2usec/D V-2V/D T-INT + † Test points are shown in action column.
		Check output of respective level or levels that are failing in converter. Test Point Level BS1 0 BS2 1 BS4 2 BS3 3 BM1 4 BM2 5 BM4 6 BM3 7	See scope display. Proceed to Step 5.	Interchange cards Z207 and Z208 and recheck. Replace defective card.	 Pos-2 TP-† H-2usec/D V-2V/D T-INT + † Test points are shown in action column
	5	In distributor, interchange register card of level that is failing with working card. Check distributor output test point CN2.	If level failure moves to corresponding level of interchanged card, replace that card and recheck Step 4.	See scope display. If same level fails, check wiring between distributor and converter. Check for loose connections in modules. If interchanged level fails, replace defective card.	 Pos-6 TP-CN2 H-2msec/D V-2V/D T-EXT + BF1

* Testing instructions cover full 8-level operation. Cards for levels 6 and 7 will be omitted on 5-level operation.

TABLE F

DATASPEED Tape Sender 1-Garbled Message

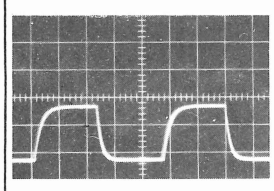
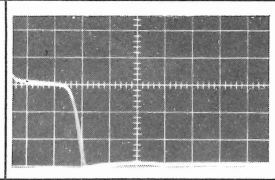
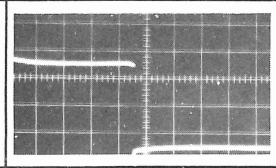
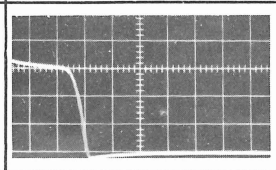
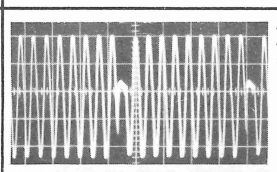
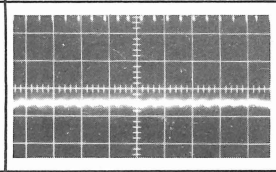
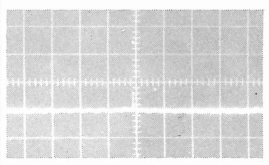
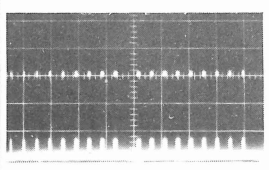
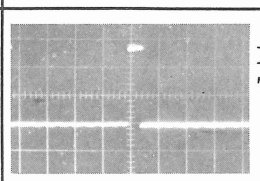
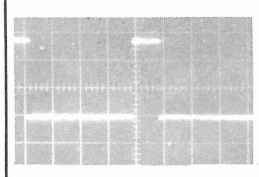
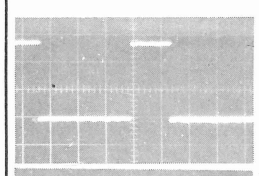
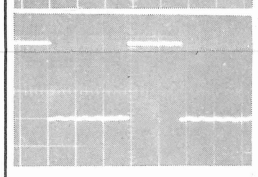
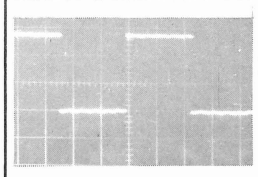
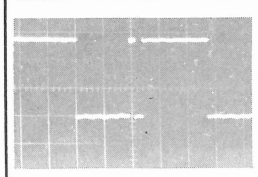
Symptom	Step	Action	Normal Indication and Procedure	Abnormal Indication and Procedure	Scope Displays and Settings
Tape reader failure	1	With start-stop lever in RUN, check tape reader operating magnet and tape feed mechanism for proper operation.	If correct, proceed to Step 2.	Check reader operating magnet circuit, tape out contacts, tight tape contact, and wiring. If necessary, readjust.	
	2	Check all reader mark contacts at converter. Test Points Levels CR1 to CR3 5 to 7 CQ1 to CQ5 0 to 4 CR4 is universal contact.	See scope display. If correct, proceed to Step 3.	If incorrect, check respective circuit card input Z201, card CQ and Z202, card CR. Check wiring. Check reader contacts for dirt, oil, etc., and if necessary readjust contacts.	 Pos-8 TP-* H-2msec/D V-5V/D T-EXT + BR2 * Test points are shown in action column.
Electronic circuit failure	3	Check sample lead in distributor at test point BH2.	See scope display. If correct, proceed to Step 6.	If incorrect, proceed to Step 4.	 Pos-2 TP-BH2 H-2usec/D V-2V/D T-INT +
	4	Check sample delay in distributor at test point BF1.	See scope display. If correct, proceed to Step 5.	If incorrect, replace Z105, card BF in distributor, adjust and recheck Step 3.	 Pos-4 TP-BF1 H-100usec/D V-2V/D T-INT +
	5	Check "SET 1" amplifier in distributor at test point BE4.	See scope display. If correct, proceed to Step 6.	If incorrect, replace Z102, card BE and recheck Step 4.	 Pos-2 TP-BE4 H-2usec/D V-2V/D T-INT +
	6	Check start-stop oscillator in distributor at test point BQ2.	See scope display. If correct, proceed to Step 7.	If incorrect, replace Z108, card BQ and make adjustments if necessary.	 Pos-7 TP-BQ2 H-2msec/D V-2V/D T-EXT + BM3
	7	Check squaring amplifier in distributor at test point BN2.	See scope display. If correct, proceed to Step 8.	If incorrect, replace Z109, card BN and recheck.	 Pos-6 TP-BN2 H-2msec/D V-2V/D T-EXT + BE3
	8	Check inhibit gate in distributor at test points BG3 and BG4.	See scope displays. If correct, proceed to Step 9.	If incorrect, replace Z106, card BG and recheck.	 Pos-6 TP-BG3 H-2msec/D V-2V/D T-INT +  Pos-6 TP-BG-4 H-2msec/D V-2V/D T-EXT + BG3
	9	Check intermittent operation of signal register cards with reader sending all spaces (blanks). With scope trigger on EXT+ at test point BF1, test cards CF2 to CL2.	See scope display.	Replace defective card and recheck.	 Pos-6 TP-CF2 H-2msec/D:V-2V/D T-EXT + BF1  Pos-6 TP-CG2 H-2msec/D:V-2V/D T-EXT + BF1  Pos-6 TP-CH2 H-2msec/D:V-2V/D T-EXT + BF1  Pos-6 TP-CJ2 H-2msec/D:V-2V/D T-EXT + BF1  Pos-6 TP-CK2 H-2msec/D:V-2V/D T-EXT + BF1  Pos-6 TP-CL2 H-2msec/D:V-1V/D T-EXT + BF1

TABLE G

DATASPEED Tape Receiver 1 - Complete Failure

Symptom	Step	Action	Normal Indication and Procedure	Abnormal Indication and Procedure	
Power failure	1	Check POWER lamp on control panel (yellow).	Should be on. Proceed to 2.	Proceed to Step 2 or check modular power supply. Should be on. Check -28 volt dc supply.	
	2	Check whether reperforator or winder motors will operate.	Proceed to Step 3.	Proceed to Step 3. Check reset button on motor.	
	3	With receiver off hook, place data set in data mode.	DATA lamp should light.	Check line fuse in cabinet. Replace if necessary with fuse rated the same. Proceed to Step 4. Check fuse in data set 202A.	
	4	If Steps 1, 2, and 3 fail, check the following: Check for loose power connections.	All plugs should be in place. Proceed to Step 5.	Place plugs in proper receptacles and recheck per Steps 1 through 3.	
	5	With power removed, check for loose or broken wires and possible short circuits using VOM. Refer to drawing.	Proceed to Step 6.	Correct and recheck per Steps 1 through 3.	
	6	Check power input to cabinet.	117-volt 60-cycle ac power should be supplied to the cabinet. The data set, modular power supply and motors should operate when their respective switches are closed. Proceed to Step 7.	If power is not available, refer this to the customer.	
	7	Visual check of modular power supply. Check all voltages by switching voltage indicator located on the power supply and reading respective voltage on the meter.	Proceed to Step 8.	Zero reading indicates blown fuses. If -6 volt fuse is blown, this may indicate -8 volt on the meter. Replace blown fuses and proceed to Step 8.	
Reperforator and winder motors do not start when in automatic answer (when provided).	8	Visual check of motor start relay on automatic answer kit. Place call to terminal using nearby telephone. Answer call and depress DATA button.	When DATA button is depressed, the motor start relay should operate. With power off, check wiring for loose connection to motors.	Indicate circuit card or data set failure. Check supply voltages. Proceed to Step 9.	
	9	Replace circuit card on automatic answer kit and repeat Step 8.	Trouble has been found.	Proceed to Step 10.	
	10	Disconnect interface on data set. Using VOM, ground instrument (1) on pin 1 of data set receptacle and place other probe on pin 6. Repeat Step 8.	VOM should read +8±1 volts when DATA button is depressed. 1. Check wiring from data set to automatic answer kit. 2. Check wiring to automatic answer kit.	Data set failure. Replace data set 202A.	

TABLE H

DATASPEED Tape Receiver-Not Punching Tape

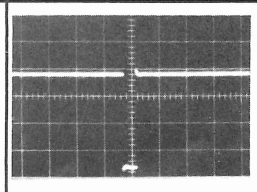
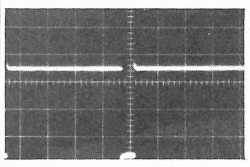
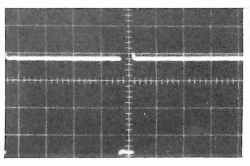
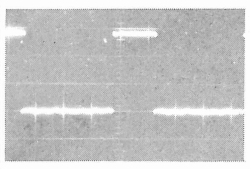
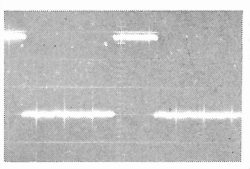
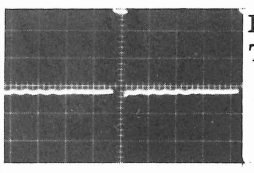
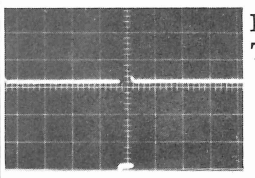
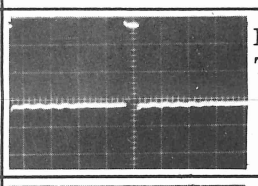
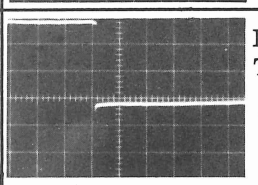
Symptom	Step	Action	Normal Indication and Procedure	Abnormal Indication and Procedure	Scope Displays and Settings
Data set 202A failure or electronic failure	1	Reperforator motor on. Depress LTRS FO button.	Reperforator should feed out letters tape. Proceed to Step 2.	Proceed to Step 13.	
	2	Place test switch located in TRD module in TEST position.	Reperforator should feed out blank tape. Check the following in sequence: 1. Check data set and replace if necessary. 2. Check wiring for loose connection between data set and signal converter.	Proceed to Step 3.	
Electronic failure	3	To check electronics use test point signal monitor or general purpose oscilloscope. Place test switch in OPERATE position. Place call to test center to obtain test all-marking signal. In signal converter check test point CF2.	If scope display is correct, this wave form represents an all-marking signal. Proceed to Step 4.	Replace card Z401 and recheck. Check terminal CFB. Check wiring between data set and signal converter.	 Pos-6 TP-CF2 H-2msec/D V-2V/D T-INT -
	4	Check signal gate test point CP1 in distributor.	If scope display is correct, proceed to Step 19. Subsequent test can be made with TEST-OPERATE switch (in distributor module) in Test position for off-line electronic check receiving blanks.	Check terminal CPC of card Z301. Also check BS2. If displays are correct, replace Z301 and recheck. If signal on CPC is abnormal, check wiring between distributor and converter with power OFF. If signal on BS2 is abnormal, replace Z324 and recheck. If still abnormal, proceed to Step 5.	 Pos-6 TP-CP1 H-2msec/D V-2V/D T-INT -  Pos-6 TP-CPC H-2msec/D V-2V/D T-INT - TYPE 1  Pos-6 TP-BS2 H-2msec/D V-2V/D T-INT + TYPE 2  Pos-6 TP-BS2 H-100usec/D V-2V/D T-INT +
	5	Test can be made off-line with distributor switch in TEST position. Check register drive emitter follower test point CL5 in distributor.	See scope display. This represents signal when blanks are being regenerated. Note: Scope display shown is for TYPE 2. TYPE 1 display is similar, except stop time is 2 bits longer.	If incorrect, replace Z302, card CL, and recheck.	 Pos-6 TP-CL5 H-2msec/D V-2V/D T-INT +
	6	In distributor, check register drive, test point BR3.	See scope display. If correct, proceed to Step 7. Note: Scope display shown is for TYPE 2. TYPE 1 display is similar except stop time is 2 bits longer.	If incorrect, replace Z303, card BR, and recheck.	 Pos-6 TP-BR3 H-2msec/D V-2V/D T-INT -
	7	In distributor, check register drive, test point BR4.	See scope display. If correct, proceed to Step 8.	If incorrect, replace Z303 card BR and recheck.	 Pos-6 TP-BR4 H-2msec/D V-2V/D T-INT -
	8	In distributor, check start delay, test point CM1.	See scope display. If correct, proceed to Step 11. Note: This is an adjustment.	If incorrect, proceed to Step 9.	 Pos-4 TP-CM1 H-100usec/D V-2V/D T-EXT + BR3

TABLE H (Continued)

DATASPEED Tape Receiver-Not Punching Tape

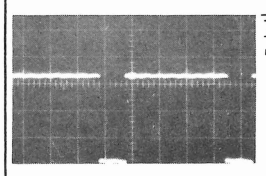
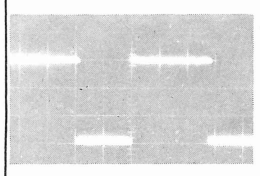
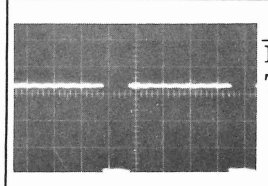
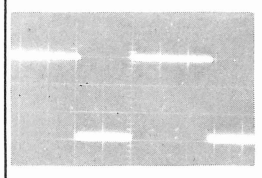
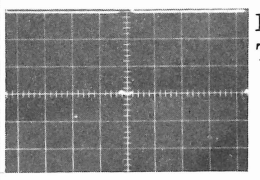
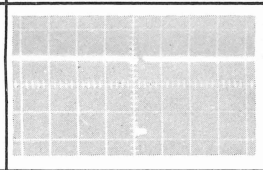
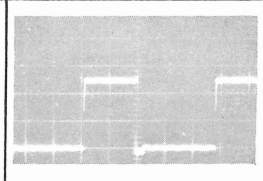
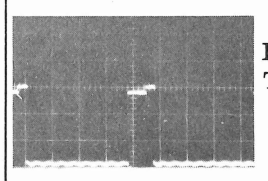
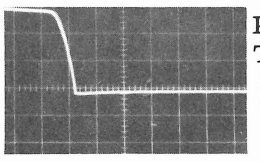
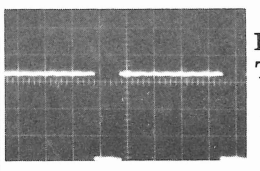
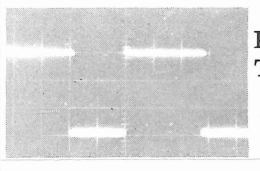
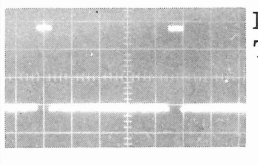
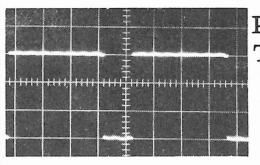
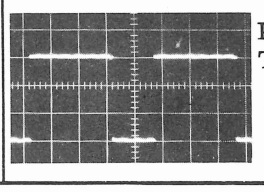
Symptom	Step	Action	Normal Indication and Procedure	Abnormal Indication and Procedure	Scope Displays and Settings
Electronic failure continued	9	Check terminal CMJ in distributor.	See scope display. If correct, replace Z305, card CM adjust and recheck.	If incorrect, proceed to Step 10.	 TYPE 1 Pos-6 TP-CMJ H-2msec/D V-2V/D T-EXT + BR3  TYPE 2 Pos-6 TP-CMJ H-2msec/D V-2V/D T-EXT + BR3
	10	Check control register in distributor, test point BG3.	See scope display. If correct, check wiring.	Replace Z310, card BG and recheck.	 TYPE 1 Pos-6 TP-BG3 H-2msec/D V-2V/D T-EXT + BR3  TYPE 2 Pos-6 TP-BG3 H-2msec/D V-2V/D T-EXT + BR3
	11	Check signal delay in distributor at test point CJ3.	See scope display. If correct, proceed to Step 12.	If incorrect, replace Z304, card CJ. Note: Control register primes START AND gate so that start pulse goes to "set 1" control register which subsequently starts the oscillator.	 Pos-6 TP-CJ3 H-2msec/D V-2V/D T-EXT + BR3
	12	Check START OR gate in distributor at test point CP4.	See scope display. If correct, proceed to Step 13.	Replace Z301, card CP and recheck.	 Pos-6 TP-CP4 H-2msec/D V-2V/D T-EXT + BR3
	13	Check START AND gate in distributor at test point CP2.	See scope display. If correct, proceed to Step 4. Note: Stop time 2 bits longer for TYPE 1.	Replace Z301, card CP and recheck.	 TYPE 1 Pos-6 TP-CP2 H-2msec/D V-2V/D T-EXT + BR3  TYPE 2 Pos-6 TP-CP2 H-2msec/D V-2V/D T-EXT + BR3
Electronic failure of control register or start-stop oscillator	14	Check start pulse amplifier in distributor at test point CL3.	See scope display. If correct, proceed to Step 15.	Replace Z302, card CL and recheck.	 Pos-2 TP-CL3 H-2usec/D V-2V/D T-INT +
	15	Check control register in distributor at test points BG2 and BG3.	See scope display, BG2 is inverse of BG3. If correct, proceed to Step 16.	Replace Z310, card BG and recheck.	 TYPE 1 Pos-6 TP-BG2 or BG3 H-2msec/D V-2V/D T-EXT + BR3  TYPE 2 Pos-6 TP-BG2 or BG3 H-2msec/D V-2V/D T-EXT + BR3
	16	With module OPERATE-TEST switch in TEST position, check signal register. For type 2 units, begin check at element BQ2. For type 1 units, begin check at element BN2. Waveforms should correspond as signal is shifted down register.	See scope display. If correct, proceed to Step 17.	Check all register cards. Note: Only 3 waveforms are shown. Remainder should be similar except for increasing space time. Waveforms applicable for Type 1 and Type 2 equipment.	 Pos-6 TP-BM2 H-2msec/D V-2V/D T-EXT + CM1  Pos-6 TP-BP2 or BM2 H-2msec/D V-2V/D T-EXT + CM1  Pos-6 TP-BN2 or BL2 H-2msec/D V-2V/D T-EXT + CM1

TABLE H (Continued)

DATASPEED Tape Receiver-Not Punching Tape

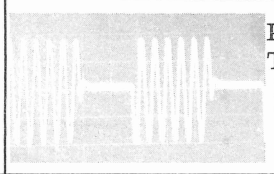
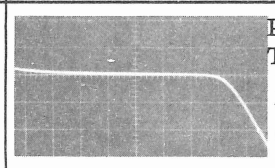
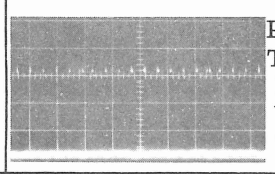
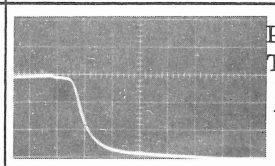
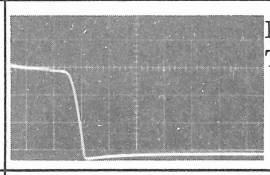
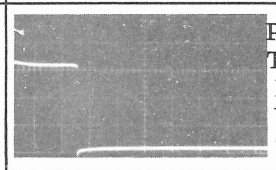
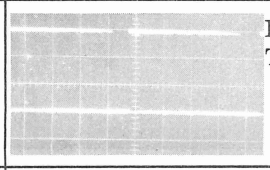
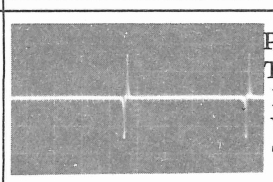
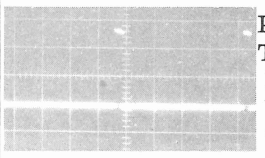
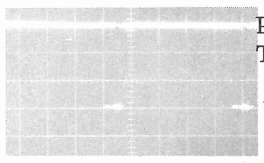
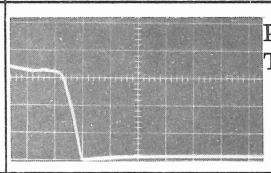
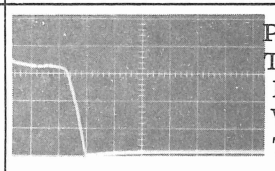
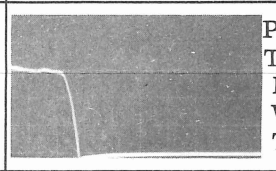
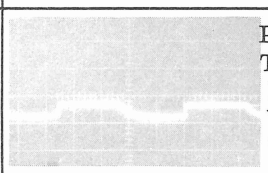
Symptom	Step	Action	Normal Indication and Procedure	Abnormal Indication and Procedure	Scope Displays and Setting
Electronic failure of control register or start-stop oscillator continued	17	Check start-stop oscillator in distributor at test point CH2.	See scope display. If correct, proceed to Step 18.	Replace Z311, card CH and recheck.	 Pos-7 TP-CH2 H-2msec/D V-2V/D T-EXT + CL2
	18	Check squaring amplifier in distributor at test point CF2.	See scope display. If correct, proceed to Step 19.	Replace Z312, card CF and recheck.	 Pos-2 TP-CF2 H-2usec/D V-2V/D T-EXT + CF2  Pos-5 TP-CF2 H-2msec/D V-2V/D T-EXT + CF2
Failure of "set 1" delay or transfer prime circuit	19	Check "set 1" delay emitter follower in distributor at test point BC5.	See scope display. If correct, proceed to Step 22.	If incorrect, proceed to Step 20.	 Pos-2 TP-BC5 H-2usec/D V-2V/D T-EXT + BD4
	20	Check "set 1" delay pulse amplifier in distributor at test point BD4.	See scope display. If correct, replace Z309, card BC.	If incorrect, proceed to Step 21.	 Pos-2 TP-BD4 H-2usec/D V-2V/D T-EXT + BD4
	21	Check "set 1" delay in distributor at test point BE1.	See scope display. If correct, replace Z308, card BD. Time-out not less than 200msec.	If incorrect, replace Z306, card BE and recheck. Proceed to Step 22.	 Pos-4 TP-BE1 H-100usec/D V-2V/D T-INT +
	22	With reperforator motor on, check transfer prime in converter at test point BJ3.	See scope display. If correct, proceed to Step 23. Positive transition moves across scope.	Replace Z403, card BJ and recheck. Check wiring between distributor and converter using VOM.	 Pos-6 TP-BJ3 H-2msec/D V-2V/D T-EXT + BGC
Failure of transfer circuitry	23	With reperforator motor on, check pick-up signal terminal of converter at CDA.	See scope display. If correct, proceed to Step 24.	Remove power and, using VOM, check continuity between -6 volts and terminal A. Should be between 800 to 900 ohms. This is reading the magnetic pickup coil.	 Pos-8 TP-CDA H-2msec/D V-10V/D T-INT -
	24	With reperforator motor on, check terminal CDJ in converter.	See scope display. If correct, proceed to Step 25.	Replace Z404, card CD and recheck.	 Pos-6 TP-CDJ H-2msec/D V-2V/D T-INT +
	25	Check variable pulse delay in converter at test point BG2.	See scope display. If correct, proceed to Step 26. Positive transition moves from right to left across scope.	Replace Z406, card BG and recheck.	 Pos-6 TP-BG2 H-2msec/D V-2V/D T-INT -
	26	Check transfer in converter at test point BF3.	See scope display. If correct, proceed to Step 27.	Replace Z408, card BF and recheck.	 Pos-2 TP-BF3 H-2usec/D V-2V/D T-INT +
	27	Check inhibit gate in converter at test point CG4.	See scope display. If correct, proceed to Step 28.	Replace Z402, card CG and recheck.	 Pos-2 TP-CG4 H-2usec/D V-2V/D T-EXT + BF3
	28	Check transfer in converter at test point CH2.	See scope display. If correct, proceed to Step 29.	Replace Z409, card CH and recheck.	 Pos-2 TP-CH2 H-2usec/D V-2V/D T-EXT + BF3
	29	In converter check magnet pulser output terminal CJ4.	See scope display.	If incorrect, check other magnet pulser cards CK, CL etc. With power off, check wiring between converter and reperforator. Check for the -28 volt dc supply to the magnets.	 Pos-8 TP-CJ4 H-2msec/D V-2V/D T-EXT + BF3

TABLE J

DATASPEED Tape Receiver-Garbled Message

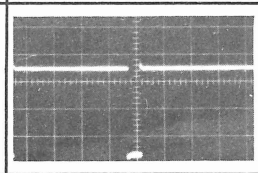
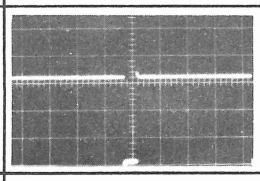
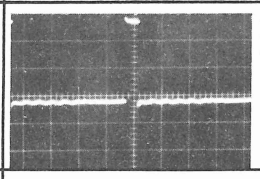
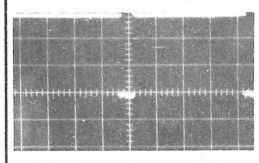
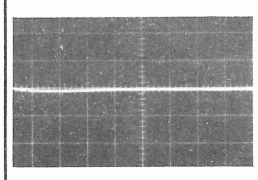
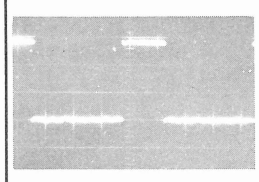
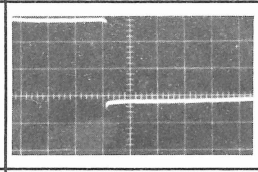
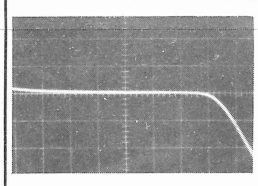
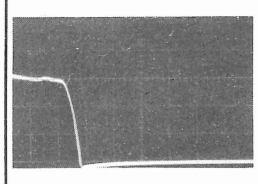
Symptom	Step	Action	Normal Indication and Procedure	Abnormal Indication and Procedure	Scope Displays and Setting
Punch or transfer circuitry failure	1	Check tape reperforator, with motors running, depress LTRS FO button.	Punched tape should contain all marks. This will indicate that the reperforator and transfer circuitry are operating. Proceed to Step 2.	Check for loose connections between reperforator and converter. Check output of power module. Proceed to Step 7.	
Receiving distributor or data set failure	2	Check receiving electronics by placing TEST switch located in cabinet to test position.	Reperforator should feed out blank tape with TEST switch in test position. This will indicate that distributor signal register and shift circuitry are working. Trouble may be in signal from data set or intermittent circuit failure.	Proceed to Step 3.	
	3	Check input signal to converter at test point CF2 with TEST switch in test position.	Under test condition a steady -6 volt signal will be present (space or open line condition). With switch in NORMAL position, reading will be 0 volt. Check data set per Section 592-013-500. If operating properly, proceed to Step 4.	Replace Z401, card CF and recheck.	
	4	Check signal gate in distributor at test point CP1.	Note: Wave form shown indicates receiving all marks.	Replace Z301, card CP	 Pos-6 TP-CP1 H-2msec/D V-2V/D T-EXT + CN1
	5	Check signal gate emitter follower in distributor at test point CL5.	See scope display. If correct, proceed to Step 6.	Replace Z302, card CL and recheck.	 Pos-6 TP-CL5 H-2msec/D V-2V/D T-EXT + CN1
	6	Check register drive in distributor at test point BR3.	See scope display. If correct, proceed to Step 7.	Replace Z303, card BR and recheck.	 Pos-6 TP-BR3 H-2msec/D V-2V/D T-EXT + CN1
	7	Check register drive in distributor at test point BR4.	See scope display. If correct, proceed to Step 8.	Replace Z303, card BR and recheck.	 Pos-6 TP-BR4 H-2msec/D V-2V/D T-EXT + CN1
	8	Check stop inserter in distributor at test point CN1.	See scope display. If correct, proceed to Step 9.	Replace Z321, card CN and recheck.	 TYPE 1 Pos-4 TP-CN1 H-100usec/D V-2V/D T-EXT + CN1  TYPE 2 Pos-6 TP-CN1 H-2msec/D V-2V/D T-EXT + CN1
	9	Check start delay timeout. Should be half a bit (475 usec) in distributor at test point CM1.	See scope display. If correct, proceed to Step 10.	Readjust or replace Z305, card CM and recheck.	 Pos-6 TP-CM1 H-2msec/D V-2V/D T-EXT + BR3
	10	Check start-stop oscillator frequency by checking output of squaring amplifier in distributor at test point CH2, trigger scope on INT + .	Pulse should be 952 ± 7 usec. Proceed to Step 11.	Readjust or replace Z311, card CH and recheck.	 TYPE 1 Pos-4 TP-CH2 H-100usec/D V-2V/D T-EXT + CF2  TYPE 2 Pos-4 TP-CH2 H-100 usec/D V-2V/D T-EXT + CF2

TABLE J (Continued)

DATASPEED Tape Receiver 1-Garbled Message

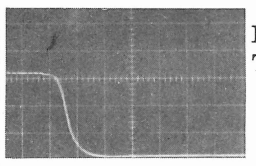
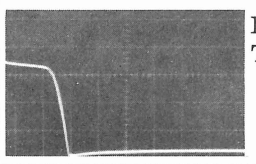
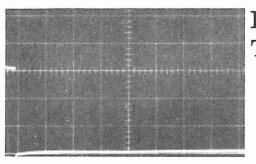
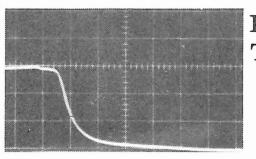
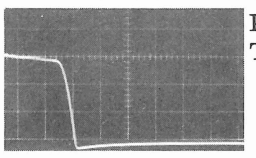
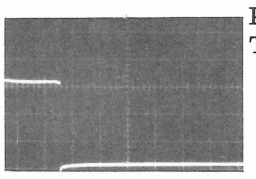
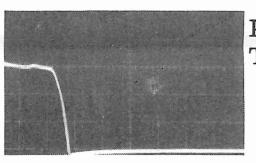
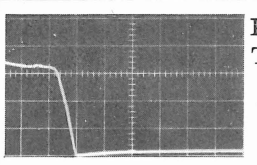
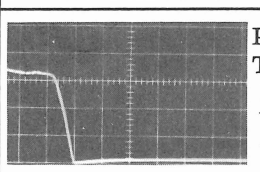
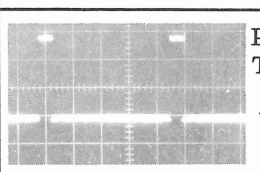
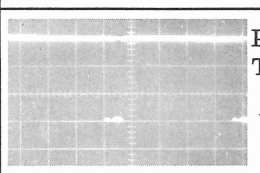
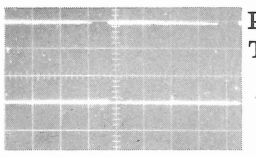
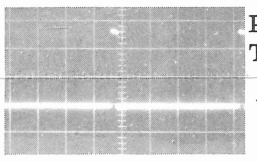
Symptom	Step	Action	Normal Indication and Procedure	Abnormal Indication and Procedure	Scope Displays and Setting
Intermittent or weak shift of transfer prime pulses	11	In distributor check shift delay emitter-follower at test point BC2.	See scope display. If correct, proceed to Step 14.	If incorrect, proceed to Step 12.	 Pos-2 TP-BC2 H-2usec/D V-2V/D T-INT +
	12	Check shift delay pulse amplifier in distributor at test point BD3.	See scope display. If correct, replace Z309, card BC and recheck Step 11.	If incorrect, proceed to Step 13.	 Pos-2 TP-BD3 H-2usec/D V-2V/D T-INT +
	13	Check shift delay in distributor at test point BF1.	See scope display. If correct, replace Z308, card BD and recheck Step 12. Note: Time-out not less than 50 usec.	If incorrect, replace Z307, card BF and recheck. Proceed to Step 14.	 Pos-4 TP-BF1 H-100usec/D V-2V/D T-INT +
	14	Check "set 1" delay emitter follower in distributor at test point BC5.	See scope display. If correct, proceed to Step 17.	If incorrect, proceed to Step 15.	 Pos-2 TP-BC5 H-2usec/D V-2V/D T-INT +
	15	Check "set 1" delay pulse amplifier in distributor at test point BD4.	See scope display. If correct, replace Z309, card BC and recheck Step 14.	If incorrect, proceed to Step 16.	 Pos-2 TP-BD4 H-2usec/D V-2V/D T-INT +
	16	Check "set 1" delay in distributor at test point BE1.	See scope display. If correct, replace Z308, card BD and recheck Step 15. Note: Time-out not less than 200 usec.	If incorrect, replace Z306, card BE and recheck.	 Pos-4 TP-BE1 H-100usec/D V-2V/D T-INT +
Transfer circuitry	17	In converter check transfer emitter follower at test point CH2.	See scope display. If correct, omit Steps 18 through 23.	If incorrect, proceed to Step 18.	 Pos-2 TP-CH2 H-2usec/D V-2V/D T-INT +
	18	Check inhibit gate in converter at test point CG4.	See scope display. If correct, replace Z409, card CH and recheck Step 17.	If incorrect, proceed to Step 19.	 Pos-2 TP-CG4 H-2usec/D V-2V/D T-INT +
	19	Check transfer pulse amplifier in converter at test point BF3.	See scope display. If correct, replace Z402, card CG and recheck Step 18.	If incorrect, proceed to Step 20.	 Pos-2 TP-BF3 H-2usec/D V-2V/D T-INT +
	20	Check transfer one-shot in converter at test point BH1.	See scope display. If correct, replace Z408, card BF and recheck Step 20.	If incorrect, proceed to Step 21.	 Pos-4 TP-BH-1 H-100usec/D V-2V/D T-INT +
	21	Check variable pulse delay in converter at test point BG2.	See scope display. If correct, replace Z407, card BH and recheck Step 20.	If incorrect, proceed to Step 22.	 Pos-6 TP-BG2 H-2msec/D V-2V/D T-INT -
	22	Check transfer prime in converter at test point BJ3.	See scope display. If correct, replace Z406, card BG and recheck Step 21.	If incorrect, proceed to Step 23.	 Pos-6 TP-BJ3 H-2msec/D V-2V/D T-EXT + BGC
	23	Check pickup on terminal in converter at CDJ.	See scope display. If correct, replace Z403, card BJ and recheck Step 22.	If incorrect, replace Z404, card CD and recheck.	 Pos-4 TP-CDJ H-100usec/D V-2V/D T-INT +

TABLE K

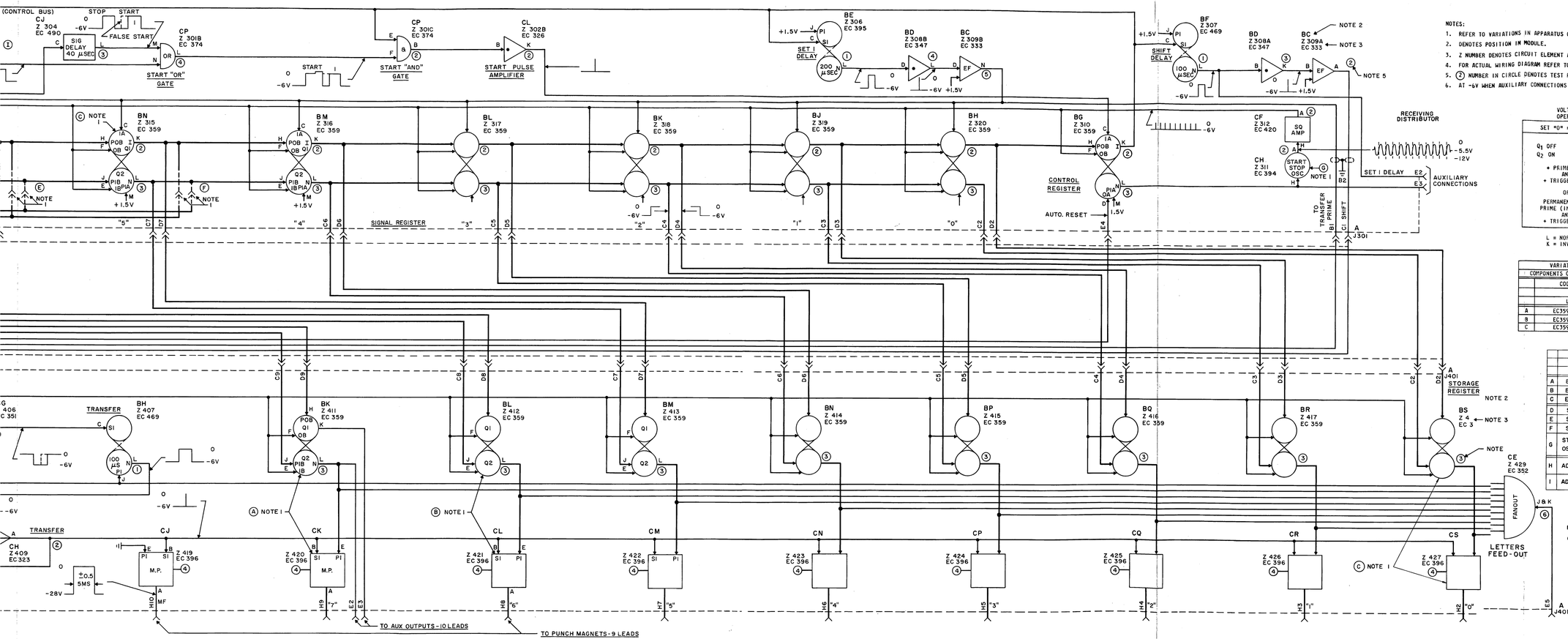
DATASPEED Tape Receiver-Dropping or Addition of Marks and Tape Feeding Failure

Symptom	Step	Action	Normal Indication and Procedure	Abnormal Indication and Procedure	
Magnet pulser or reperforator maladjustment	1	A. If dropping marks, with motors on press LTRS FO and observe punched tape. B. If adding marks, place module TEST switch in TEST position. C. If feeding failure occurs, proceed to Step 4. Note: After trouble has been cleared always place test switch in normal position and recheck operation of the receiver by calling the test center and receiving a test message to ensure proper operation.	Tape should contain all marks. Proceed to Step 2. Should punch blank tape. Proceed to Step 2.	Interchange cards CS through CK one at a time and recheck. If trouble is in same level, make a visual check of tape reperforator for maladjustment, broken springs, etc. Check for loose wires and connectors or defective components associated with the errored level. Refer to section referring to reperforator adjustments. If trouble changes level when cards are interchanged, replace defective card and recheck.	
Storage register or signal register failure	2	Replace storage register card of failing level and repeat Step 1.	Punch tape should contain all marks or all spaces depending on which test is made in Step 1.	If trouble continues in same level, proceed to Step 3. If trouble is cleared, retest receiver with test center.	
Signal register failures or defective wiring	3	If marks are being picked up, in distributor, replace signal register card of failing level with known working card. Place test switch in TEST position and observe that reperforator is feeding blank tape.	Reperforator is feeding blank tape. Retest with test center.	If trouble continues in the same level, turn power off and using VOM check wiring between converter and distributor of the particular level that is failing. Check for loose connections in modules and correct as required.	
Tape feed failure complete failure not feeding at all	4	Replace feed magnet pulser circuit card and depress LTRS FO button.	Punch should feed out letters tape. Recheck Step 29 of Table F.	If punch does not feed tape, make a visual check of feed mechanism for possible maladjustment, broken or worn parts. Proceed to Step 5.	
Punch feed failure	5	If punch condition appears to be normal, depress LTRS FO button and note whether feed magnet is energized.	Feed magnet armature should be pulled in and tape should feed. If tape does not feed, punch feeding mechanism is at fault. This can be checked using a small screwdriver and holding feed magnet armature down. Care should be used when doing this.	If magnet is not energized, use wave form indicator and check output of feed magnet pulser. See Step 29 of Table F. If signal is not correct, turn power off and, using VOM, check the wiring of feed magnet circuit and associated components. Replace defective components, or correct wiring and recheck.	
Extra feed (inserted blank) or dropping of feed	6	Call test center, and with test signal received (test pattern) check output of tape punch.	Test pattern should be punched as shown on test tape.	If trouble is due to extra feed, extra blanks will appear in punched tape. Make visual inspection of punch and clean off excess lubricants on feed magnet armatures. Note added friction and lubricate if necessary. A slight change in pickup adjustment may clear this difficulty. However, a test should be conducted to make certain another trouble has not been inserted. If trouble is due to feed failure, an overlap of punched characters will appear. Proceed to Step 7.	

TABLE K (Continued)

DATASPEED Tape Receiver-Dropping or Addition of Marks and Tape Feeding Failure

Symptom	Step	Action	Normal Indication and Procedure	Abnormal Indication and Procedure	
Feed magnet pulser failure		The preceding step may not resolve the difficulty, and the trouble may be in the feed magnet pulser. Receiving a test signal and using signal monitor, check output of the feed magnet pulser at test terminal CJA. Trigger indicator on EXT ± on test point BF3 and note operation of magnet pulser.	See Step 27 of Table F. If signal is normal, punch pickup or feed mechanism may be out of adjustment, or worn parts may be the problem. A quick check can be made by loosening the pickup and changing the position. Note and mark the original position. To retard pickup pulse, move pickup in clockwise direction as viewed from front. To advance pickup signal, move coil in counterclockwise direction. Further adjustments should be made according to the section covering adjustments and procedure.	Replace defective element and check time-out. Adjust magnet pulser until time-out is approximately 5.0 to 5.5 msec.	



NOTES:

1. REFER TO VARIATIONS IN APPARATUS CODES CHART.
2. DENOTES POSITION IN MODULE.
3. Z NUMBER DENOTES CIRCUIT ELEMENT AND EC NUMBER REFERS TO CIRCUIT BOARD.
4. FOR ACTUAL WIRING DIAGRAM REFER TO 3837WD AND 4440WD.
5. (2) NUMBER IN CIRCLE DENOTES TEST POINT ON CIRCUIT CARD.
6. AT -6V WHEN AUXILIARY CONNECTIONS ARE NOT USED.

VOLTAGES REQUIRED FOR FLIP-FLOP OPERATION OF EC359 CIRCUIT CARD

SET "0" = SPACE	SET "1" = MARK
OUTPUT Q_1 OFF L = -6 Q_2 ON K = 0	OUTPUT Q_1 ON L = 0 Q_2 OFF K = -6
+ PRIME ON H AND + TRIGGER ON F	+ PRIME ON J AND + TRIGGER ON E
OR PERMANENT +1.5 PRIME (INTERNAL) AND + TRIGGER ON D	OR PERMANENT +1.5 PRIME ON M AND + TRIGGER ON C

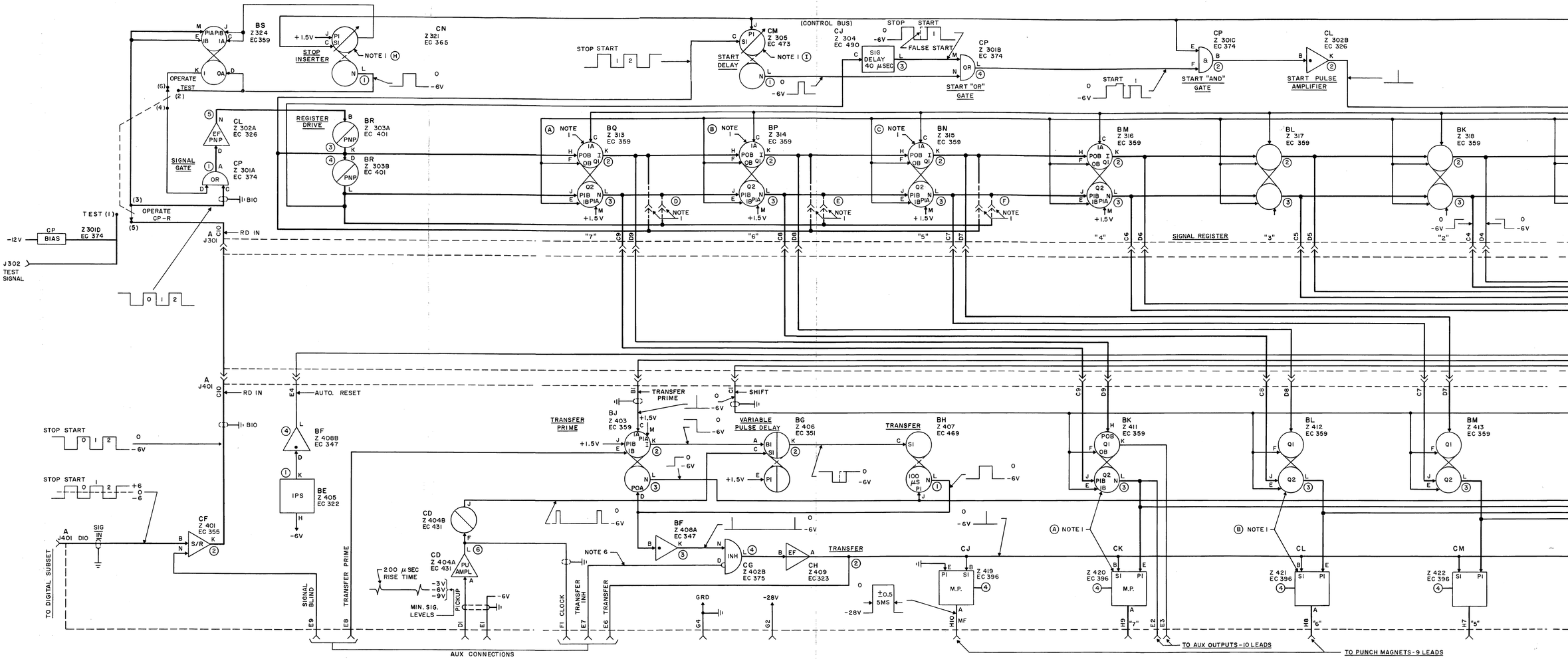
L = NORMAL OUTPUT
K = INVERTED OUTPUT

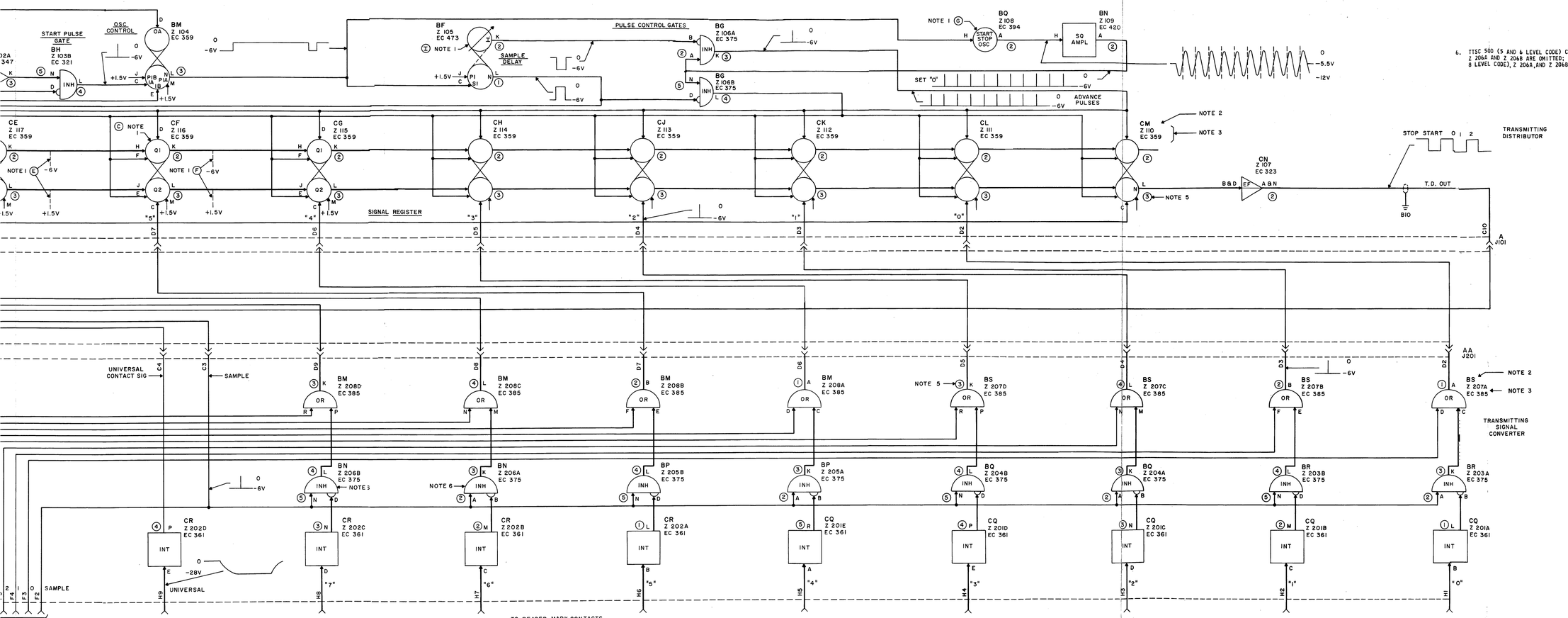
VARIATIONS IN APPARATUS CODES CHART

COMPONENTS OMITTED OR INCLUDED - OMIT X INCLUDE					
	CODE-TRSC	500	600	700	800
	LEVEL	5	6	7	8
A	EC359 & EC396	-	-	-	X
B	EC359 & EC396	-	-	X	X
C	EC359 & EC396	-	X	X	X

	CODE-TRD	603	804
	BIT RATE	1050	1050
	LEVEL	6	5 TO 8
A	EC 359	-	X
B	EC 359	-	X
C	EC 359	X	X
D	STRAPS	-	-
E	STRAPS	X	-
F	STRAPS	-	-
G	START-STOP OSCILLATOR	EC394 0.95 M SEC	SAME
H	ADJUST TO	2.3 M SEC +0.1 M SEC - 0 M SEC	950 U SEC +100 U SEC - 0 U SEC
I	ADJUST TO	475 U SEC	SAME

Fig. 5 — Logic Diagram of the Transmitting Control Unit


BS Z 324 EC 359
CN Z 321 EC 365
STOP INSERTER
NOTE 1 (H)
CM Z 305 EC 473
START DELAY
NOTE 1 (I)
(CONTROL BUS)
CJ Z 304 EC 490
SIG DELAY 40 μSEC
STOP START
FALSE START
CP Z 301B EC 374
START "OR" GATE
CP Z 301C EC 374
START "AND" GATE
CL Z 302B EC 326
START PULSE AMPLIFIER
OPERATE TEST
CL Z 302A EC 326
SIGNAL GATE
CP Z 301A EC 374
REGISTER DRIVE
BR Z 303A EC 401
BR Z 303B EC 401
BQ Z 313 EC 359
BP Z 314 EC 359
BN Z 315 EC 359
BM Z 316 EC 359
BL Z 317 EC 359
BK Z 318 EC 359
OPERATE CP-R
TEST (1)
CP BIAS
Z 301D EC 374
-12V
J302 TEST SIGNAL
RD IN
BIO
SIGNAL REGISTER
"7"
"6"
"5"
"4"
"3"
"2"
AUTO. RESET
TRANSFER PRIME
SHIFT
BJ Z 403 EC 359
BG Z 406 EC 351
VARIABLE PULSE DELAY
BH Z 407 EC 469
TRANSFER
BF Z 408B EC 347
IPS
BE Z 405 EC 322
BK Z 411 EC 359
BL Z 412 EC 359
BM Z 413 EC 359
STOP START
CF Z 401 EC 355
S/R
CD Z 404B EC 431
CD Z 404A EC 431
PU AMPL
PICKUP
200 μSEC RISE TIME
MIN. SIG. LEVELS
BF Z 408A EC 347
CG Z 402B EC 375
CH Z 409 EC323
CJ Z 419 EC 396
M.P.
MF
CK Z 420 EC 396
CL Z 421 EC 396
CM Z 422 EC 396
TO DIGITAL SUBSET
SIGNAL BLIND
TRANSFER PRIME
TRANSFER INH
TRANSFER
CLOCK
GRD
-28V
AUX CONNECTIONS
TO AUX OUTPUTS-10 LEADS
TO PUNCH MAGNETS-9 LEADS



NOTES:

1. REFER TO VARIATIONS IN APPARATUS CODES CHART.
2. DENOTES POSITION IN MODULE.
3. Z NUMBER DENOTES CIRCUIT ELEMENT AND EC NUMBER REFERS TO CIRCUIT BOARD.
4. FOR ACTUAL WIRING DIAGRAM REFER TO 3835WD AND 4438WD.
5. (7) NUMBER IN CIRCLE DENOTES TEST POINT ON CIRCUIT CARD.
6. TTSC 500 (5 AND 6 LEVEL CODE) CIRCUIT ELEMENTS Z 206A AND Z 206B ARE OMITTED; TTSC 800 (7 AND 8 LEVEL CODE), Z 206A AND Z 206B ARE INCLUDED.

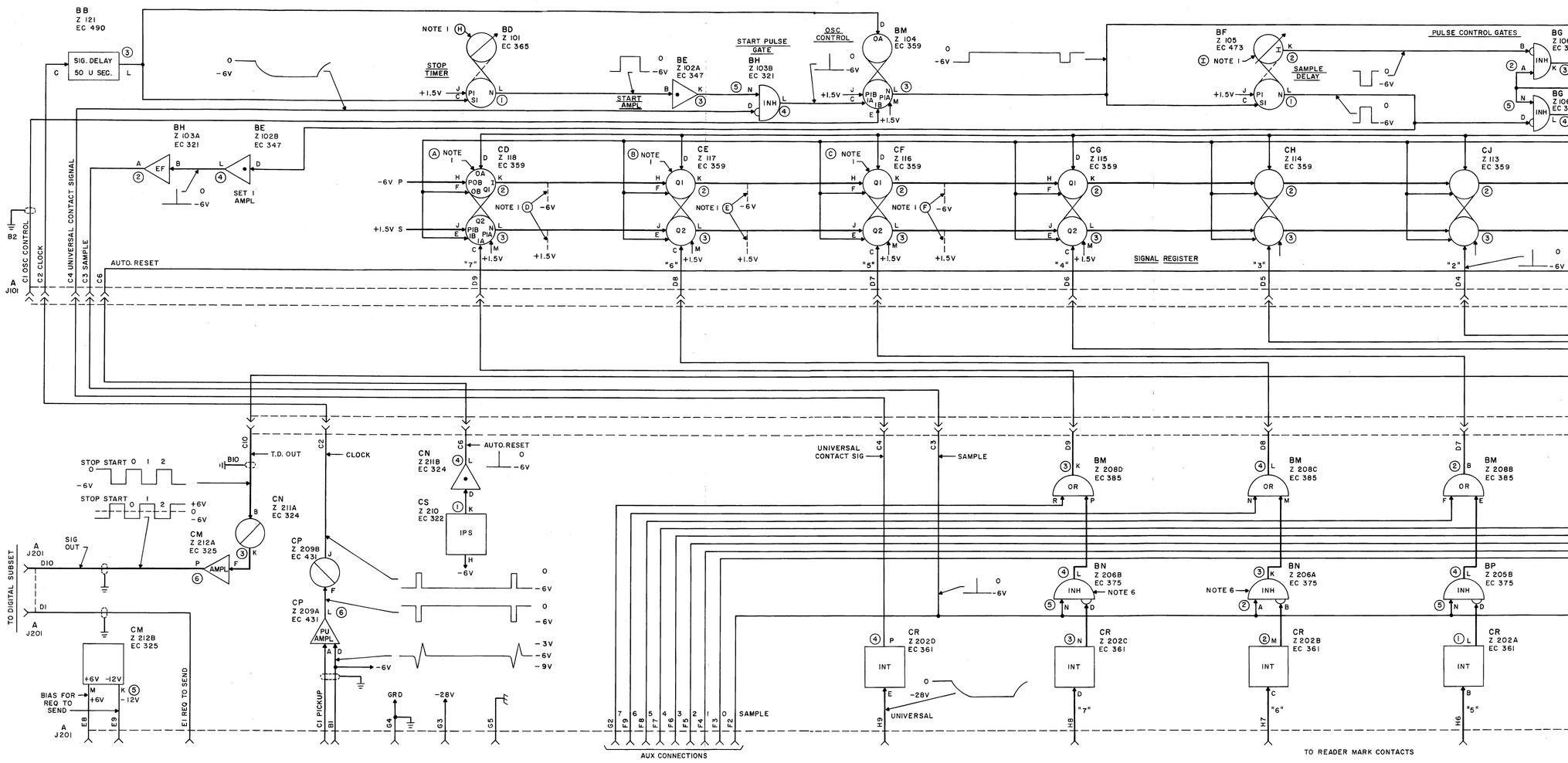
VOLTAGES REQUIRED FOR FLIP-FLOP OPERATION OF EC359 CIRCUIT CARD

SET "0" = SPACE	SET "1" = MARK
Q_1 OFF OUTPUT L = -6 Q_2 ON K = 0	Q_1 ON OUTPUT L = 0 Q_2 OFF K = -6
+ PRIME ON H AND + TRIGGER ON F	+ PRIME ON J AND + TRIGGER ON E
OR	OR
PERMANENT +1.5 PRIME (INTERNAL) AND + TRIGGER ON D	PERMANENT +1.5 PRIME ON M AND + TRIGGER ON C

L = NORMAL OUTPUT
K = INVERTED OUTPUT

	CODE-TTD	603	804
	BIT RATE	1050	1050
	LEVEL	6	5 TO 8
A	EC359	-	X
B	EC359	-	X
C	EC359	X	X
D	STRAPS	-	—
E	STRAPS	X	—
F	STRAPS	-	—
G	START-STOP OSCILLATOR	EC394 0.952MSEC	SAME
H	ADJUST TO	900USEC	SAME
I	ADJUST TO	475USEC	SAME

Fig. 6—Logic Diagram of the Receiving Control Unit


BB Z 121 EC 490
SIG. DELAY 50 U SEC.
BD Z 101 EC 365
STOP TIMER
BE Z 102A EC 347
START AMPL
START PULSE GATE
BH Z 103B EC 321
OSC CONTROL
BM Z 104 EC 359
BF Z 105 EC 473
SAMPLE DELAY
PULSE CONTROL GATES
BG Z 106 EC 3
BH Z 103A EC 321
BE Z 102B EC 347
SET 1 AMPL
CD Z 118 EC 359
CE Z 117 EC 359
CF Z 116 EC 359
CG Z 115 EC 359
CH Z 114 EC 359
CJ Z 113 EC 359
SIGNAL REGISTER
AUTO. RESET
C1 OSC. CONTROL
C2 CLOCK
C4 UNIVERSAL CONTACT SIGNAL
C3 SAMPLE
C6
B2
A J101
STOP START
T.D. OUT
CLOCK
CN Z 211A EC 324
CM Z 212A EC 325
CN Z 211B EC 324
CS Z 210 EC 322
IPS
CP Z 209B EC 431
CP Z 209A EC 431
PU AMPL
SIG OUT
TO DIGITAL SUBSET
CM Z 212B EC 325
BIAS FOR REQ TO SEND
REQ TO SEND
C1 PICKUP
GRD
-28V
UNIVERSAL CONTACT SIG
SAMPLE
BM Z 208D EC 385
BM Z 208C EC 385
BM Z 208B EC 385
BN Z 206B EC 375
BN Z 206A EC 375
BP Z 205B EC 375
CR Z 202D EC 361
CR Z 202C EC 361
CR Z 202B EC 361
CR Z 202A EC 361
INT
UNIVERSAL
AUX CONNECTIONS
TO READER MARK CONTACTS