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Crane System Part 2- Installation and Setup

By Cristhian Bermudez

This article, I am going to explain the configuration of the sensors and DREDGEPACK® for the crane system. If you want to know more about the recommended installation for each sensor, please read my previous article [the Crane System – Installation and Setup Part 1](#).

The configuration for every crane is different. If you have questions about how to configure your system, please contact sales@hypack.com or help@hypack.com.

This system has a list of network devices, such as the dual antenna GPS, the radio links, the main interface box, the remote PC, remote display, etc. In this example, I am going to describe a possible configuration of the system. It does not mean your system must be like this, because some components may be optional.

NETWORK CONFIGURATION

There are several ways to configure the network interfaces; however, to make the system more stable, I suggest configuring static IP addresses for every sensor.

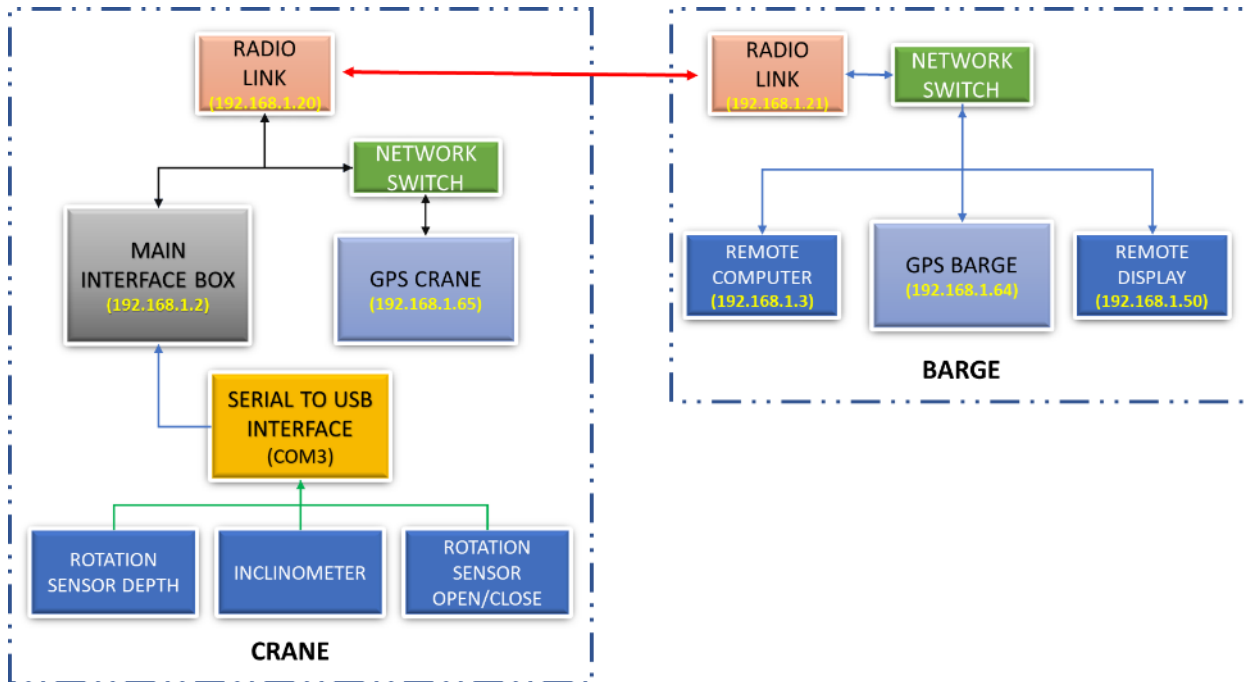
I usually configure the network in the type C IP range (192.0.0.0 to 223.255.255.255). For instance, the network I normally use is 192.168.1.0. Using this network, I can configure addresses for each sensor in the range from 192.168.1.1 to 192.168.1.254.

In configuring the sensor addresses, there are a few rules to follow in order to avoid problems:

- You cannot use the 192.168.1.0 address, because this is the network address.
- You cannot use the address 192.168.1.255, because this is the broadcast address.
- You cannot use the same IP address for two devices.
- Use the same subnet mask in all of the devices. In this example, I used 255.255.255.0

Figure 1 shows an example for the IP address configuration. As you can see, I can use an IP address anywhere in the range. When the configuration is complete, I can check the connectivity of each sensor using a ping packet or other software.

FIGURE 1. Sample DREDGEPACK® Crane System and IP Address Configuration



SENSOR CONFIGURATION

GPS FOR THE CRANE CABIN AND THE BARGE

The configuration of the GPS devices on the cabin and on the barge is very similar.:

- **Check the installation of the antennas to determine the true heading the GPS needs to output.** For example, if your GPS main antenna is installed on the port side, and the auxiliary antenna is on the starboard side, you must add a 90-degree offset (in the Receiver Configuration tab using the Vector link).
- **Configure the Output Messages:** DREDGEPACK® needs the following two NMEA messages.
 - **GGA:** Because the crane does not move much, you can output the GGA at 5Hz.
 - **HDT:** To have a smoother presentation when the crane turns, I suggest an output rate of 10 Hz.

Figure 2 shows a sample configuration.

FIGURE 2. GPS Messages for DREDGEPACK®

I/O Configuration

TCP/IP 5017 NMEA

Server: TCP 192.168.3.101: 5017

Client
 Output only/Allow multiple connections
 UDP Mode
 Authenticate, set password:

Input/Output

Output:NMEA-GGA (5 Hz), Output:NMEA-HDT (10 Hz)

NMEA

AVR: Off	BPQ: Off	DG: Off	DP: Off
GBS: Off	GGA: 5 Hz	GGK: Off	GLL: Off
GNS: Off	GRS: Off	GSA: Off	GST: Off
GSV: Off	HDT: 10 Hz	LLQ: Off	PJK: Off
PJT: Off	RMC: Off	ROT: Off	VGK: Off
VHD: Off	VTG: Off	ZDA: Off	

Report max DQI=2 in NMEA GGA string
 Report max correction age 9 sec in NMEA GGA string
 Report GST message always as GPGST
 Conform to IEC61162-1:2010

OK Delete

- **Connection Settings:**
 - **Network Connections using UDP or TCP protocol.** For the GPS on the crane that is connected to the switch in the cabin, I suggest using TCP to reduce the traffic that crosses the radio link, so you are not broadcasting messages to the barge.
 - **Port Settings:** In my configuration, I used a different network port for each GPS—5017 for the barge, and 5018 for the crane. If you have to troubleshoot communication problems, it can be helpful to have separate data streams. You can use separate ports whether you use UDP or TCP protocol.

CRANE RADIO LINK

In order for the two devices to communicate, one must be the master and the other one the slave. In this case, the master should be in Wireless mode “Access Point”. I also recommend using a static IP address for the bullets, because you can check the connectivity any time. Remember that, with this configuration, any computer in the network can access any of the devices.

I also suggest changing the default Wireless password. If you don’t, someone could have access to your network. The following figures show screen captures of the configuration.

FIGURE 3. Master Radio Link Configuration—Main Tab

BULLET M5 TITANIUM

MAIN
WIRELESS
NETWORK
ADVANCED
SERVICES
SYSTEM

Tools: ▼
Logout

Status

<p>Device Model: Bullet M5 Titanium</p> <p>Device Name: Bullet M5 Titanium</p> <p>Network Mode: Bridge</p> <p>Wireless Mode: Access Point</p> <p> SSID: rio1</p> <p> Security: WPA2-AES</p> <p> Version: v5.6.11 (XM)</p> <p> Uptime: 08:55:53</p> <p> Date: 2016-10-01 00:32:46</p> <p>Channel/Frequency: 168 / 5840 MHz</p> <p>Channel Width: 20 MHz</p> <p>Frequency Band: 5830 - 5850 MHz</p> <p> Distance: 0.1 miles (0.2 km)</p> <p>TX/RX Chains: 1X1</p> <p> TX Power: 25 dBm</p> <p> Antenna: Main</p> <p>WLAN0 MAC: 68:72:51:84:60:4C</p> <p> LAN0 MAC: 68:72:51:85:60:4C</p> <p> LAN0: 100Mbps-Full</p>	<p>AP MAC: 68:72:51:84:60:4C</p> <p>Connections: 1</p> <p>Noise Floor: -92 dBm</p> <p>Transmit CCQ: 99.1 %</p> <p>airMAX: Enabled</p> <p>airMAX Quality: 97 %</p> <p>airMAX Capacity: 47 %</p> <p>airSelect: Disabled</p>
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Monitor

[Throughput](#) | [Stations](#) | [Interfaces](#) | [ARP Table](#) | [Bridge Table](#) | [Routes](#) | [Log](#)

WLAN0

RX: 127kbps
TX: 286kbps

LAN0

RX: 272kbps
TX: 121kbps

FIGURE 4. Master Radio Link Configuration—Wireless Tab

The screenshot shows the 'Basic Wireless Settings' section of the airOS configuration interface. The page has a dark header with the 'BULLET M5 TITANIUM' logo on the left and the 'airOS' logo on the right. Below the header is a navigation bar with tabs for 'MAIN', 'WIRELESS', 'NETWORK', 'ADVANCED', 'SERVICES', and 'SYSTEM'. The 'WIRELESS' tab is selected. In the top right corner, there are 'Tools:' and 'Logout' options. The main content area is titled 'Basic Wireless Settings' and contains the following configuration options:

- Wireless Mode: Access Point
- WDS (Transparent Bridge Mode): Enable
- SSID: rio1 Hide SSID
- Country Code: United States
- IEEE 802.11 Mode: A/N mixed
- Channel Width: 20 MHz
- Frequency, MHz: auto
- Extension Channel: None
- Frequency List, MHz: Enable 5735,5740,5745,5750,5755,5800
- Calculate EIRP Limit: Enable
- Antenna Gain: 0 dBi Cable Loss: 0 dB
- Output Power: 25 dBm
- Data Rate Module: Default
- Max TX Rate, Mbps: MCS 7 - 65/72.2 Auto

Below this section is the 'Wireless Security' section with the following options:

- Security: WPA2-AES
- WPA Authentication: PSK
- WPA Preshared Key: dragario1 Show
- MAC ACL: Enable

FIGURE 5. Master Radio Link Configurations—AirMAX Settings

The screenshot shows the 'airMAX Settings' section of the airOS configuration interface. The page has the same dark header and navigation bar as Figure 4. The 'WIRELESS' tab is selected. The main content area is titled 'airMAX Settings' and contains the following configuration options:

- airMAX: Enable
- Long Range PtP Link Mode:
- airView Port: 18888
-
- airSelect: Enable

A 'Change' button is located at the bottom right of the configuration area.

FIGURE 6. Master Radio Link Configurations—Network Tab

The screenshot displays the configuration interface for a Bullet M5 Titanium device. The top navigation bar includes tabs for MAIN, WIRELESS, NETWORK, ADVANCED, SERVICES, and SYSTEM. The NETWORK tab is active. The interface is divided into three sections:

- Network Role:** Network Mode is set to Bridge; Disable Network is set to None.
- Configuration Mode:** Configuration Mode is set to Simple.
- Management Network Settings:** Management IP Address is set to Static. The IP Address is 192.168.1.20, Netmask is 255.255.255.0, and Gateway IP is 192.168.1.1. Primary and Secondary DNS IP fields are empty. MTU is 1500. Management VLAN, Auto IP Aliasing (checked), and STP are all disabled.

IPv6 is also shown as disabled.

BARGE RADIO LINK

In this case, the other radio link is in station mode. In the same way I did with the master radio, I configured a static IP address, which helps in checking the connectivity or solving other problems.

Now, just as you do with a cell phone or laptop when you have to connect with the wireless network, you have to find the SSID and enter the password.

The following images show some screen captures of the configuration.

FIGURE 7. Slave Radio Link Configurations—Main Tab

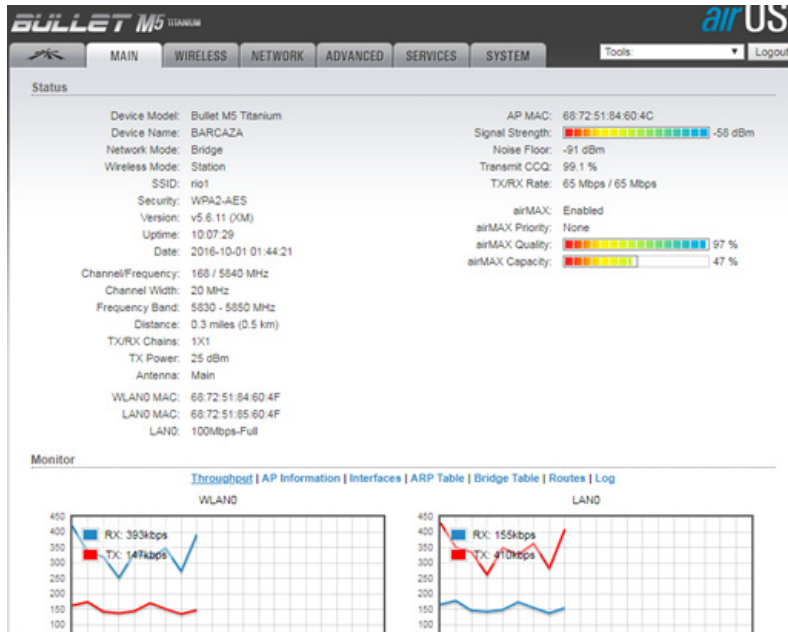


FIGURE 8. Slave Radio Link Configurations—Wireless Tab

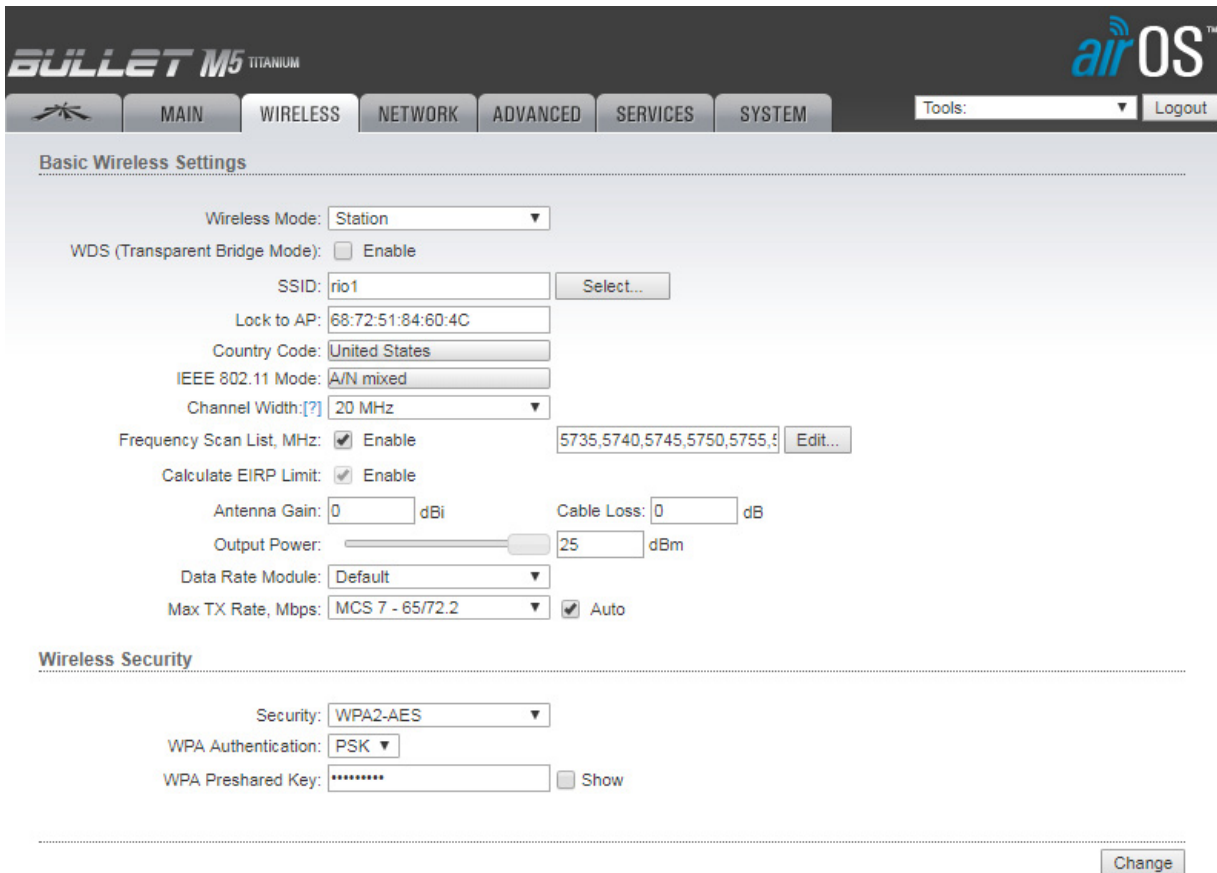


FIGURE 9. Slave Radio Link Configurations—AirMAX Settings

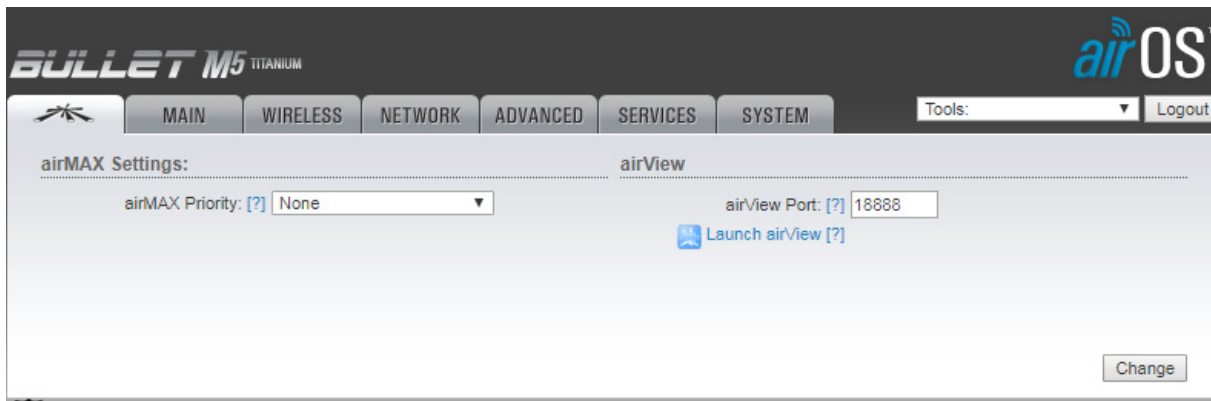
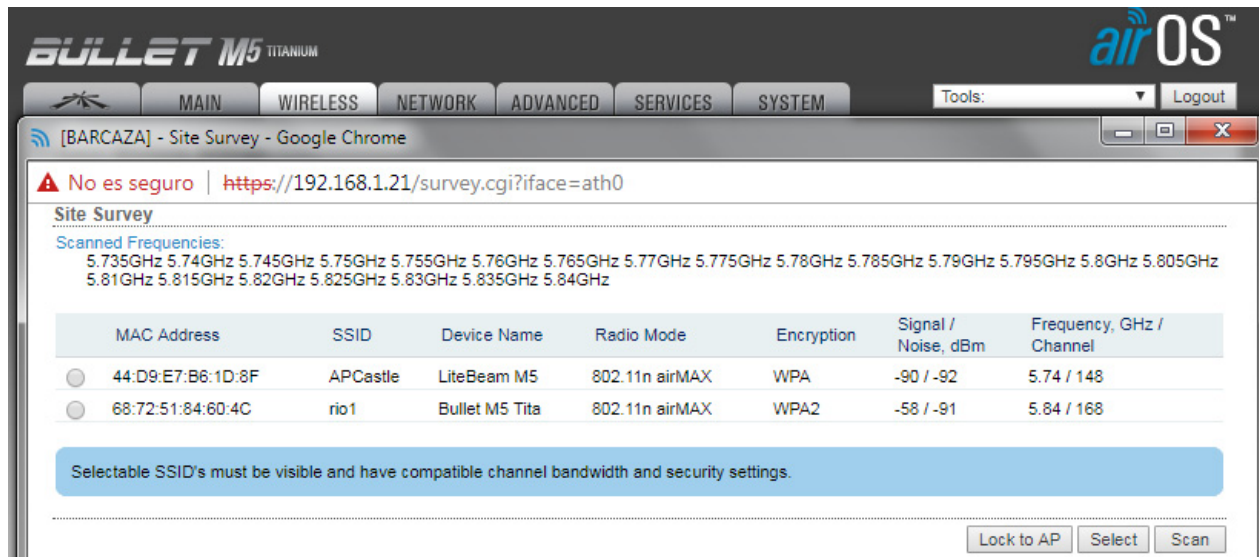


FIGURE 10. Connecting to the Master Through the Network



DREDGEPACK CONFIGURATION

For a crane system, we are going to use 3 mobiles: one for the crane cabin, one for the boom and one for the barge. The cabin and the barge each have a GPS for positioning. The boom position is calculated based on the position and heading of the GPS on the cabin, and the measurements from the DQM_Mechanical driver.

CRANE AND BARGE GPS

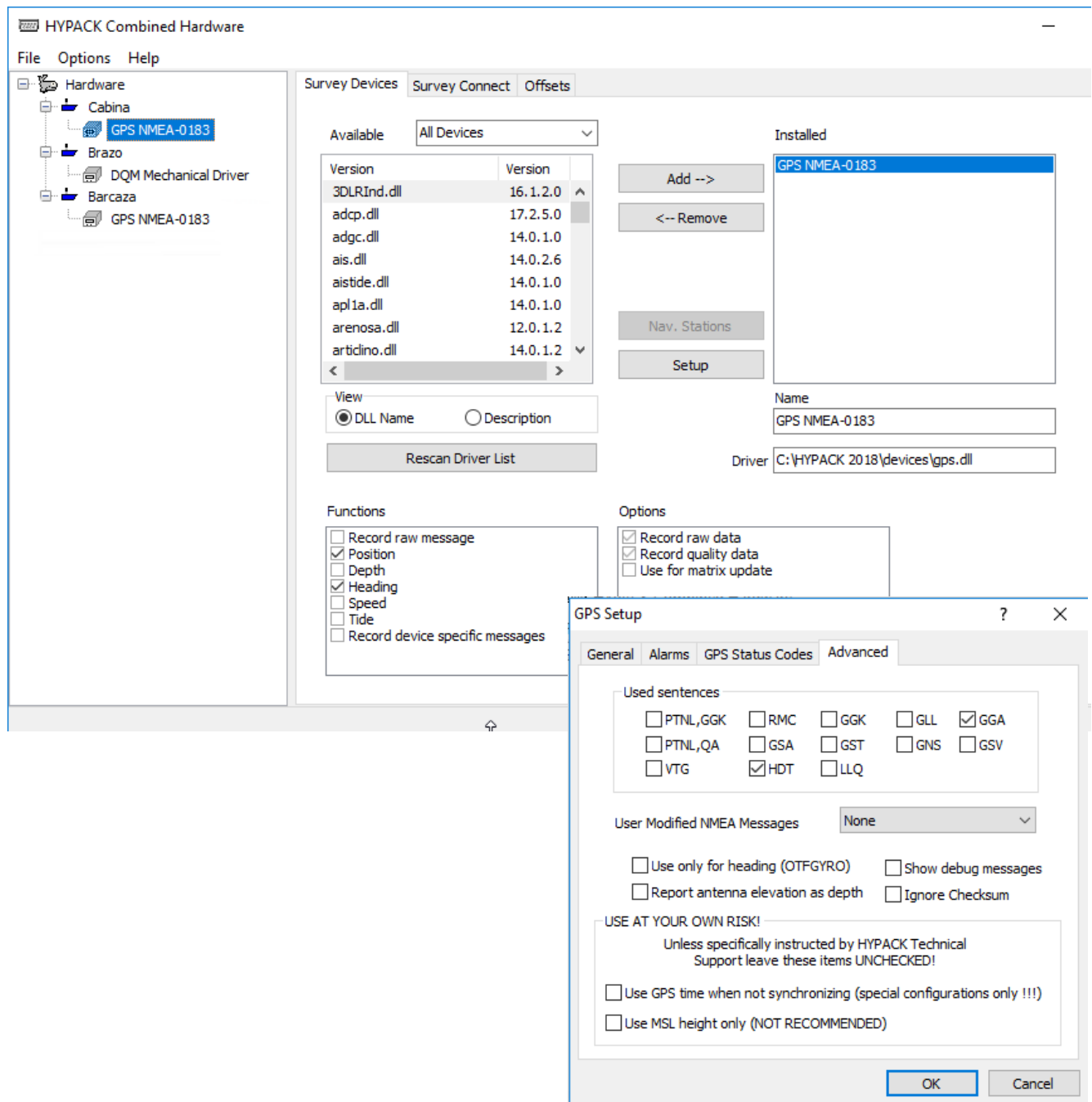
The GPS driver functions and setup options are the same for the barge and the cabin. The connection settings and offsets are different.

Common Function and Setup Options

As we saw previously, we are using dual antenna GPS devices that can send GGA and HDT NMEA messages.

In the HARDWARE configuration, we enable the **Position** and **Heading** functions and, in the Advanced tab of the GPS Setup dialog, we also enable the **GGA** and **HDT** messages.

FIGURE 11. Crane and Barge GPS Configuration



Connection Settings

Remember that I configured different static IP addresses and network ports for each GPS in order to have a more stable configuration. The following figures show the different Device Connection parameters in the Survey Connect tab:

FIGURE 12. GPS.dll Driver Interfacing—Cabin

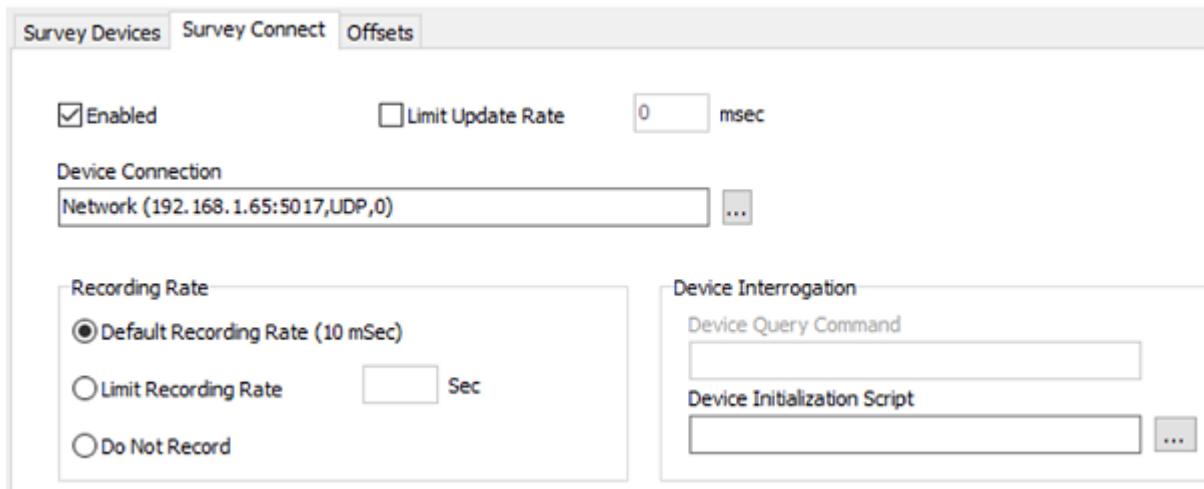
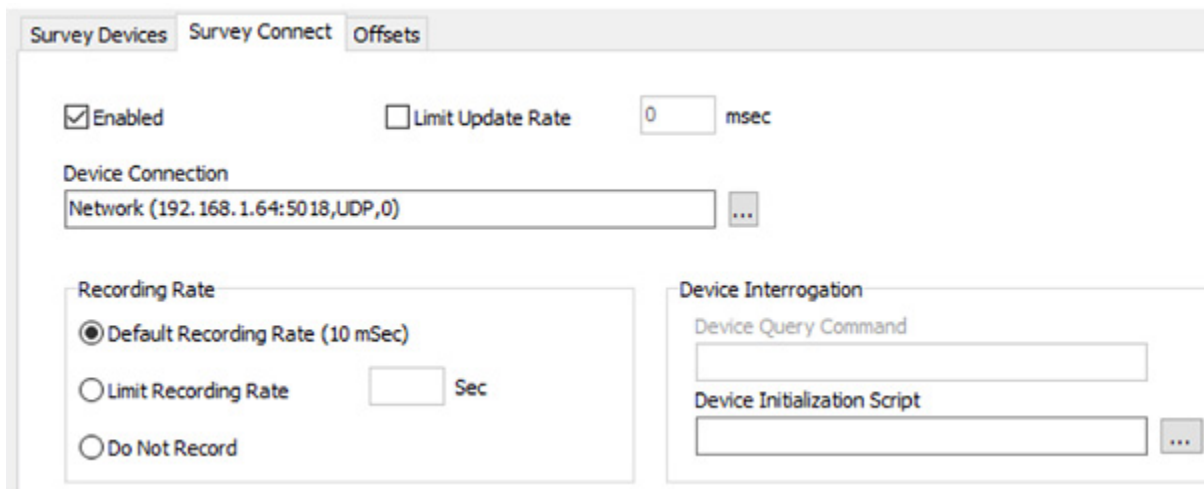


FIGURE 13. GPS.dll Driver Interfacing—Barge

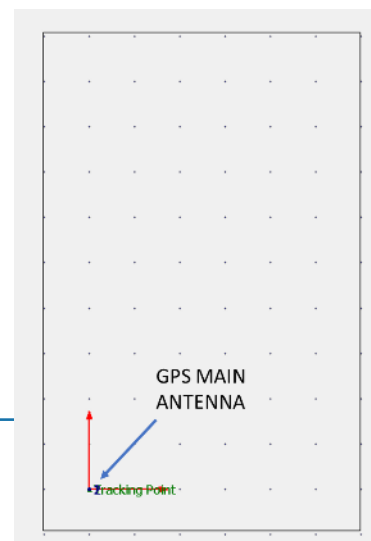


Enter the offsets of each GPS as follows:

- **For the GPS on the cabin**, measure the starboard and forward offsets from the center of the boom pin. The vertical offset is relative to the water surface.
- **For the GPS on the barge**, select any reference point position. I usually try to use the position of the GPS as the reference point, so I don't have to enter any offsets in the hardware configuration.

Remember, the barge boat shape is also based on this reference point.

FIGURE 14. The Barge Shape Uses the Reference Point at the Position of the Main Antenna



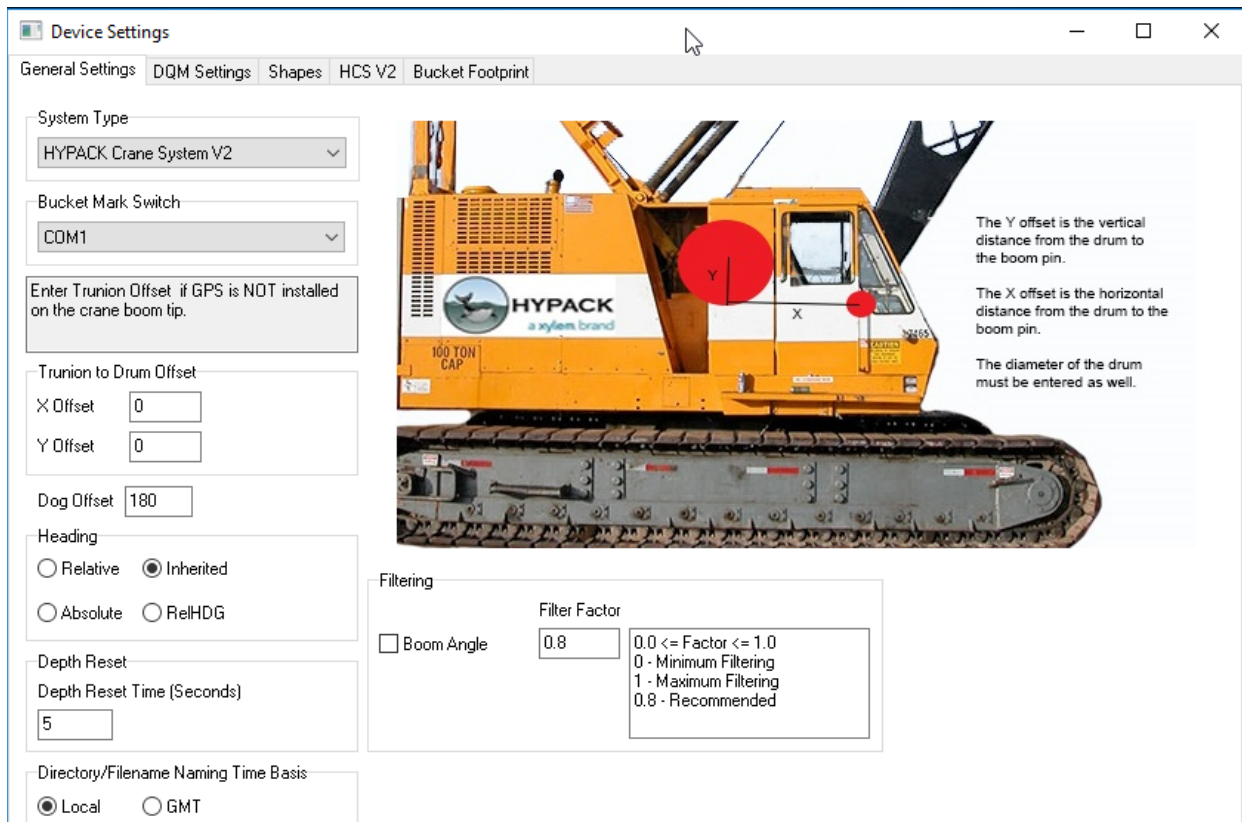
INCLINOMETER AND ROTATION SENSORS

The inclinometer and rotation sensors are all configured in the same driver—the DQM_Mechanical.dll. This driver should be on a separate mobile for the boom, because HYPACK® positions the bucket in the Map window based on the position of the GPS on the cabin.

For the DQM_Mechanical driver, configure the following parameters:

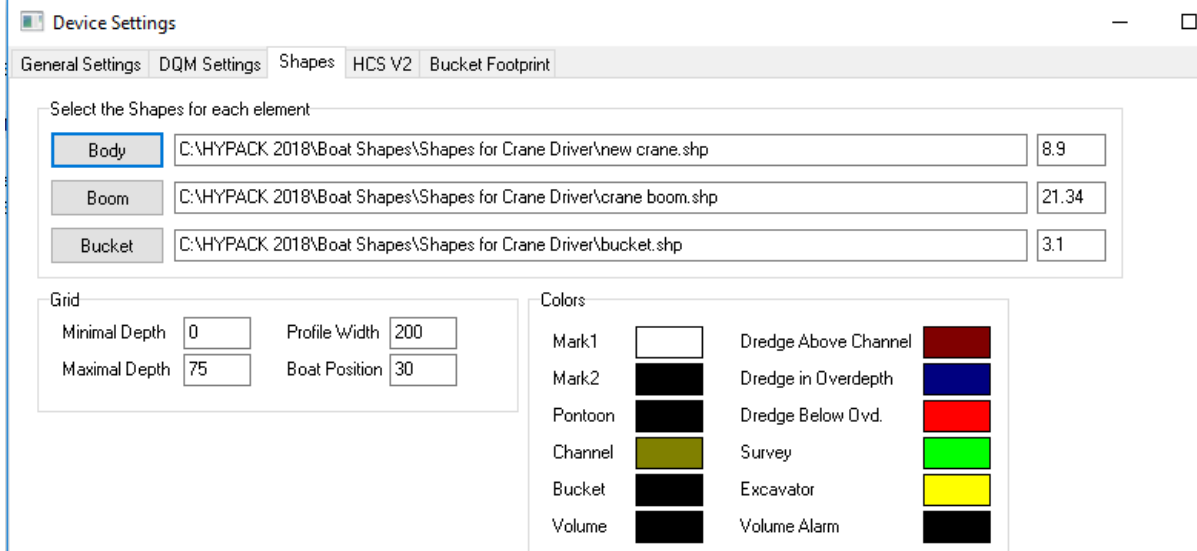
- **System Type:** Select the **HYPACK Crane system V2**.
- **Heading:** Select **Inherited** to use the same heading as the cabin for the boom. (The cabin gets the heading from the GPS.)

FIGURE 15. Configuration General Settings Tab of the DQM_Mechanical Driver



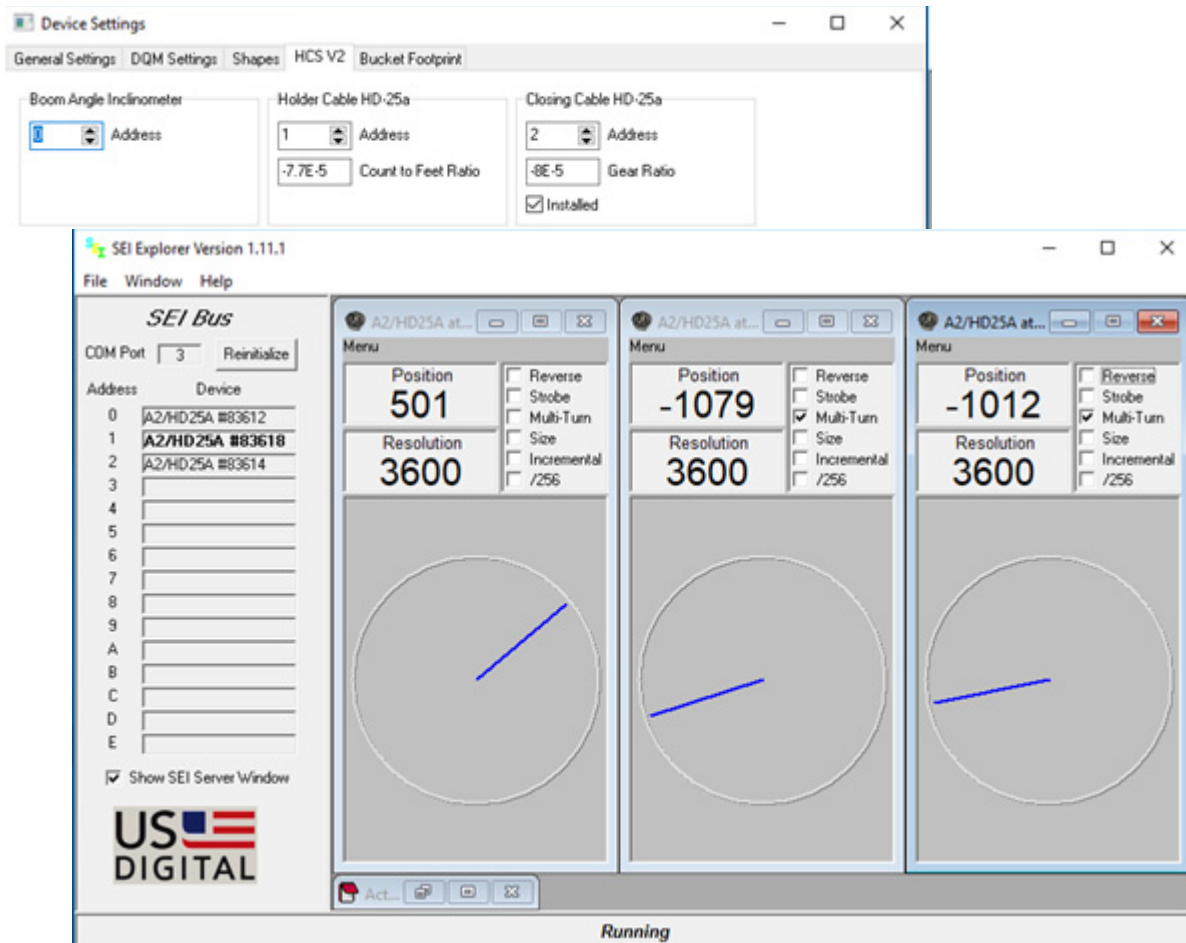
- **In the Shapes tab, select the shapes for the body, boom and bucket and enter the size of each element.** The only measurement that affects the position of the bucket is the length of the bucket. The other two values are for display purposes only.

FIGURE 16. *Selecting the Shapes for the Body, Boom and Bucket*



- **Select the address of each sensor: Boom Angle, Holder Cable (depth) and Closing Cable.** You can check the addresses using SEI Explorer. If you have a rotation sensor to determine the open/close status of the bucket, check the **Installed** option.

FIGURE 17. *Setting the Address Configured with SEI Explorer*



- **Select the COM port for the USB to Serial connection.** As you can see in Figure 17, SEI Explorer can show us the COM port number.

FIGURE 18. *DQM_Mechanical Connection*

