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* RADIO SHACK NETWORK III *
* TROUBLESHOOTING GUIDE *
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* produced by *
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NETWORK III TROUBLESHOOTING GUIDE

OVERVIEW

The Radio Shack Network III is an RS232 based communications multiplexer used to allow up to 16 STUDENT STATIONS to load programs from and save data to a single HOST computer. The Network is capable of multiplexing at a rate set by an internal clock, or it can step to individual stations on command from the HOST computer.

While the HOST and STUDENT STATIONS connect to the Network III by way of standard DB25 connectors, only 4 signals are actually multiplexed. These are:

- Data from STUDENT STATION to HOST
- Data from HOST to STUDENT STATION
- Request To Send from STUDENT STATION
- Acknowledge from HOST

SOFTWARE OPERATION

Each unit in a Network III system must load and run a special operating system. on the HOST computer this program is called **HOST/CMD**. On the STUDENT STATIONS this program is called **STUDENT/CMD**. The two programs interact with each other using the RS232 and the Network III, and allow the STUDENT STATION to work much like a terminal attached to the HOST computer. the STUDENT STATION can download and upload programs utilizing the HOST disk system.

NBASIC is supplied on the HOST diskette and is downloaded through the Network III like any other program. **NBASIC** operates much like normal Disk BASIC, but allows the STUDENT STATION to utilize the HOST disk system to store and recall data files.

HOST/CMD is on the operating system diskette supplied with the Network III package. It operates the Network III in the POLLED mode. The HOST computer is actually controlling the scanning of the Network III by toggling the RTS line once for each count. Therefore, if the Network III is currently stopped on Station 10 and the HOST wishes to access Station 9 it must toggle the RTS line 15 times. Obviously, **HOST/CMD** must contain a certain amount of "intelligence" to keep track of the currently accessed station, where it is going, and how many times to toggle the RTS line.

STUDENT/CMD may be loaded into the **STUDENT STATION** computer in one of three ways:

- 1) Load the **STUDENT/CMD** cassette tape through the cassette port using a cassette recorder at each station.
- 2) Load the **STUDENT/CMD** cassette tape through the cassette port using one cassette recorder and a Network II.
- 3) Load the **STUDENT/CMD** file through the RS232 port using the special NETWORK III **STUDENT STATION ROM**.

The first two ways are self-explanatory. The third way is slightly more involved from a software standpoint.

The **STUDENT STATION NETWORK III ROM** contains a special program to "bootstrap" the **STUDENT/CMD** program through the RS232 port. To make room for this program in ROM, the **ROUTE** function has been removed. **TIMES** is not used in any Radio Shack educational programs, and **ROUTE** has been permanently patched out by **TRSDOS**, so the lack of either program will not affect any educational software.

The **STUDENT STATION ROM** routine automatically sets up the RS232 port to 9600 baud, 8 bits, no parity, and 1 stop bit. It then sends a special set of signals and handshaking routines to the **HOST**. The host interprets these signals as a request to load and send a file called **RBOOT/CIM** which is resident only on the **NETWORK III HOST OPERATING SYSTEM VERSION 1.1** or greater diskette.

RBOOT/CIM is loaded by the **HOST** computer and sent to the **STUDENT STATION**. The **STUDENT STATION** receives **RBOOT/CIM** one byte at a time and loads it into a specific memory location. After **RBOOT/CIM** is downloaded the **STUDENT STATION** sends an acknowledge byte to the **HOST**, and begins to execute **RBOOT/CIM**.

The purpose of **RBOOT/CIM** is to download the file **STUDENT/CMD** from the **HOST** diskette. Once **STUDENT/CMD** is loaded it is executed. This **STUDENT/CMD** is the same program provided on the cassette tape. If the **STUDENT STATION ROM** is present no separate cassette recorders are necessary.

The operation appears as follows:

- 1) At the **READY** prompt on the **STUDENT STATION**, type **SYSTEM <ENTER>**
- 2) At the **SYSTEM** prompt, type **/12327 <ENTER>** (or **/12363** if using the Model 4 ROMs).

- 3) RBOOT/CIM and STUDENT/CMD should load from the HOST disks into the STUDENT STATION.
- 4) The BAUD RATE? prompt should appear on the STUDENT STATION. Answer the prompt with <ENTER>.

The Network III system should now be operational.

REQUIRED TOOLS

- > Network III service manual National Parts number MS2601212
- > Digital Voltmeter (DVM)
- > Oscilloscope 10 MHz minimum bandwidth
- > Oscilloscope probe xl response
- > (3) clip leads Radio Shack catalog number 278-1156 or equivalent
- > (1) 1K ohm 1/4 watt 5% resistor
- > (1) Model III or Model 4 HOST system --48K memory with one disk drive
- > Network III HOST operating system version 1.1 or greater
- > (1 or more) Model III or Model 4 Network III Student Station
(or)
- > (1 or more) Model III or Model 4 48K with Network III Student Station upgrade ROMs
(or)
- > (1 or more) Model III or Model 4 48K Cassette based system with cassette player and Student Station Software on cassette

GENERAL NOTES

Follow the troubleshooting guide in exactly the order indicated.

Do not attach any computers, clip leads, or components until you are instructed to do so.

Do not remove any clip leads or components until you are instructed to do so.

If a test fails, stop and fix the problem before going to the next step.

FLOWCHART

- STEP 1: Check power supply
- STEP 2: Check for all necessary modifications, and make sure that they are working
- STEP 3: Check for proper clock activity
- STEP 4: Check REQUEST TO SEND input multiplexer
- STEP 5: Check DATA INPUT multiplexer
- STEP 6: Check DATA OUTPUT multiplexer
- STEP 7: Check ACKNOWLEDGE multiplexer
- STEP 8: Check HOST input/output buffers
- STEP 9: Operational check

TROUBLESHOOTINGSTEP 1 -- CHECK THE POWER SUPPLY

Attach the external power module to the power jack, plug the module into a wall outlet, and push the ON/OFF button on the front of the Network III.

Using the DVM, measure the +5 volts, +12 volts, and -12 volts supply. These can be found at the appropriate test points which are silkscreened on the PCB.

The +5 volts must be between +4.9 and +5.1 volts.
The +12 volts must be between +11.4 and +12.6 volts
The -12 volts must be between -11.4 and -12.6 volts

Measure all three supply voltages using the oscilloscope. Use the following oscilloscope settings:

AC coupling
Horizontal - 10 milliseconds per division
Vertical - 100 millivolts per division
Sync - internal, automatic

Each supply must have no more than 50 millivolts peak-to-peak noise and ripple combined.

If there are NO voltages present, suspect the external power supply module. If only one or two voltages are present suspect the Network III.

Excessive noise on the power supply can usually be traced to failure of the appropriate filter capacitor (C1, C3, C8), but can also be caused by failure of the voltage regulator. Watch for high amplitude, high frequency waveforms appearing on the power supplies. This would indicate oscillation of the voltage regulator due to failure of the filter capacitor.

The power supply is extremely simple, so detailed troubleshooting instruction will not be included here.

STEP 2 -- CHECK FOR MODIFICATIONS

Check to see that the RS232 pull down resistor packages (RP1, RP2, RP3, RP4, RP5) are 10K ohm values (marked 10K or 103). If they are 20K or 22K values (marked 20K, 22K, 203, or 223) they MUST be changed.

After changing RP1, RP2, RP3, RP4, and RP5, or if they are already the correct 10K ohm value, use the DVM to measure the INPUT pins of U1, U2, U3, U4, U11, U12, U13, and U14. All input pins should measure greater than -3 volts, typically -3.5 volts to -4 volts.

If any input measures between -3 volts and +3 volts check the resistor pack going to that input for breaks or bad soldering. Also suspect the corresponding IC itself, replacing it if necessary.

STEP 3 -- CHECK FOR PROPER CLOCKING

Set the oscilloscope to the following settings:

- DC coupling
- Horizontal - As necessary to view at least 4 full cycles
- Vertical - 2 volts per division
- Sync - Channel A
- Ground the probe tip and make sure the base line is on zero.

Using one of the clip leads, ground TP1. A ground staking pin is provided. Using the oscilloscope, check TP10. TP10 should be a TTL level square wave of approximately 13.5 KHz (74 microseconds period). The actual frequency is not overly critical. Any frequency between 10 KHz (100 microseconds period) and 15 KHz (66 microseconds period) is acceptable. If the square wave is not present, or is not a good TTL level signal, suspect U25 or U26.

This same wave should be present at U28 pin 3 and U26 pin 3. If it is not, suspect U28 or U26.

Put the unit into the AUTOMATIC mode by pressing the front panel switch until it lights up. If it will not light up suspect the bulb, Q1, or the switch.

Using the oscilloscope, check TP4 for a TTL level square wave similar to TP10 and at the same frequency. If the clock is not present press the MODE front panel switch once. The light should be OFF. If the clock is now present the MODE switch is wired backwards.

If no clock can be found in either MODE suspect U26, U27, or U20.

Using the oscilloscope, check TP5, TP6, TP7, and TP8. Each should show a TTL level square wave at half the frequency of the previous test point. That is, TP5 should be half the frequency of TP4, TP6 should be half the frequency of TP5, etc. If all four test points show no frequency check the logic level of U20 pin 7 and U20 pin 1. U20 pin 7 should be a logic HIGH (>3.5 volts) and U20 pin 1 should be a logic HIGH (> 3.5 volts). Incorrect levels here indicate problems with U10 or U20.

If U4 has a clock, and U20 pins 7 and 1 are correct, the the problem may lie with U20, U21, U22, U23, or U24.

After verifying the presence of proper clocking signals going into and coming out of U20 make sure that these clocking signals are getting to the input pins of U21, U22, U23, and U24 by measuring the input pins of these chips. If a signal is present at TP5, TP6, TP7, or TP8 but not at the input pins then suspect a broken or burned trace.

STEP 4 -- CHECK REQUEST TO SEND (RTS) MULTIPLEXING

Attach the oscilloscope probe to TP11. Attach the 1K ohm resistor to one end of a clip lead. Attach the free end of the clip lead to the +12 volt supply staking pin.

Apply +12 volts to the RTS input on one of the REMOTE DB25 connectors. Do this by inserting the free end of the 1K resistor into Pin 4 of the desired DB25 connector. TP11 should go to a HIGH logic level when the resistor is inserted and go to a logic LOW when the resistor is removed. Check all 16 REMOTE DB25 connectors in this manner.

If TP11 fails to change states when the resistor is inserted into ANY REMOTE DB25, suspect U21 or U10. If some channels produce a change at TP11 while others don't suspect the corresponding RS232 level shifters (U1, U2, U11, U12) or the spectra strip connecting the connector PCB to the main PCB. U21 is also suspect.

If all input channels function properly, move the oscilloscope probe to TP4. Look for the 13.5 KHz square wave found in STEP 3. Apply +12 volts to pin 4 of each REMOTE DB25 connector as above. The clock at TP4 should stop when the resistor is inserted, and start again immediately when the resistor is removed. If this test fails suspect U26 or U28.

STEP 5 -- CHECK DATA INPUT MULTIPLEXING

Move the oscilloscope probe to TP3. Apply +12 volts to pin 2 of the REMOTE DB25 connectors using the resistor/clip lead combination. With the resistor inserted, TP3 should show narrow positive going TTL pulses. Check all 16 inputs in this manner.

If no pulses are present at TP3 suspect U22 or U10. If pulses are present for some inputs but not for others suspect the corresponding input level shifters (U3, U4, U13, U14) or the spectra strip connecting the connector PCB to the main PCB. U21 is also suspect.

STEP 6 -- CHECK DATA OUTPUT MULTIPLEXING

Set the oscilloscope to the following settings:

- DC coupling
- Horizontal - As necessary to view at least 4 full cycles
- Vertical - 5 volts per division
- Sync - Channel A
- Ground the probe tip and make sure the base line is on zero.

Using another clip lead, ground TP9. Using the oscilloscope, check for positive going RS232 pulses at pin 3 of all 16 REMOTE DB25 connectors. The pulses should measure at least 16 volts peak-to-peak with typical reading being 20 volts peak to peak. The pulses should be centered around zero volts (+/- 8 volts to +/- 10 volts).

If no pulses are present on any channel suspect U24. If some channels are active and some are not suspect the corresponding output level shifters (U7, U8, U17, U18) or the spectra strip connecting the connector PCB to the main PCB. U24 is also suspect.

STEP 7 -- CHECK ACKNOWLEDGE MULTIPLEXING

Remove the grounding clip from TP9. Using the oscilloscope, check for positive going RS232 pulses at pin 6 of all 16 REMOTE DB25 connectors. The pulses should measure at least 16 volts peak-to-peak with typical reading being 20 volts peak to peak. The pulses should be centered around zero volts (+/- 8 volts to +/- 10 volts).

If no pulses are present on any channel suspect U23. If some channels are active and some are not suspect the corresponding output level shifters (U5, U6, U15, U16) or the spectra strip connecting the connector PCB to the main PCB. U23 is also suspect.

STEP 8 -- CHECK HOST INPUT/OUTPUT BUFFERS

Using the DVM, measure pin 8 of the HOST DB25. It should measure between +10 and +12 volts DC. If not suspect R1.

Attach the oscilloscope probe to pin 5 of the HOST DB25 connector. Apply +12 volts to pin 4 of any of the REMOTE DB25 connectors. Pin 5 of the HOST DB25 connector should go to approximately +10 volts. It should drop to approximately -10 volts when the resistor is removed. If this test fails suspect U10 or U19.

Attach the oscilloscope probe to pin 3 of the HOST DB25 connector. Apply +12 volts to pin 2 of any of the REMOTE DB25 connectors. Pin 3 of the HOST DB25 connector should show narrow positive going RS232 level pulses. The pulses should measure at least 16 volts peak-to-peak with typical reading being 20 volts peak to peak. If this test fails suspect U10 or U19.

Attach the oscilloscope probe to TP9. Apply +12 volts to pin 2 of the HOST DB25 connector. TP9 should read a logic LOW. Move the resistor/clip lead combination to the -12 volt staking pin. Apply -12 volts to pin 2 of the HOST DB25. TP9 should read a logic HIGH. If this test fails suspect U9 or U24.

Remove the clip lead that grounds TP1. Attach the oscilloscope probe to TP1. Move the resistor/clip lead combination to the +12 staking pin.

Apply +12 volts to pin 20 of the HOST DB25 connector. TP1 should measure logic LOW. Move the resistor/clip lead combination to the -12 volt staking pin. Apply -12 volts to pin 20 of the HOST DB25. TP1 should read a logic HIGH. stem. Replace the ICs corresponding to the faulty channel(s).

If the RS232 levels return to normal when using a different computer, suspect the computer's RS232 board. Check and repair it as necessary.

Attach the oscilloscope to TP2. Look for narrow negative going TTL level pulses. If there are no pulses RESET the HOST and try again. If there are still no pulses suspect the cable connecting the HOST to the Network III, the RS232 board in the HOST computer, or U9 or U27 in the Network III.

Move the oscilloscope probe to TP4. You should see narrow positive going TTL level pulses. If there are no pulses suspect U27.

Attach one Student Station to Channel 1 of the Network III. If the Student Station does NOT have a Network III Student Station ROM, load and execute the Student Station Operating System by using a cassette recorder and the Student Station Operating System cassette supplied with the Network III software.

If the Student Station DOES have a Network III Student Station ROM, enter the RS232 Bootstrap Routine by typing

* /12327 If the Model III Network III ROM is present.

* /12363 If the Model 4 Network III ROM is present.

If, when using the cassette based operating system, the program fails to load suspect the cassette volume, the cassette recorder, the cassette cables, or the cassette circuitry inside the Student Station Model III.

If, when using the ROM based operating system, the program fails to load suspect the RS232 cable connecting the Student Station to the Network III, the RS232 board in the Student Station, or the I/O buffers in the Network III. Using the oscilloscope, check for proper RS232 levels on both the REMOTE DB25 connector at the Network III and at the RS232 board in the Student Station. Improper RS232 levels on either board indicate a loading problem. Check the same Network III connector using another computer. If the problem remains the fault probably lies in the Network III's ability to drive the system. Replace the ICs corresponding to the faulty channel(s).

If the RS232 levels return to normal when using a different computer, suspect the computer's RS232 board. Check and repair it as necessary.