Serial Interface (638-6896-001)

Rockwell International

instructions

Collins Telecommunications Products Division

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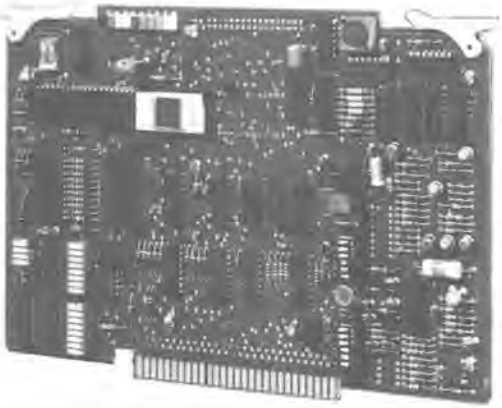
1. DESCRIPTION

Serial Interface 638-6896-001, shown in figure 1, is a 2-layer planar card with a 56-pin edge-on connector (2 layers, 28 pins each).

The serial interface card consists of the following primary circuits; an FSK/RS-232 select switch, an FSK receiver, an RS-232 receiver, an asynchronous communications interface adapter (ACIA), a microprocessor circuit, a parallel-to-serial output shift register, a strobe decoder, a word subaddress latch, a bit/band rate and clock generator, data input buffers, an FSK keyer, FSK transmit enable gate, and an RS-232 driver.



TPA-2843-017

Serial Interface
Figure 1

2. PRINCIPLES OF OPERATION

2.1 General (Refer to figure 2.)

As a serial data receiver, the serial interface card receives FSK, RS-232C, of MIL-STD-188C serial data control signals and checks for address, command status, and data errors. It then provides error, clock, word subaddress, strobe, and serial data outputs for decoding by a parallel output card.

As a serial data transmitter, the serial interface card receives parallel data inputs and a transmit word initiate and provides FSK, RS-232C, or MIL-STD-188C serial data monitor signals. The serial data monitor signals are supplied to the associated unit/control.

2.2 Serial Data Inputs and Outputs

When strapped accordingly, the serial interface card receives and transmits data according to one of the following types of control techniques.

a. FSK (mark = 1280 Hz, space = 2133 Hz) with mark equivalent to logic 1 data and space equivalent to logic 0 data. Data is transmitted/received at 75, 109, 150, 300, or 600 bauds.
b. EIA RS-232C (mark = -6 ±1 V dc, space = +6 ±1 V dc) with mark equivalent to logic 1 data and space equivalent to logic 0 data. Data is transmitted/received at 75, 109, 150, 300, 600, 1200, 2400, 4800, 9600, or 19,200 bauds.
c. MIL-STD-188C (mark = +6 ±1 V dc, space = -6 ±1 V dc) with mark equivalent to logic 1 data and space equivalent to logic 0 data. Data is transmitted/received at 75, 109, 150, 300, 600, 1200, 2400, 4800, 9600, or 19,200 bauds.

The control word inputs may be in either HF-80 8-bit format or ASCII 7-bit format. When applied to the asynchronous communications interface adapter, the

control word is reformatted so that each control word is composed of five 11-bit characters. The last two or three bits of each character group are stop and parity bits. The first bit is a start bit. In the 8-bit format, the first character of each control word is reserved for equipment address, word identification (subaddress), and word sync information. Bits seven and eight of the second character in each word are reserved for command and status request control bits. The remaining characters of each word carry frequency, control, and monitor information. In the 7-bit format, separate characters are used for equipment address, subaddress, word sync, and command and status request control bits.

Refer to figure 3. Control (and monitor) word timing is accomplished by a crystal-controlled oscillator on the microprocessor chip. A divider reduces the frequency to the desired values. Strapping permits selection of the baud rate for clock inputs to the various circuits. Selection is from 75, 109, 150, 300, 600, 1200, 2400, 4800, 9600, and 19,200 bauds. (Clock frequency is 16 times baud rate).

Refer to figure 2. Monitor data (serial data input) is applied to the microprocessor on the serial interface card. Word and status information is decoded from the monitor data and is used to determine strobe address information. The monitor data is then applied serially through a shift register to the data input of four word serial-to-parallel converters on the associated parallel output card. Each serial-to-parallel converter is enabled before it accepts and processes the monitor data. This occurs when the strobe address input is decoded and an enable signal is generated by the word enable circuit.

Refer to figure 2. Control information (serial data output) is stored in the multiplexers on the associated parallel input card. Mux control is supplied by the microprocessor through the multiplexer output latch on the serial interface card. The mux address information enables the applicable multiplexer on the parallel input card, which transfers the stored parallel information to the serial interface card. The serial interface card then formats the information into 8-bit or 7-bit format and outputs it serially, using the ACIA, through the FSK keyer or RS-232C driver circuit to the control data output.

2.3 Monitor Data (Refer to figure 2.)

Monitor data (serial data input) is received by the FSK/RS-232C select and applied to the appropriate receiver. In FSK, the FSK receiver applies the received FSK signal to the FSK demodulator where a 1280-Hz signal is converted to a logic 1 output and a 2133-Hz signal is converted to a logic 0 output.

In RS-232C or MIL-STD-188C operation, the RS-232C receiver converts a +6-V dc input to a logic 0 (ground) output and converts a -6-V dc input to a logic 1 (+4.7-V dc) output.

The asynchronous communications interface adapter (ACIA) receives the monitor data input and converts it to HF-80 8-bit format and applies it to the microprocessor. If the monitor data is command data (command bit = 0), the microprocessor converts the data word to parallel receive data outputs and clocks the data through the parallel to serial converter to the appropriate storage registers on the parallel output card. The serial interface card then supplies the word subaddress and strobe so that the data is accepted into the appropriate storage register in the associated parallel output card as determined by the word subaddress.

2.4 Control Data (Refer to figure 2.)

Control data (serial data output) is transmitted by an FSK keyer (for FSK operation) or by a line driver (for RS-232C or MIL-STD-188C operation).

In FSK operation, the FSK keyer converts logic 0 outputs from the asynchronous communications interface adapter (ACIA) to 1280-Hz FSK signals and logic 1 outputs from the ACIA to 2133 Hz.

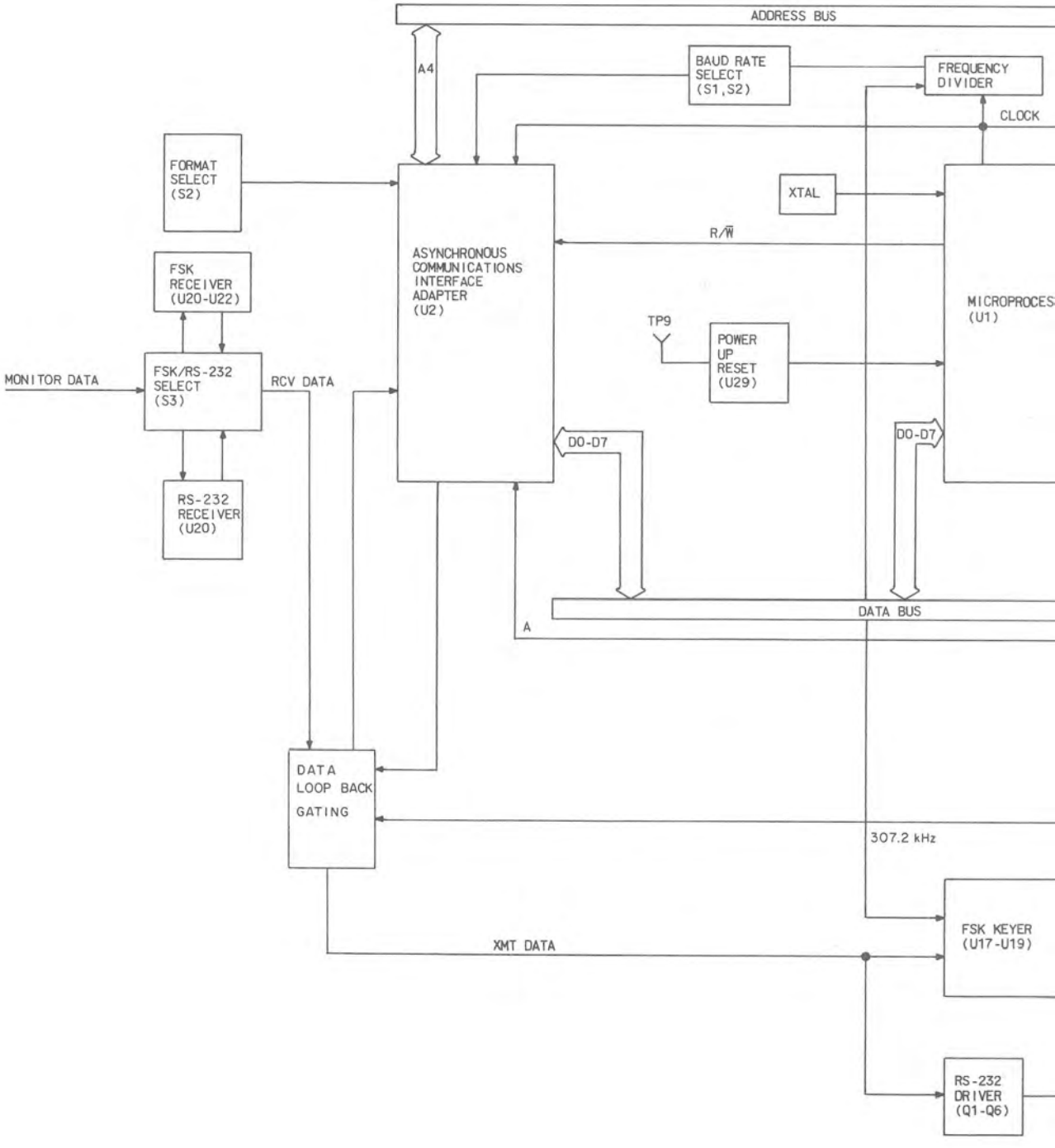
In RS-232 operation, the line driver converts logic 0 inputs to the line driver to +6 V dc and logic 1 inputs to the line driver to -6 V dc.

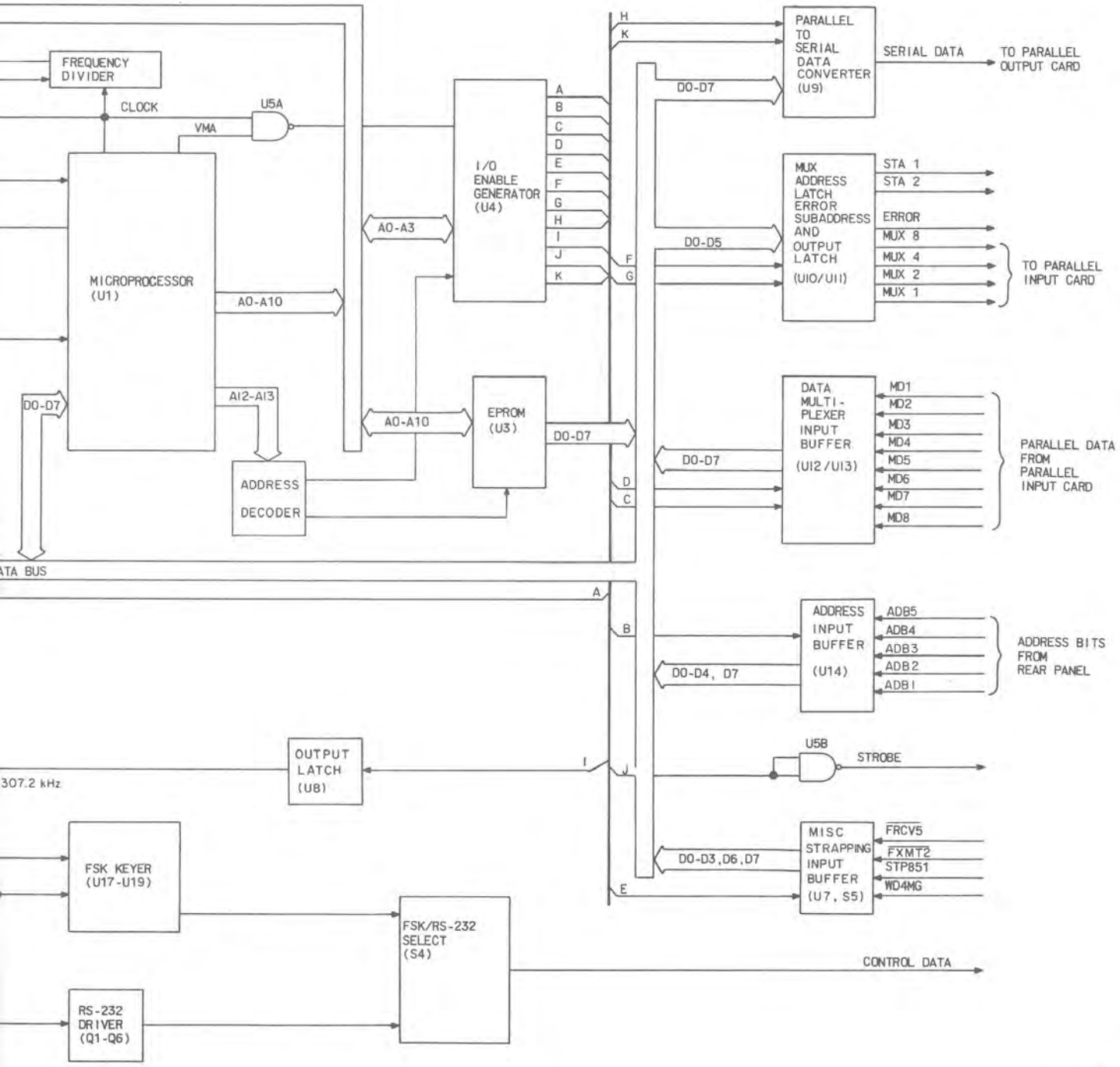
In MIL-STD-188C operation, the line driver converts logic 0 inputs to the line driver to -6 V dc and logic 1 line inputs to the line driver to +6 V dc.

Parallel input data are address selected by the microprocessor and applied to the ACIA. The ACIA supplies the data as serial output (so) data to the line driver or FSK keyer. The serial data is converted to the appropriate signal data and supplied to the associated remote unit/control.

2.5 Purpose of Strapping

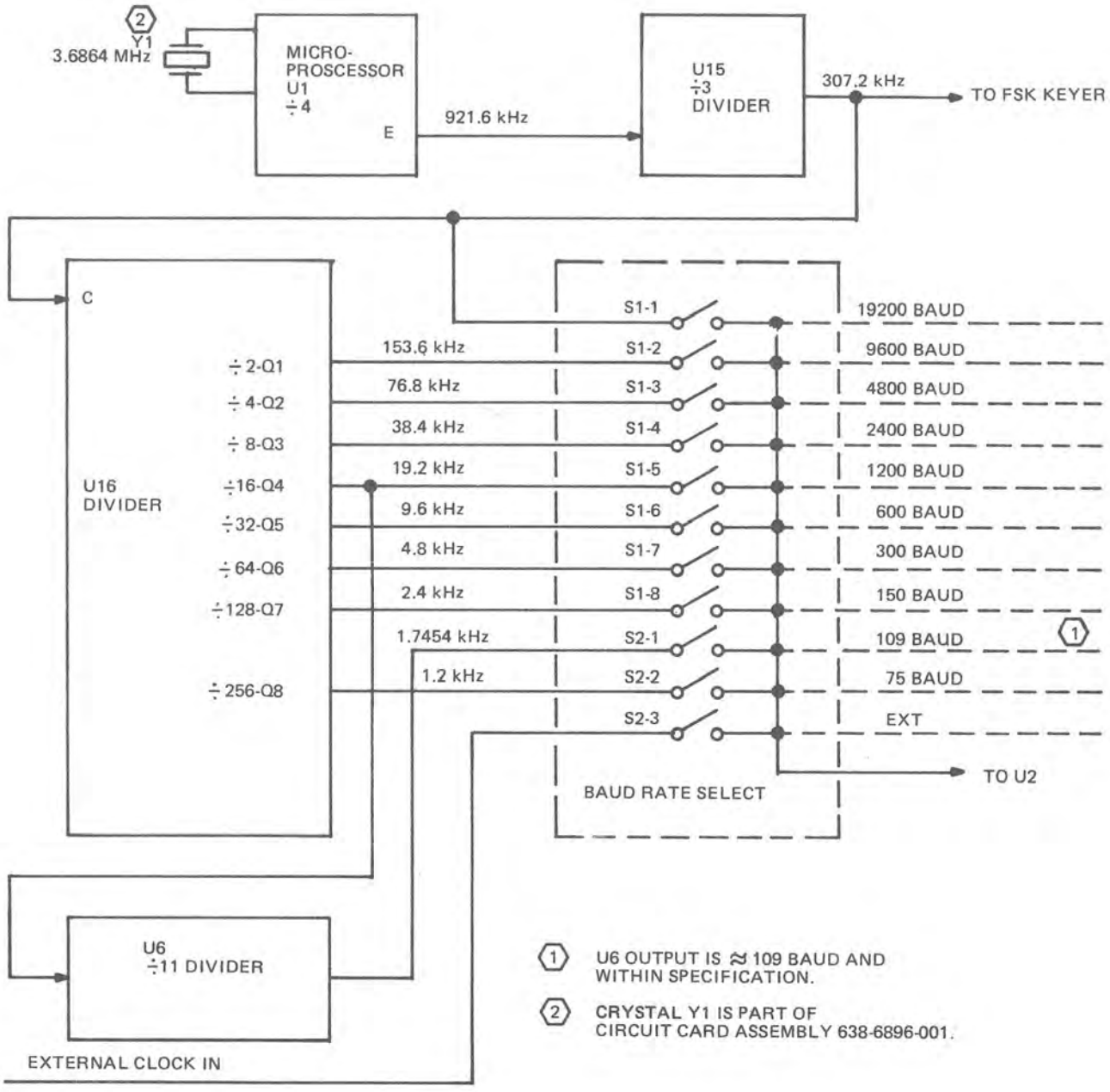
Unit strapping is accomplished using five dipswitches located on the UUT, S1 through S5. These control baud rate, FSK/RS-232 signaling, word format, EIA/MIL-STD-188C polarity, parity, number of stop bits, radio or control, and address recognition enable/disable. The card outline in figure 4 shows the location of these dipswitches. Switch 1 of each dipswitch is towards the top of the card.


ADDRESS BUS
A4
BAUD RATE SELECT (S1,S2)
FREQUENCY DIVIDER
CLOCK
FORMAT SELECT (S2)
XTAL
R/W
ASYNCHRONOUS COMMUNICATIONS INTERFACE ADAPTER (U2)
MICROPROCES (U1)
FSK RECEIVER (U20-U22)
TP9
POWER UP RESET (U29)
MONITOR DATA
FSK/RS-232 SELECT (S3)
RCV DATA
D0-D7
D0-D7
RS-232 RECEIVER (U20)
DATA BUS
A
DATA LOOP BACK GATING
307.2 kHz
FSK KEYER (U17-U19)
XMT DATA
RS-232 DRIVER (Q1-Q6)

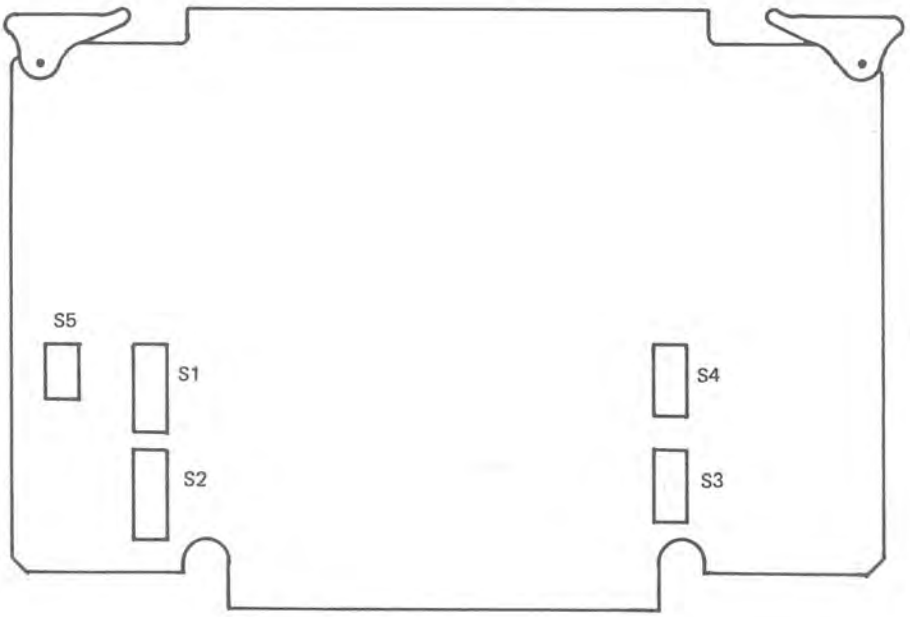


TPA-2671-014

Serial Interface, Block Diagram
Figure 2



Bit and Baud Rate Generator, Block Diagram
Figure 3



Dipswitch Location
Figure 4

Address strapping is accomplished by applying the necessary logic levels to ADB1 through ADB5 (pins 41, 14, 40, 39, and 15 respectively).

2.5.1 FSK Control

Close only switches 1, 2, and 3 of S3 and S4 for FSK. Open switch 4 of S2 for FSK (to provide EIA data polarity).

2.5.2 RS-232C Control

Close only switches 4, 5, and 6 of S3 and S4 for RS-232C.

2.5.3 EIA-MIL-STD-188C Control

Open switch 4 of S2 for EIA data polarity. Close switch 4 of S2 for MIL-STD-188C polarity.

2.5.4 Parity, HF-ASCII Word Format, and Number of Stop Bits

Switches 6, 7, and 8 of S2 control the basic character format according to tabulation below:

*SWITCH			WORD FORMAT	PARITY	NO OF STOP BITS
8	7	6			
C	C	C	ASCII	Even	2
C	C	O	ASCII	Odd	2
C	O	C	ASCII	Even	1
C	O	O	ASCII	Odd	1
O	C	C	HF-80	None	2
O	C	O	HF-80	None	1
O	O	C	HF-80	Even	1
O	O	O	HF-80	Odd	1

*O = Open, C = Closed

2.5.5 Address Recognition

Open switch 1 of S5 to enable address recognition. Close switch 1 of S5 to disable address recognition. When address recognition is disabled, the UUT will accept a word with any address if the word is otherwise correct.

2.5.6 Radio/Control Selection

Open switch 5 of S2 for radio. Close switch 5 of S2 for control.

All eight of the switches in S1 and switches 1, 2, and 3 of S2 control the baud rate. Closing one and only one of these switches will select the baud rate as given:

BAUD RATE SELECTION		
DIPSWITCH	SWITCH	BAUD RATE
S1	1	19,200
S1	2	9,600
S1	3	4,800
S1	4	2,400
S1	5	1,200
S1	6	600
S1	7	300
S1	8	150
S2	1	109
S2	2	75
S2	8	EXTERNAL

2.5.7 Polling Control

In addition to the internal strapping options listed above, an additional strapping option permits a control unit to function in a polling mode of operation. This mode of operation is intended for use when an auxiliary system status display is used to display the current status of several or more remote equipments.

In the polling mode of operation, the control unit automatically and sequentially requests status information from all sixteen possible remote addresses. As a status information is received from each addressed remote unit, it is then transmitted by the control unit, on the common system control bus, to a remote status display for update of the display. The remote status display must be connected to the system control bus to receive the updated display information. If no status response is received from a polled unit, no status data is transmitted to the status display by the control unit.

Since the status display device connects to the common system control bus, it is programmed to recognize its own unique address, and the remote control unit is programmed to use this same address (00-000 for ADB5 through ADB1) when communicating with the status display. Therefore, when using the polling capability along with an external system status display and the 8-bit byte character data format, only fifteen of the sixteen address combinations are available for remote unit assignment, since the display unit itself requires one of the addresses. If, however, the 7-bit ASCII character data format is used in the system, all sixteen remote unit addresses are available for use because the address assigned to the status display is not among the sixteen addresses (of the 32 possible in this format) controlled by the thumbwheel address selector switch of the remote control unit.

Open switch 2 of S5 to disable polling. Close switch 2 of S5 to enable polling.

2.6 Asynchronous Communications Interface Adapter (ACIA) (Refer to figure 5.)

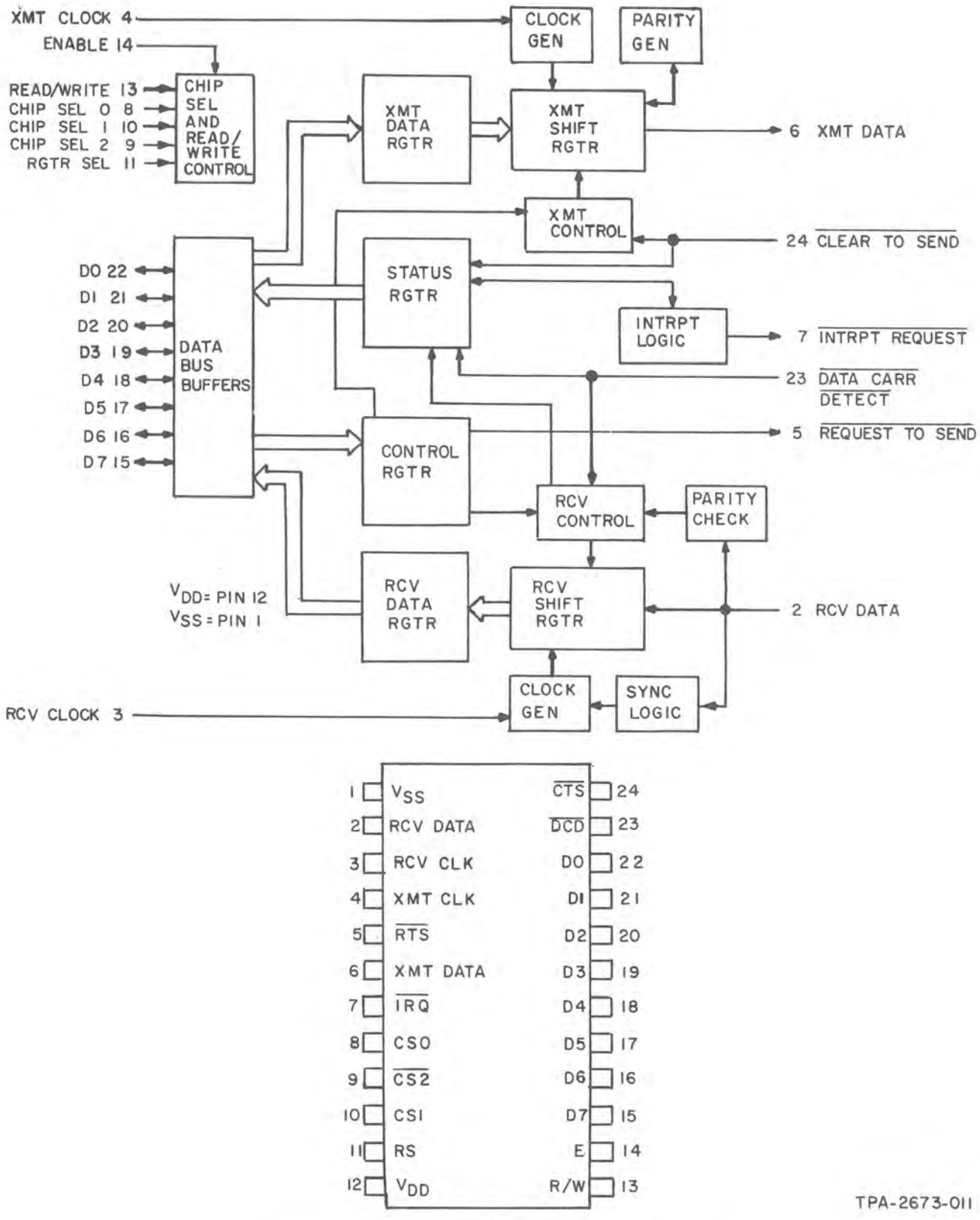
The ACIA is an LSI subsystem which allows the user to use either ASCII or HF-80 8-bit word formatting. When used in conjunction with a microprocessor, the ACIA has the flexibility to handle various baud rates, parity modes, bits per word, and number of stop bits per word. The device is constructed on a single 24-lead dual-in-line package. All inputs and outputs are directly compatible with MTOS/MTNS logic, and also with TTL/DTL/CMOS logic without the need for interfacing components. The strobed outputs (D0 through D7) are interfaced directly with the microprocessor data bus.

2.7 Processor (Refer to figure 2.)

Processor circuit controls all operations on the serial interface card through the use of a software program packaged in a 16K (2K x 8) EPROM.

The processor circuit consists of the following components with associated gating circuits:

a. Microprocessing unit (MPU)
b. Electrically programmable read-only memory (EPROM)
c. ACIA
d. Clock generator
e. I/O enable generator



Asynchronous Communications Interface Adapter 351-8455-010
Figure 5

2.7.1 Microprocessor (Refer to figure 6.)

Microprocessing unit (MPU) is the central processing device. Through the software program, the MPU controls the receiving and transmitting of control and monitor information, address generation, strobe generation and timing, display programing, and system polling. The MPU is controlled by the following inputs:

a. Clock - Provides timing/gating signals. The crystal mounted external to the MPU provides a stable reference which is divided by four on the MPU.
b. Reset - Used to reset and start MPU from a power-down condition resulting from a power failure or initial startup.

The MPU generates two control signals that are used to enable peripherals: valid memory address (VMA) and read/write (R/$\overline{W}$). The VMA signal is gated with the clock in U5A and then is applied to I/O enable generator U4. This signal indicates to the peripherals that a valid memory address from the MPU is on the address bus. The R/$\overline{W}$ output signal is used by the ACIA to set its circuits in a read or write operation. The 8-bit data bus (D0 through D7) provides bidirectional bus for transferring data to and from memory and the peripherals. The address bus (A0 through A15), a 16-bit bus, provides 65 kilabytes of addressing for the MPU to retrieve and transmit information.

The reset pulse is generated by U29 whenever the +5 V dc is interrupted and then reapplied.

2.7.2 EPROM (Refer to figure 7.)

The electrically programmable read-only memory (U3) contains the program for the MPU. The program in the EPROM controls the MPU after startup. The MPU communicates with the EPROM through the address bus and the data bus. The EPROM consists of a 16, 384-bit cell matrix, X and Y address decoders, Y gating circuit, output data buffers and program circuits. The EPROM is packaged in a ceramic, 24-lead dual-in-line package and is TTL, CMOS, and DTL logic compatible.

2.7.3 I/O Generator - Decoder/Demultiplexer (Refer to figure 8.)

I/O enable generator U4 is a binary decoder that decodes address bus lines A0, A1, A2, and A3, (refer to table 1) generating enabling signals to enable the

Table 1. I/O Generator Truth Table.

INPUTS						OUTPUTS															
G1	G2	D	C	B	A	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	L	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	H	L	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	H	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	H	L	L	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H
L	L	L	H	L	H	H	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H
L	L	L	H	H	L	H	H	H	H	H	H	L	H	H	H	H	H	H	H	H	H
L	L	L	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H	H	H
L	L	H	L	L	L	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H	H
L	L	H	L	L	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H
L	L	H	L	H	L	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H
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L	L	H	H	L	L	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H	H
L	L	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H
L	L	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H
L	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L
L	H	X	X	X	X	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
H	L	X	X	X	X	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
H	H	X	X	X	X	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H

H = High level, L = Low level, X = Don't care

various input and output decoders and the ACIA. The I/O generator employs low-power Schottky transistor-to-transistor logic (TTL) and is packaged in a dual-in-line configuration.

2.8 Noninverting, 3-State Buffer (Refer to figure 9.)

Data multiplexer inputs U12, U13, address select inputs U14, and miscellaneous strapping input are accessed by the processor through noninverting, 3-state buffers. Inputs/outputs 1 through 4 are controlled by disable A while inputs/outputs 5 and 6 are controlled by disable B.

3. TESTING AND TROUBLESHOOTING

3.1 Test Equipment and Power Requirements

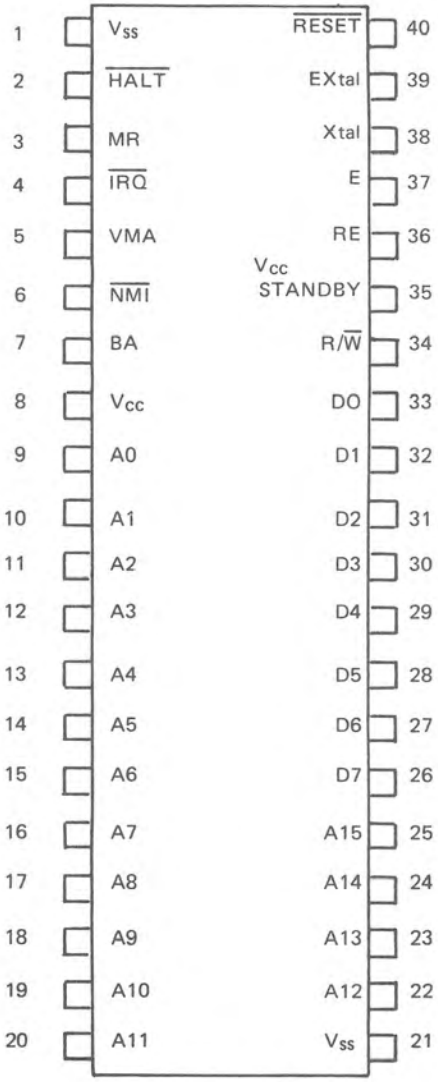
Test equipment and power sources required to test, troubleshoot, and repair the serial interface card are listed in the maintenance section of this instruction book.

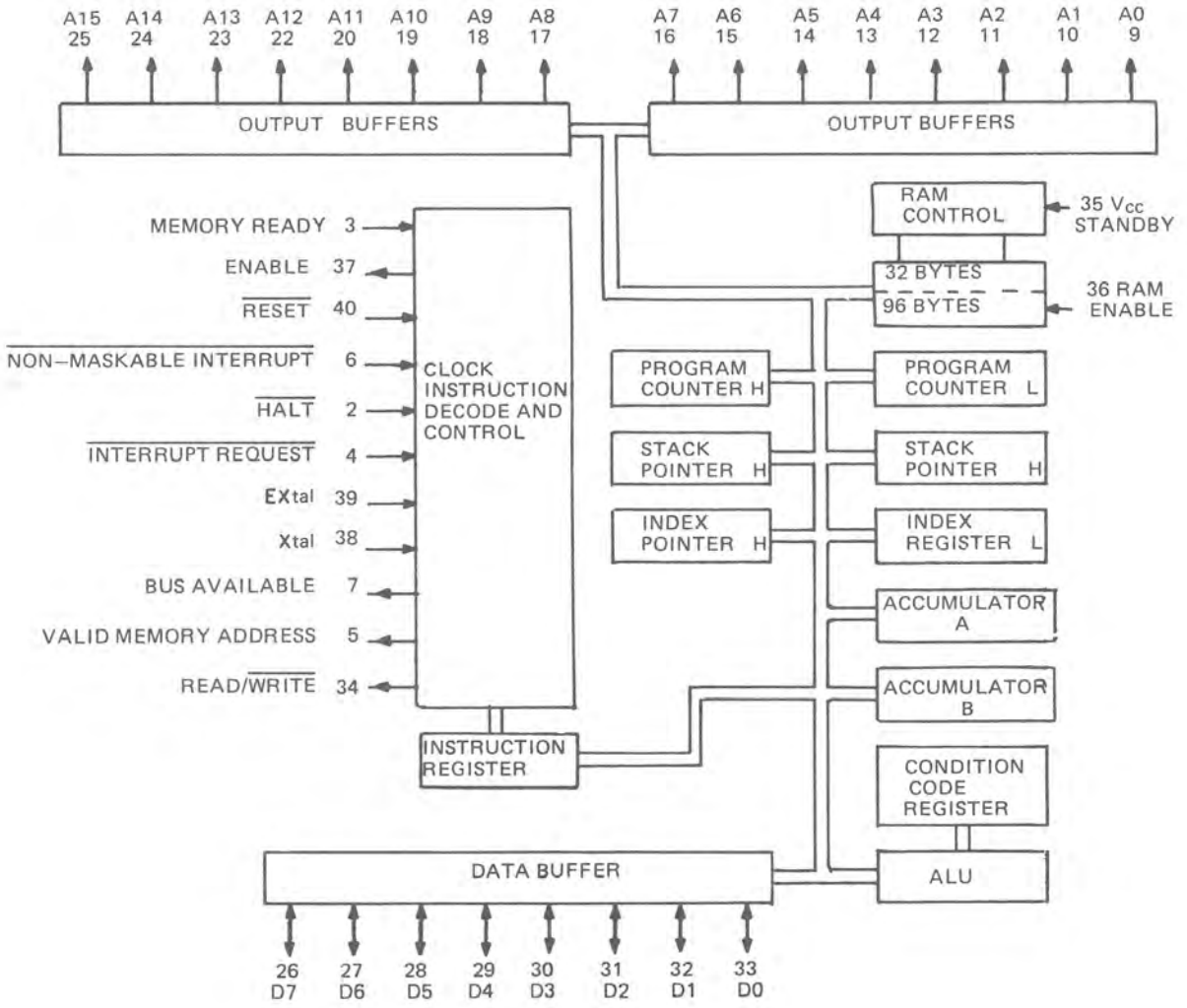
3.2 Testing

The test procedures in table 2 check total performance of the serial interface card. These test procedures will confirm that a problem exists on the serial interface card and isolate it to a functional area.

3.3 Troubleshooting

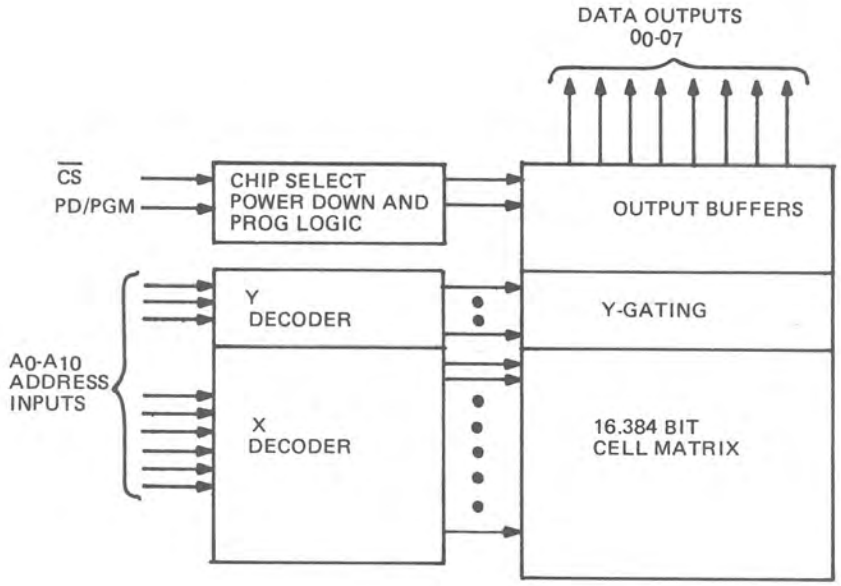
It is recommended that the serial interface card be returned to Collins Telecommunications Products Division for repair. The serial interface card is controlled by the microprocessor running a software program stored in the EPROM. It is necessary to have the software program and a method of controlling the program to isolate a fault to a specific component or circuit.

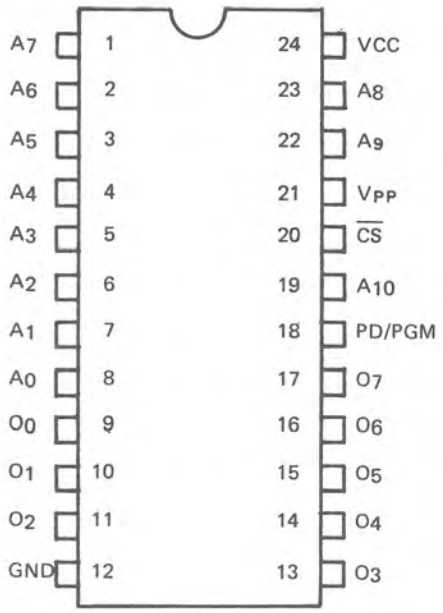

1 Vss
2 HALT
3 MR
4 IRQ
5 VMA
6 NMI
7 BA
8 Vcc
9 A0
10 A1
11 A2
12 A3
13 A4
14 A5
15 A6
16 A7
17 A8
18 A9
19 A10
20 A11
RESET 40
EXtal 39
Xtal 38
E 37
RE 36
Vcc STANDBY 35
R/W 34
DO 33
D1 32
D2 31
D3 30
D4 29
D5 28
D6 27
D7 26
A15 25
A14 24
A13 23
A12 22
Vss 21



TPA-2672-013

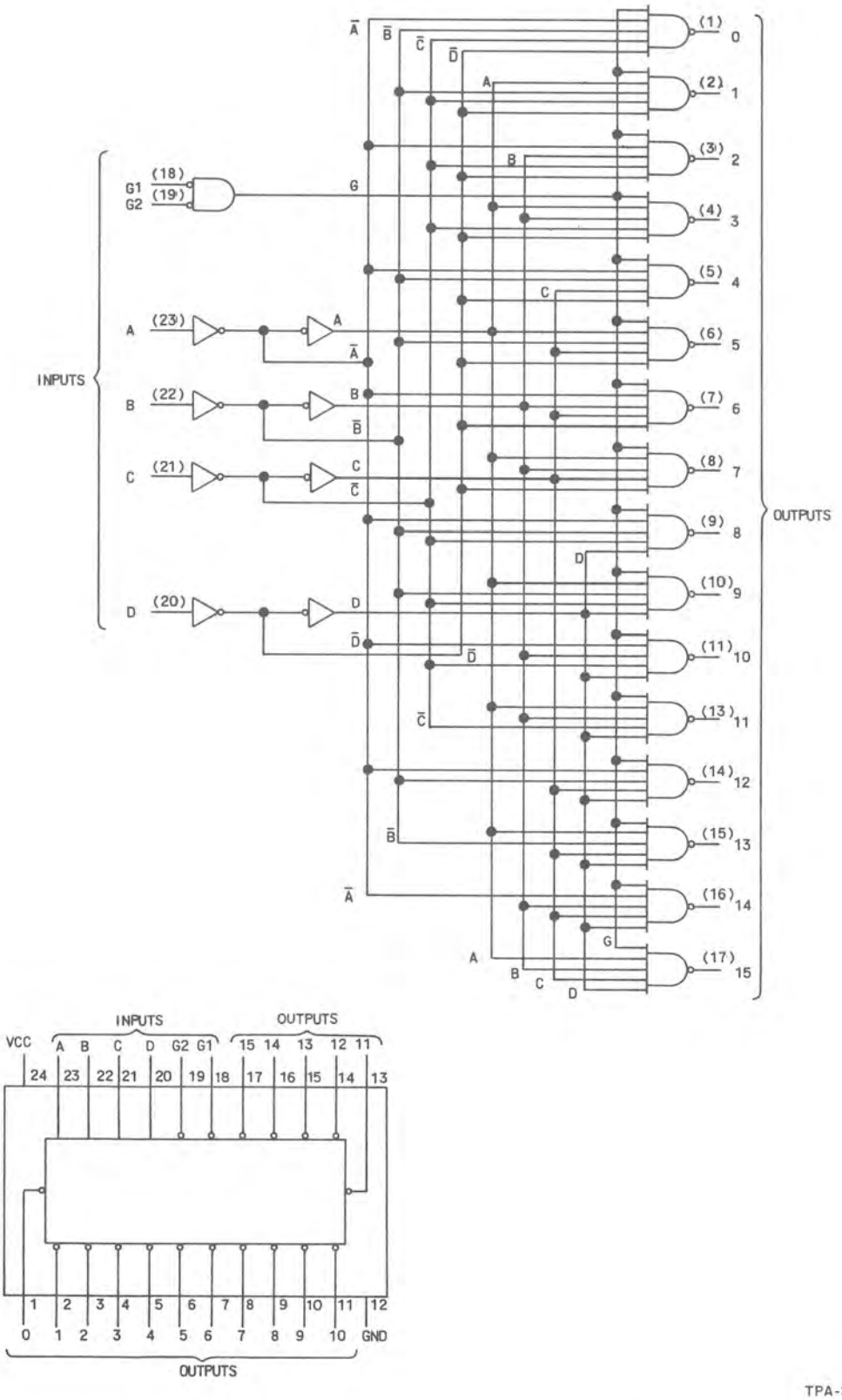
Microprocessor 351-8676-010
Figure 6





TPA-2675-011

EPROM 647-2751-001
Figure 7

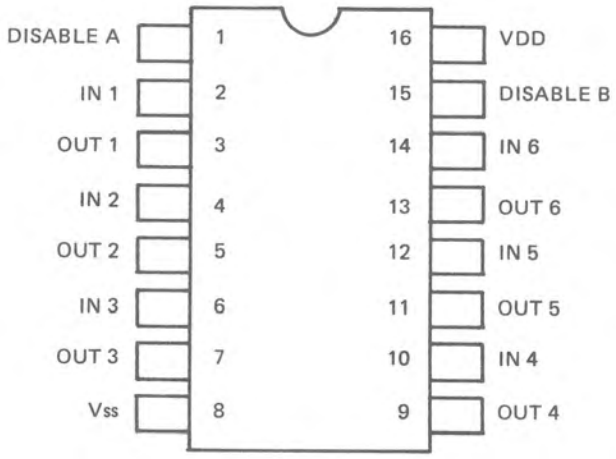


Decode/Demultiplexer 351-1526-090
Figure 8

IN_n	APPROPRIATE DISABLE INPUT	OUT_n
0	0	0
1	0	1
X	1	HIGH IMPEDANCE

NOTE: X = DON'T CARE

TRUTH TABLE



PIN CONFIGURATION

TPA-2676-011

Noninverting, 3-State Buffer 351-8490-010
Figure 9

Table 2. Serial Interface, Testing and Troubleshooting Procedures.

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
1. Setup	**Note** These testing and troubleshooting procedures are based on using a control unit and an associated local unit. The most effective method of testing and troubleshooting is obtained by installating the questionable serial interface in the control unit. During these tests when a control unit is referred to it is a receiver-exciter control, an exciter control, or a receiver control. When a local unit is referred to it is a receiver-exciter, an exciter, or a receiver. For all tests, the serial interface card is strapped for HF-80 8-bit format. (Refer to paragraph 2.5.4.)		
	a. Remove top cover of unit containing the serial interface to be tested.		
	b. Remove serial interface. Install it on an extender card and place it in the control unit.		
	c. Set unit LINE SELECTOR switches to 115 V.		
	d. Connect units to 115-V ac power source and set power on.		
	e. Measure dc voltages between the following pins and ground (TP1, brown): J1-23 J1-28 J1-6	 +15 ±1.0 V dc. +5 ±0.5 V dc. -15 +1.0 V dc.	 Check associated power supply.
	f. Strap local unit for address 0.		
	g. Connect local unit to a control unit.		
2. FSK data levels	**Note** UUT must be strapped for FSK operation.		
	a. Connect an audio voltmeter between J1-26 and J1-27.		
(Cont)	b. Open EIA-MIL-STD-188C polarity switch.		

Table 2. Serial Interface, Testing and Troubleshooting Procedures (Cont)

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
2. (Cont)	c. Note audio voltmeter reading.	0 ±5 dB mW.	Check U18, U17 and associated circuits.
	d. Close EIA-MIL-STD-188C polarity switch.		
	e. Note audio voltmeter reading.	Step c reading ±5 dB mW.	
	f. Open EIA-MIL-STD-188C polarity switch.		
3. Serial data command with status request	a. Set local unit front-panel CONT switch to REM.		
	b. Set control unit ADDRESS to 0.		
	Note Local unit is strapped for address 0 recognition.		
	c. Set control unit front-panel controls as follows:		
	FREQUENCY KHZ to 29999.9 (0).		
	MODE to ISB.		
	CH A1 to ON (receiver only)		
	RF GAIN to full ccw (receiver only)		
	CH A1 AGC to DATA and AGC BUS to ON (receiver only)		
	CHANNEL ENABLE A1 to LINE (exciter only)		
	KEY to NORM (exciter only)		
	PA PWR to STBY (exciter only)		
	PILOT CARR to OFF (exciter only)		
	PEAK CLIP to OFF (exciter only)		
	CONT to NORM.		
	d. Set control unit ADDRESS to 1.		
	e. Change any and all of controls in step c.		
	f. Note response signals on the control unit as follows:		
(Cont)			

Table 2. Serial Interface, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)	EQUIPMENT STATUS indicators	No change in indications.	Check U14, and associated address circuits.
	BANDWIDTH indicators (receiver only).	No change in indications.	
	FREQUENCY KHZ indicators.	No change in indications.	
	g. Set control unit ADDRESS to 0.		
	h. Note response signals on the control unit as follows:		
	EQUIPMENT STATUS indicators.	No fault indications, MODE indicates A1 ISB (exciter and receiver).	Check U7, U9, U10, U11, U1, U2, U3, U4, and associated circuits.
	FREQUENCY KHZ indicators.	Indicates 29999.9 (0) kHz.	
	Note Do not connect ground lead to J1-30 until frequency indication is normal (29999.9).		
	i. Connect a storage oscilloscope to TP6 (blue). Sweep time = 10 ms. Trigger = TRIGGER. Vert scale = 1 V per division. Horiz sweep = Normal. Display = STORE.		
	j. Connect a jumper from J1-30 to ground.	R/E FAULT indicator flashes at 0.5-Hz rate (2 s on, 2 s off). *Note* Flashing starts approximately 7 seconds after ground connected to J1-30.	
	k. On control unit, change any FREQUENCY KHZ control (thumbwheel control only).	Oscilloscope display should look similar to command word with status request word 1 (refer to figure 10). Each frequency change changes data pattern.	Check U1 thru U4, U7, U24, U9, U29, U30, and associated circuits.
(Cont)			

Table 2. Serial Interface, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)		*Note* Without special equipment it is impossible to note exact waveform. Look at spacing and bits of data.	
	l. Erase scope and repeat step k as often as necessary to obtain a good result. *Note* 10-MHz and 1-MHz frequency controls change bit pattern of word 1, character 2. 100-kHz and 10-kHz frequency controls change bit pattern of word 1, character 3. 1-kHz and 100-Hz frequency controls change bit pattern of word 1, character 4. 10-Hz and 1-Hz frequency controls (if applicable) change bit pattern of word 1, character 5.		
	m. Erase scope. On control unit, change RF GAIN control position.	Oscilloscope display should look similar to command word with status request, word 2 (refer to figure 10). Each RF GAIN control changes data pattern. Refer to note of step k.	Same as step k.
(Cont)	n. Erase scope and repeat step m as necessary to obtain a good result. *Note* RF GAIN control changes bit pattern of word 2, character 2. A1 AGC switch changes bit pattern of word 2, character 4. VBFO enable switch (if applicable) changes bit pattern of word 2, character 4. MODE control changes bit pattern of word 2, character 5.		

Table 2. Serial Interface, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)	o. Erase scope. On control unit, change PA PWR control position.	Oscilloscope display should look similar to command word with status request word 3 (refer to figure 10). Each PA PWR control change changes data pattern. Refer to note of step k.	Same as step k.
	p. Erase scope and repeat step o as often as necessary to obtain a good result. *Note* VBFO 1-kHz and sign controls (if applicable) change bit pattern of word 3, character 2. VBFO 100-Hz and 10-Hz controls (if applicable) change bit pattern of word 3, character 3. PA PWR control changes bit pattern of word 3, character 5. P CAR switch changes bit pattern of word 3, character 5.		
	q. Erase scope. On control unit, change KEY control position.	Oscilloscope display should look similar to command word with status request word 4. (Refer to figure 10.) Each application or removal of a key changes data pattern. Refer to note of step k.	Same as step k.
	r. Erase scope and repeat step q as often as necessary to obtain a good result.		
(Cont)	s. Erase scope. On control unit (with continuous tuning control) set DIAL switch to FINE and rotate TUNING knob.	Oscilloscope display should look similar to command word with status request word 4. (Refer to figure 10.) Each change of TUNING knob rotation speed changes data pattern. Refer to note of step k.	Same as step k.

Table 2. Serial Interface, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
3. (Cont)	t. Erase scope and repeat step s as often as necessary to obtain a good result. u. Remove jumper from J1-30 to ground.		
4. Serial data status only (Cont)	a. Repeat steps 3.a. through 3.i. b. Set local unit front-panel controls as follows: FREQUENCY KHZ to 29999.9 (0). MODE to ISB. RF GAIN to full ccw (receiver only). CH A1 AGC to DATA (receiver only). CH A1 AGC BUS to ON (receiver only). CHANNEL ENABLE A1 to LINE (exciter only). KEY to NORM (exciter only). PA PWR to STBY (exciter only). PILOT CARR to OFF (exciter only). CONT to LCL. c. Change any or all of the above front-panel controls on the control unit. d. Note response signals on the control unit. e. Set control unit ADDRESS to 0. f. Note response signals on the control unit as follows: EQUIPMENT STATUS indicators. ISB indicators (receiver only). FREQUENCY KHZ indicators.	No changes. No fault indications, mode indicates ISB (exciter and receiver). BUSY indicator is lit. Indicate A1. Indicates 29999.9 (0) kHz.	Same as test 3.

Table 2. Serial Interface, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
4. (Cont)	g. Connect a storage oscilloscope to TP6 (blue). Sweep time = 20 ms. Trigger = INTERNAL. Vert scale = 1 V per division. Horiz sweep = SINGLE SWEEP. Display = STORE. h. Note oscilloscope waveform. i. Repeat steps g and h as often as necessary to obtain a good result.	Should look similar to status request only words (refer to figure 10). *Note* Without special equipment it will be impossible to note exact waveform. Look at spacing and bits of data.	
5. Serial data status only (Cont)	a. Repeat steps 3.a through 3.i. b. Set local unit front-panel controls as follows: FREQUENCY KHZ to 29999.9 (0). MODE to ISB. RF GAIN to full ccw (receiver only). CH A1 AGC to DATA (receiver only). CH A1 AGC BUS to ON (receiver only). CHANNEL ENABLE A1 to LINE (exciter only). KEY to NORM (exciter only). PA PWR to STBY (exciter only). PILOT CARR to OFF (exciter only). CONT to LCL. c. Change any or all of the above front-panel controls on the control unit.		Same as test 3.

Table 2. Serial Interface, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
5. (Cont)	d. Note response signals on the control unit.	No changes.	
	e. Set control unit ADDRESS to 0.		
	f. Note response signals on the control unit as follows:		
	EQUIPMENT STATUS indicators.	No fault indications mode indicates ISB (exciter and receiver).	
		BUSY indicator is lit.	
	ISB indicators.	Indicate A1.	
	FREQUENCY KHZ indicators.	Indicates 29999.9 (0) kHz.	
	g. Connect a storage oscilloscope to TP5 (green). Sweep time = 20 ms. Trigger = INTERNAL. Vert scale = 1 V per division. Horiz sweep = SINGLE SWEEP. Display = STORE.		
	h. Note oscilloscope waveform.	Should look similar to monitor word(s)/ command word(s) with no status request, (refer to figure 10). ***Note*** Without special equipment it will be impossible to note exact waveform. Look at spacing and bits of data.	
	i. Repeat steps g and h as often as necessary to obtain a good result.		
6. FSK receiver sensitivity	a. Connect local unit to a control unit through a 40-dB attenuator in both the monitor and data lines.		Check U34A and associated circuits.
	b. Repeat test 3.	Results should be same as test 3 results.	

Table 2. Serial Interface, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
7. Address recognition (Cont)	a. Set local unit CONT switch to REM.		
	b. Set control unit ADDRESS to 0.		
	c. Set control unit front-panel controls as follows:		
	FREQUENCY KHZ to 29999.9(9).		
	MODE to ISB.		
	RF GAIN to full ccw (receiver only).		
	CH A1 AGC to DATA (receiver only).		
	CH A1 AGC BUS to ON (receiver only).		
	CHANNEL ENABLE A1 to LINE (exciter only).		
	KEY to NORM (exciter only).		
	PA PWR to STBY (exciter only).		
	PILOT CARR to OFF (exciter only).		
	d. Note response signals on the control unit as follows:		
	EQUIPMENT STATUS indicators.	No fault indications mode indicates ISB.	Check U1 thru U4, U7, U6, U8, U9, U20, U21, U11, U12, and associated circuits.
		PA READY might be lit (exciter only).	
	ISB indicators.	Indicates A1.	
	FREQUENCY KHZ indicators.	Indicates 29999.9 (9) kHz.	
	e. Set control unit ADDRESS to 1.		
	f. Note response signals on the control unit as follows:		
	EQUIPMENT STATUS indicators.	EXCTR FAULT, RCV FAULT, or R/E FAULT indicator flashes at a 0.25-Hz rate (on 2 seconds, off 2 seconds). All other indications should remain the same.	Check U1, U2, U3, U4, U5, U27, U28, U29, U30, U8, and associated circuits. Check also busy circuit on parallel output.
	ISB indicators.	No change from step d.	

Table 2. Serial Interface, Testing and Troubleshooting Procedures (Cont).

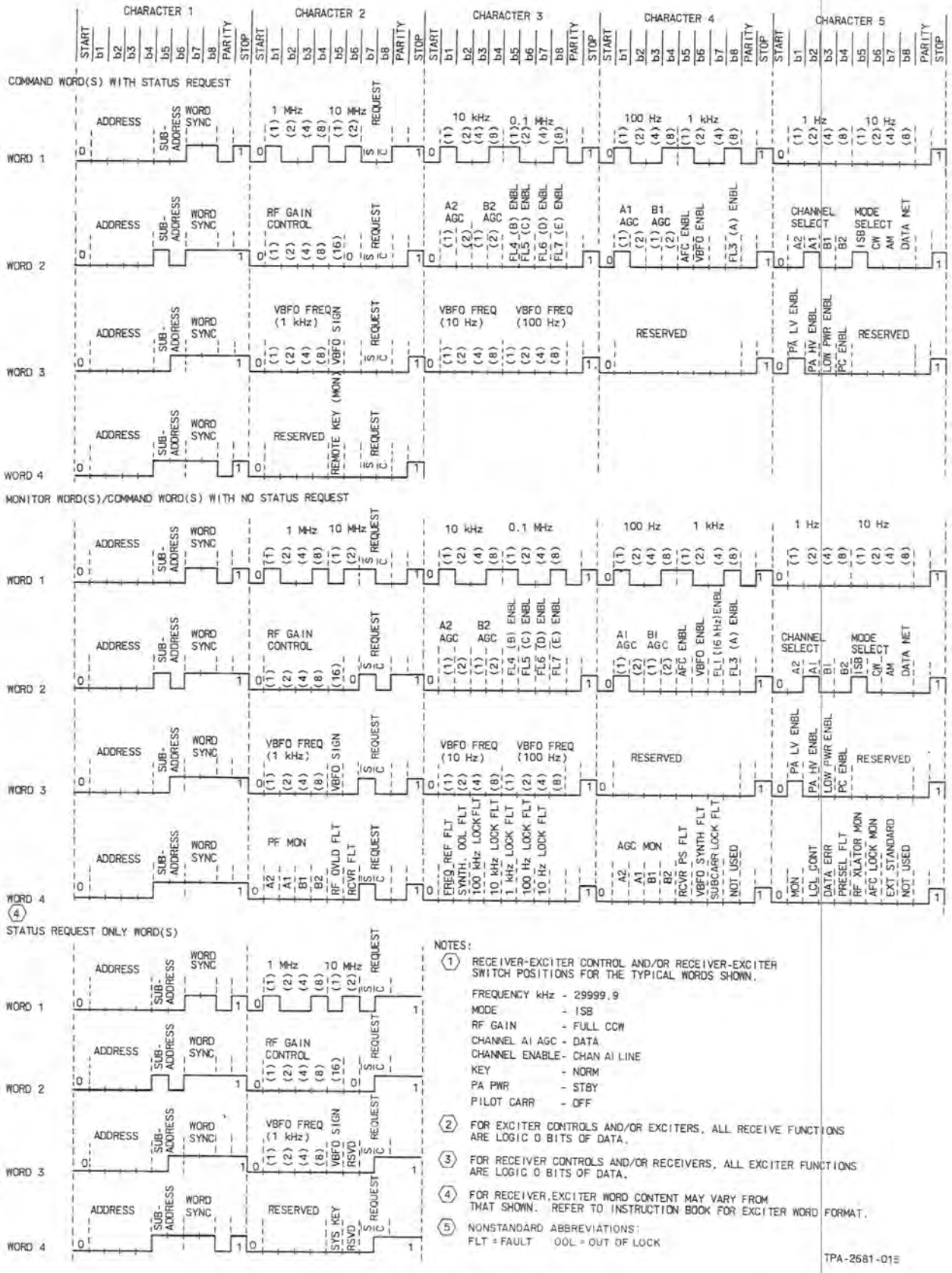
TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
7. (Cont)	FREQUENCY KHZ indicators. g. Note response signals on the control unit with the ADDRESS to each position 2 through 15.	No change from step d. Same as step f.	Check U1, U2, U3, U4, U5, U27, U28, U29, U30, U8, and associated circuits. Check also busy circuit on parallel output.
8. Word 4 continuous transmit	a. Set control unit ADDRESS to 0. b. Set control unit CONT switch to NORM. c. Connect oscilloscope to TP6 (blue). Sweep time = 20 ms. Trigger = INTERNAL. Vert scale = 1 V per division. Horiz sweep = NORMAL d. Apply a ground to J1-30. e. Remove J1-30 ground.	Continuous data monitored on oscilloscope should look similar to status request only word, word 4. Continuous data on oscilloscope is terminated.	Check U1 thru U4, U7, U23, U24 and associated circuits. Same as step c.
9. Data loop back (Cont)	a. Set control unit address to 0. b. Disconnect control unit from local unit. c. Set control unit CONT switch to TEST. d. Connect a dual-trace storage oscilloscope with upper trace to TP6 (blue) and lower trace to TP5 (green). e. Set oscilloscope as follows: Sweep time = 20 ms. Trigger = INTERNAL. Vert scale = 1 V per division. Horiz sweep = NORMAL. f. Set control unit front-panel controls as follows: FREQUENCY KHZ to 29999.0 (9). MODE to ISB. RF GAIN to full ccw (receiver only). CH A1 AGC to DATA (receiver only). CH A1 AGC BUS to ON (receiver only). CHANNEL ENABLE A1 to LINE (exciter only).		

Table 2. Serial Interface, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
9. (Cont)	KEY to NORM (exciter only).		
	PA PWR to STBY (exciter only).		
	PILOT CARR to OFF (exciter only).		
	g. Set oscilloscope display to STORE.		
	h. Erase display. Set FREQUENCY KHZ to 29999.9(9).	Both oscilloscope traces are identical and look similar to command word with status request, word 1. (Refer to figure 10.)	Check U1 through U4 and associated circuits.
	i. Erase display. Set MODE control to AM.	Both oscilloscope traces are identical and look similar to command word with status request, word 2. (Refer to figure 10.)	Same as step h.
	j. Erase display. Set PA PWR to HIGH PWR.	Both oscilloscope traces are identical and look similar to command word with status request, word 3. (Refer to figure 10.)	Same as step h.
	k. Erase display. Set KEY control to LOCK.	Both oscilloscope traces are identical and look similar to command word with status request, word 4. (Refer to figure 10.)	Same as step h.
	l. Set control unit CONT switch to NORM.		
	m. Repeat steps g through j.	Upper trace same as steps g through j. Lower trace, straight line.	Same as step h.
10. Baud rate check	a. Note baud rate strapped in unit.	Reference.	
	b. Strap baud rate for 75.		
	c. Repeat test 10.	Same as test 10 except monitor word spacing increases as baud rate decreases and vice versa.	Same as test 10.
(Cont)			

Table 2. Serial Interface, Testing and Troubleshooting Procedures (Cont).

TEST	PROCEDURE	NORMAL INDICATION	IF INDICATION IS ABNORMAL
10. (Cont)	d. Strap baud rate for 19 200. e. Repeat test 10. f. Return to baud rate strapping referenced in step a.		



Timing Diagram/Typical Waveforms
Figure 10

4. ALIGNMENT/ADJUSTMENT

4.1 Control Data Strapping

For strapping instructions and information, refer to paragraph 2.5 of this instruction.

4.2 Adjustment of FSK Detector Symmetry

a. Perform test setup of table 2, test 1.
b. Strap card for FSK signaling (refer to paragraph 2.5.1).
c. Strap card for 1200 bauds (refer to paragraph 2.5.6).
d. Strap for odd parity (refer to paragraph 2.5.4).
e. Apply a 0-dB mW FSK signal with a symmetrical 1:1 (mark, space) data pattern between P1-54 and P1-55.
f. Using an oscilloscope, monitor the waveform at TP5 (green) to ground (TP1, brown).
g. Adjust R67 to obtain best symmetry of the waveform at TP5.

5. REPAIR

Repair of the serial interface card is accomplished using standard maintenance and planar card repair procedures. Refer to the maintenance section of this instruction book for planar card repair procedures.

6. PARTS LIST/DIAGRAMS

6.1 Introduction

Caution

This equipment contains electrostatic discharge sensitive (ESDS) devices. Special handling methods and materials must be used to prevent equipment damage. Refer to the maintenance section for the equipment before assembly/disassembly or repair is performed. ESDS items are identified in the description column of the parts list by (ESDS).

All supporting parts list illustrations that contain ESDS items are shown with the following symbol

This paragraph assists in identification, requisition, and issuance of parts and in maintenance of the equipment. A parts location illustration, schematic diagram, parts list tabulation, and modification history are included in the schematic diagram (figure 11). The parts location illustration is a design engineering drawing that shows exact component placement on the circuit cards.

Use the reference designator indicated on the schematic and parts location diagram to locate parts in the parts list tabulation. The Collins part number and description are listed for each reference designator. In addition, the manufacturer's code and part number are listed when applicable.

6.2 Parts List

REF DES Column — Reference designators of each part/subassembly are listed in alphanumeric sequence. These are the reference designators shown on the parts location drawing and schematic diagram.

DESCRIPTION Column — Lists the noun name, modifier, descriptive information, and modifications.

Modifications are identified by an alphanumeric identifier assigned to each design change. These identifiers are referenced in the DESCRIPTION column of the parts list in parentheses and on the schematic diagram inside an arrow that points to the change. Each change relates to the revision identifier (REV) stamped on the circuit card/subassembly and is listed in the EFFECTIVITY column of the modification history.

COLLINS PART NUMBER Column — Lists the Collins part number for each item in the parts list.

USABLE ON CODE Column — Part variations within a group of equipment are indicated by a letter code (A, B, C, etc). Absence of a code indicates part applies to all models.

MFR CODE Column — Lists the manufacturer's code from which selected parts can be procured.

MFR PART NUMBER Column — Lists the manufacturer's part number for the selected parts.

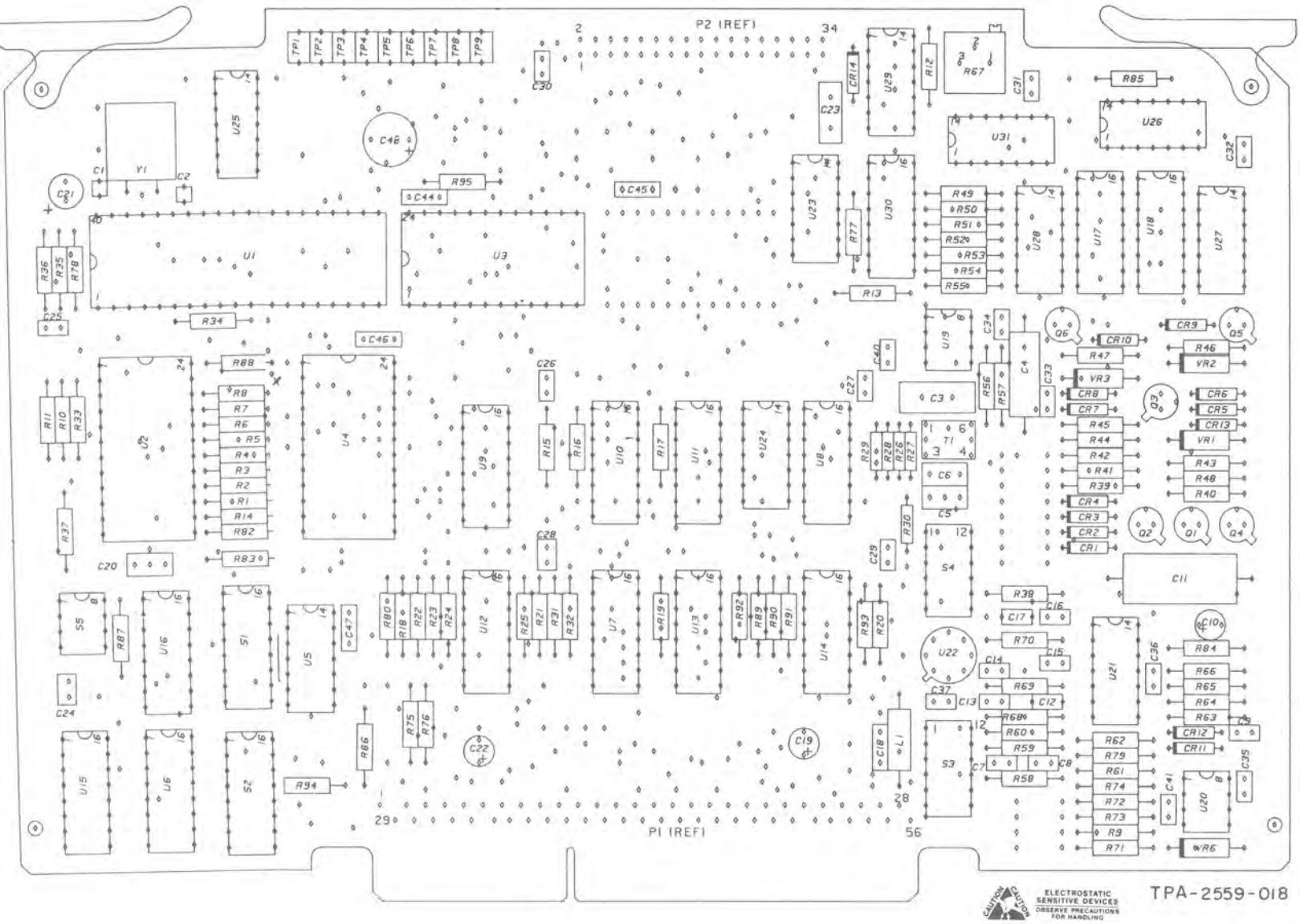
Listed below are the manufacturer's names and addresses for the manufacturer's codes used in this parts list.

MFR CODE	MANUFACTURER'S NAME AND ADDRESS
00136	MCCOY ELECTRONICS CO WATTS AND CHESTNUT ST MT HOLLY SPRINGS PA 17065
01295	TEXAS INSTRUMENTS INC SEMICONDUCTOR GROUP 13500 N CENTRAL EXPRESSWAY P O BOX 225012 M/S 49 DALLAS TX 75222
02735	RCA CORP SOLID STATE DIVISION ROUTE 202 SOMERVILLE NJ 08876
03508	GENERAL ELECTRIC CO SEMI-CONDUCTOR PRODUCTS DEPT W GENESEE ST AUBURN NY 13021
04713	MOTOROLA INC SEMICONDUCTOR PRODUCTS GROUP 5005 E MCDOWELL RD PHOENIX AZ 85008
07263	FAIRCHILD CAMERA AND INSTRUMENT CORP SEMICONDUCTOR DIV 464 ELLIS ST MOUNTAIN VIEW CA 94042
07388	TOROTEL INC 13402 S 71 HIGHWAY GRANDVIEW MO 64030
12040	NATIONAL SEMICONDUCTOR CORP COMMERCE DR P O BOX 443 DANBURY CT 06810
12954	SIEMENS CORP COMPONENTS GROUP 8700 E THOMAS RD P O BOX 1390 SCOTTSDALE AZ 85252
15818	TELEDYNE SEMICONDUCTOR 1300 TERRA BELLA AVE MOUNTAIN VIEW CA 94043
16546	GLOBE-UNION INC USCC/CENTRALAB ELECTRICS DIV 4561 COLORADO LOS ANGELES CA 90039
18324	SIGNETICS CORP 811 E ARQUES SUNNYVALE CA 94086
27014	NATIONAL SEMICONDUCTOR CORP 2900 SEMICONDUCTOR DR SANTA CLARA CA 95051
27264	MOLEX INC CORPORATE HQ 2222 WELLINGTON COURT LISLE IL 60532
27735	F-DYNE ELECTRONICS 449 HOWARD AVE BRIDGEPORT CT 06605
56289	SPRAGUE ELECTRIC CO NORTH ADAMS MA 01247
72136	ELECTRO MOTIVE CORP SUBSIDIARY OF INTERNATIONAL ELECTRONICS CORP LAUTER AVE P O BOX 7600 FLORENCE SC 29501
72982	ERIE TECHNOLOGICAL PRODUCTS INC 644 W 12TH ST ERIE PA 16512
74970	JOHNSON E F CO 299 10TH AVE S W WASECA MN 56093
81349	MILITARY SPECIFICATION
81483	INTERNATIONAL RECTIFIER 9220 SUNSET BLVD P O BOX 2321 TERMINAL ANNEX LOS ANGELES CA 90054
96906	MILITARY STANDARD

6.3 Equipment Covered

Listed below are the circuit cards/subassemblies with the latest effectivity covered by these instructions.

CIRCUIT CARD/ SUBASSEMBLY	COLLINS PART NUMBER	LATEST EFFECTIVITY
Serial Interface	638-6896-001	REV F



Serial Interface, Schematic Diagram
Figure 11 (Sheet 1 of 5)

PARTS LIST

REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	SERIAL INTERFACE (ESDS)	638-6896-001			
CR1-CR14	SEMICOND DEVICE	353-3644-010		03508	1N4454GE
C1,C2	CAPACITOR,FXD CER DIEL, 27PF, 10%, 100V	913-1098-570		72982	8111A100C0G0-270 K
C3	CAPACITOR,FXD MICA DIEL, 470PF, 5%, 500V	912-2864-000		72136	DM15F471J300WV4C R
C4	CAPACITOR,FXD PLSTC DIEL, 0.0056UF, 10%, 80V	933-1039-320		27735	PE1S0056-80-10
C5,C6	CAPACITOR,FXD CER DIEL, 1UF, 20%, 50V	913-3279-270		16546	CY30C105M
C7-C9	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-680		16546	CY20C104M
C10	CAPACITOR,FXD TNTLM ELCTLT, 15UF, 20%, 15V	184-9102-130		56289	199D156X0015CB1
C11	CAPACITOR,FXD PLSTC DIEL, 0.047UF, 10%, 200V	933-1039-040		27735	PE1S047-200-10
C12	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C13	CAPACITOR,FXD CER DIEL, 0.1UF, 20%, 50V	913-3279-680		16546	CY20C104M
C14-C16	CAPACITOR,FXD CER DIEL, 0.01UF, 20%, 50V	913-3279-110		16546	CY20C103M
C17	CAPACITOR,FXD CER DIEL, 1000PF, 10%, 200V	913-4018-000		81349	CK05BX102K
C18	CAPACITOR,FXD CER DIEL, 0.47UF, PORM10%, 50V	913-5019-520		81349	CK06BX474K
C19	CAPACITOR,FXD TNTLM ELCTLT, 1UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1
C20	CAPACITOR,FXD CER DIEL, 0.22UF, 20%, 50V	913-3279-220		16546	CY30C224M
C21	CAPACITOR,FXD TNTLM ELCTLT, 68UF, 20%, 6V	184-9102-040		56289	199D686X0006DB1
C22	CAPACITOR,FXD TNTLM ELCTLT, 1UF, 20%, 35V	184-9102-350		56289	199D105X0035BB1
C23	CAPACITOR,FXD CER DIEL, 1.5UF, 20%, 50V	913-3279-280		16546	CY40C155M
C24-C37	CAPACITOR,FXD CER DIEL, 0.01UF, 20%, 50V	913-3279-110		16546	CY20C103M
C38,C39	NOT USED				
C40,C41	CAPACITOR,FXD CER DIEL, 0.01UF, 20%, 50V	913-3279-110		16546	CY20C103M
C42,C43	NOT USED				
C44-C47	CAPACITOR,FXD CER DIEL, 0.47UF, PORM10%, 50V	913-5019-520		81349	CK06BX474K
C48	CAPACITOR,FXD TNTLM ELCTLT, 100UF, 20%, 10V	184-9102-100		56289	196D235
L1	COIL,RF 1UH	240-2715-130		96906	MS75088-1
Q1	TRANSISTOR	352-0551-010		15818	2N2907A
Q2	TRANSISTOR	352-0661-020		07263	2N2222A
Q3	TRANSISTOR	352-0551-010		15818	2N2907A
Q4	TRANSISTOR	352-0661-020		07263	2N2222A
Q5	TRANSISTOR	352-0551-010		15818	2N2907A
Q6	TRANSISTOR	352-0661-020		07263	2N2222A
R1-R8	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R9	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R10-R21	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R22-R25	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R26-R30	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/8W	745-2449-000		81349	RCR05G105KS
R31,R32	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R33-R38	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R39-R41	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R42	RESISTOR,FXD CMPSN, 1.5K, 10%, 1/4W	745-0755-000		81349	RCR07G152KS
R43	RESISTOR,FXD CMPSN, 390 OHMS, 10%, 1/4W	745-0734-000		81349	RCR07G391KS
R44,R45	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R46,R47	RESISTOR,FXD CMPSN, 680 OHMS, 10%, 1/4W	745-0743-000		81349	RCR07G681KS
R48	RESISTOR,FXD CMPSN, 1K, 10%, 1/4W	745-0749-000		81349	RCR07G102KS
R49-R52	RESISTOR,FXD FILM, 20.5K, 1%, 1/8W	705-1059-000		81349	RN55D2052F
R53,R54	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R55,R56	RESISTOR,FXD FILM, 48.7K, 1%, 1/8W	705-1077-000		81349	RN55D4872F
R57,R58	RESISTOR,FXD CMPSN, 560 OHMS, 10%, 1/4W	745-0740-000		81349	RCR07G561KS
R59,R60	RESISTOR,FXD CMPSN, 22K, 10%, 1/4W	745-0797-000		81349	RCR07G223KS
R61	RESISTOR,FXD CMPSN, 0.47MEGO, 10%, 1/4W	745-0845-000		81349	RCR07G474KS
R62	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W	745-0761-000		81349	RCR07G222KS
R63	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R64	RESISTOR,FXD CMPSN, 15K, 10%, 1/4W	745-0791-000		81349	RCR07G153KS
R65	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R66	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R67	RESISTOR,VAR WW, 2K, PORM5%, 3/4W	381-1721-050		81349	RT22C2P20Z
R68-R70	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R71	RESISTOR,FXD CMPSN, 0.10MEGO, 10%, 1/4W	745-0821-000		81349	RCR07G104KS
R72	RESISTOR,FXD CMPSN, 0.82MEGO, 10%, 1/4W	745-0854-000		81349	RCR07G824KS
R73	RESISTOR,FXD CMPSN, 0.18MEGO, 10%, 1/4W	745-0830-000		81349	RCR07G184KS
R74	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W	745-0761-000		81349	RCR07G222KS
R75-R77	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R78	RESISTOR,FXD CMPSN, 4.7K, 10%, 1/4W	745-0773-000		81349	RCR07G472KS
R79	RESISTOR,FXD CMPSN, 0.47MEGO, 10%, 1/4W	745-0845-000		81349	RCR07G474KS
R80	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R81,R82	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R83	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R84	RESISTOR,FXD CMPSN, 0.47MEGO, 10%, 1/4W	745-0845-000		81349	RCR07G474KS
R85	RESISTOR,FXD CMPSN, 2.2K, 10%, 1/4W	745-0761-000		81349	RCR07G222KS
R86,R87	RESISTOR,FXD CMPSN, 1MEGO, 10%, 1/4W	745-0857-000		81349	RCR07G105KS
R88	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
R89-R94	RESISTOR,FXD CMPSN, 0.39MEGO, 10%, 1/4W	745-0842-000		81349	RCR07G394KS
R95	RESISTOR,FXD CMPSN, 10K, 10%, 1/4W	745-0785-000		81349	RCR07G103KS
S1,S2	SWITCH,DUAL PKG	266-0243-050		27264	A10040-108
S3,S4	SWITCH,DUAL PKG	266-0243-030		27264	A10040-106
S5	SWITCH,DUAL PKG	266-0243-010		27264	A10040-104
TP1	JACK,TIP BRN	360-0484-070		74970	105-1108-011
TP2	JACK,TIP RED	360-0484-020		74970	105-1102-011
TP3	JACK,TIP ORN	360-0484-050		74970	105-1106-011
TP4	JACK,TIP YEL	360-0484-060		74970	105-1107-011
TP5	JACK,TIP GRN	360-0484-040		74970	105-1104-011
TP6	JACK,TIP BLU	360-0484-080		74970	105-1110-011
TP7	JACK,TIP VIO	360-0484-090		74970	105-1112-011
TP8	JACK,TIP GRA	360-0484-100		74970	105-1113-011
TP9	JACK,TIP WHT	360-0484-010		74970	105-1101-011
T1	TRANSFORMER, RF	677-0324-320		07388	26077
U1	MICROPROCESSOR (ESDS)	351-8676-010		04713	MC6802P
U2	INTEGRATED CIRCUIT COMM INTFC ADAPTER (ESDS)	351-8455-010		04713	MC6850P
U3	INTEGRATED CIRCUIT EPROM (ESDS)	647-2751-001			2716

PARTS LIST (Cont)

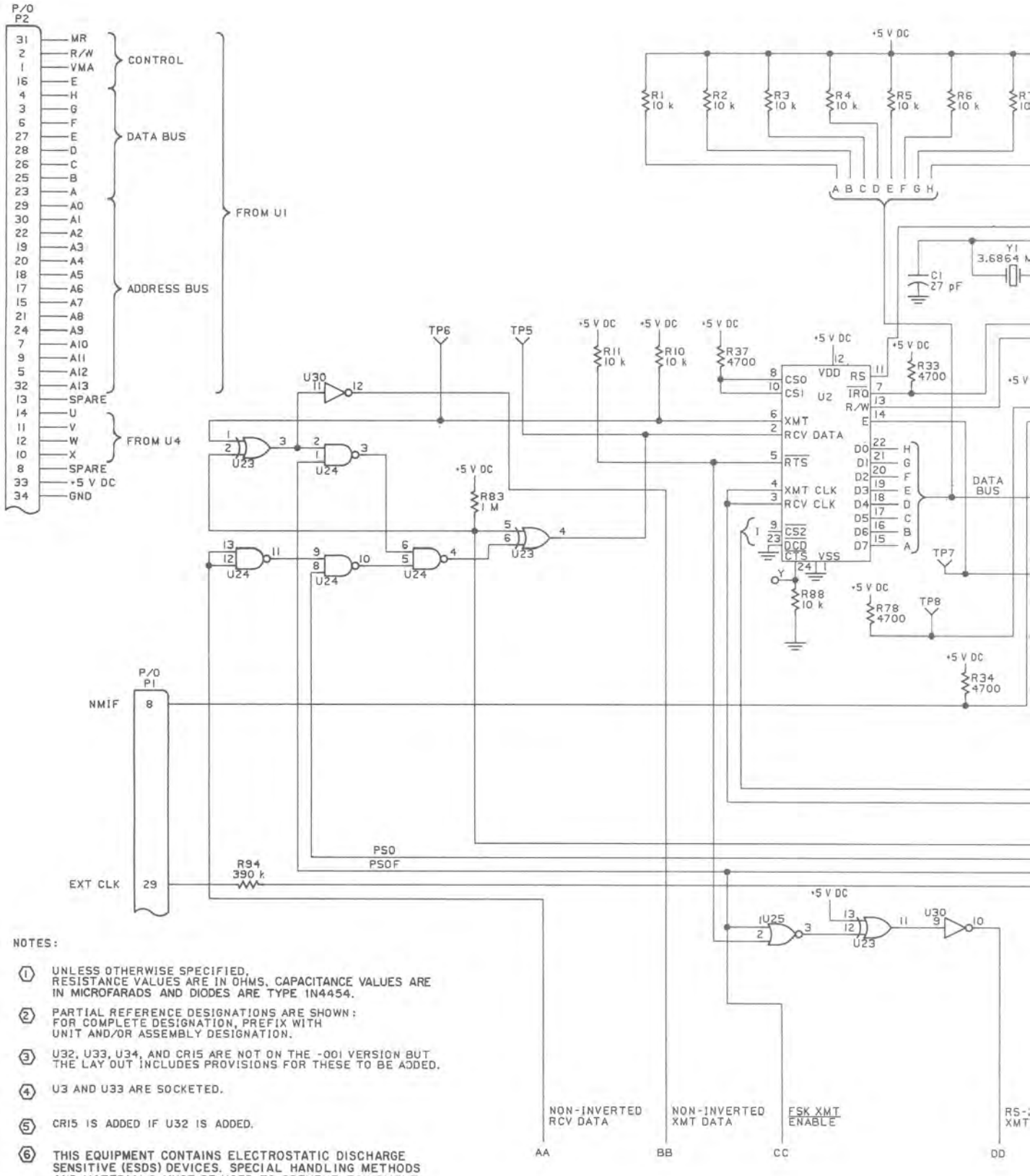
REF DES	DESCRIPTION	COLLINS PART NUMBER
U4	INTEGRATED CIRCUIT DECODER	351-152
U5	INTEGRATED CIRCUIT LOGIC GATE	351-152
U6	INTEGRATED CIRCUIT COUNTER (ESDS)	351-827
U7	INTEGRATED CIRCUIT (ESDS)	351-849
U8	INTEGRATED CIRCUIT (ESDS)	351-815
U9	INTEGRATED CIRCUIT (ESDS)	351-815
U10,U11	INTEGRATED CIRCUIT (ESDS)	351-815
U12-U14	INTEGRATED CIRCUIT (ESDS)	351-849
U15	INTEGRATED CIRCUIT (ESDS)	351-815
U16	INTEGRATED CIRCUIT (ESDS)	351-815
U17	INTEGRATED CIRCUIT (ESDS)	351-831
U18	INTEGRATED CIRCUIT (ESDS)	351-825
U19	INTEGRATED CIRCUIT OPNL AMPLIFIER	351-107
U20	INTEGRATED CIRCUIT AMPLIFIER	351-128
U21	INTEGRATED CIRCUIT	351-111
U22	INTEGRATED CIRCUIT COMPARATOR	351-109
U23	INTEGRATED CIRCUIT (ESDS)	351-840
U24	INTEGRATED CIRCUIT (ESDS)	351-815
U25,U26	INTEGRATED CIRCUIT (ESDS)	351-815
U27	INTEGRATED CIRCUIT (ESDS)	351-815
U28	INTEGRATED CIRCUIT (ESDS)	351-840
U29	INTEGRATED CIRCUIT (ESDS)	351-834
U30	INTEGRATED CIRCUIT (ESDS)	351-815
U31	INTEGRATED CIRCUIT (ESDS)	351-815
VR1	SEMICOND DEVICE	353-2938
VR2,VR3	SEMICOND DEVICE	353-2712
VR4,VR5	NOT USED	
VR6	SEMICOND DEVICE	353-2708
Y1	CRYSTAL UNIT,QTZ 3.6864MHZ	289-7120

IST

	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
	638-6896-001			
	353-3644-010		03508	1N4454GE
	913-1098-570		72982	8111A100C0G0-270 K
	912-2864-000		72136	DM15F471J300WV4C R
V	933-1039-320		27735	PE1S0056-80-10
	913-3279-270		16546	CY30C105M
	913-3279-680		16546	CY20C104M
	184-9102-130		56289	199D156X0015CB1
V	933-1039-040		27735	PE1S047-200-10
	913-4018-000		81349	CK05BX102K
	913-3279-680		16546	CY20C104M
	913-3279-110		16546	CY20C103M
	913-4018-000		81349	CK05BX102K
V	913-5019-520		81349	CK06BX474K
	184-9102-350		56289	199D105X0035BB1
	913-3279-220		16546	CY30C224M
	184-9102-040		56289	199D686X0006DB1
	184-9102-350		56289	199D105X0035BB1
	913-3279-280		16546	CY40C155M
	913-3279-110		16546	CY20C103M
	913-3279-110		16546	CY20C103M
V	913-5019-520		81349	CK06BX474K
V	184-9102-100		56289	196D235
	240-2715-130		96906	MS75088-1
	352-0551-010		15818	2N2907A
	352-0661-020		07263	2N2222A
	352-0551-010		15818	2N2907A
	352-0661-020		07263	2N2222A
	352-0551-010		15818	2N2907A
	352-0661-020		07263	2N2222A
	745-0785-000		81349	RCR07G103KS
	745-0857-000		81349	RCR07G105KS
	745-0785-000		81349	RCR07G103KS
	745-0857-000		81349	RCR07G105KS
	745-2449-000		81349	RCR05G105KS
	745-0857-000		81349	RCR07G105KS
	745-0773-000		81349	RCR07G472KS
	745-0785-000		81349	RCR07G103KS
	745-0755-000		81349	RCR07G152KS
	745-0734-000		81349	RCR07G391KS
	745-0749-000		81349	RCR07G102KS
	745-0743-000		81349	RCR07G681KS
	745-0749-000		81349	RCR07G102KS
	705-1059-000		81349	RN55D2052F
	745-0785-000		81349	RCR07G103KS
	705-1077-000		81349	RN55D4872F
	745-0740-000		81349	RCR07G561KS
	745-0797-000		81349	RCR07G223KS
	745-0845-000		81349	RCR07G474KS
	745-0761-000		81349	RCR07G222KS
	745-0773-000		81349	RCR07G472KS
	745-0791-000		81349	RCR07G153KS
	745-0785-000		81349	RCR07G103KS
	745-0773-000		81349	RCR07G472KS
	381-1721-050		81349	RT22C2P202
	745-0785-000		81349	RCR07G103KS
	745-0821-000		81349	RCR07G104KS
	745-0854-000		81349	RCR07G824KS
	745-0830-000		81349	RCR07G184KS
	745-0761-000		81349	RCR07G222KS
	745-0857-000		81349	RCR07G105KS
	745-0773-000		81349	RCR07G472KS
	745-0845-000		81349	RCR07G474KS
	745-0857-000		81349	RCR07G105KS
	745-0785-000		81349	RCR07G103KS
	745-0857-000		81349	RCR07G105KS
	745-0845-000		81349	RCR07G474KS
	745-0761-000		81349	RCR07G222KS
	745-0857-000		81349	RCR07G105KS
	745-0785-000		81349	RCR07G103KS
	745-0842-000		81349	RCR07G394KS
	745-0785-000		81349	RCR07G103KS
	266-0243-050		27264	A10040-108
	266-0243-030		27264	A10040-106
	266-0243-010		27264	A10040-104
	360-0484-070		74970	105-1108-011
	360-0484-020		74970	105-1102-011
	360-0484-050		74970	105-1106-011
	360-0484-060		74970	105-1107-011
	360-0484-040		74970	105-1104-011
	360-0484-080		74970	105-1110-011
	360-0484-090		74970	105-1112-011
	360-0484-100		74970	105-1113-011
	360-0484-010		74970	105-1101-011
	677-0324-320		07388	26077
	351-8676-010		04713	MC6802P
DS1	351-8455-010		04713	MC6850P
	647-2751-001			2716

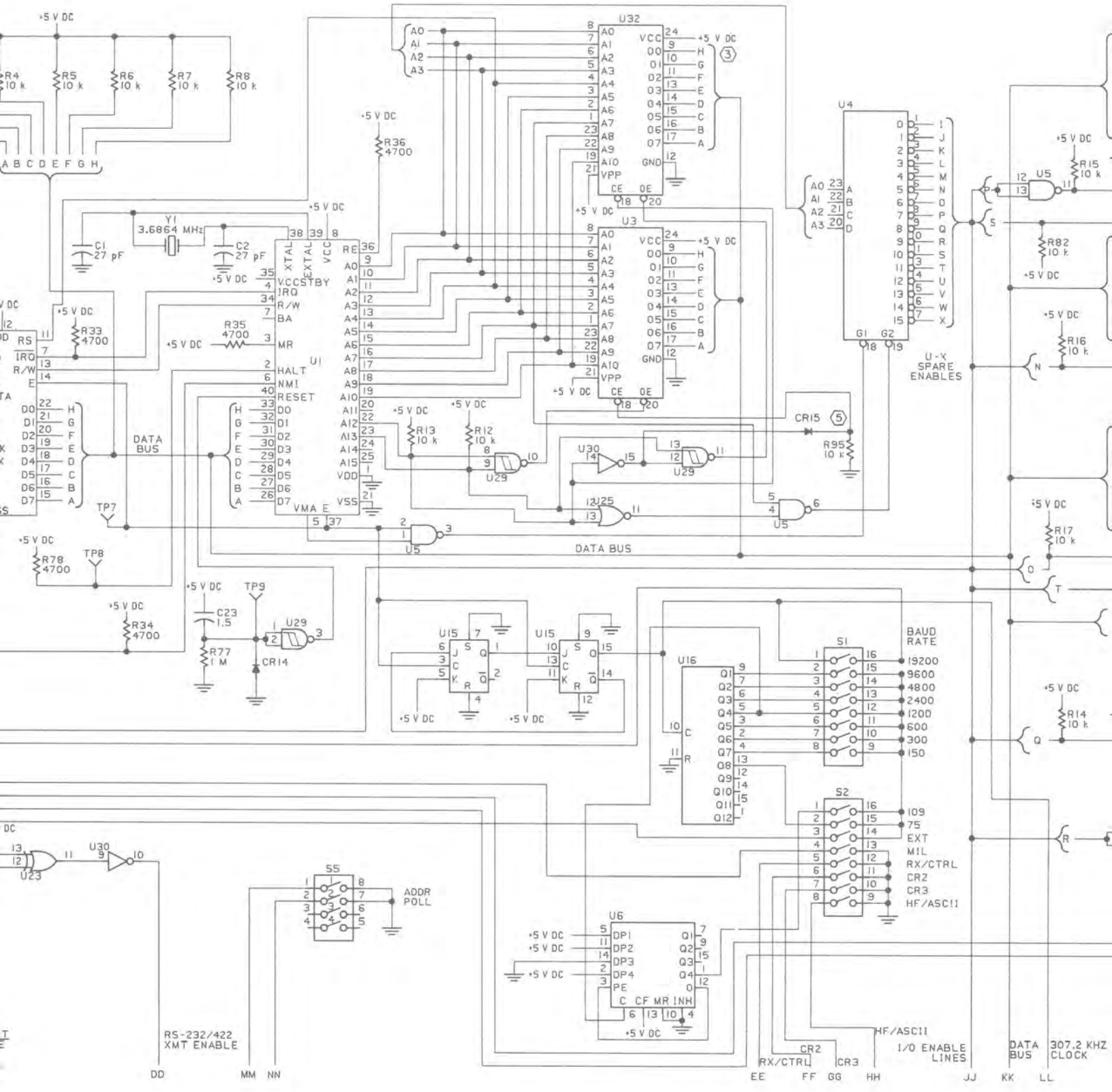
PARTS LIST (Cont)

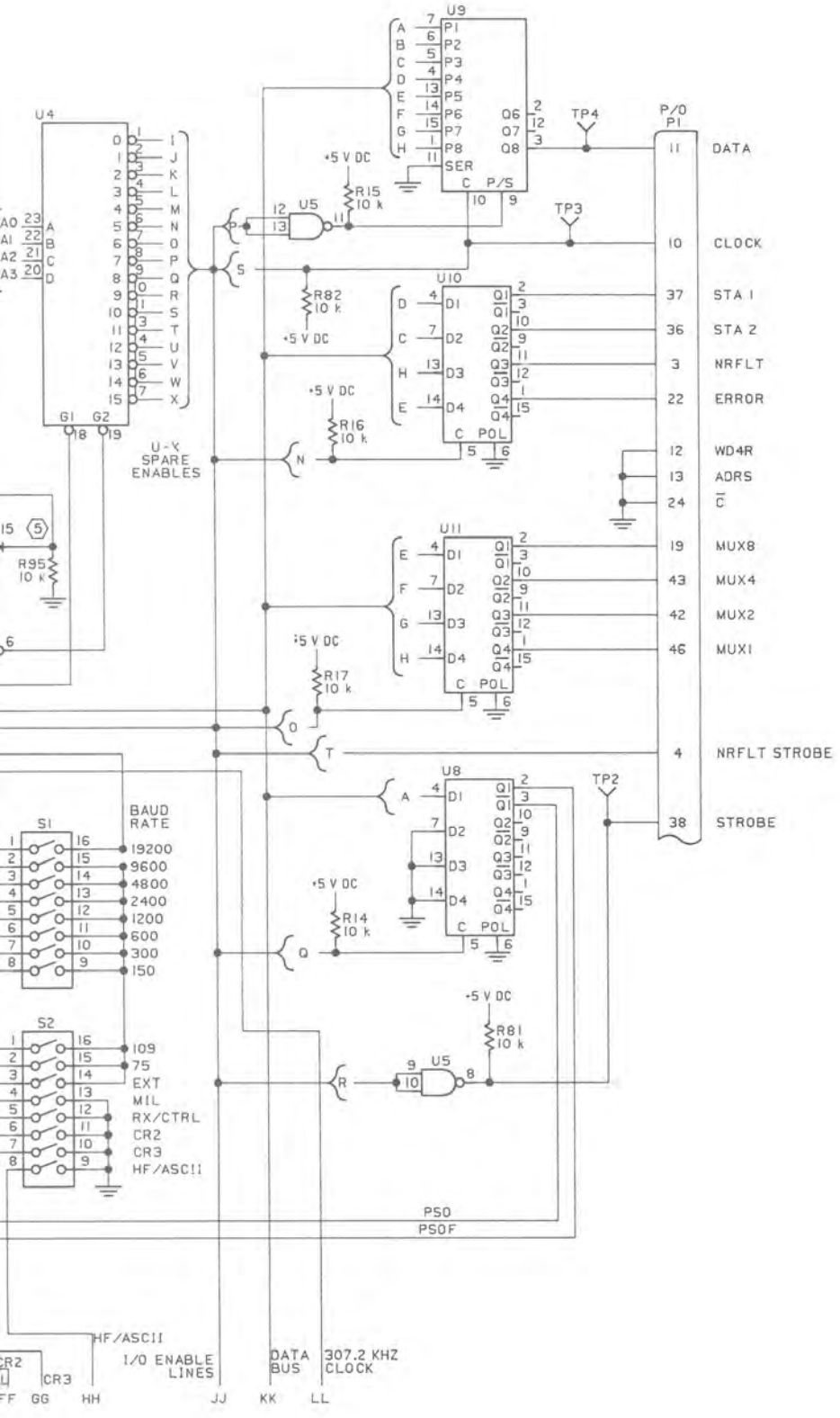
REF DES	DESCRIPTION	COLLINS PART NUMBER	USABLE ON CODE	MFR CODE	MFR PART NUMBER
U4	INTEGRATED CIRCUIT DECODER	351-1526-090		27014	DM74LS154N
U5	INTEGRATED CIRCUIT LOGIC GATE	351-1523-110		18324	N74LS00N
U6	INTEGRATED CIRCUIT COUNTER (ESDS)	351-8277-010		04713	MC14526BCP
U7	INTEGRATED CIRCUIT (ESDS)	351-8490-010		04713	MC14503BCP
U8	INTEGRATED CIRCUIT (ESDS)	351-8159-160		07263	4042BPC
U9	INTEGRATED CIRCUIT (ESDS)	351-8159-230		07263	4021BPC
U10,U11	INTEGRATED CIRCUIT (ESDS)	351-8159-160		07263	4042BPC
U12-U14	INTEGRATED CIRCUIT (ESDS)	351-8490-010		04713	MC14503BCP
U15	INTEGRATED CIRCUIT (ESDS)	351-8159-180		07263	4027BPC
U16	INTEGRATED CIRCUIT (ESDS)	351-8159-240		07263	4040BPC
U17	INTEGRATED CIRCUIT (ESDS)	351-8315-010		07263	F4520PC
U18	INTEGRATED CIRCUIT (ESDS)	351-8253-010		04713	MC14018BCP
U19	INTEGRATED CIRCUIT OPNL AMPLIFIER	351-1071-070		07263	UA1458TC
U20	INTEGRATED CIRCUIT AMPLIFIER	351-1286-010		07263	UA1558RM
U21	INTEGRATED CIRCUIT	351-1114-010		27014	LM565CN
U22	INTEGRATED CIRCUIT COMPARATOR	351-1094-060		12040	LM311H
U23	INTEGRATED CIRCUIT (ESDS)	351-8407-010		04713	MC14070BCP
U24	INTEGRATED CIRCUIT (ESDS)	351-8159-340		07263	4011BPC
U25,U26	INTEGRATED CIRCUIT (ESDS)	351-8159-320		07263	4001BPC
U27	INTEGRATED CIRCUIT (ESDS)	351-8159-340		07263	4011BPC
U28	INTEGRATED CIRCUIT (ESDS)	351-8407-010		04713	MC14070BCP
U29	INTEGRATED CIRCUIT (ESDS)	351-8342-010		02735	CD4093BE
U30	INTEGRATED CIRCUIT (ESDS)	351-8159-210		07263	F4049BPC
U31	INTEGRATED CIRCUIT (ESDS)	351-8159-320		07263	4001BPC
VR1	SEMICOND DEVICE	353-2938-000		01295	1N746A
VR2,VR3	SEMICOND DEVICE	353-2712-000		12954	1N752A
VR4,VR5	NOT USED				
VR6	SEMICOND DEVICE	353-2708-000		81483	1N750A
Y1	CRYSTAL UNIT,QTZ 3.6864MHZ	289-7120-060		00136	289-7120-060M20



NOTES:

1. UNLESS OTHERWISE SPECIFIED, RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS AND DIODES ARE TYPE 1N4454.
2. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN: FOR COMPLETE DESIGNATION, PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.
3. U32, U33, U34, AND CR15 ARE NOT ON THE -001 VERSION BUT THE LAY OUT INCLUDES PROVISIONS FOR THESE TO BE ADDED.
4. U3 AND U33 ARE SOCKETED.
5. CR15 IS ADDED IF U32 IS ADDED.
6. THIS EQUIPMENT CONTAINS ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) DEVICES. SPECIAL HANDLING METHODS AND MATERIALS MUST BE USED TO PREVENT EQUIPMENT DAMAGE.


+5 V DC
R4 10 k
R5 10 k
R6 10 k
R7 10 k
R8 10 k
A B C D E F G H
U32
U3
U4
U5
U1
U29
U30
U25
U15
U16
U6
S1
S2
S5
R36 4700
R35 4700
R33 4700
R34 4700
R78 4700
R82 10 k
R15 10 k
R16 10 k
R17 10 k
R14 10 k
R13 10 k
R12 10 k
R95 10 k
Y1 3.6864 MHz
C1 27 pF
C2 27 pF
C23 1.5
R77 1 M
CR14
CR15
TP7
TP8
TP9
DATA BUS
U-X SPARE ENABLES
BAUD RATE
19200
9600
4800
2400
1200
600
300
150
109
75
EXT
MIL
RX/CTRL
CR2
CR3
HF/ASCII
ADDR POLL
RS-232/422 XMT ENABLE
I/O ENABLE LINES
307.2 KHZ CLOCK
DD
MM
NN
EE
FF
GG
HH
JJ
KK
LL



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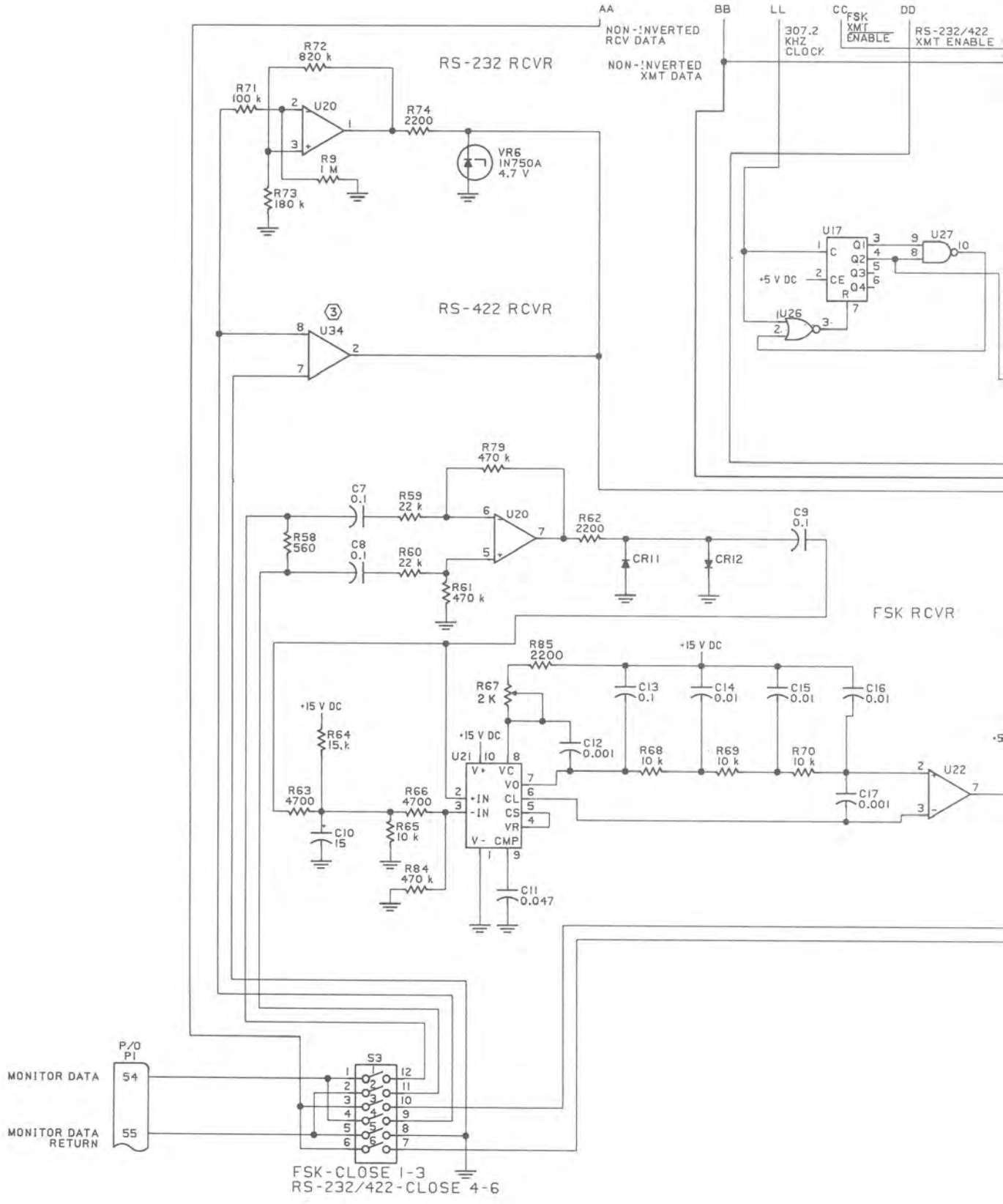
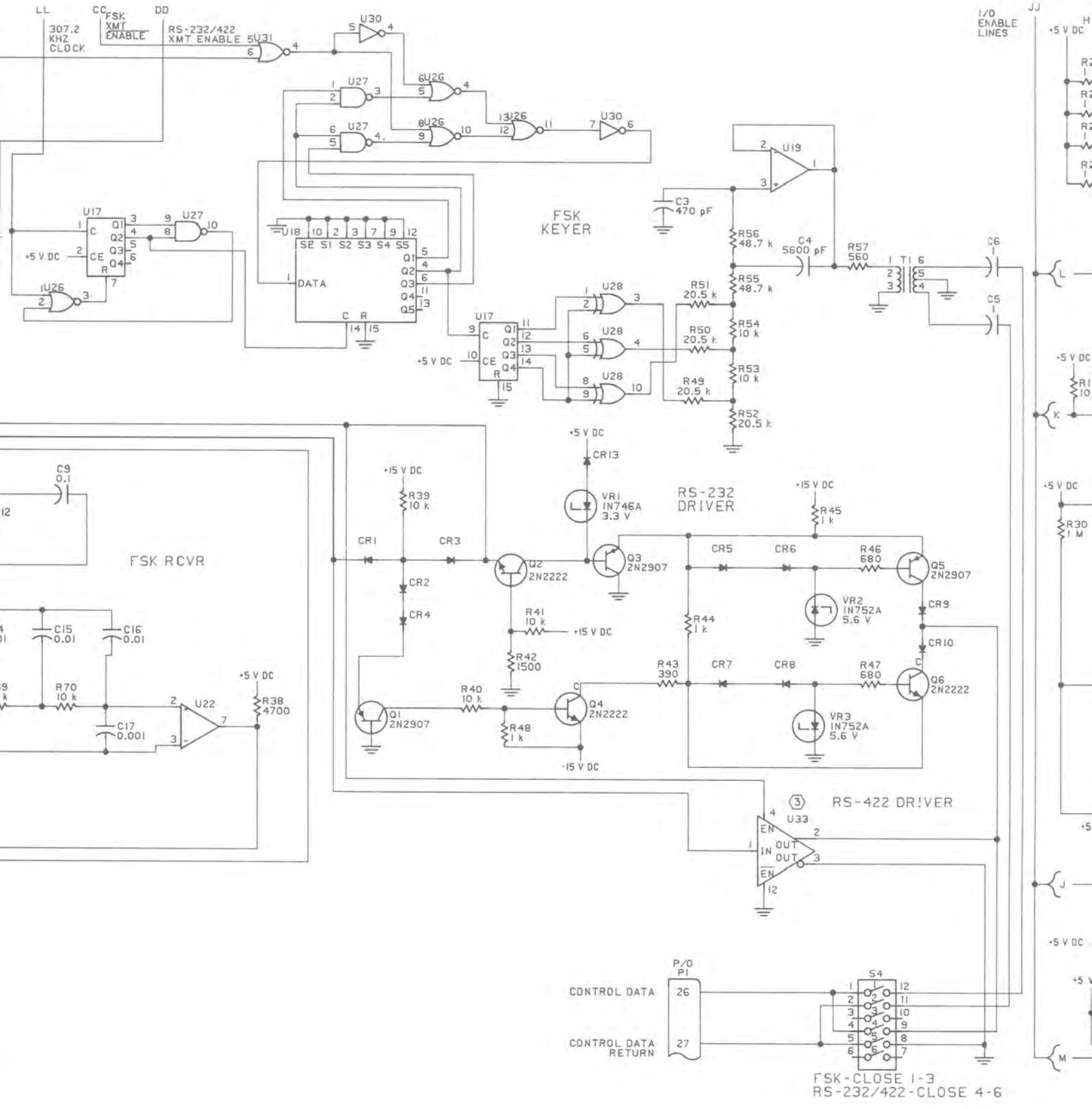
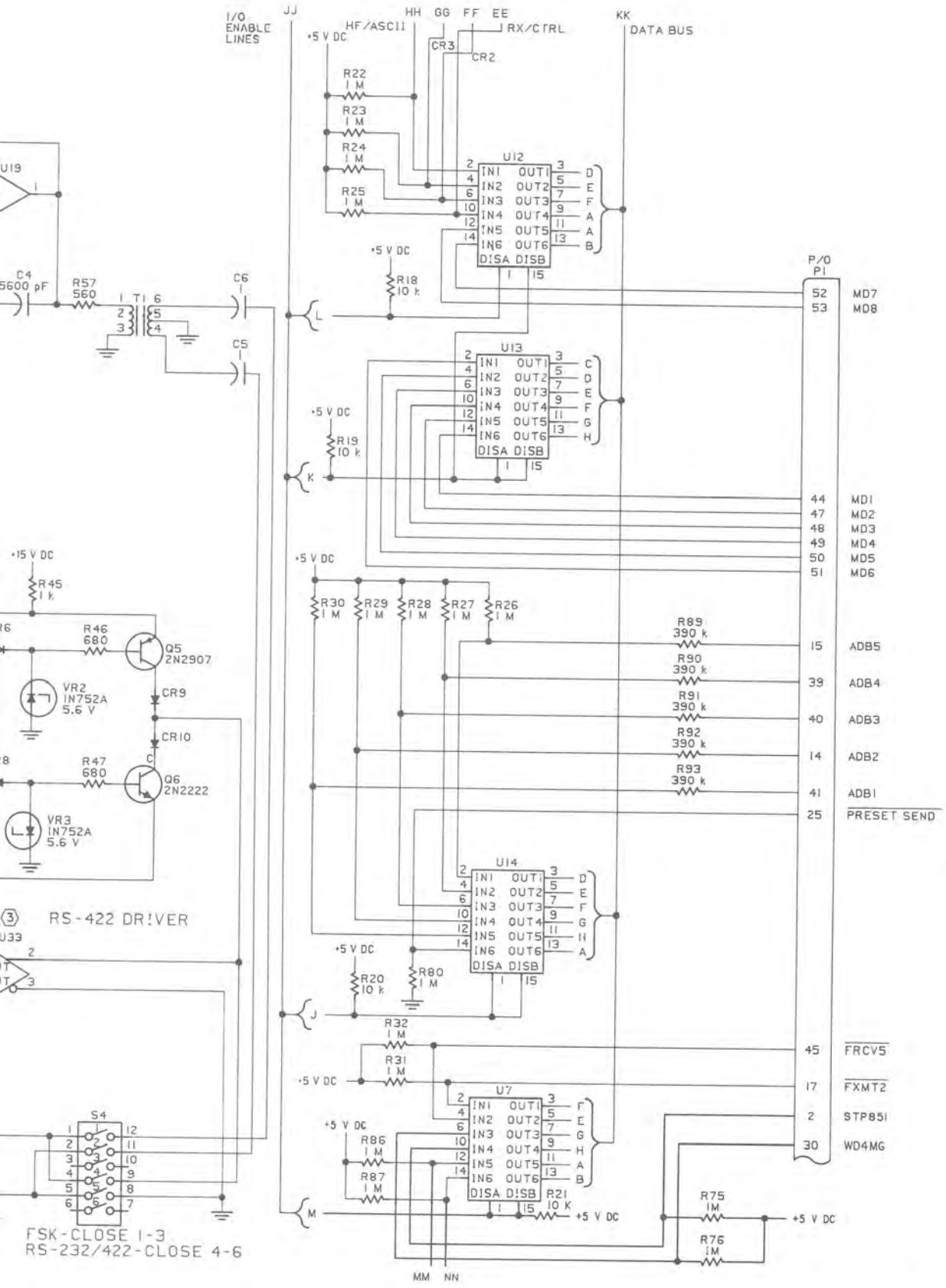
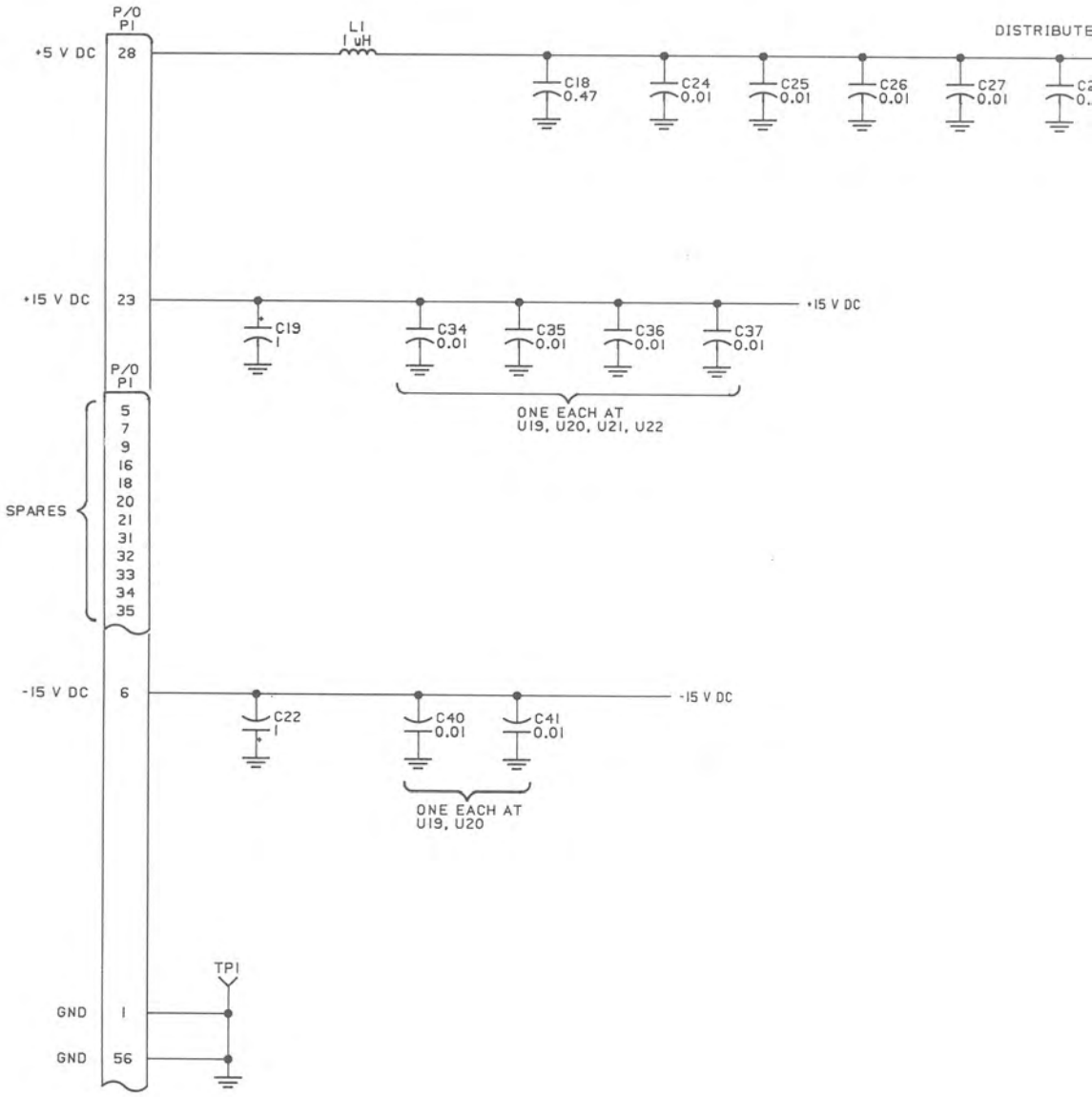
Serial Interface, Schematic Diagram
Figure 11 (Sheet 3)


AA
NON-INVERTED RCV DATA
BB
NON-INVERTED XMT DATA
LL
307.2 KHZ CLOCK
CC
FSK XMT ENABLE
DD
RS-232/422 XMT ENABLE
RS-232 RCVR
R72 820 k
R71 100 k
U20
R74 2200
VR6 IN750A 4.7 V
R9 1 M
R73 180 k
U17
U27
U26
+5 V DC
RS-422 RCVR
3
U34
R79 470 k
C7 0.1
R59 22 k
U20
R62 2200
C9 0.1
R58 560
C8 0.1
R60 22 k
R61 470 k
CR11
CR12
FSK RCVR
R85 2200
+15 V DC
R67 2 K
C13 0.1
C14 0.01
C15 0.01
C16 0.01
C12 0.001
R68 10 k
R69 10 k
R70 10 k
U22
C17 0.001
R64 15 k
U21
V+ VC
VO
+IN CL
-IN CS
VR
V- CMP
R63 4700
R66 4700
R65 10 k
C10 15
R84 470 k
C11 0.047
P/O P1
MONITOR DATA
54
MONITOR DATA RETURN
55
S3
FSK-CLOSE 1-3
RS-232/422-CLOSE 4-6

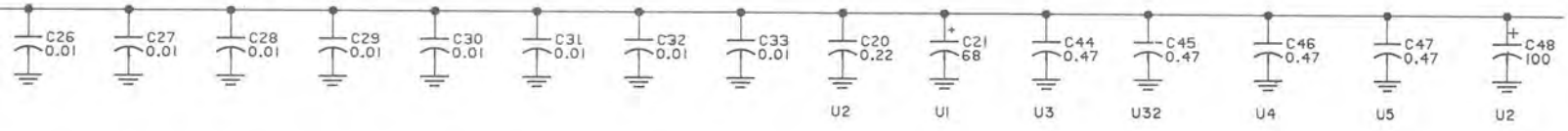

LL
307.2 KHZ CLOCK
CC
FSK XMT ENABLE
DD
RS-232/422 XMT ENABLE
U31
U30
U27
U26
U17
U18
FSK KEYER
DATA
+5 V DC
C3 470 pF
U19
R56 48.7 k
C4 5600 pF
R57 560
T1
C6
C5
R55 48.7 k
R54 10 k
R53 10 k
R52 20.5 k
R51 20.5 k
R50 20.5 k
R49 20.5 k
U28
I/O ENABLE LINES
JJ
H
L
K
J
M
FSK RCVR
C9 0.1
C15 0.01
C16 0.01
C17 0.001
R70 10 k
U22
R38 4700
+15 V DC
CR13
VR1 IN746A 3.3 V
RS-232 DRIVER
R39 10 k
CR1
CR3
CR2
CR4
Q2 2N2222
Q3 2N2907
R41 10 k
R42 1500
R40 10 k
Q1 2N2907
Q4 2N2222
R48 1 k
-15 V DC
R45 1 k
CR5
CR6
R46 680
Q5 2N2907
VR2 IN752A 5.6 V
CR9
R44 1 k
CR10
R43 390
CR7
CR8
R47 680
Q6 2N2222
VR3 IN752A 5.6 V
R30 1 M
RS-422 DRIVER
U33
EN
IN
OUT
P/O P1
CONTROL DATA
26
CONTROL DATA RETURN
27
S4
FSK-CLOSE 1-3
RS-232/422-CLOSE 4-6



Serial Interface, Schematic Diagram
Figure 11 (Sheet 4)


P/O P1
+5 V DC
28
L1
1 uH
DISTRIBUTE
C18
0.47
C24
0.01
C25
0.01
C26
0.01
C27
0.01
+15 V DC
23
C19
1
C34
0.01
C35
0.01
C36
0.01
C37
0.01
+15 V DC
ONE EACH AT
U19, U20, U21, U22
P/O P1
SPARES
5
7
9
16
18
20
21
31
32
33
34
35
-15 V DC
6
C22
1
C40
0.01
C41
0.01
-15 V DC
ONE EACH AT
U19, U20
TP1
GND
1
GND
56

DISTRIBUTE AMONG PACKS



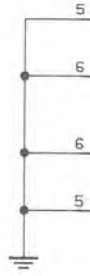
V DC

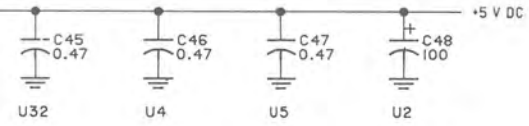
U NO.	TYPE	POWER					
		+5 V DC	+12 V DC	+15 V DC	-5 V DC	-15 V DC	GND
U1	MC6802	8,35					1,21
U2	MC6850	12					1
U3	2716	24,21					12
U4	74LS154	24					12
U5	74LS00	14					7
U6	4526	16					8
U7	4503	16					8
U8	4042	16					8
U9	4021	16					8
U10	4042	16					8
U11	4042	16					8
U12	4503	16					8
U13	4503	16					8
U14	4503	16					8
U15	4027	16					8
U16	4040	16					8
U17	4520	16					8
U18	4018	16					8
U19	MC1458			8		4	
U20	MC1558			8		4	
U21	NE565			10			1
U22	LM311H			8			1,4
U23	4070	14					7
U24	4011	14					7
U25	4001	14					7
U26	4001	14					7
U27	4011	14					7
U28	4070	14					7
U29	4093	14					7
U30	4049	1					8
U31	4001	14					7
U32	2716	24,21					12
(3) U33	AM26LS31	16					8
U34	9637	1					4
U35							
U36							
U37							
U38							
U39							
U40							

HIGHEST NUMBERS

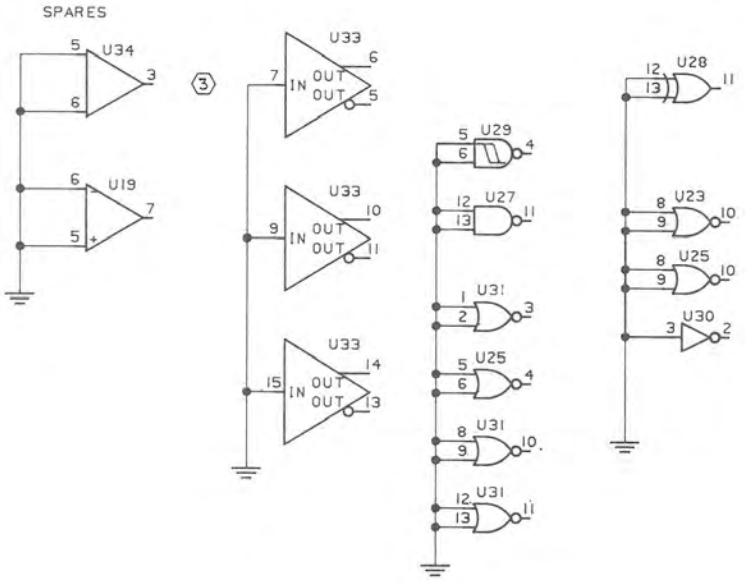
U34
R95
C48
CR15
VR6
L1

SPAR





	GND
	1,21
	1
	12
	12
	7
	8
	8
	8
	8
	8
	8
	8
	8
	8
	8
	8
	1
	1,4
	7
	7
	7
	7
	7
	7
	7
	8
	7
	12
	8
	4



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Serial Interface, Schematic Diagram
Figure 11 (Sheet 5)