Precision Development E84 Host Emulator

The E84 host emulator is designed to provide an E84-compliant interface for equipment testing and fab integration. It has an intuitive user interface, is powered by the USB cable, and is small, light, and easily carried into the fab.

Figure 1. E84 Host Emulator

Figure 1 shows the emulator. The USB connector is designed to hold on to the cable so it will not come unplugged. All power for the unit comes from the USB cable, so there is no need to find another power outlet in a fab.

(Note: because it is USB powered, the emulator cannot drive a transceiver; if that is needed the transceiver will need to be powered separately.)

Figure 2 shows the E84 connector end of the emulator.

Figure 3 shows the screen layout. All functional operations are carried out from this one screen.
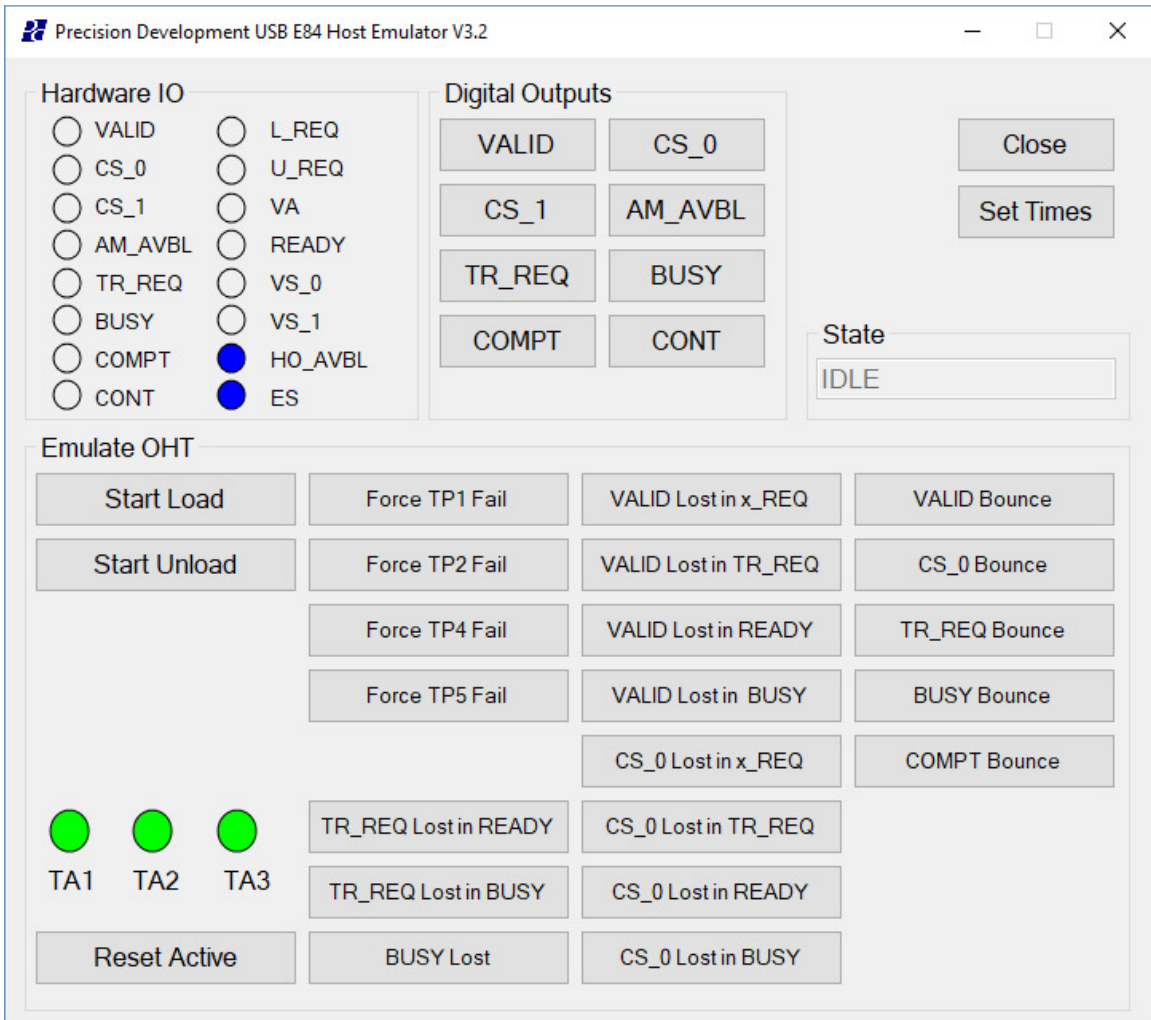

Figure 3. Screen Layout

Status of the IO is displayed in the upper left corner. The IO is updated every hundred milliseconds. The output buttons allow the user to operate the interface manually. If you know what you are doing, you can do an E84 handoff using only these buttons.

The "Set Times" button is used to setup the E84 timers. Pressing this button results in a pop up dialog shown as Figure 4:
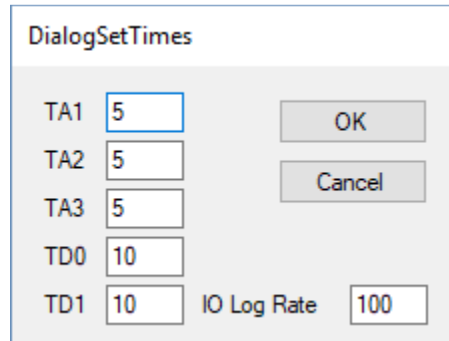
Figure 4. Timer Setup

The TD0 & TD1 times have special meaning in this context. They actually control the time between CS_0 and VALID. This enables the user to test for conditions in which VALID is asserted before CS_0, to verify equipment behavior.

The IO log rate is the sample time in milliseconds for the IO log (.csv file) that is running whenever the program is running. 100 is the minimum. Setting this value to zero turns off logging.

The data in the signal log are arranged so that after loading it into excel, a graph of the handshake(s) can easily be plotted. A sample graph of a load is shown in Figure 5. By moving the legend to the side and stretching it a bit, the legend lines up with the signals. Figure 6 shows an Unload.
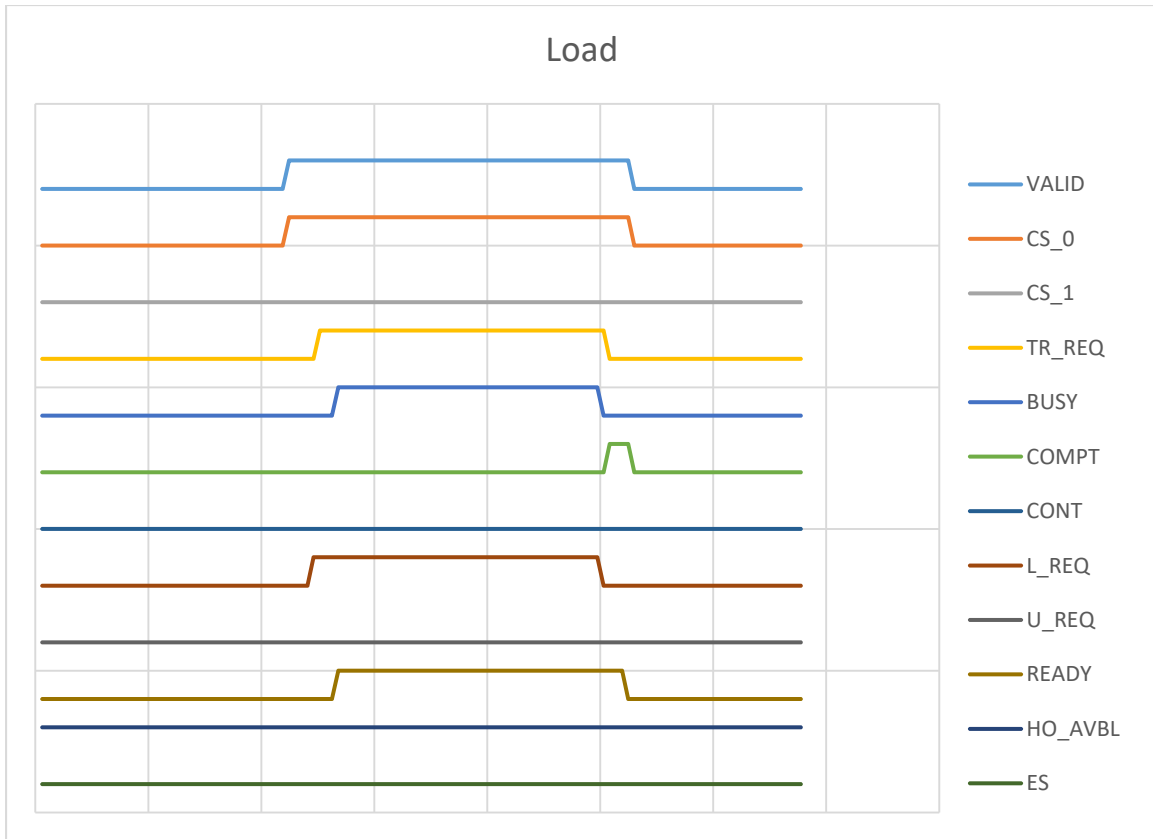
Figure 5. Plot of Log File for Load

There is also an event log running which shows the state transitions and their times. This is the event log for the Load:

```
07:04:08 Starting Event Log
07:04:12 SetCS_0
07:04:12 SetVALID
07:04:13 WAITL_REQ
07:04:13 SetTR_REQ
07:04:13 WAITREADY
07:04:13 SetBUSY
07:04:13 WAITPLACED
07:04:18 ClearBUSY
07:04:18 SetCOMPT
07:04:18 ClearTR_REQ
07:04:18 WAITDONE
07:04:18 ClearVALID
07:04:19 ClearCS_0
07:04:19 ClearCOMPT
```
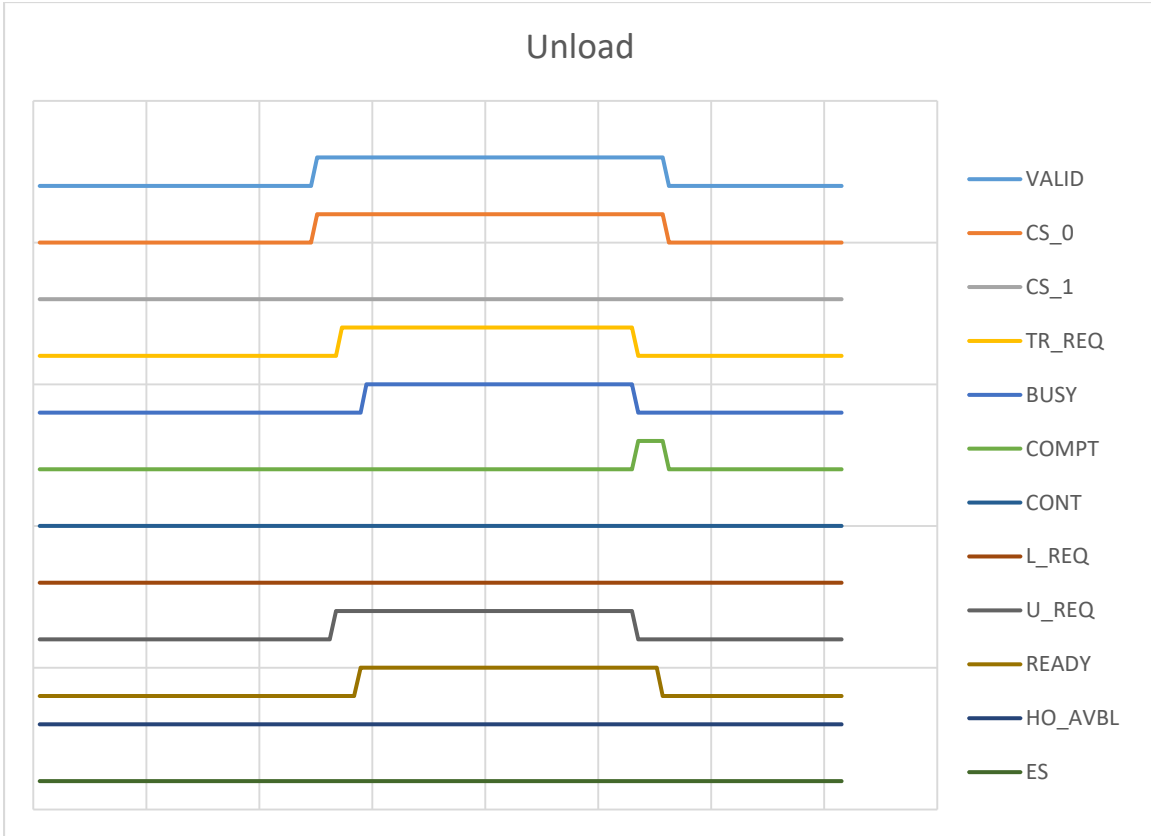
Figure 6. Plot of Log File for Unload

Event log for Unload:

    07:04:26 Starting Event Log
    07:04:31 SetCS_0
    07:04:31 SetVALID
    07:04:31 WAITU_REQ
    07:04:32 SetTR_REQ
    07:04:32 WAITREADY
    07:04:32 SetBUSY
    07:04:32 WAITPICKED
    07:04:37 ClearBUSY
    07:04:37 SetCOMPT
    07:04:37 ClearTR_REQ
    07:04:37 WAITDONE
    07:04:37 ClearVALID
    07:04:37 ClearCS_0
    07:04:37 ClearCOMPT
    07:04:37 IDLE

Inside of the "Emulate OHT" frame are the controls for doing handoffs and other testing. In the first column are the following controls:

- Start Load
- Start Unload
- (timer)
- Reset Active
- TA1, TA2, TA3

Start Load is used to initiate a carrier load transaction. If the load-port is ready to accept a carrier, the handshake will run until it is ready for the carrier. At that time, a timer will appear on the screen between "Start Unload" and "Reset Active." The carrier will need to be manually placed on the load port before the timer times out. Once the carrier is placed, the handshake will run to completion.

Start Unload is used to initiate a carrier unload transaction. If the load-port is ready to unload a carrier, the handshake will run until it is ready for the carrier to be removed. At that time, a timer will appear on the screen between "Start Unload" and "Reset Active." The carrier will need to be manually picked up from the load port before the timer times out. Once the carrier is removed, the handshake will run to completion.

Reset Active is used when there are errors in the handoff. Many of the tests result in the handshake going into an error state. The reset button brings the active side back to a ready state. Usually the Equipment side will also need to be reset.

TA1, TA2, TA3 are the host-side timers. If one of them times out, it will change from **Green** to **Red**. They are reset by pressing **Reset Active.**

Test Descriptions

Timer failures

These tests are performed by pausing the sequence at the right time in order to cause timers on the Load Port to reach their limits. We are looking for HO_AVBL off on the interface and an event report from the Load Port. After failure, both the host emulator and the Load Port will need to be reset.

- TP1 Fail – Start a handoff and delay response until TP1 fails.

- TP2 Fail – Start a handoff and delay response until TP2 fails.

- TP3 Fail – Start a handoff and don't move a carrier and then wait for TP3 to time out.

- TP4 Fail – Start a handoff and delay response until TP4 fails.

- TP5 Fail – Start a handoff and delay response until TP5 fails.

Lost signal tests

These tests are performed by dropping the signal at various points in the sequence in order to trigger lost signal detection on the Load Port. We are looking for HO_AVBL off and an event report from the Load Port. After failure, both the host emulator and the Load Port will need to be reset.

- VALID Lost in x_REQ – Start a handoff, wait for L_REQ response and then drop VALID.

- VALID Lost in TR_REQ – Start a handoff, wait for TR_REQ response and then drop VALID.

- VALID Lost in BUSY – Start a handoff, wait for BUSY state and then drop VALID.

- CS_0 Lost in x_REQ – Start a handoff, wait for L_REQ response and then drop CS_0.

- CS_0 Lost in TR_REQ – Start a handoff, wait for TR_REQ response and then drop CS_0.

- CS_0 Lost in BUSY – Start a handoff, wait for BUSY state and then drop CS_0.

- TR_REQ Lost in READY – Start a handoff, wait for READY response and then drop TR_REQ.

- TR_REQ Lost in BUSY – Start a handoff, wait for BUSY state and then drop TR_REQ.

- BUSY Lost – Start a handoff, wait for BUSY state and then drop BUSY.

Signal Chatter tests

These tests are performed by pulsing the signal at increasing pulse lengths. The idea is to find out how long the signal has to be in the new state before it is recognized by the Load Port as having changed state. Positive tests are those where we expect an OFF-to-ON transition to trigger a response, and Negative tests are those where we expect an ON-to-OFF transition to trigger a response. We are generally looking for HO_AVBL off and an event report from the Load Port. After failure, both the host emulator and the Load Port will need to be reset. Load Port settings need to be adjusted to enable 200 ms debouncing on all signal lines.

- VALID Bounce – Set CS_0, then set VALID for 160 ms, then back off, then set VALID for 170 ms, then off. Continue adding 10msec each time until the tool responds with x_REQ. This is a positive test.

- CS_0 Bounce – Set CS_0 then Valid and wait for x_REQ. Then take CS_0 down for 160 ms, then back up, then back down for 170msec; and continue adding 10msec each time until the tool reports a failure. This is a negative test

- TR_REQ Bounce – Start handoff until TR_REQ start. At TR_REQ start, sequence TR_REQ through times between 100ms and 500ms. This is a negative test

- BUSY Bounce – Start handoff until BUSY start. At BUSY start, sequence BUSY through times between 160ms and 500ms. Monitor when either HO_AVBL goes off or L_REQ/U_REQ go off. This is a negative test

- COMPT Bounce – Start handoff until COMPT start. At COMPT start, sequence COMPT through times between 160ms and 500ms. Monitor when READY goes off. This is a positive test

Installation notes

This software requires the .net 4.6 library, and if it is not installed on your computer it will ask you to install it. The installer makes a few directories and copies the files and creates a menu link to it. These are some notes on installation:

- The USB driver will automatically install by just plugging it in to the computer with the computer connected to the internet.
- The E84 software is installed by inserting the CD in the drive and double clicking H84 Host Emulator.msi.
- If the .net library ver 4.6 is not already installed on the computer, the installer will ask that you install it from the Microsoft web site.
- After installation, plug in the emulator and click the menu shortcut and the screen shown in the manual will appear.