Radio Shack®

Service Manual

26-1212

TRS-80®

NETWORK 3 CONTROLLER

CATALOG NUMBER 26-1212

CUSTOM MANUFACTURED IN U.S.A. BY RADIO SHACK TC A DIVISION OF TANDY CORPORATION

10 9 8 7 6 5 4 3 2

NETWORK 3 CONTROLLER

FUNCTIONAL DESCRIPTION

The Network 3 Controller is a low cost device that is capable of connecting up to sixteen computer/terminal devices directly to a host computer for the purpose of transferring files. File transfers can be made from the host computer to the computer/terminals or from a computer/terminal to the host computer.

The Host computer (to be called Host) can be a TRS-80 Model I, II or III; while the computer/terminals (to be called Slaves) can be a TRS-80 Model I, II, III or a Color Computer.

An RS-232C is the Interface between the Host and the Network 3 Controller. The Controller also has one cable going to the Host and one each going to the sixteen Slaves.

A two-position switch on the front panel can select either of two modes: Polling or Auto Select.
NOTE: The switch button will be lighted in the auto select, or Auto Mode, and unlighted in the polling, or Host Mode.

The Host Mode works as follows:
The Network 3 Controller, at a command from the Host, selects the first logical Slave (one of sixteen computers) and forms a full duplex serial data path between the Host and the selected Slave. A Request To Send is routed from that Slave to the Host and is used by the Host to determine if the Slave is requesting service. If no service is requested, the Host operator selects the next logical Slave and tests the service request status.

If a selected Slave is requesting service, the Host sends an ENQ character (Enter Question) to the Slave and the Slave must reply with a series of characters that define the service that has been requested (i.e., LOAD, SAVE, RPRINT). The Host then services the request and the next logical Slave is selected by the Host operator.

This process continues until all sixteen Slaves have been polled. The Host operator then selects the first logical Slave and begins the polling process again.
NOTE: The data transfer rate can be up to 9600 baud.

The second mode of operation, Auto Mode, allows the Network 3 Controller to test the service request signal of each Slave in turn and will stop on any channel that has an active service request. An acknowledge signal is sent to the selected Slave, indicating that the Slave may send a sequence of characters that define the service requested. When the selected Slave has been serviced, it must release the service request signal. This allows the Network 3 Controller to resume searching for an active request from other channels.

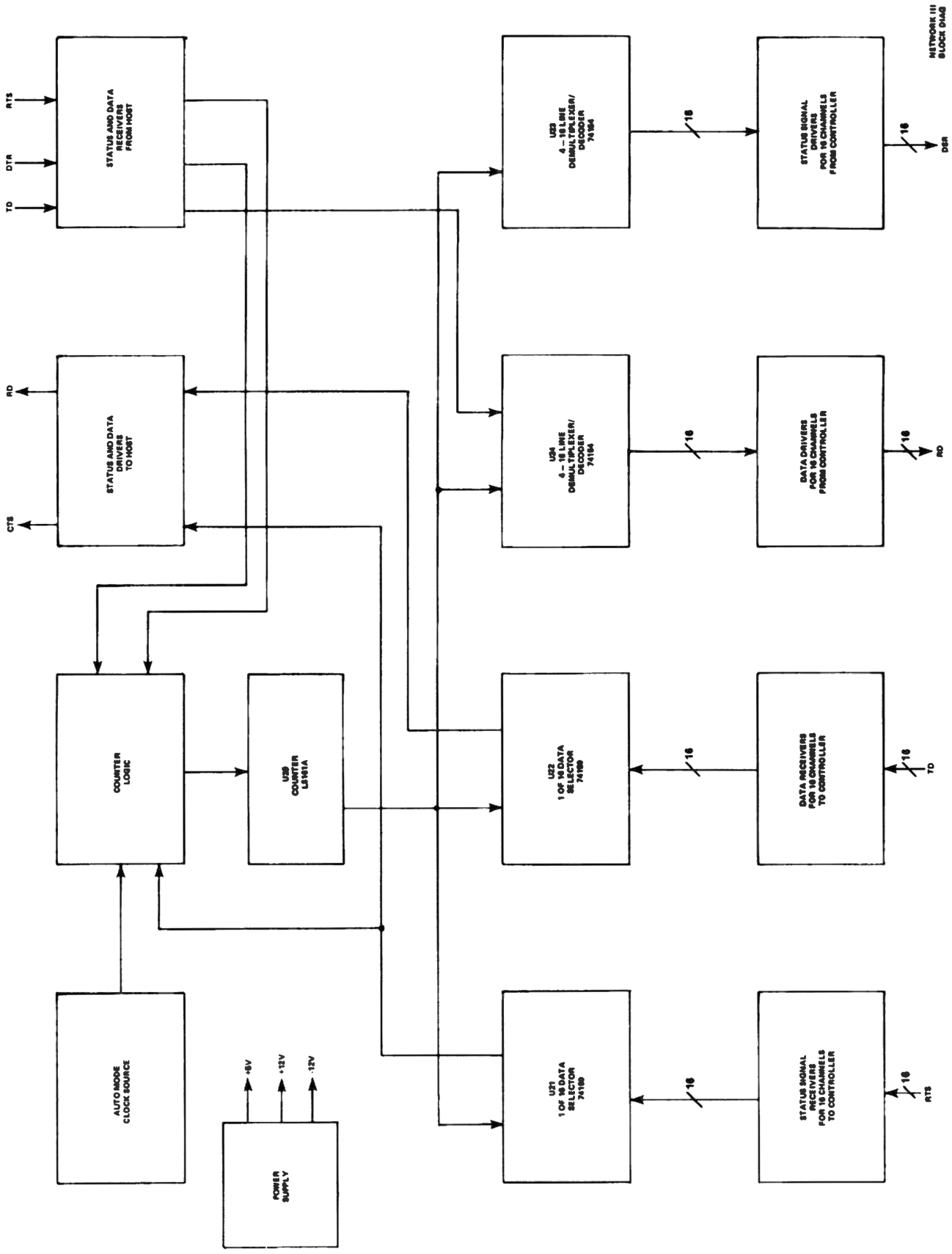


FIGURE 1. NETWORK 3 BLOCK DIAGRAM

THEORY OF OPERATION

POWER SUPPLY

The Network 3 Controller draws its AC power from an external TRS-80 Power Pack that plugs into a 5-pin DIN connector that is located on the rear panel of the Controller. The four inputs that are used on the DIN are: ground, AC, and half-wave rectified AC. The voltages seen here should be as follows:

pin 4 . . . . . Ground
Pin 2 . . . . . Half-wave rectified, +20 volts (measured with S1 off)
Pins 1 and 3 . . . 23 volts AC

Pins 1 and 3 pass through a voltage doubling set of capacitors, C5 and C6, and then into the input of CR1. The output of CR1 should be about −18 volts DC unregulated. This is fed to the input of VR2, giving a regulated output of −12 volts DC.

Pins 1 and 3 are also rectified through diodes CR2 and CR3 to give a +11 volts DC unregulated input to VR3. The output of VR3 should be a regulated +5 volts DC. Pin 2 is connected to a 2 watt resistor, R6. This output is the input to VR1 and should be +18 volts DC unregulated. VR1 should have a regulated output of +12 volts DC. Pins 1, 2 and 3 of the DIN go through S1 and are connected to circuit board pads W3, W2 and W1, respectively. Pin 4 of the DIN is wired directly to pad W4 of the circuit board.

CONNECTORS

The Network 3 Controller is connected to the Host and sixteen Slaves via an RS-232C Interface. The Controller has DB-25 connectors mounted on the rear panel for each of the Slaves and the Host. These connectors are designed for standard RS-232C cables with male connectors.

CIRCUIT DESCRIPTION

All data and control signals from the DB-25s to the Controller pass through EIA to TTL receivers, while all signals to the DB-25s from the Controller pass through TTL to EIA drivers.

The heart of the Controller is a 4-bit binary counter (U20) whose outputs are connected parallel to two 4-line-to-16-line decoders (U23 and U24) and two 1-of-16 data selectors (U21 and U22). The logic at the counter's outputs gives the channel number in binary (Ø – F) which the other four devices (decoders and selectors) select. All decoders and selectors will have the same channel selected at any one time.

The counter may be clocked by either of two methods that are determined by the MODE switch that is located on the front panel. These two modes of operation are designated "Auto" (indicated by the lighted button on the switch) and "Host" (indicated by the unlighted button).

When the MODE switch is set for Host (unlighted) the counter's clock is controlled by the Host. Beginning at channel Ø (after power up), the Host will check its Clear To Send (CTS) signal, from the Controller, for an active request from the channel Ø Slave.
NOTE: There will be a delay time of 50 to 100 μSeconds from the time a channel is selected until the request (CTS) will be valid.

If no request is present, or for any other reason, the Host may increment to the next channel by toggling its Request To Send (RTS) signal.

Upon each RTS toggle (1-Ø-1), the counter will increment its output by one. The counter will increment up to 15 and then start over again at Ø. At any time, the Host may select any one of the sixteen Slaves (regardless of active requests on other channels) by toggling RTS the appropriate number of times.

When the MODE switch is set for Auto MODE (lighted), the counter's clock will be run by the Controller's internal clock source. This clock is composed of a 555 Timer IC (U25) that is set to generate a TTL level square wave output at approximately 10 kHz. This square wave is enabled through the Controller's counter logic and fed into the clock input of the counter. This signal should be seen at test point (TP) 10 whenever power is on. This output frequency is determined by R23, R24 and C27. Variations of up to 500 Hz either way are acceptable.

During this mode of operation, the Host RTS signal is disabled and will not affect the counter's channel selection. While in Auto MODE, the counter will step through and select each channel at approximately 600 times per second. The counter's clock will be stopped on any channel when that channel's Slave has set its RTS line active.
NOTE: For both modes of operation, channel incrementing is achieved only by holding the Host Data Terminal Ready (DTR) signal active. This signal, as seen at TP1, should be Ø volts or logic Ø to enable channel counting.

While any channel is currently selected, in Host or Auto MODE, that channel's Slave will receive an active signal on its Data Set Ready (DSR) line. The counter will restart clocking at the next logical channel upon the currently selected channel's release of its RTS line. The counter will stop again on the next logical channel that is holding its RTS line active.

Data is transmitted from the Host through EIA/TTL receivers in the Controller's input. The data then goes into a decoder (U24) which sends it out through one of sixteen outputs selected by the the counter. It then passes through a TTL/EIA driver and out the appropriate DB-25 connector to that channel's Slave.

Data from the Slaves to the Controller follow a similar path through their respective DB-25 connectors to an EIA/TTL receiver and then into a 1-of-16 data selector (U22). The currently selected Slave's data will appear at the output of U22 and then through a TTL/EIA driver to the Host's DB-25 connector.

HOST OUTPUT SIGNALS

Data Terminal Ready	Request To Send	Control Function
Logic 1	Logic 1	Reset to Channel Ø
Logic Ø	Logic 1	Enable Channel Select
Logic Ø	Logic 1 > Ø > 1	Increment Channel #

Transmit Data – Serial Data Output To Slaves

HOST INPUT SIGNALS

Carrier Detect – Logic Ø Always
Clear To Send – Logic Ø = Active Request From Selected Slave
– Logic 1 = No Active Request From Selected Slave
Receive Data – Serial Data From Slaves To Host

PIN ASSIGNMENTS FOR HOST DB-25 CONNECTOR

Signal Ground	Pin 1
Transmit Data	Pin 2
Receive Data	Pin 3
Request To Send	Pin 4
Data Terminal Ready	Pin 20
Carrier Detect	Pin 8
Clear To Send	Pin 5

HOST TO NETWORK 3 INTERFACE SUMMARY

SLAVE INPUT SIGNALS

Data Set Ready – Logic Ø = This Slave is Currently Selected by Controller
Receive Data – Serial Data to Slave from Host

SLAVE OUTPUT SIGNALS

Request To Send – Logic Ø = Selected Slave is Requesting Service
– Logic 1 = Selected Slave is not Requesting Service
Transmit Data – Serial Data from Slave to Host

PIN ASSIGNMENTS FOR SLAVE DB-25 CONNECTORS

Signal Ground	Pin 1
Transmit Data	Pin 2
Receive Data	Pin 3
Request To Send	Pin 4
Data Set Ready	Pin 6

EIA AND TTL LOGIC LEVELS

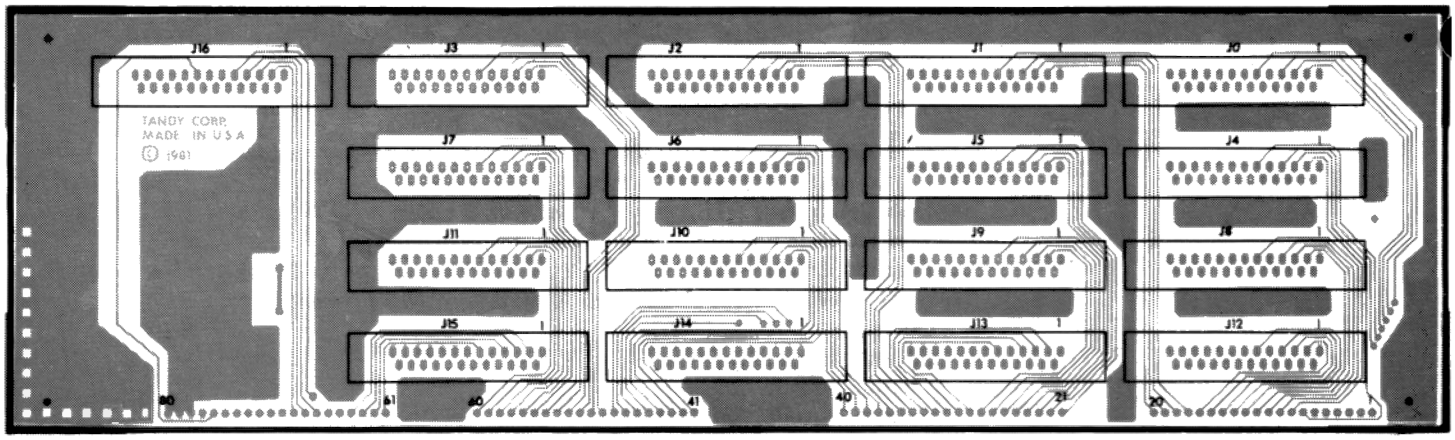
Logic	EIA Voltage	TTL Voltage
Ø	> +3 V	< +0.8 V
1	< –3 V	> +2 V

SLAVE TO NETWORK 3 INTERFACE SUMMARY

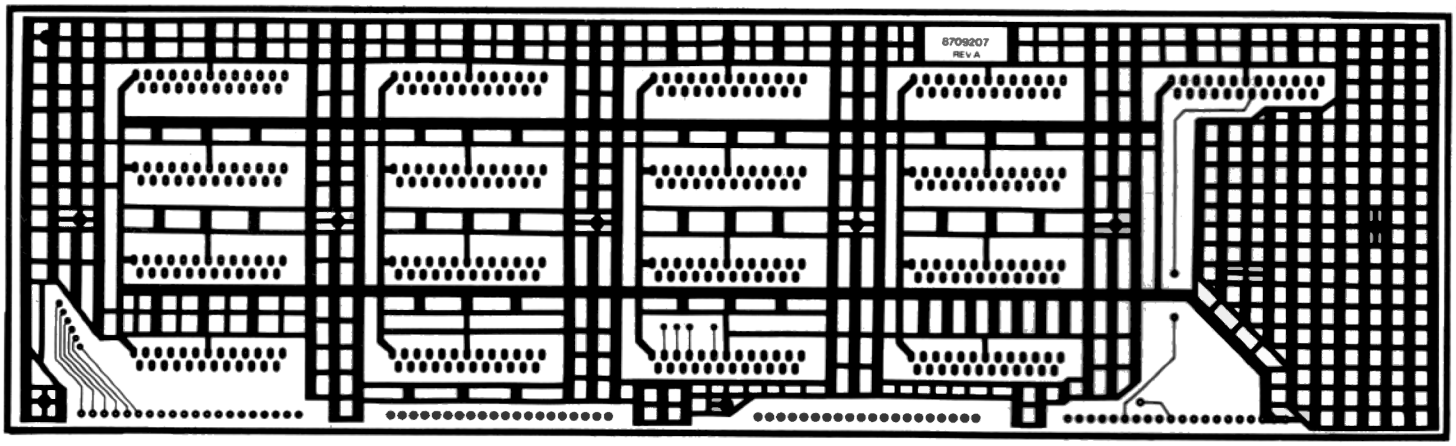
TABLE 1. INTERFACE SUMMARY

TEST POINT	SIGNAL DESCRIPTION
1	Host Computer's DTR as seen by Network 3 Logic. Ø V enables the Controller's Channel Counter
2	Host Computer's RTS as seen by Network 3 Logic
3	Inverted Data line from selected 1-of-16 Slave channels
4	Input to Channel Counter U20. In Auto Mode will be a 1Ø kHz square wave. In Host Mode transition rate is software dependent
5	Counter output QØ (LSB)
6	Counter output Q1
7	Counter output Q2
8	Counter output Q3 (MSB)
9	TTL level data line from Host computer
10	Output of 555 (U25), 1Ø kHz square wave
11	Network 3 REQ signal, derived from the selected Slave Computer's RTS

TABLE 2. TEST POINTS

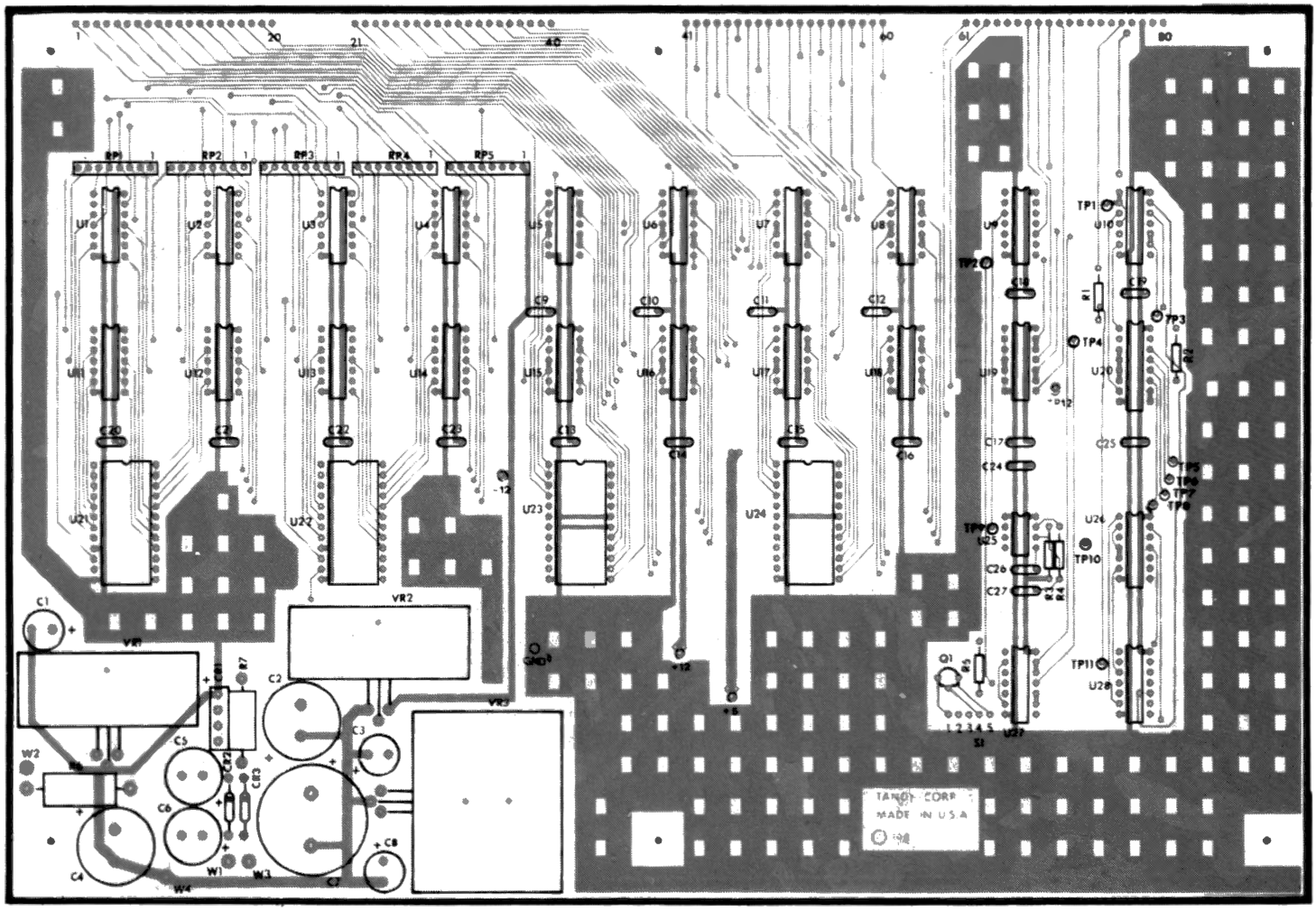


COMPONENT SIDE



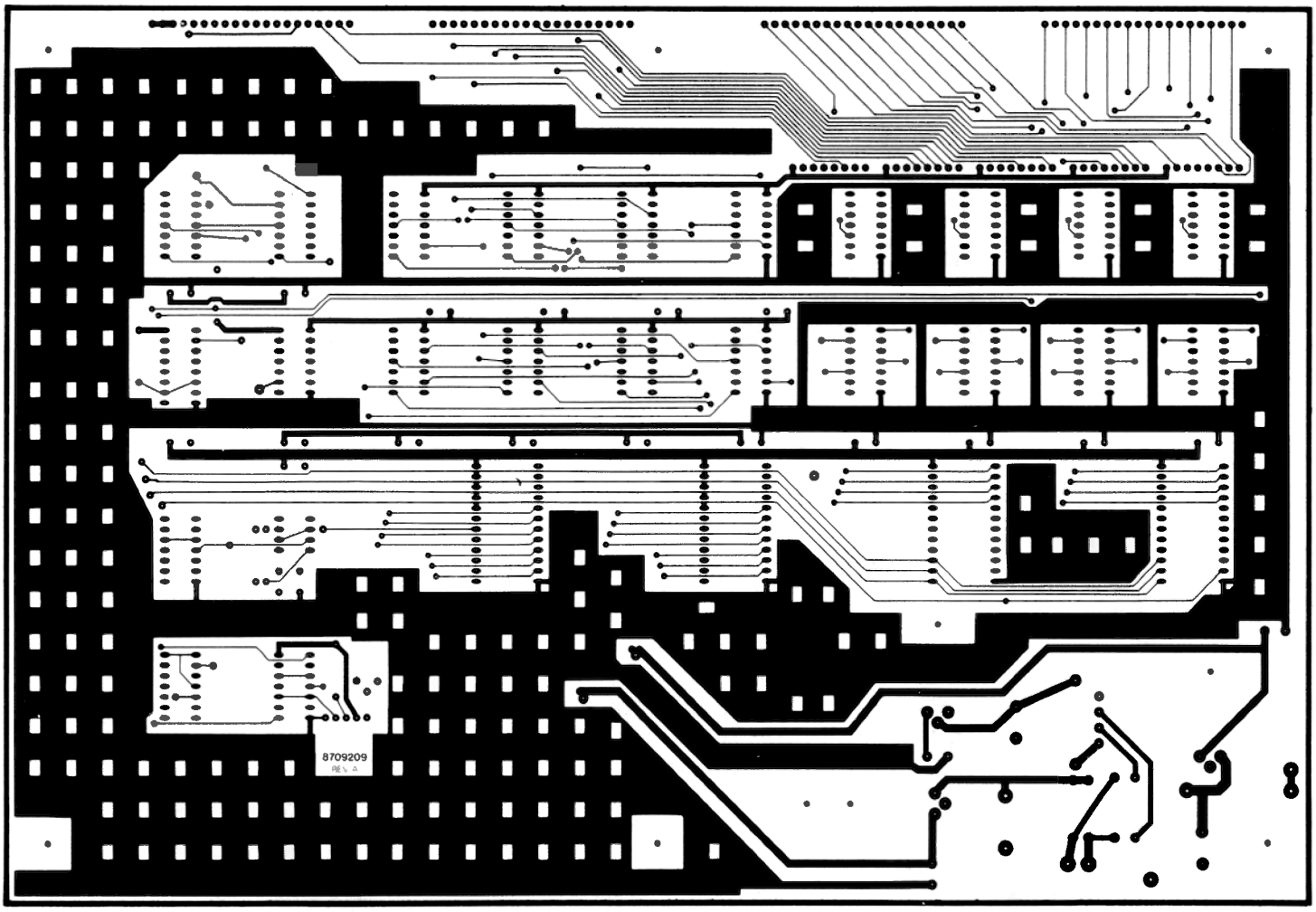
SOLDER SIDE

FIGURE 2. NETWORK 3 CONNECTOR P. C. BOARD



COMPONENT SIDE

FIGURE 3. NETWORK 3 LOGIC P.C. BOARD



SOLDER SIDE

FIGURE 3. NETWORK 3 LOGIC P.C. BOARD

PARTS LIST
NETWORK 3 CONTROLLER

Symbol	Description	Manufacturer's Part Number
	Logic P.C. Board (Rev. A)	8894101
	Connector P.C. Board (Rev. A)	8894103
	CAPACITORS	
C1	220μF, 35V, Electrolytic, Radial	8327223
C2	1000μF, 35V, Electrolytic, Radial	8328103
C3	220μF, 35V, Electrolytic, Radial	8327223
C4	1000μF, 35V, Electrolytic, Radial	8328103
C5	220μF, 35V, Electrolytic, Radial	8327223
C6	220μF, 35V, Electrolytic, Radial	8327223
C7	4700μF, 16V, Electrolytic	8328471
C8	220μF, 35V, Electrolytic, Radial	8327223
C9	0.1μF, 50V, Bypass, Mono Ceramic	8374104
↓	↓ ↓ ↓	↓
C26	0.1μF, 50V, Bypass, Mono Ceramic	8374104
C27	0.001μF, 50V, ±5%, (Mylar or Metal Film)	———
	DIODES	
CR1	Bridge, 2 Amp	8160202
CR2	1N4001	8150001
CR3	1N4001	8150001
	INTEGRATED CIRCUITS	
U1	SN75189, Quad Line Receiver	8050189
↓	↓ ↓	↓
U4	SN75189, Quad Line Receiver	8050189
U5	SN75188, Quad Line Driver	8050188
↓	↓ ↓	↓
U8	SN75188, Quad Line Driver	8050188
U9	SN75189, Quad Line Receiver	8050189
U10	SN74LS00, Quad 2-In NAND	8020000
U11	SN75189, Quad Line Receiver	8050189
↓	↓ ↓	↓
U14	SN75189, Quad Line Receiver	8050189
U15	SN75188, Quad Line Driver	8050188
↓	↓ ↓	↓
U19	SN75188, Quad Line Driver	8050188
U20	SN74LS161, Synchronous 4-Bit Counter	———
U21	SN74150, 1-of-16 Data Selector	8000156
U22	SN74150, 1-of-16 Data Selector	8000156
U23	SN74154, 4-to-16 Line Decoder	8000154
U24	SN74154, 4-to-16 Line Decoder	8000154
U25	LM555, Timer	8050555
U26	SN74LS00, Quad 2-In-NAND	8020000
U27	SN74LS00, Quad 2-In-NAND	8020000
U28	SN74LS74, Dual D, Flip-Flop	———

PARTS LIST (Cont'd)
NETWORK 3 CONTROLLER

Symbol	Description	Manufacturer's Part Number
	REGULATORS	
VR1	MC78M12CT, +12V, 500 mA	8050812
VR2	MC79M12, –12V, 500 mA	8050912
VR3	MC78M05CT, +5V, 500 mA	———
	RESISTORS	
R1	10K, 1/4W, 5%	8207310
R2	2.2K, 1/4W, 5%	8207222
R3	62K, 1/4W, 5%	8207362
R4	27K, 1/4W, 5%	8207327
R5	2.2K, 1/4W, 5%	8207222
R6	3.3 Ohm, 2W, 5%	———
R7	10 Ohm, 1W, 5%	———
RP1	22K, SIP, Network, 8-Pin	———
RP2	22K, SIP, Network, 8-Pin	———
RP3	22K, SIP, Network, 8-Pin	———
	SWITCHES	
S1	3PDT, with Light Assembly	8489045
S2	5PDT, with Red Light	8489044
	TRANSISTOR	
Q1	2N3906	———
	MISCELLANEOUS	
	Cable, Adapter (DB, Female to Female)	———
	Cable, Adapter (DB, Female to 4-Pin DIN)	———
	Cable, Adapter (Model III)	———
	Cable, Flat Flex, 4 inches, (4)	———
	Cable, Host, 6 feet	8709163
	Cable, Slave, 10 feet	———
	Cable, Slave, 25 feet	———
	Cable, Slave, 50 feet	———
	Cable, Slave, 100 feet	———
	Connector, DB25 (15U" Gold) (17)	8519116
	Connector, DB25 (30U" Gold) (17)	———
	Connector, 20-pos. Straight, In-Line (4)	———
	Cover, Top	9729075
	Cover, Bottom	9729074
	Diskette, (Mod I, III) Education	———
	or	
	Diskette, (Mod I, III) Business	———
	or	
	Diskette, (Mod II) Education	———
	or	
	Diskette, (Mod II) Business	———
	Foot, Rubber (4)	8590100
	Harness, DC	8709260
	Harness, Reset	8709259

PARTS LIST (Cont'd)
NETWORK 3 CONTROLLER

Symbol	Description	Manufacturer's Part Number
	Heatsink, VR3, #6072	8549004
	Heatsink, VR1 and VR2 #6063 (2)	————
	Light Indicator	————
	Nut, Keps #6 (18)	8579004
	Power Pak (TRS-80 Model I)	8790021
	Screw, #6 x 1-1/4", PPH, Black (18)	————
	Screw, #6-32 x 1/4", PPH, Black (18)	8569118
	Screw, Sheet Metal #6 x 1/4", PPH, Black (15)	8569122
	Socket, 5-Pin DIN	8519085
	Staking Pin (15)	8529014
	Standoff, Hex, #6 x 1/4", Male/Female (18)	8589058
	Washer, #6, Internal Tooth, Zinc (18)	8589043

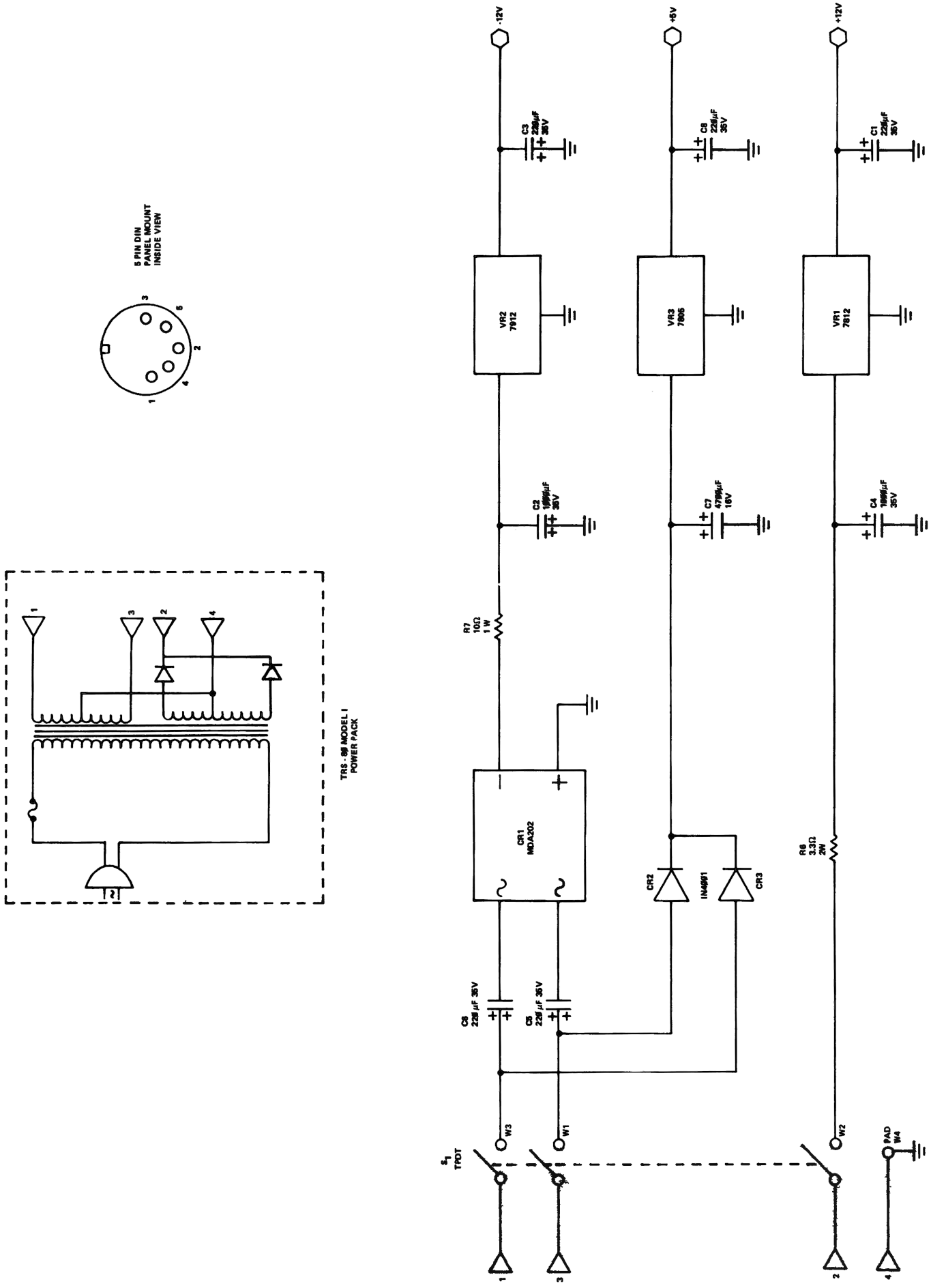


FIGURE 4. NETWORK 3 POWER SUPPLY SCHEMATIC DIAGRAM

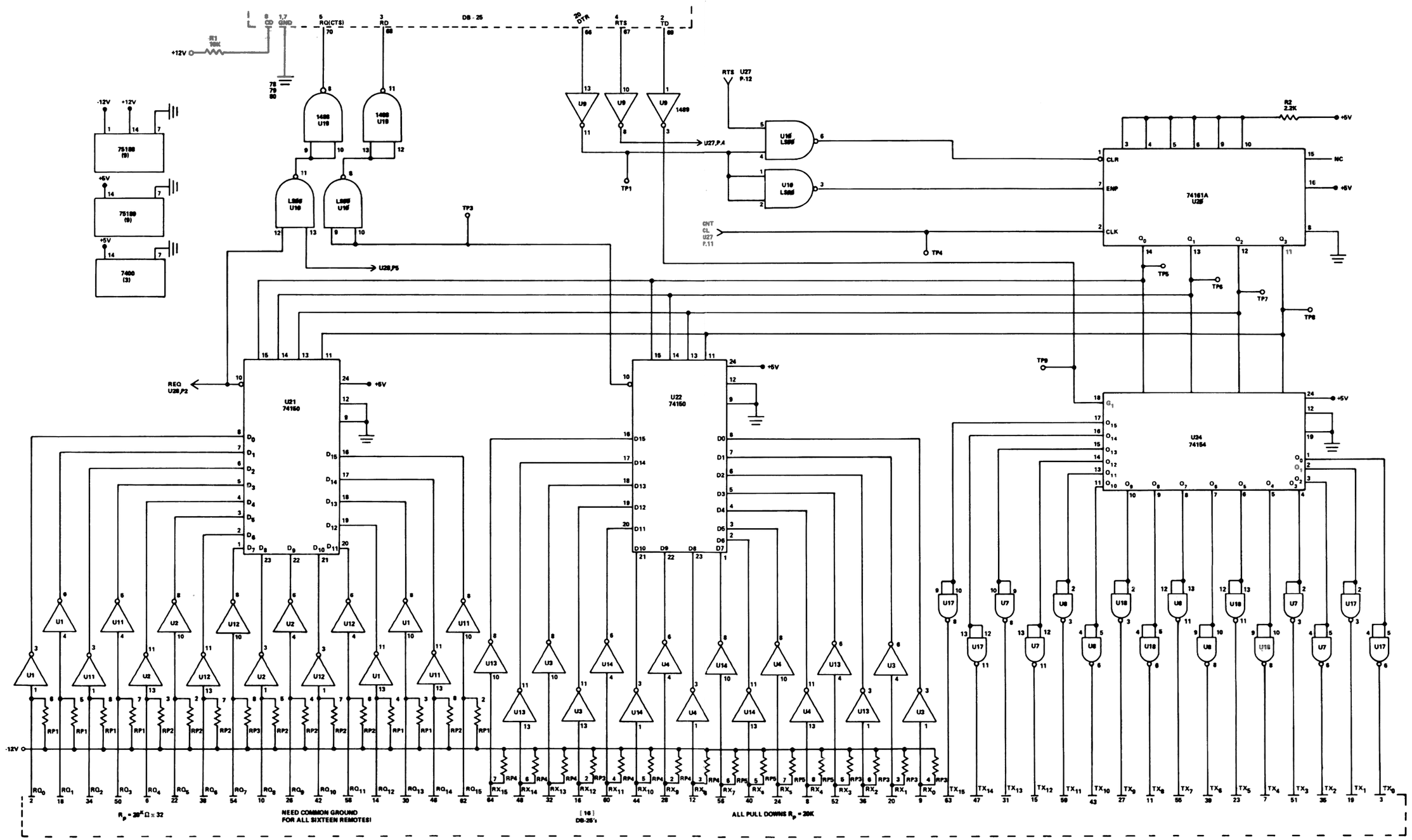


FIGURE 5. NETWORK 3 CONTROLLER SCHEMATIC DIAGRAM (Sheet 1)

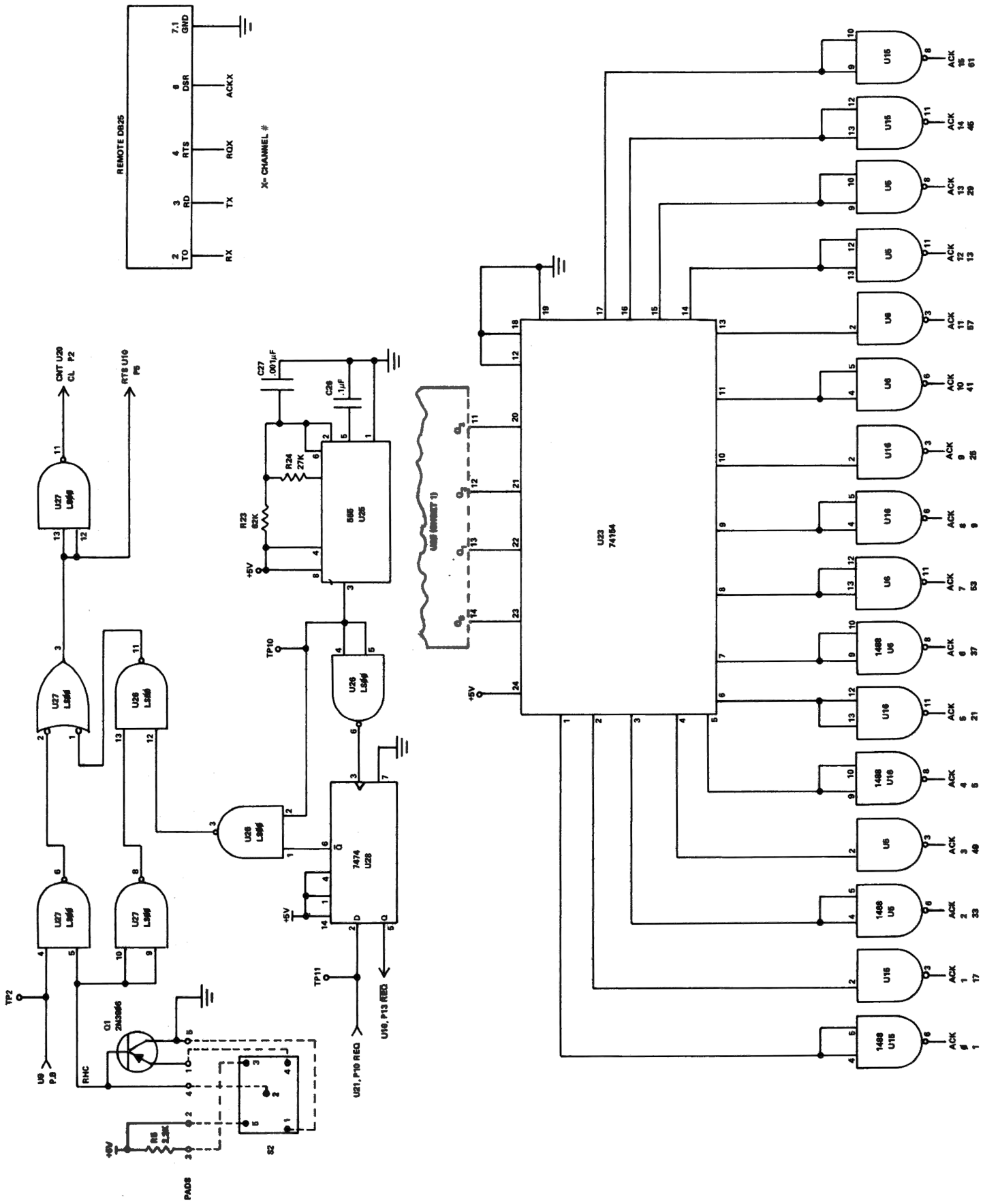


FIGURE 5. NETWORK 3 CONTROLLER SCHEMATIC DIAGRAM (Sheet 2)

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CANADA: BARRIE, ONTARIO L4M 4W5

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