Universal Development Kit
User Guide
Part No. 875-0284-000 Rev E1

Hemisphere *GPS*

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(2) this device must accept any interference received, including interference that may cause undesired operation.

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This user guide provides detailed information on the interface and workings of the Universal Development Kit, its specifications, and how to connect a Hemisphere GPS OEM board to the Universal Development Kit.

This user guide does not cover receiver operation, the PocketMax™ utility, or commands and messages (NMEA 0183, NMEA2000® or HGPS proprietary). For information on these subjects refer to the Hemisphere GPS Technical Reference (go to www.hemispheregps.com and click the GPS Reference icon).

What is the Universal Development Kit?

The Universal Development Kit allows you to integrate a Hemisphere GPS OEM board into your design and includes the following:

- Enclosure
- Main carrier board
- Set of four adapter boards for use with small form factor Hemisphere GPS OEM boards
- Power cable and AC power supply
- Two serial cables - one straight serial cable and one null modem cable for RTK

Note: Throughout the rest of this user guide, the Universal Development Kit is referred to simply as the UDK.

Supported OEM Boards

The UDK supports the following Hemisphere GPS OEM boards:

- Crescent®
- Crescent Vector™ II
- Eclipse™
- Eclipse Vector™
- LX-2™ (L-band DGPS service, L-band high precision services, L-band high precision service with GLONASS)

See Table 3-1 on page 15 for a list of specific OEM board models the UDK supports.

Supporting Documentation

For the Hemisphere GPS OEM board you purchase with the UDK there is an Integrator Guide available for download from the Hemisphere GPS website at www.hemispheregps.com.

UDK Components

Figure 1-1 shows the parts included in the UDK and Table 1-1 provides part numbers and descriptions.

Note: The UDK does not include an antenna or antenna cable; they are available from Hemisphere GPS as accessory items.
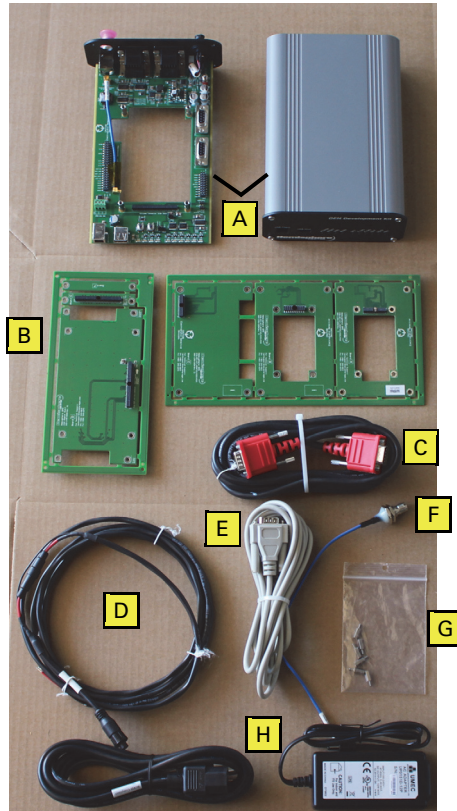
Figure 1-1: UDK components

Table 1-1: UDK parts list

Item	Part No.	Description	Qty
A	802-1066-000#	Enclosure (includes outer enclosure, front and rear panels, main carrier board, RF cable)	1
B	725-1293-000#	Adapter boards (set of 4: Boards A, B, C, D) *Note: Two additional adapter boards (E and F) are included with Board D and act as spacer boards.*	1
C	051-0172-000#	Serial data cable, DB9 male - DB9 male, 3 m	1
D	054-0009-000#	Power cable, 3 m	1

**Table 1-1: UDK parts list (*continued)*

Item	Part No.	Description	Qty
E	050-0011-022#	Serial I/O cable, DB9 female - DB9 male, 3 m	1
F	053-0046-000#	RF cable, TNC female - MCX male, 280 mm *Note: For use with Crescent Vector II and Eclipse Vector OEM boards only.*	1
G	675-0002-004# 676-1007-000# 678-0003-001# 680-0007-000#	Machine screw, 4-40, 1/4", PPHC, SS Nut, hex, 4-40, SS, nylon insert Washer, lock, #4, SS Standoff, hex, M-F, 4-40, 5/16″, SS	8 8 8 12
H	427-0030-000#	AC adapter	1
	054-0084-000#	AC cable, 2 m	1

OEM Board Integration Requirements

Successful integration of a Hemisphere GPS OEM board within a system requires electronics expertise that includes:

- Power supply design
- Serial port level translation
- Reasonable radio frequency competency
- Understanding of electromagnetic compatibility
- Circuit design and layout

For general integration requirements refer to the appropriate OEM Board Integrator Guide available from the Hemisphere GPS website at www.hemispheregps.com.

⚠**WARNING:** You may open and operate the UDK without the enclosure; however, use ESD protection when opening the enclosure and operating the UDK without the enclosure.

Chapter 2: Kit Specifications

Cable Interface

The UDK enclosure provides power, data, and GPS antenna cable interfaces. Figure 2-1 shows the various connections located on the rear panel of the UDK enclosure.

Note: The Secondary GPS RF connection is for Crescent Vector II and Eclipse Vector OEM boards only, both of which allow for the use of two GPS antennas. You must connect this port using the provided TNC cable (Part F in Table 1-1 on page 3) to enable the functionality of this port.
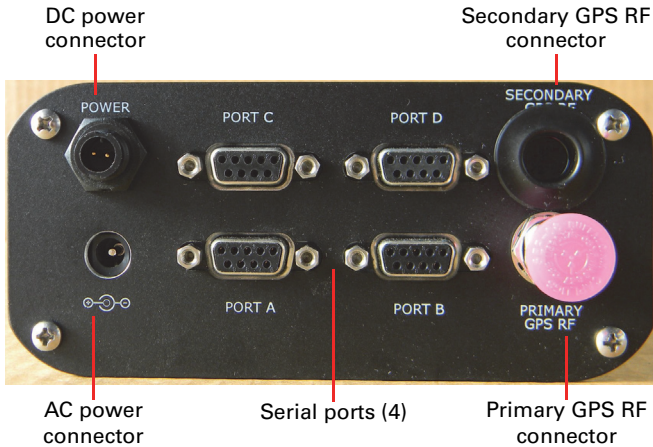
Figure 2-1: Rear panel connections

Routing and Securing the Cables

Consider the following when routing UDK cables:

- Power cable must reach an appropriate power source
- Antenna cable must reach from the antenna to the receiver
- Data cable may connect to a data storage device, computer, or other device that accepts GPS data
- Do not run cables in areas of excessive heat
- Do not expose cables to corrosive chemicals
- Do not crimp or excessively bend cables
- Do not place tension on cables
- Coil up excess cable near unit
- Secure along the cable route using plastic tie wraps as necessary
- Do not run cables near high voltage or strong RF noise and transmitter sources

⚠WARNING: Improperly installed cables near machinery can be dangerous.

Environmental Requirements

The UDK is designed to be stored and operated between -40°C and +85°C (-40°F and +185°F). The optional Hemisphere GPS antennas available for the UDK are designed to operate in an outdoor environment and are waterproof.

Note: Refer to the OEM board Integrator Guide for environmental requirements for your OEM board.

Powering the UDK

The UDK accepts from 5 to 18 VDC and the supplied power should be continuous and clean for best performance. The UDK will start when an acceptable voltage is applied.

⚠️**WARNING:** Do not apply a voltage higher than 18 VDC. This will damage the receiver and void the warranty.

You can power the UDK in either of the following ways:

- Connect the DC power cable to a suitable power source

    a. Connect the red wire of the cable's power input to DC positive (+).

    b. Connect the black wire of the cable's power input to DC negative (-).

    Note: A 1.0 A fast-blow fuse is equipped and situated in-line of the power input of the power cable and protects the UDK from power surges. The fuse container should remain accessible after installation.

    ⚠️**WARNING:** Do not operate the UDK with the fuse bypassed. This will void the product warranty.

- Connect the AC power adapter to the UDK

If the OEM board does not power on, make sure the internal power switch on the carrier board is in the "ON" position (see Figure 2-2).
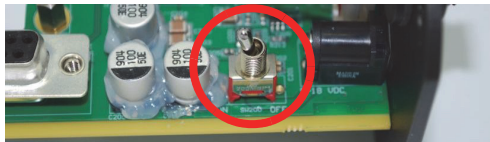
Figure 2-2: Carrier board ON/OFF switch

⚠️**WARNING:** Connecting more than one source of power at a time can seriously damage the unit and will void the warranty.

Serial Ports

The UDK provides four RS-232 compatible serial ports (located on the rear panel, see Figure 2-1 on page 6) for communicating with external data loggers, navigation systems, PCs, and other devices. The serial ports are labeled Port A, Port B, Port C, and Port D.

Ports A, B and/or C may be used for communication. Port D is designed to communicate with Hemisphere GPS' SBX-4™ DGPS beacon receiver to receive DGPS corrections and only operates at 9600 baud with an 8 data bit, no parity, 1 stop bit configuration (8-N-1). Ports A, B or C may also receive external DGPS or RTK corrections.

> Note: The baud rate of the UDK's serial ports and the devices they are trying to communicate with must match. Refer to your OEM board's documentation to determine the default baud rate of your OEM board. Refer to the Hemisphere GPS Technical Reference (go to www.hemispheregps.com and click the GPS Reference icon) for information on changing baud rates.

Table 2-1 provides the pin assignments for the serial ports. Refer to your OEM board documentation for communication protocols specific to your OEM board.

Table 2-1: Serial port pinouts

Port	Pin	Signal	Description
A,B,C	2	TXD	NMEA 0183, Hemisphere GPS proprietary binary, RTCM v2.3 (DGPS), RTK v3, and CMR output
	3	RXD	NMEA 0183, Hemisphere GPS proprietary binary, RTCM v2.3 (DGPS), RTK v3, CMR, and CMR+ input
	5	Signal ground	Signal return
D	2	TXD	Hemisphere GPS proprietary
	3	RXD	RTCM input
	4	Signal ground	Signal return

Figure 2-3 shows the pinout of each serial port of the UDK.


Figure 2-3: DB-9 socket numbering

> Note: Hemisphere GPS OEM boards use a CMOS level interface. The UDK carrier board converts from CMOS to RS-232.

USB Ports

The front panel of the UDK has ports for a USB client (device) and a USB host (see Figure 2-5). Refer to your OEM board's documentation for information on USB functionality available for your OEM board.

LED Indicators

The UDK carrier board features surface-mounted diagnostic LEDs that indicate OEM board status (see Figure 2-4). You can view the LEDs via the front panel of the UDK enclosure, shown in Figure 2-5.
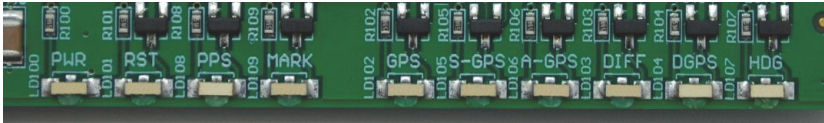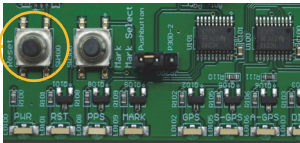

Figure 2-4: LEDs on the carrier board
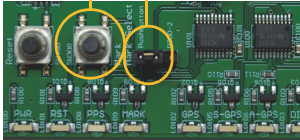
Figure 2-5: LED indicators on UDK front panel

Table 2-2 describes the functionality of each LED.

Table 2-2: LED indicators

LED	Color	Function	Description
POWER	Red	Power indicator	Illuminates when the OEM board is powered on.
RESET	Green	Reset indicator	Illuminates when you press the Reset button and also flashes on powerup. Note: Since the Reset button is inside the UDK enclosure, use ESD protection when opening the enclosure.

Table 2-2: LED indicators (*continued*)

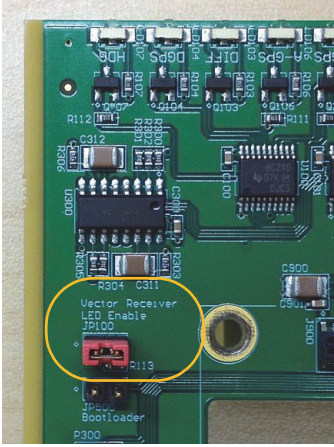| LED	Color	Function	Description
1 PPS	Blue	Timing signal (1 PPS)	Flashes once per second once a GPS signal lock is obtained.
MARK	Red	Mark indicator	Illuminates when you press the Mark button (manual mark). Pins 1 and 2 of JP300 (marked 'Pushbutton') require a jumper to enable the Mark button. *Note: Since the Mark button is inside the UDK enclosure, use ESD protection when opening the enclosure.*
GPS	Yellow	Primary GPS lock indicator	Illuminates when the OEM board achieves a valid position solution. If this LED continues to flash, it could indicate receiver or antenna hardware failure.
S-GPS	Yellow	Not used (always off)	
A-GPS	Yellow	Not used (always off)	
DIFF	Yellow	Differential lock indicator	Illuminates when the OEM board: • Achieves solid SBAS or L-band lock with better than a 150 bit error rate (BER)—if the SBAS BER is higher than 150, but the receiver is still locked, this LED will flash, indicating marginal lock • Receives external DGPS RTCM corrections • Receives L-band DGPS corrections • Receives RTK corrections in any acceptable correction format *Note: Not all differential corrections are available on all Hemisphere GPS OEM boards. See your OEM board documentation for details.*

**Table 2-2: LED indicators (*continued)*

LED	Color	Function	Description
DGPS	Green	DGPS position indicator	Illuminates to indicate high accuracy positioning • For SBAS, DGPS or L-band DGPS positioning solutions, the LED appears as follows: – SOLID if position solution accuracy estimate is below the $JLIMIT command setting • For L-band DGPS, L-band high precision, and L-band high precision with GLONASS positioning solutions, the LED appears as follows: – SOLID if position accuracy estimate is below the $JLIMIT command setting, and current GGA message quality indicator is 4 or 5 – FLASHES if accuracy is above $JLIMIT setting, or GGA quality indicator is 2 • For RTK positioning solutions, the LED appears as follows: – SOLID if current GGA message quality indicator is 4 – FLASHES if current GGA message quality indicator is 2 or 5 *Note: Not all differential corrections are available on all Hemisphere GPS OEM boards. Some differential corrections require a paid subscription. An OEM board, such as the LX-2, is required for L-band positioning solutions. A UHF radio is necessary to receive some differential corrections. See your OEM board documentation for details.*

**Table 2-2: LED indicators (*continued)*

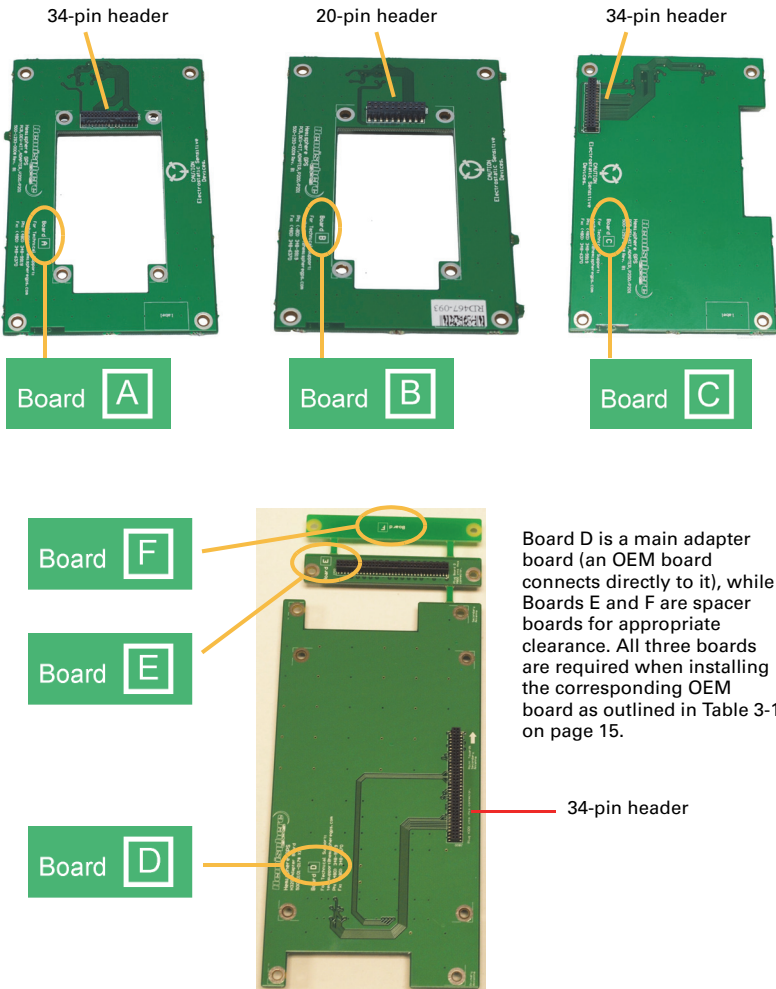| LED	Color	Function	Description
HDG	Blue	Heading lock indicator	Only in use for Crescent Vector II and Eclipse Vector OEM boards
			Illuminates continuously when the Crescent Vector II OEM board or Eclipse Vector OEM board has achieved a solid heading lock. Blinking on and off repeatedly may indicate receiver hardware failure.
			Note: You must install a jumper (included in your kit) on JP100 (Vector Receiver LED Enable) to enable heading LED functionality.

Chapter 3: Installing an OEM Board

Using an Adapter Board

The UDK includes four adapter boards: Boards A, B, C, and D. The UDK also includes two spacer boards (Boards E and F) that are used in conjunction (and only) with Board D.

You can identify the type of adapter board in either of two ways (see Figure 3-1):

- Designation on the board itself ('Board A' or 'Board B' or 'Board C' or 'Board D' is imprinted on the board)
- Number of pins in, and location of, the header connector:
  - Board A has a 34-pin header along the short edge of the board
  - Board B has a 20-pin header along the short edge of the board
  - Boards C and D have a 34-pin header along the long edge of the board

34-pin header   20-pin header   34-pin header

Board [A]   Board [B]   Board [C]

Board [F]

Board [E]

Board [D]

Board D is a main adapter board (an OEM board connects directly to it), while Boards E and F are spacer boards for appropriate clearance. All three boards are required when installing the corresponding OEM board as outlined in Table 3-1 on page 15.

34-pin header

Figure 3-1: Board A, B, C, and D indicators

If you are integrating with a large form factor board, such as the Eclipse II, you do not need an adapter board. However, if you are integrating with a small form factor board, such as the Crescent or miniEclipse, use Table 3-1 to determine which adapter board you will need for your OEM board.

Table 3-1: OEM boards and associated adapter boards

| OEM Board Family	OEM Board Model	Board A	Board B	Board C	Board D
Crescent	P100, P102, P104	X			
Crescent	P101, P103		X		
Crescent Vector II	H101			X	
Eclipse Vector	H200			X	
Eclipse Vector	H320				X
miniEclipse	P200, P202, P300, P302	X			
miniEclipse	P201, P203, P301, P303		X		
LX-2 (requires Crescent or miniEclipse board that uses Board A)	N/A	X			

# Installing Your OEM Board - No Adapter Board Required

> **Caution:** Use electrostatic discharge (ESD) protection, such as by wearing an ESD strap that is attached to an earth ground, before handling the UDK or any OEM boards. If an ESD strap is not available touch a metal object prior to handling the UDK or any OEM boards.

Complete the following steps to install your OEM board where no adapter board is required (such as with the Eclipse II board).

1. Unpack your UDK. Refer to "UDK Components" on page 3 for the parts included in your UDK.

2. Remove the four screws from the corners of the rear panel of the enclosure.
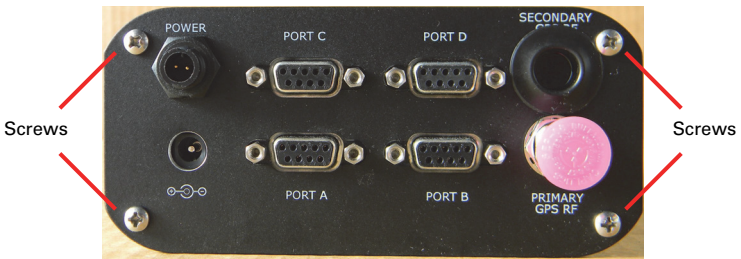
3. Slowly remove the rear panel and attached main carrier board from the enclosure.
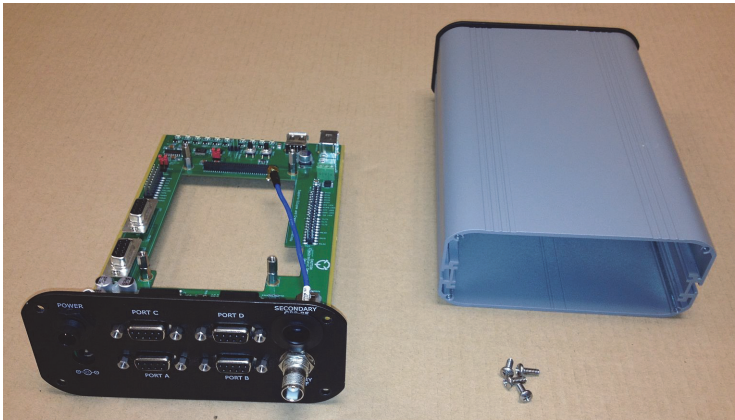
4. There are two stacked sets of four standoffs on the main carrier board. Remove the top set of four standoffs and set them aside. You will use them later to secure the OEM board to the carrier board.
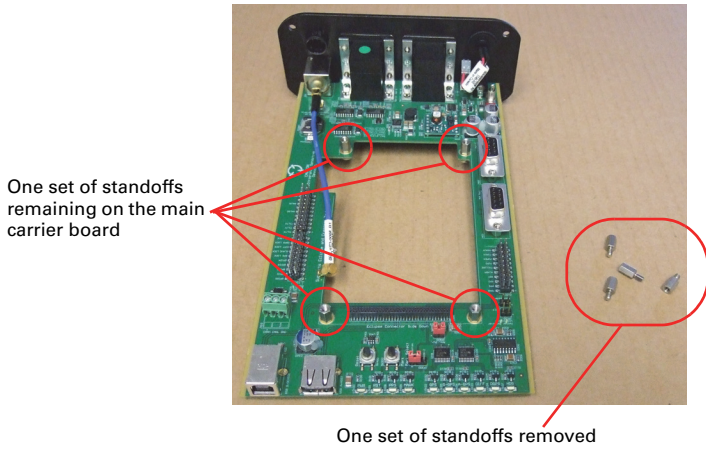
One set of standoffs remaining on the main carrier board

One set of standoffs removed

5. Connect the free end of the TNC cable to your OEM board (make sure one end is already connected to the main carrier board).
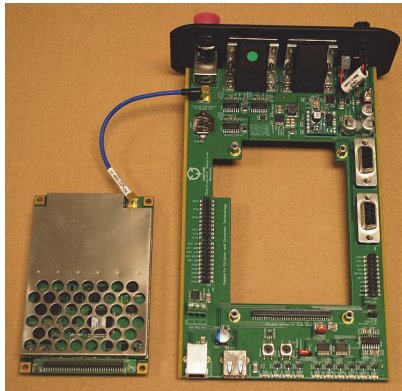
6. Place the OEM board on the standoffs so the pin header on the OEM board faces downward and fits into the mating pin header on the main carrier

board, and then attach the standoffs you removed in step 4 to secure the OEM board to the main carrier board (hand-tighten only).
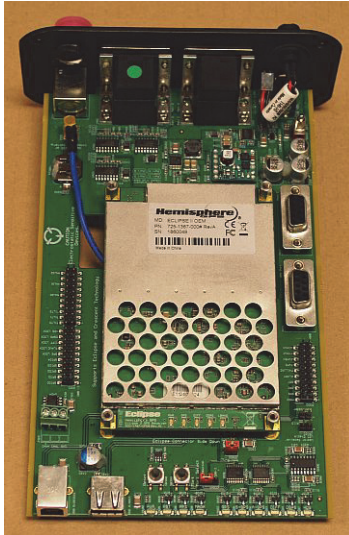
7. Slide the rear panel / main carrier board assembly into the enclosure and use the four screws you removed in step 2 on page 16 to secure the rear panel to the enclosure.

8. Connect an external GPS antenna to the Primary GPS RF port on the rear panel.

9. Connect the serial cable to Port A on the rear panel and to a serial port on your PC.

10. Connect the power cable to a power port on the rear panel and to an external power source. See "Powering the UDK" on page 7 for information on using AC or DC power for the UDK.

11. Power on the UDK.

12. Run PocketMax or SLXMon™ for development and diagnostic testing. PocketMax and SLXMon are Hemisphere GPS products and both are available for download from the Hemisphere GPS website at www.hemispheregps.com.

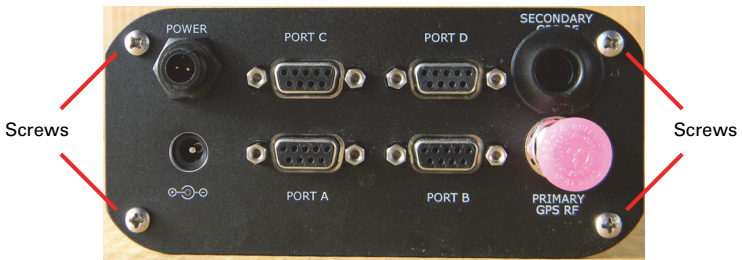# Installing Your OEM Board Using Adapter Board A or B

Caution: Use electrostatic discharge (ESD) protection, such as by wearing an ESD strap that is attached to an earth ground, before handling the UDK or any OEM boards. If an ESD strap is not available touch a metal object prior to handling the UDK or any OEM boards.
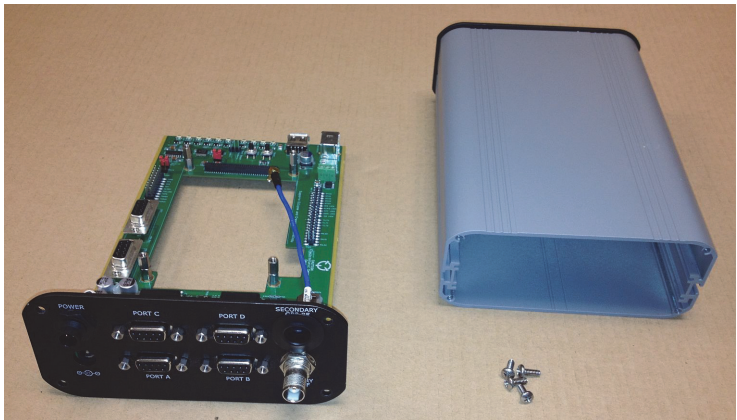
Note: This procedure applies to installing one OEM board or two OEM boards. A two OEM board configuration refers to installing an OEM board with the LX-2 board. Refer to Table 3-1 on page 15 for which OEM boards are compatible with the LX-2 board.

Complete the following steps to install your OEM board where an adapter board (Board A or B) is required. Refer to Table 3-1 on page 15 to determine the adapter board required for your OEM board.

1. Unpack your UDK. Refer to "UDK Components" on page 3 for the parts included in your UDK.

2. Remove the four screws from the corners of the rear panel of the enclosure.

3. Slowly remove the rear panel and attached main carrier board from the enclosure.

4. There are two stacked sets of four standoffs on the main carrier board. Remove the top set of four standoffs and set them aside. You will use them later to secure the adapter board to the carrier board.

One set of standoffs remaining on the main carrier board

One set of standoffs removed
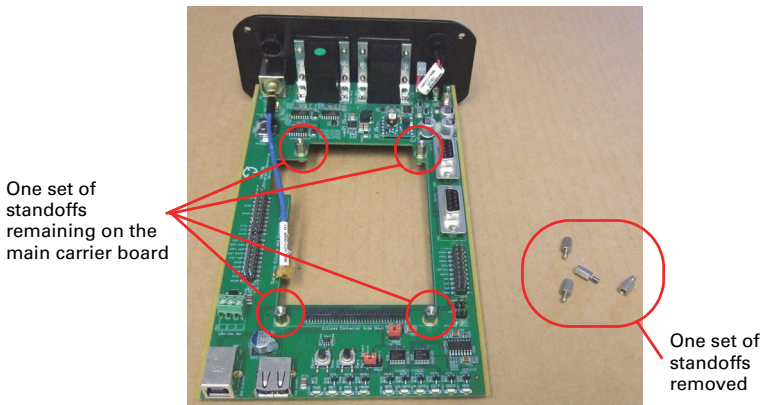
Note: If you will be installing an LX-2 board, you must install the LX-2 board first and then install the required OEM board on top of it. Proceed to step 5.

If you are not installing an LX-2 board, you will only install your OEM board. Proceed to step 6.

5. Using the nuts, washers, and standoffs from part G (see Table 1-1 on page 3):

a. Attach four standoffs to the adapter board, securing them from the underside of the board with the nuts and washers (Figure A below).

b. Attach the LX-2 board to the adapter board so the LX-2 board's pin header faces downward and fits into the adapter board's mating pin header and secure the LX-2 board with four standoffs (Figure B below).

c. Attach the OEM board to the LX-2 board so the OEM board's pin header faces downward and fits into the LX-2 board's mating pin header and secure the OEM board with four standoffs (Figure C below).
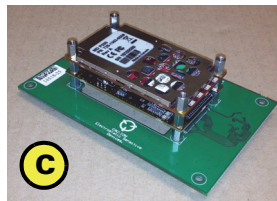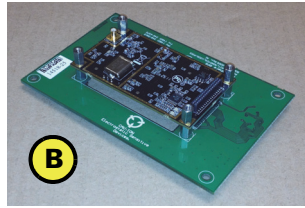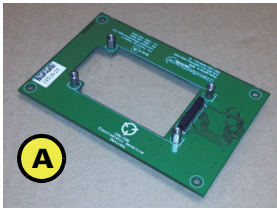
6. Using the nuts, washers, and standoffs from part G (see Table 1-1 on page 3):

    a. Attach four standoffs to the adapter board, securing them from the underside of the board with the nuts and washers (Figure A below).

    b. Attach the OEM board to the adapter board so the OEM board's pin header faces downward and fits into the adapter board's mating pin header and secure the OEM board with four standoffs (Figure B below).
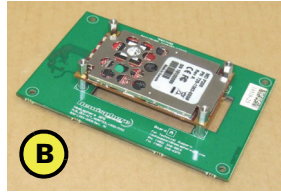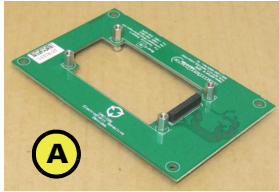
7. Connect the free end of the TNC cable to your OEM board (make sure one end is already connected to the main carrier board).

    Note: If you installed the LX-2 board in step 5, you will connect the free end of the TNC cable to the LX-2 board.
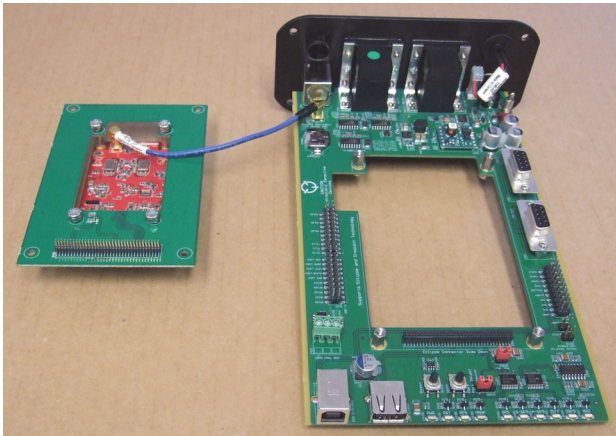
8. Place the adapter board on the standoffs so the adapter board's pin header faces downward and fits into the main carrier board's mating pin header, and

then attach the standoffs you removed in step 4 to secure the adapter board to the main carrier board (hand-tighten only).
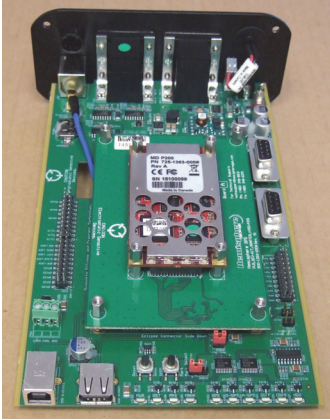
One OEM board attached
to adapter board
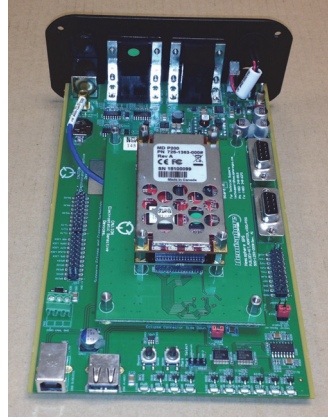
Two OEM boards attached
to adapter board

9. Slide the rear panel / main carrier board assembly into the enclosure and use the four screws you removed in step 2 on page 20 to secure the rear panel to the enclosure.

10. Connect an external GPS antenna to the Primary GPS RF port on the rear panel.

11. Connect the serial cable to Port A on the rear panel and to a serial port on your PC.

12. Connect the power cable to a power port on the rear panel and to an external power source. See "Powering the UDK" on page 7 for information on using AC or DC power for the UDK.

13. Power on the UDK.

14. Run PocketMax or SLXMon for development and diagnostic testing. PocketMax and SLXMon are Hemisphere GPS products and both are available for download from the Hemisphere GPS website at www.hemispheregps.com.

Installing Your OEM Board Using Adapter Board C

	Caution: Use electrostatic discharge (ESD) protection, such as by wearing an ESD strap that is attached to an earth ground, before handling the UDK or any OEM boards. If an ESD strap is not available touch a metal object prior to handling the UDK or any OEM boards.

Complete the following steps to install your OEM board where adapter board C is required.

1. Unpack your UDK. Refer to "UDK Components" on page 3 for the parts included in your UDK.

2. Remove the four screws from the corners of the rear panel of the enclosure.

3. Slowly remove the rear panel and attached main carrier board from the enclosure.

4.   There are two stacked sets of four standoffs on the main carrier board. Remove the top set of four standoffs and set them aside. You will use them later to secure the adapter board to the carrier board.

One set of standoffs remaining on the main carrier board

One set of standoffs removed

5.   Remove the rubber grommet from the Secondary GPS RF port on the rear panel of the enclosure and then attach the standalone RF connector (Part F in Table 1-1 on page 3) to the Secondary port opening.

6.   Place the adapter board on the standoffs so the adapter board's pin header faces downward and fits into the main carrier board's mating pin header, and then attach the standoffs you removed in step 4 to secure the adapter board to the main carrier board (hand-tighten only).

7.   Connect the free end of each TNC cable to your OEM board as shown below.

8.   Attach the OEM board to the adapter board so the OEM board's pin header faces downward and fits into the adapter board's mating pin header, and then using standoffs from part G (see Table 1-1 on page 3) secure the OEM board to the standoffs (hand-tighten only).
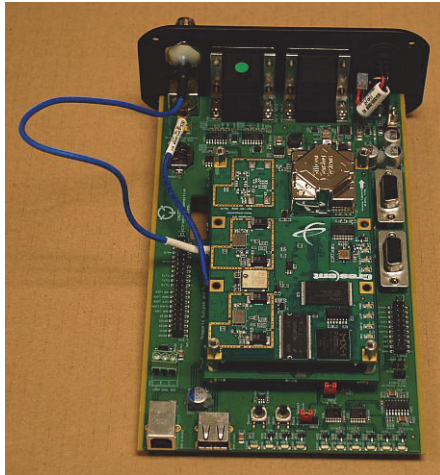
9. Slide the rear panel / main carrier board assembly into the enclosure and use the four screws you removed in step 2 on page 25 to secure the rear panel to the enclosure.

10. Connect two external GPS antennas to the rear panel of the UDK: one to the Primary GPS RF port and the other to the Secondary GPS RF port.

11. Connect the serial cable to Port A on the rear panel and to a serial port on your PC.

12. Connect the power cable to a power port on the rear panel and to an external power source. See "Powering the UDK" on page 7 for information on using AC or DC power for the UDK.

13. Power on the UDK.

14. Run PocketMax or SLXMon for development and diagnostic testing. PocketMax and SLXMon are Hemisphere GPS products and both are available for download from the Hemisphere GPS website at www.hemispheregps.com.

Installing Your OEM Board Using Adapter Board D

Caution: Use electrostatic discharge (ESD) protection, such as by wearing an ESD strap that is attached to an earth ground, before handling the UDK or any OEM boards. If an ESD strap is not available touch a metal object prior to handling the UDK or any OEM boards.

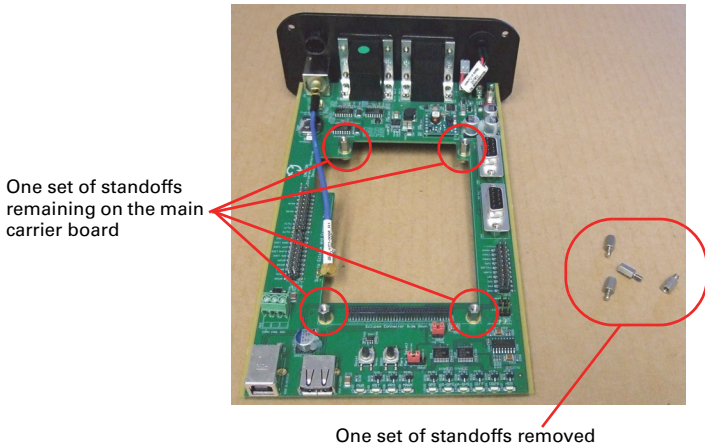Complete the following steps to install your OEM board where adapter board D is required.

1. Unpack your UDK. Refer to "UDK Components" on page 3 for the parts included in your UDK.

2. Remove the four screws from the corners of the rear panel of the enclosure.

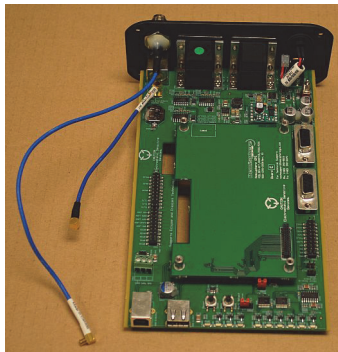3. Slowly remove the rear panel and attached main carrier board from the enclosure.

4.   There are two stacked sets of four standoffs on the main carrier board.
     Remove the top set of four standoffs and set them aside. You will use them
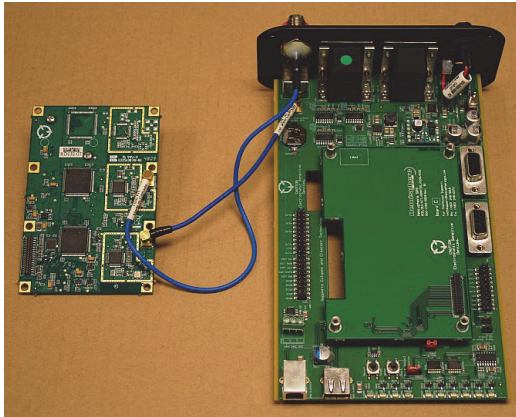   later to secure the adapter board to the carrier board.

One set of standoffs
remaining on the main
carrier board

One set of standoffs removed

5.   Remove the rubber grommet from the Secondary GPS RF port on the rear
     panel of the enclosure and then attach the standalone RF connector (Part F in
   Table 1-1 on page 3) to the Secondary port opening.
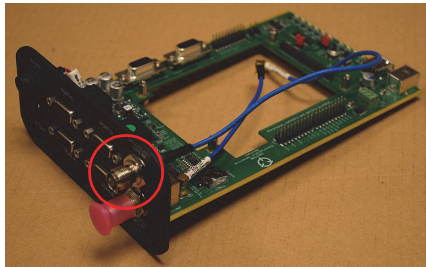
6.   Attach adapter boards D, E, and F:

     a.   Place adapter board E on the
          standoffs near the carrier
          board's header so the
          adapter board's pin header
          faces downward and fits into
          the main carrier board's
          mating pin header.

     b.   Place adapter board F on the
          other two standoffs.

     c.   Attach the standoffs you
          removed in step 4 to secure
          adapter boards E and F to the
          main carrier board
          (hand-tighten only).
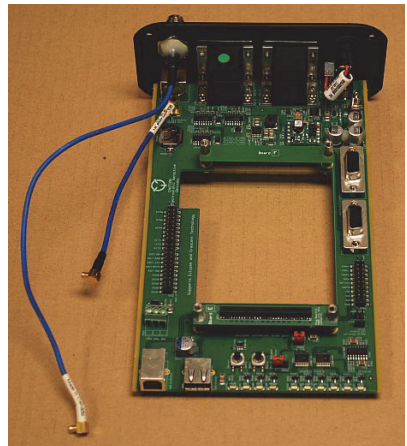
d.   Attach four standoffs and screws from part G (see Table 1-1 on page 3) to the four outer holes of adapter board D. Make sure the standoffs are on the side of the board with the connector (J800) on the long side of the board.
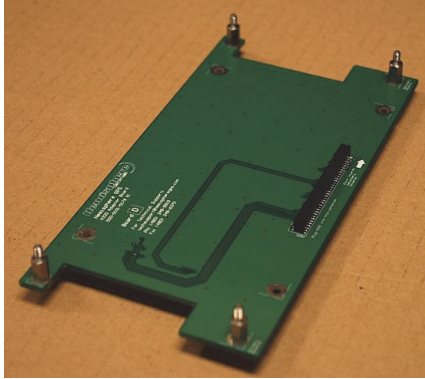
e.   Place adapter board D on the standoffs above adapter boards E and F so adapter board D's pin header faces downward and fits into adapter board E's mating pin header, and then secure adapter board D with four nuts and four washers from part G (see Table 1-1 on page 3).
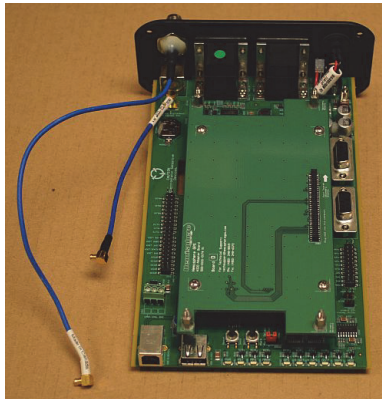
7.   Connect the free end of each TNC cable to your OEM board as shown below.
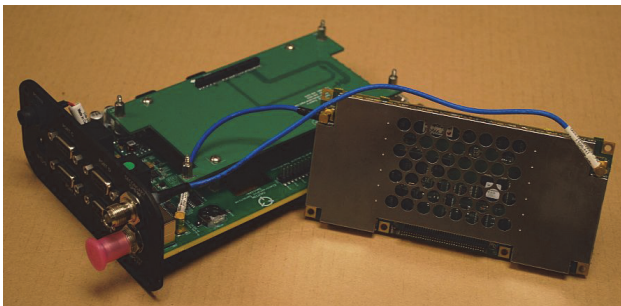
8. Attach the OEM board to the adapter board so the OEM board's pin header faces downward and fits into the adapter board's mating pin header, and then using the nuts from part G (see Table 1-1 on page 3) secure the OEM board to the standoffs.
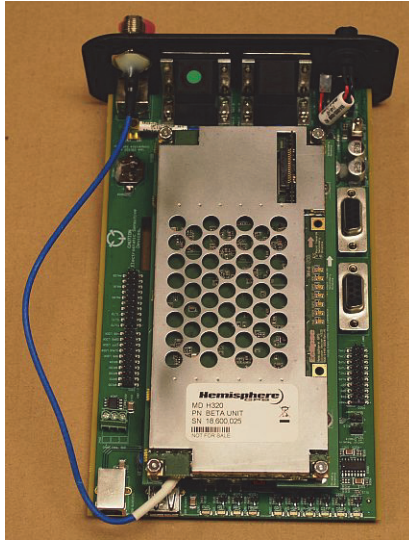
9. Slide the rear panel / main carrier board assembly into the enclosure and use the four screws you removed in step 2 on page 29 to secure the rear panel to the enclosure.

10. Connect two external GPS antennas to the rear panel of the UDK: one to the Primary GPS RF port and the other to the Secondary GPS RF port.

11. Connect the serial cable to Port A on the rear panel and to a serial port on your PC.

12. Connect the power cable to a power port on the rear panel and to an external power source. See "Powering the UDK" on page 7 for information on using AC or DC power for the UDK.

13. Power on the UDK.

14. Run PocketMax or SLXMon for development and diagnostic testing. PocketMax and SLXMon are Hemisphere GPS products and both are available for download from the Hemisphere GPS website at www.hemispheregps.com.

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OBTAINING WARRANTY SERVICE. In order to obtain warranty service, the end purchaser must bring the Product to a Hemisphere GNSS approved service center along with the end purchaser's proof of purchase. Hemisphere GNSS does not warrant claims asserted after the end of the warranty period. For any questions regarding warranty service or to obtain information regarding the location of any of Hemisphere GNSS approved service center, contact Hemisphere GNSS at the following address:

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