



Testing the URI ICED Protosys Laboratory Hardware

Augustus K. Uht
Dept. of Electrical and Computer Engineering
University of Rhode Island

May 27, 2000

1 Introduction

This paper is aimed at ICED support staff who need to install or maintain the ICED Protosys hardware. Such support staff include departmental faculty, technicians and teaching assistants. The primary focus of this paper is on testing the ICED hardware; [construction notes](#) are given elsewhere.

Before beginning the tests, it is necessary that you read, or at least skim, the [Overview of the URI ICED Protosys Laboratory](#) paper. The figures in that paper will be referred to in this paper; they are very helpful in understanding the general physical layout of Protosys.

The testing strategy employed assumes only that the hardware has been built, and no power has yet been applied. Testing is employed at the card, subsystem and system levels. The following sections address each of these areas.

2 d-card-h Initial Test

Recall that the d-card-h is the d-card mounted on the EVC1 card and contained in the host (Sun Ultra 1).

Tests:

1. With the d-card-h completely unconnected and not plugged-in, measure the resistance to ground of the +5 supply net, using both probe polarities (+ on +5, and - on +5). A good place to test this is across the tantalum SMT bypass capacitor on the card; it's the ~0.1"x0.2" yellow block. Typical resistance values are: ???
If an excessively low value is obtained, the card's +5 net is probably shorted to ground. **Fix this before going any further.**
2. Before further d-card testing, ensure that the EVC1 is in the host and is working. (See the computer staff for testing procedures.)
3. After powering down the host, remove the host's case and remove the EVC1 card. Referring to Figure x, plug the d-card-h into the EVC1 and bolt on the customized bracket, securing the bracket with two 4-40x3/8" machine screws going through the bracket, the bottom of the EVC1, a 1/4" round nylon spacer, and the d-card-h. Use a #4 lockwasher and #4 nut on the other side of the d-card-h.
4. Plug the EVC1/d-card-h assembly back into the host's Sbus slot. Keep the host's cover off. Power-up the host, and watch for any signs of overheating (smoke test).

After about 15 minutes check the case temperature of the d-card-h's IC's with your finger. The IC's should be warm but not burning.

After the host has booted, re-test the EVC1. Debug as necessary.

Copyright c 2000 URI, A. K. Uht

5. End of d-card-h test.

3 sys-card/-box Initial Tests

These tests will establish the basic worthiness of the sys-card/-box.

Tests:

1. Similar to the d-card-h supply/ground short test, with the sys-card/-box completely unconnected (not plugged into the AC, as well), check the resistance to ground of the four different power supply voltages: +12, +5, -5, and -12. Use the banana sockets on the right side of the sys-box. Again, check both polarities.

Typical resistance values are:

+12 V. to Ground	00000 ohms
+5 V. to Ground	
-5 V. to Ground	
-12 V. to Ground	

2. Connect an AC power cord (only) to the sys-box and plug the cord into the wall outlet. Turn on the sys-box with the power switch (on the left side of the sys-box). Some of the parts will get hot (but should not smoke). This is the smoke test; using your finger (CAREFULLY), ensure that the sys-card ICs and other parts are not excessively hot. The parts that do get warm are the blue r-pack pull-up resistors for the LEDs and some of the circuitry for the ICEDnet interface (possibly including ICs U51 and U53).

The IBUS's 64 DBUS, ABUS and CBUS LEDs should all be lit, but NOT the four EVC1 LEDs. The top row of 32 LEDs should be green, the lower-right 24 LEDs yellow, and the lower-left 8 LEDs red.

3. Turn off the sys-box. Using electrostatic discharge precautions, plug the 8 Mbyte SIMM into its socket on the sys-card (U91). Turn on the sys-box and do another temperature check, including the ICs on the SIMM this time.
4. End of initial sys-card/-box tests.

4 d-card-s Initial Tests

This d-card resides on the sys-card.

Tests:

1. Perform test 1 of Section 2.
2. Turn off the sys-box, if it isn't already off. Plug the d-card-s onto the sys-card. Smoke test: power up the sys-box and check the d-card-s ICs for excessive temperature. Also, ensure that all of the sys-card IBUS LEDs are lit.
3. End of initial d-card-s tests.

5 System Tests

It is difficult to test the operation of the Protosys circuit boards individually. Instead, the whole system is connected and different system tests are run which will both detect faults and help to locate them.

Preliminary Tests:

1. Power down both the sys-box and the host.
2. Using two 68-wire SCSI VHDIC cables, connect P1 of d-card-h to P1 of d-card-s, and P2 of d-card-h to P2 of d-card-s.
3. Power up the host.
4. Do a temperature test of the d-cards.
5. Power on the sys-box.
6. Do a temperature test of the d-cards and the sys-card.
7. End of preliminary system tests.

Tests:

The five system tests are described in detail in:

[ICED Protosys Hardware System Tests](#)

For each test the general procedure is as follows:

1. Power down the sys-box. You do not need to power down the host.
2. With a protoboard, make the specified DIP cable connections between the sys-card and protoboard, and make the specified jumper settings on the protoboard.
3. Power up the sys-box.
4. Run the specified monitor program on the host. Use the specified monitor program commands to actually perform the test.
5. Debug as necessary. (If there is a problem, it may be helpful to run all tests 1-3 to help localize the fault.)

The first three tests are “static” tests; changes only happen every second or so. They will still find most of the faults.

The last two tests, 4 and 5, are dynamic tests, run at a nominal system clock frequency of 1 MHz. Test 4 exercises and tests the SIMM on the sys-card. Test 5 uses an ICED CPU on the FPGA to run a program in the SIMM that displays a message on the sys-card’s LCD display; it is the same message as is shown in Figure 4 of:

[Overview of the URI ICED Protosys Laboratory.](#)

6 ICEDnet Test

As of this writing, we have not designed or built an interface to the ICEDnet circuitry on the sys-card. However, it is still possible to do a good test of this circuitry with an incomplete interface.

ICEDnet Circuitry Test:

1. Power down the sys-box.
2. Using a DIP cable, bring the P71 signals over to the protoboard.
3. Make the following connections on the protoboard to the P71 signals:
 - a) TXD to the IBUS clock CCLK1.
 - b) LBK to 0.
 - c) Temporary: TXE to 0.
4. Use a scope probe to examine the following signals. Set the scope for single trigger operation. Connect TXE to 1, and to 0 between signals. Look at each signal as TXE is connected to 1.
 - a) COL - should start low then go high (may oscillate at a KHz rate)
 - b) RXD - should be data alternating between 0 and 1, then stay at a constant value then alternate again, etc.
 - c) CRS - should start low then go high, then low (may oscillate at a KHz rate)
 - d) RXC - should be a 10 MHz square wave, always
 - e) TXC - should be a 10 MHz square wave, always

- f) ICEDnet (on BNC connector) - NOTE: for this test put the ground clip of the scope on the shield of the BNC jack, and put the probe itself on the center conductor (the BNC ground floats) - should start off at about -0.5V., then the alternating data should be seen, between -0.5 V. and -1.0V.; it will then trail off to 0 V.

This is what is going on: with TXE at 0, nothing is transmitted and no signal is received. When TXE goes to 1, the TXD phony data (CCLK1) is sent out on the network. Simultaneously, the data is received on RXD.

Eventually, within milliseconds, the maximum Ethernet packet length will have been reached, a collision will be detected (COL=1), and the transmitter section will shut down, so no more data will be broadcast on the net.

Once inactivity has stabilized, the process will repeat. (Data may only be seen on the net when TXE first goes to 1.)

- 5. End of test.

7 Summary

Those are all of the tests necessary to have high confidence that the ICED Protosys hardware (and some of the software) is working.