Universal Development Kit ST User Guide

The Hemisphere GNSS Universal Development Kit ST (UDK ST) is a convenient platform for developing hardware and software solutions to meet your GNSS needs. The UDK ST provides easy access to USB, CAN, Serial, and Ethernet capabilities of the GNSS boards to make a complete GNSS solution. **For more information, or for GNSS board technical specifications, go to the Hemisphere GNSS website to access the Integrator Guide for each board.**

Figure 1: HGNSS UDK ST (see Figure 5 for details)

Supported GNSS Boards

OEM Board Family	GNSS Board Model	HGNSS Part Number	Connect board to…
Phantom™	Phantom 20 Phantom 34 Phantom 40	725-1585-11 725-1584-11 725-1592-11	Adapter board
Vega™	Vega 28 Vega 40	725-1582-11 725-1593-11	Adapter board
	Vega 60	725-1583-11	Main carrier board
Crescent®	Crescent P206 Crescent P207	725-1510-0 725-1511-0	Adapter board

Not supported: Crescent/Vector H200 GNSS boards. For information on how to connect Cresecent or Eclipse boards not listed here, contact HGNSS Technical Support.

Supporting Documentation. You can download the Integrator Guide for your GNSS board from the Hemisphere GNSS website.

Questions or Comments. This user guide does not cover receiver operation, the PocketMax™ utility, or commands and messages (NMEA 0183, NMEA 2000® or HGNSS proprietary messages). For information on these subjects refer to the Hemisphere GNSS Technical Reference Manual.

Kit Contents

Part Number	Description	Quantity
802-1099-10	Enclosure (includes outer enclosure, front and rear panels, main carrier board, RF cable). Included boards: 725-1586-10 and 725-1590-10	1
050-0011-022#	Serial data cable	1
710-0208-10	Kit, RF Cables, SX6 Dev Kit	1
054-0084-000# and 427-0082-10	2M cable, North America 3-prong power to universal IEC 60320 C13 AC-DC converter, 100-240 VAC in, 12V,19W out, IDC 2.1 x 5.5mm	1 each
051-0447-10	Ethernet cable	1
051-0172-000#	Serial cable null modem	1
051-0448-10	USB-C to USB-A cable	1
710-0178-10	Phantom 34/40 Vega 40/60 Mounting Kit	1
710-0179-10	Phantom 20 Mounting Kit	1
710-0180-10	Vega 28 Mounting Kit	1

WARNING:

If you open and operate the UDK ST without the enclosure-you must use ESD protection.

Cable Assembly

Note: The secondary GPS RF connection is for heading and positioning products, for GNSS or external clock input.

Required Connector Cables

Connector Cables are used to connect to the TNC input to the GNSS board. All RF cables will have an MCX straight connector to connect to the required GNSS RF connector. Required RF connectors for your board include:

Connector Cable	Part Number	Use with
MCX (M). 6 in	053-0122-10	P20, P34
MMCX (M), 6 in	053-0123-10	V40, P40, V28
MMBX (M), 7 in	053-0124-10	V60

LED Indicators

The UDK ST main board features surface-mounted diagnostic LEDs to indicate GNSS board status. Refer to the table below for a list of the LED indicators and descriptions. **Note:** Individual GNSS boards may not support all the listed indicators. Refer to the Integrator Guide for your specific board.

Figure 2: LED Indicators

LED	Color	Function	Description
Power	Red	Power indicator	Illuminates when the UDK ST is powered on.
GNSS	Amber	GNSS Lock Indicator	Illuminates once a 2D GNSS position is acquired.
Diff	Amber	Differential lock indicator	Illuminates when GNSS board: • Achieves a 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 correction in any acceptable correction format. **Note:** Not all differential corrections are available on all HGNSS GNSS boards. See your GNSS board documentation for details.
DGNSS	Green	DGNSS lock indicator	Illuminates when the GNSS board achieves a corrected position solution (on antenna one for multi-antenna boards).
PPS	Blue	Timing signal (PPS)	Flashes once per second, triggered by PPS, once a GPS signal lock is obtained.
Manual Mark	Amber	Mark indicator	Illuminates when you press the Mark button (manual mark).
Reset	Amber	Reset indicator	Illuminates when you press the Reset button or when a Reset is asserted by other means.
Red Stat	Red	Future	Reserved
Green Stat	Green	Future	Reserved
PVALID	Green	Position Valid Indicator	Illuminates once the receiver has computed a valid position.

Board Installation Quick Check

GNSS Board	Mounting	Internal RF Cables	Main Board Settings (Page 2)			Adapter Board Settings (Page 3)		
			SW900	SW400/410	SW300/301	SW400	SW280	SW500
Phantom 20	J200, Mech7, 11, Mech15, 19	RF to Primary Ant 053-0122-10	N/A	Select CAN Termination*	Off / Off	See Table: Adapter Board Settings (Pg. 3)	N/A	See Table: Adapter Board Settings (Pg. 3)
Phantom 34	J340, Mech9, 13, Mech17, 21	RF to Primary Ant 053-0122-10	See Table: Receiver Specific Carrier Board Switch Settings (Pg. 2)	Select CAN Termination*	Off / Off	Off	N/A	Off
Phantom 40	J400, J401, Mech3, 4, 5, Mech22, 23, 24	RF to Primary Ant 053-0123-10	N/A	Select CAN Termination*	On / On	See Table: Adapter Board Settings (Pg. 3)	N/A	See Table: Adapter Board Settings (Pg. 3)
Vega 28	J280, Mech8, 12, Mech16, 20	RF to Primary Ant and Secondary Ant 053-0123-10 (2x)	N/A	Select CAN Termination*	Off / Off	See Table: Adapter Board Settings (Pg. 3)	See Table: Adapter Board Settings (Pg. 3)	See Table: Adapter Board Settings (Pg. 3)
Vega 40	J400, J401, Mech3, 4, 5, Mech22, 23, 24	RF to Primary Ant and Secondary Ant 053-0123-10 (2x)	N/A	Select CAN Termination*	On / On	See Table: Adapter Board Settings (Pg. 3)	N/A	See Table: Adapter Board Settings (Pg. 3)
Vega 60	Main board P900, Mech6, 10, Mech14, 18	RF to Primary Ant and Secondary Ant 053-0124-10 (2x)	PortE or Flow Ctrl	Select CAN Termination*	Off / Off	N/A	N/A	N/A

*Note: To use the receiver's on-board 120 ohm CAN termination, set the switch to the "TRMTD" positon.

Receiver Specific Carrier Board Switch Settings

GNSS Board	SW300	SW301	SW900
			4
Phantom 20	Off	Off	Off
Phantom 34	Off	Off	On
Phantom 40	On	On	Off
Vega 28	Off	Off	Off
Vega 40	On	On	Off
Vega 60	Off	Off	Off
Crescent P206	Off	Off	Off
Crescent P207	Off	Off	Off

For termination of CAN BUS-use switches SW400 and SW410.

Refer to the Hemisphere GNSS Technical Reference Manual for more configuration options.

Installation & Powering Steps

The UDK ST accepts from 8 to 32 VDC. The supplied power should be continuous and clean for the best performance. The UDK ST will start when an acceptable voltage is applied and power switch SW100 is in the ON position.

⚠WARNING: Do not apply a voltage higher than 32 VDC. This will damage the receiver and void the warranty. USB power should be 5V. Power the UDK ST in any of the following ways:

1. Connect the AC power adapter to the UDK ST, center pin is positive (+).
   a. Set SW105 to DIS to disengage the USB power.
2. Connect USB power adapter to the UDK ST (if not using external DC power).
   a. Set SW105 to EN to engage USB power.
3. Connect an 18-pin Data I/O cable to a suitable power source:
   a. Set SW105 to "DIS" to disengage the USB power.
   b. Connect Pin 8 to DC positive (+).
   c. Connect Pin 9 to DC negative (-).

⚠WARNING: Connecting more than one source of power at a time can seriously damage the unit and will void the warranty. If you plan to use USB but provide power externally, set SW105 External USB Power switch to DIS to prevent supplying USB power to the receiver.

The power supply in the UDT ST kit accepts standard IEC 60320 C13 power connectors. To source a cable locally, search for IEC 60320 C13 POWER CABLE in an internet browser.

Figure 3: UDK ST Main Carrier Board

Adapter Board Switch Settings

GNSS Board	SW500			SW280				SW400	
	1	2	3	1	2	3	4	1	2
Phantom 20	On	On	N/A	N/A	N/A	N/A	N/A		
Phantom 34	Off	Off	N/A	N/A	N/A	N/A	N/A		
Phantom 40	Off	On	Off	N/A	N/A	N/A	N/A	On On = PortC Rx/Tx, Off Off = Event2/User0	
Vega 40	Off	On	Off	N/A	N/A	N/A	N/A	On On = PortC Rx/Tx, Off Off = Event2/User0	
Vega 28	On	Off	On	Off	Off				
Port C Rx/Tx				N/A	N/A	Off	Off		
CAN A				Off	Off	N/A	N/A		
USB	On	Off		N/A	N/A	On	Off		
Crescent P206/306/326	Off	Off	N/A	N/A	N/A	N/A	N/A		
Crescent P207/307/327	On	On	N/A	N/A	N/A	N/A	N/A		

Using the Adapter Board with the Main Carrier Board

To install 20-pin, 28-pin, 34-pin, and 40-pin boards you will need to remove the adapter board and install appropriate mounting hardware before re-installing the adpater board on the main board. To install the Vega 60 board, you will need to remove the installed adapter board.

Step	Action
1	Unpack your UDK ST. Refer to Kit Contents for the parts included in your UDK ST.
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	When installing the Vega 60 board you must remove the screws to the adapter board from the main carrier board standoffs before removing the adapter board.

For more detailed instructions, refer to the Hemisphere GNSS YouTube channel.

To re-install the adapter board to the main board, install the necessary hardware for the GNSS board to be mounted to the adapter board. Once the GNSS hardware has been secured, re-install the adapter board to the main carrier board following the steps above.

USB Ports. The front panel of the UDK ST has ports for a USB client (device) and a USB host. Refer to the Integrator Guide for your GNSS board for information on USB functionality available on your GNSS board. For dual role support, the USB UID pin must be read at the time of powering the unit. Switching from the USB Device to the USB Host on the Dual Role port will require a power cycle.

Environmental Requirements. The UDK ST is designed to be stored and operated between -40°C and +85°C (-40°F and +185°F). The UDK ST is not designed for a harsh environment and is not waterproof. The optional Hemisphere GNSS antennas available for the UDK ST are designed to operate in an outdoor environment and are waterproof.

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

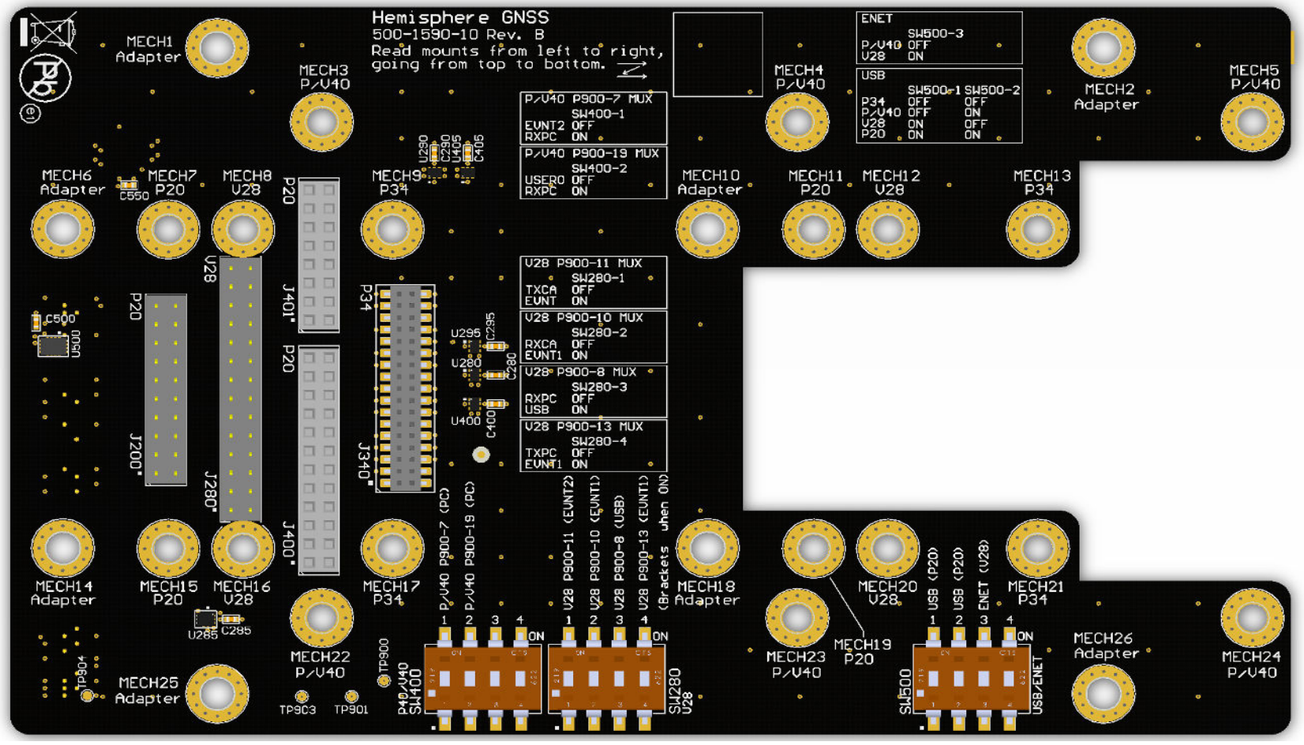

Figure 4: UDK ST Adapter Board

Serial Ports

Hemisphere GNSS boards use a CMOS level interface. The UDK ST main board converts from CMOS to RS-232.

Figure 5: Serial Ports

The UDK ST has up to five serial ports 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 GNSS' 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) (Refer to the Integrator Guide for your specific OEM board). Ports A, B or C may also receive external DGPS or RTK corrections. Port E (18-pin) is used as an additional communication port (only available on the Vega 60). **Note:** The baud rate of the UDK ST's serial ports must match to the communication device. Refer to your GNSS board's documentation to determine the default baud rate of your GNSS board. Refer to the Hemisphere GNSS Technical Reference Manual (TRM) for information on changing baud rates.

Port	Pin	Signal	Description
A, B	2	TXD	NMEA 0183, Hemisphere GNSS proprietary binary, RTCM v2.3 (DGPS), RTK v3, and CMR output
	3	RXD	NMEA 0183, Hemisphere GNSS proprietary binary, RTCM v2.3 (DGPS), RTK v3, CMR, and CMR+ input
	5	Signal ground	Signal Return
	7	CTS-422*	Port B (UART) Clear to Send, input
	8	RTS-422*	Ready to Send, output
C, D	2	TXD	NMEA 0183, Hemisphere GNSS proprietary binary, RTCM v2.3 (DGPS), RTK v3, and CMR output
	3	RXD	NMEA 0183, Hemisphere GNSS proprietary binary, RTCM v2.3 (DGPS), RTK v3, CMR, and CMR+ input
	5	Signal Ground	Signal return

***Flow Control and RS-422 selection requires a future firmware update.**

Device Compliance. This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: 1. This device may not cause harmful interference, and 2.this device must accept any interference received, including interference that may cause undesired operation.

Pinouts

The UDK ST 18-pin connector allows for powering the unit with a single power/data cable. It provides the fifth serial port (Port E) to be used. The 18-pin connector also provides support of various LEDs and Manual Mark options.

Pin	Description
1	User 0
2	PPS
3	User 1
4	Position Valid
5	Error
6	Ground
7	User 2
8	Power Input +
9	Power Input -
10	Manual Mark**
11	VARF
12	ME Ready
13	Port E Tx (Vega 60 only)
14	Port E Rx (Vega 60 only)
15	Port A RTS (RS-422*)
16	Port A Rx (RS-232/RS-422*)
17	Port A CTS (RS-422*)
18	Port A Tx (RS-232/RS-422*)

*** Flow Control and RS-422 selection requires a future firmware update.**

****Must select external Manual Mark on Main board SW900-3, set to off.**

SMA-PPS Out

The UDK ST includes 1 SMA-PPS out. The Pulse-per-second (PPS) timing signal is used in applications where devices require time synchronization. **Note:** PPS is typical of most GNSS boards but not essential to normal receiver operation. Do not connect this pin if you do not need this function. The PPS is a 3.3v CMOS signal. By default, the PPS is a rising edge synchronized pulse occurring once per second with a width approximately 1ms. The UDK ST supports a programmable PPS. Users can select the frequency to 1, 2, 5, or 10Hz. The pulse can be programmed as either active high (rising edge synchronized) or active low (falling edge synchronized). The UDK ST can support pulse widths as wide as 900 ms.

$JPPS,RATE,<Rate_In_Hz (limited to 1.0 ,2.0 ,5.0 ,10.0 >,[SAVE]

or if you prefer to work with the period (inverse of RATE)

$JPPS,PERIOD,<Period in seconds (limited to 1.0, 0.5, 0.2, 0.1) >,[SAVE]

PPS Width can be controlled using

$JPPS,WIDTH,<width in µs (microseconds)>,[SAVE]

The width command parameter is in µs (microseconds).

$JPPS,ACTIVE_EDGE,<RISE | FALL>,[SAVE]

Controls which edge of the PPS signal is synchronized to the GNSS second.

Note: $JSAVE does NOT save the JPPS configuration. The optional SAVE argument in the commands above may be included to save the settings to non-volatile memory, or the desired PPS configuration settings must be applied every time the receiver is powered on. Each parameter must be individually saved as it is entered (by adding the optional SAVE at the end of the command). **Note**: LED on/off duration is not affected by pulse width.

Connectors

USB. The UDK ST uses two standard USB-C cables to USB-C device, and USB-dual role (host/device). The USB device supports USB 1.0/2.0 (black/white) and USB 3.0 (blue). In order to power the UDK ST via USB, you must use USB 3.0 (blue).
TNC. The UDK ST includes two TNC female connectors: Primary antenna and Secondary antenna/clock.
CAN. The CAN connectors allow for the input and output of NMEA 2000 commands and messages. The UDK ST includes two M12 5-pin male connectors.

Ethernet Capabilities

The GNSS boards that can use an Ethernet connection are listed below:

- Vega 40
- Phantom 40
- Vega 28
- Vega 60