ThinSat Phase 2
Engineering Model Set Up Procedures

Drafted by NearSpace Launch, Inc.
Matt Orvis, mattorvis@nearspacelaunch.com

NSL: NearSpace Launch Inc.
Technology. Service. Education
8702 E 825 S, Upland, IN, 46989
www.nearspacelaunch.com

Thank you for participating in the ThinSat Program. We are excited that you have progressed to Phase 2 of the program, the Engineering Model (EM) Unit. For a quick and easy startup, please follow these simple steps and you will be on your way in a matter of minutes!

1.0 What's in the box:

1.1 ThinSat – Engineering Model (EM) Unit (Figure 1)
- 1.1.1 Main PC board
- 1.1.2 3D printed frame
- 1.1.3 Removable clear cover plate with laminate
- 1.1.4 4 #2-56 Philips head mounting screws

1.2 Micro-B to USB + power cable (Figure 2)
1.3 ThinSat Student Payload ICD
1.4 EM Set Up Procedures (this document)

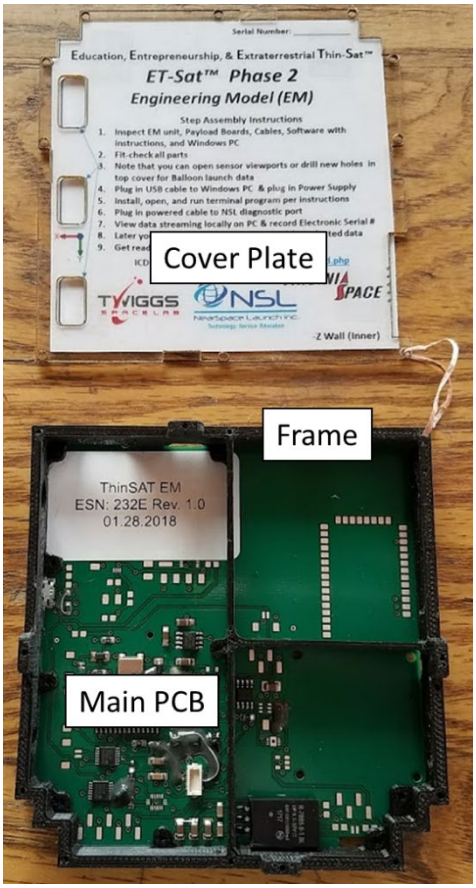

Figure 1 Engineering Model (EM) ThinSat, with Main PCB, Frame, and attached Cover Plate.

2.0 Included Hardware

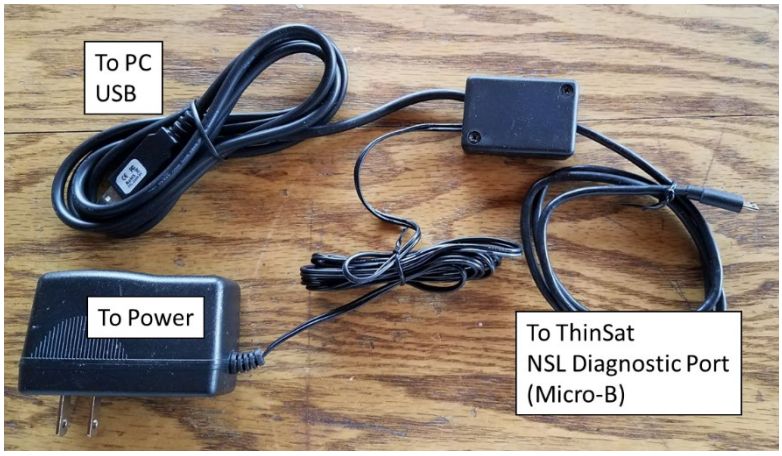

Figure 2 Micro-B to USB + power cable

3.0 Assembly

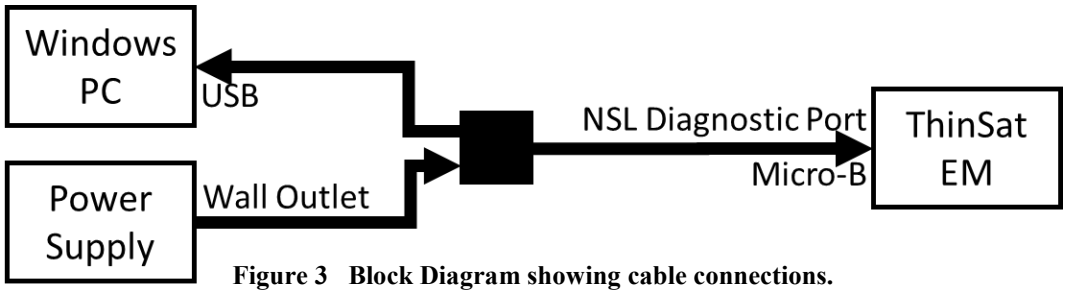

Figure 3 Block Diagram showing cable connections.

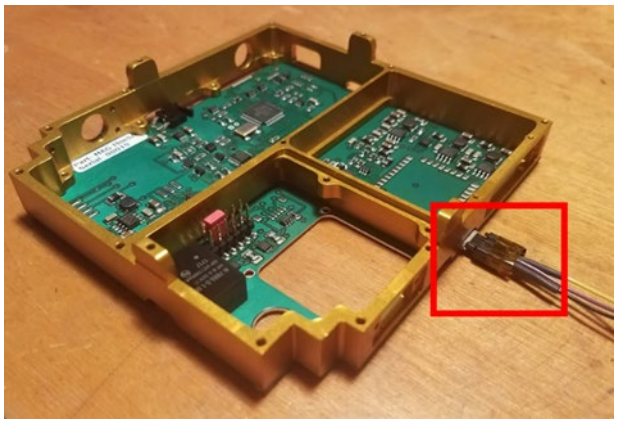

Figure 4 Picture of included cable properly connected to the ThinSat NSL Diagnostic Port.

4.0 Warnings

4.1 Check the Space Data Dashboard for the most recent ICD and Set Up Procedure documents.
4.2 READ THE ThinSat ICD AND SET UP PROCEDURES THOROUGHLY BEFORE STARTING!!
4.3 Be careful when connecting the EM, applying voltage to the wrong port can destroy the EM.

5.0 Help Understanding your EM

5.1 For Pin Out diagram, see ThinSat ICD page 7.
5.2 The only provided method to read data from the ThinSat Bus is through the NSL Diagnostic Port (See Figure 4). This is a read only port. The EM does not include any additional diagnostic ports that connect to your payload. However, you should have your own diagnostic connector, using the suggested payload diagnostic port.
5.3 Every transmission consists of a 48 byte packet.
  5.3.1 13 bytes are headers and identifiers, while 35 bytes consist of Beacon or Payload data.
  5.3.2 Bytes 2 and 3 identify the type of packet (MEDO, TSL, custom, etc..).
  5.3.3 Bytes 11 through 46 contain the 35 byte payload data.
5.4 Upon power-up, the EM will send a packet of the unit's ID data in Ascii.
5.5 After the first ID packet, payload packets are sent every 15 seconds in Hex.
5.6 There will always be one packet of health and safety data, followed by any TSL, MEDO or other payload packets.
5.7 Payload does not receive power until 30 seconds after the ThinSat powers up, so payload packets will not transmit until 2 health and safety packets have passed.

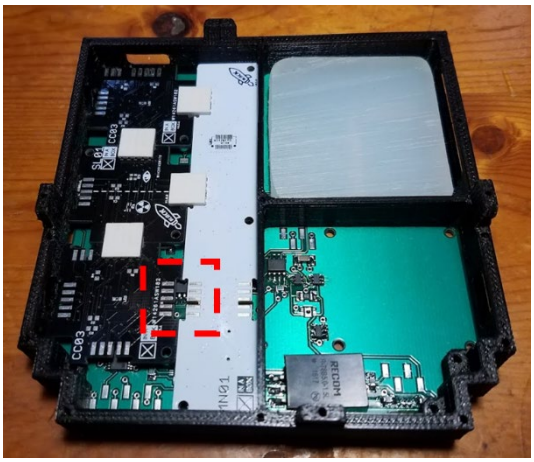

Figure 5 Picture showing recommended MEDO chip to remove.

5.8 If you are using MEDO boards, one of the connectors between the chips interferes with a part on the ThinSat main PCB. We recommend removing the MEDO chip connector between the bottom-

most chip and the MEDO connector board. See Figure 5. If this causes connection issues, you may replace the connector in its original spot, with some slight interference issues.

6.0 Accessing the Space Data Dashboard

All students and teachers participating in the ThinSat program have access to the Space Data Dashboard (SDD). The steps are set forth below:

6.1 Create a Gmail account specifically for use in the ThinSat Program (ex. Centralhs.ThinSat@gmail.com). The SDD uses Google to authenticate users.
6.2 Send an email to Matt Craft, Twiggs Space Lab at matt.craft@twiggsspacelab.com requesting access to the SDD and providing your Gmail account name.
6.3 The user account name will be added to the SDD.
6.4 Log into the SDD at https://sdd.nsldata.com/dashboard.php.
6.5 On the home page of the SDD is a login screen. Enter your Gmail account and password to enter the SDD.

7.0 Simple Set Up Procedures

7.1 Inspect EM Unit.
- 7.1.1 Check any and all payload boards (TSL, MEDO, Alternative Student Payload Board, or custom payload designs).
- 7.1.2 Check the included cable with one end able to connect to NSL Diagnostic Port, and the other end splitting to a USB and a power supply. See Figure 2.
- 7.1.3 Ensure you have the required software and drivers and a Windows PC (See Section 8).
- 7.1.4 Do not mount or connect any payload board yet. This will come later, once you verify the unit is working on its own.

7.2 Plug in the cable to PC and power supply (not yet to ThinSat).
- 7.2.1 Plug the USB connector into a USB port on your Windows PC.
- 7.2.2 Plug the power connector, split from the same end of the cable as the USB, into a power supply.
- 7.2.3 It is important that these are plugged in BEFORE you connect to the ThinSat.

7.3 Install, open, and run terminal program.
- 7.3.1 Recommended free terminal program is RealTerm, found at: https://sourceforge.net/projects/realterm/files/
- 7.3.2 You may use any terminal program, as long as it is able to read raw Ascii and Hex. If RealTerm begins missing packets, please try options like CoolTerm (Windows/Mac) or YAT.
- 7.3.3 In Realterm, set the Baud Rate to 4800, and set the Port to the corresponding to USB port.

7.4 Plug in the fully powered cable to the NSL Diagnostic Port (AFTER plugging in to PC and power).
- 7.4.1 Located on the +X face, resembling an Android phone charger (See Figure 4).

7.5 View data streaming locally on PC and record Electronic Serial # (ESN). See Section 9.
7.6 Fit-check all parts.
- 7.6.1 Make sure the main PC board and cover board screw on to the frame. Be careful to not strip screw by over-tightening.
- 7.6.2 If the 3D printed frame interferes with any part of your payload or exterior panels, carefully file back the interfering edge on the ThinSat Bus.

7.6.3 Check that the payload boards fit easily in the payload section.
7.6.4 Check that the payload holes line up with the screw holes in the 3D printed frame.
7.7 Note the sensor ports that are available for access from the payload space to the exterior.
7.7.1 You must cut open the laminate paper to expose any sensor holes that your instruments need to access.
7.7.2 Students may drill or cut the clear polycarbonate cover plate to open the sensor holes, or create new ones, in order increase a sensor's field of view.
7.7.2.1 Note that these modifications will not be reflected in the ThinSat Flight Unit.
7.8 Mount your payload into the EM unit, then repeat steps 7.2 to 7.6.
7.9 Later, you can switch to online SDD for selected data. See Section 6 and 9.
7.10 Get ready for balloon launches in Spring 2018!

8.0 Installation of Internet Streaming Software

8.1 One file must be downloaded from the Space Data Dashboard server to your computer in order to stream data to the Dashboard.
8.2 Download "EMStreamV2.exe" file from the resources tab at this link: https://sdd.nsldata.com/dashboard.php

9.0 Running the Software

9.1 Local Data Streaming
9.1.1 Download and install RealTerm terminal program at: https://sourceforge.net/projects/realterm/
9.1.1.1 You may use any terminal program, as long as it is able to read raw ASCII and HEX.
9.1.2 Open RealTerm after plugging cable in to power and PC USB.
9.1.3 Under "Port" tab, set these options. Afterwards, select "Change":
9.1.3.1 Baud: 4800
9.1.3.2 Port: "Double click to scan", then select appropriate port
9.1.3.3 Parity: None
9.1.3.4 Data Bits: 8
9.1.3.5 Stop Bits: 1 bit
9.1.3.6 Flow Control: None (Hardware or Software)

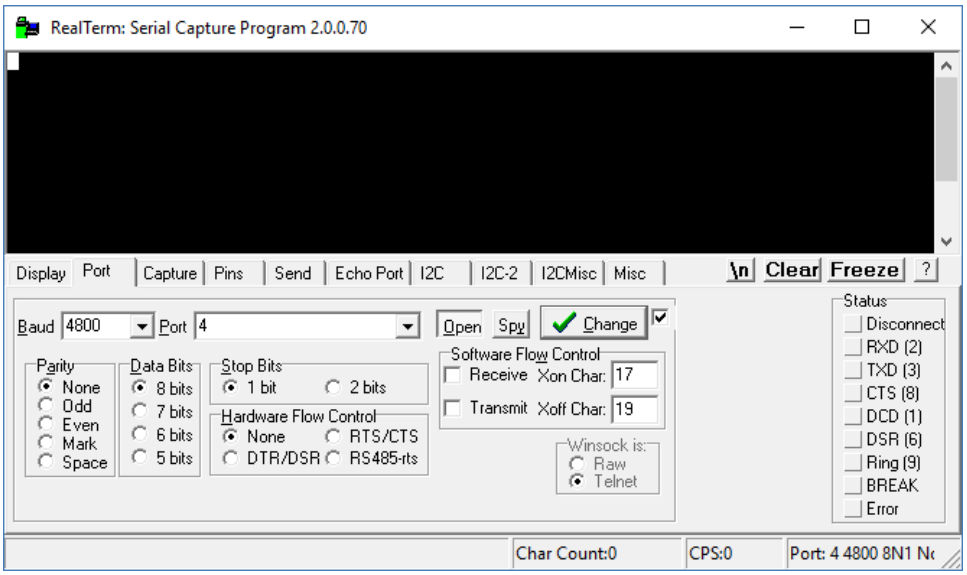

Figure 6 RealTerm console showing EM unit set up.

9.1.4 EM Unit will first output your unit ID data in Ascii, then switch to payload data in Hex. To view your EM Unit's ESN, under "Display" tab set "Display As" to Ascii.

9.1.5 Plug cable into Micro-B NSL Diagnostic Port on ThinSat EM Unit.

9.1.5.1 This port looks like an Android phone charger port.

9.1.5.2 You will then immediately see your EM Unit ID info in Ascii.

9.1.5.3 Sometimes, the computer has a hard time reading the first few bits when plugging in, and this data may not display correctly. Unplugging and plugging into the EM resets the unit and gives your PC another chance at correctly parsing that first ID packet.

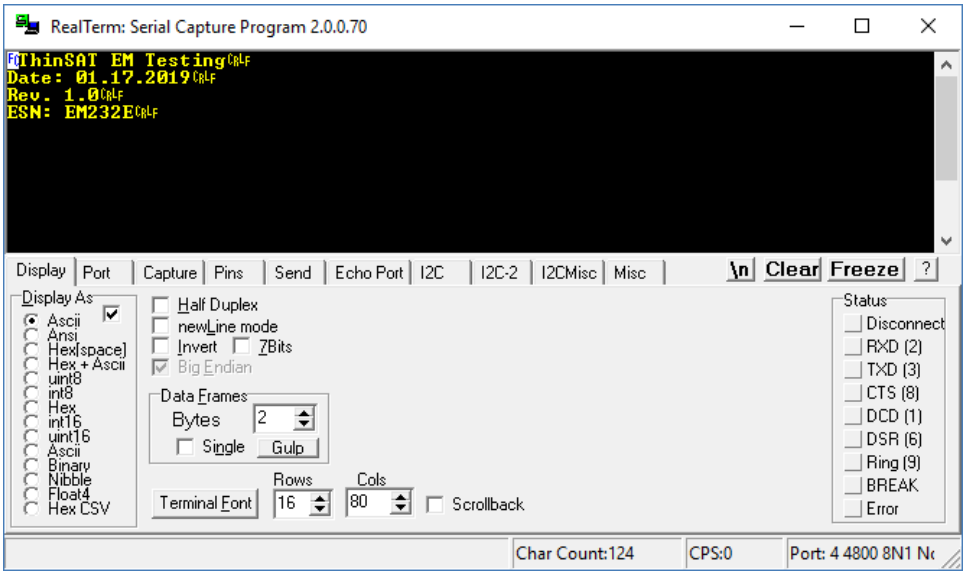

Figure 7 RealTerm console showing Ascii selection and EM ID data.

9.1.6 To then view payload data, switch “Display As” to Hex[space]

9.1.6.1 This will let you view the raw Hex data, separated into bytes by spaces.

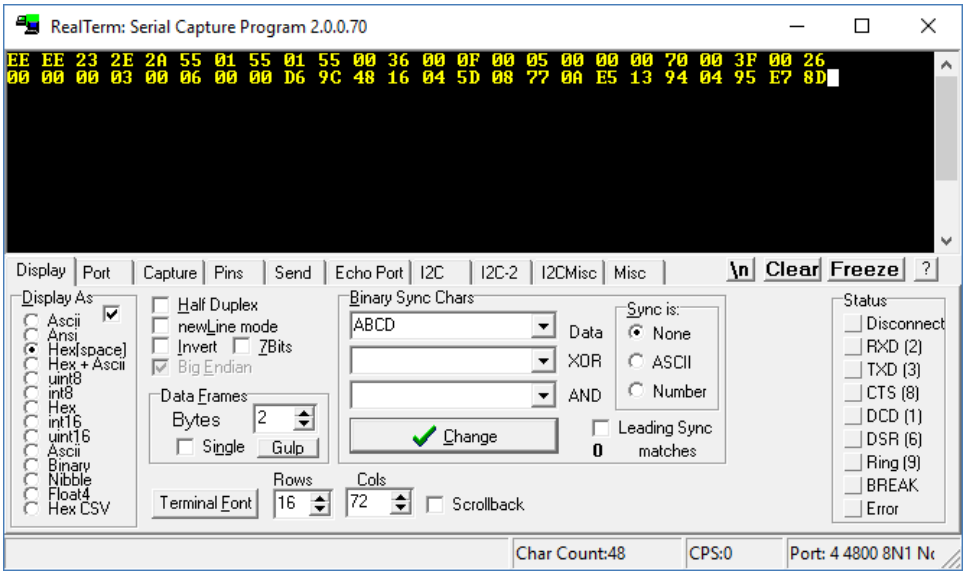

Figure 8 RealTerm console showing Hex selection and EM payload data.

9.1.7 View your payload data streaming in Hex bytes

9.1.7.1 Packets are sent every 15 seconds.

9.1.7.2 If no payload is plugged in, the EM unit will send one packet of health and safety every 15 seconds.

9.1.7.3 If a TSL, MEDO or other payload is plugged in, the unit sends both packets every 15 seconds. Note that the payload does not receive power until 30 seconds after the ThinSat powers on. Therefore, two health and safety packets will transmit before the payload packets begin.

9.2 Internet Data Streaming

9.2.1 Ensure the “EMStreamV2.exe” file has been downloaded.

9.2.2 Run your EM Unit according to Section 7.

9.2.3 Run the file that you downloaded.

9.2.3.1 You will be presented with a list of possible COM ports, and prompted to select one. Find out which COM port your ThinSat EM unit is plugged in to, and select this port. This will usually be labeled as a USB/COM port.

9.2.4 Note that you cannot run a terminal program at the same time that is accessing the same port, as it will interfere.

9.2.5 Log in to the Dashboard and view your data streamlining online, if you have registered your devices and EM board!

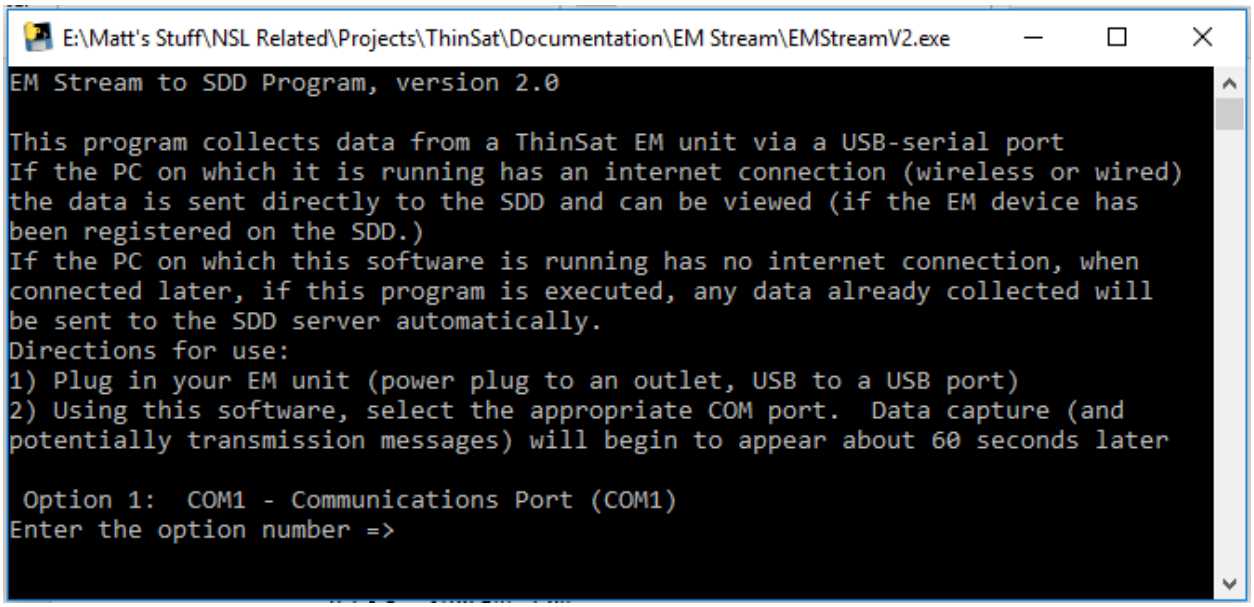

Figure 9 EMStreamV2.exe console display. Note the list of COM ports provided (only one in this case), and the prompt to select one of them.

10.0 Parsing your data

10.1 Health and Safety Packet Data

Byte #	Function	Content	Conversion
0	Header	EE	
1		EE	
2	ESN	Hi Byte	
3		Lo Byte	
4	Header	2A	
5		55	
6		01	
7		55	
8		01	
9		55	
10	Analog Input 1	Hi Byte	V = DEC x 5 / 1023
11		Lo Byte	
12	Analog Input 2	Hi Byte	V = DEC x 5 / 1023
13		Lo Byte	
14	Analog Input 3	Hi Byte	V = DEC x 5 / 1023
15		Lo Byte	
16	Analog Input 4	Hi Byte	V = DEC x 5 / 1023
17		Lo Byte	
18	Analog Input 5	Hi Byte	V = DEC x 5 / 1023
19		Lo Byte	
20	Analog Input 6	Hi Byte	V = DEC x 5 / 1023
21		Lo Byte	
22	Temperature (C)	Hi Byte	If C>0: C = DEC / 2, If C<0: C = DEC – 255 + 0.5 (Not active for some EM units)
23		Lo Byte	
24	NA		
25	NA		
26		00	
27	Digital Inputs 1-2	Byte	Bit0 = DI1, Bit1 = DI2
28	Packet Count	Hi Byte	Count = DEC
29		Lo Byte	
30-45	NA		

Contact for orders and information

Matt Orvis, Project Engineer
(808) 990-4488

Jeff Dailey, Chief Engineer
(260) 241-0409

Hank Voss, President
(765) 618-3813

NSL@nearspacelaunch.com
http://www.nearspacelaunch.com/

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