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Sounding Better!

HARDWARE Setup Edgetech 6205 Combined Bathymetry & Side Scan Sonar Pt 1: Inertial Navigation

By Peter Ramsay

INTRODUCTION

I recently visited EdgeTech in Massachusetts to give the support staff a HYPACK® training course. As part of the course, we configured HYPACK® HARDWARE for the 6205 combined bathymetry/side scan sonar, traditional side scan sonar and sub-bottom profilers.

In this *Sounding Better!* article, I will work through the HYPACK Preferred Method of setting up an EdgeTech 6205 with a POS MV (or similar inertial navigation system). The Preferred HYPACK Method is described by Joe Burnett in the March 2017 edition of *Sounding Better* and provides recommendations for entering the offsets for systems with INS positioning and bathymetry sonars. The HYPACK Preferred Method for measuring and entering offsets is copied from [Joe Burnett's March 2017 article](#).

In Part 2 of this series, I will cover the EdgeTech 6205 setup using a standard RTK GNSS, motion sensor (e.g. TSS DMS-05) & gyro (e.g. TSS Meridian). This is referred to as a Component System Setup in which the motion and heading data interfaced to the 6205 is time-stamped in the sonar and sent to HYPACK® along with the bathymetry and sonar data using the GPS and Edgetech 4600/6205 device drivers.

To operate the EdgeTech 6205 sonar, please ensure that Discover is installed and running on the PC together with HYPACK®/HYSWEEP®. In this article it is assumed that both Discover & HYPACK®/HYSWEEP® are running on the same acquisition PC. The IP network address of a 6205 is typically 192.9.0.99 and, when setting up the 6205 to accept network messages from the POS MV, it is important that the IP address of the POS MV is set to a same IP network range, such as 192.9.0.102; otherwise, the 6205 will not accept the positioning & motion network packets.

SETTING THE HYPACK® PROJECT GEODESY

Firstly, start a new project in HYPACK® and define the survey Geodesy for the area in which the survey is to be conducted. For a bathymetry survey it is important to select the RTK Tide Method if the user wants to process and apply RTK tides. In this particular example, the survey is being conducted off New Bedford (MA) and we will be using the VDatum model referenced to Mean Lower Low Water as the vertical datum (see Figure 1).

FIGURE 1. *Geodesy & RTK Method Project Setup*

Geodetic Parameters

File Tools Options Help

Predefined

Grids

State Plane NAD-83

Zone

MA-2001 MASSACHUSETTS MAINLAND

Distance Unit

Meter

Depth Unit

same as horizontal

☐ Elevation Mode (Z-axis positive going up)

Ellipsoid

WGS-84

Semi-Major Axis

6378137

Flattening

298.257223563

Datum transformation parameters

Delta X 0.000 Delta rX 0.00000

Delta Y 0.000 Delta rY 0.00000

Delta Z 0.000 Delta rZ 0.00000

Delta Scale 0.00000

Datum shift file ... X

Projection

Lambert Conformal Conical

Central Meridian 071 30 0 W

Reference Latitude 41 00 0 N

Scale Factor 1.0000000000

North Parallel 42 41 0 N

South Parallel 41 43 0 N

False Easting 200000.0001

False Northing 750000.0000

☐ Local Grid Adjustment Local Grid

RTK Tide Method

☐ Not using RTK tide

☐ (K-N) from KTD file

☐ N from geoid model, K from KTD file

☒ N from geoid model, K from VDatum

☐ N from geoid model, K from user value

☐ (K-N) from user value

Geoid Model

g2012b-CONUS ... X

Orthometric Height Correction

0.000 m

VDatum zone

Maine, New Hampshire, Massachusetts (Gulf of Maine) v. 1.3

Chart Datum

Mean Lower Low Water

OK Cancel

MEASURING AND ENTERING OFFSETS BASED ON THE HYPACK® PREFERRED METHOD

1. Find the Boat Reference Point.

- On the vessel, locate the fore-aft, port-starboard center point and mark it somehow. (Put a screw in the deck, permanent marker, whatever works.) This mark will now be your Boat Reference Point (BRP).
- From the BRP, measure its vertical offset to the waterline.

IMPORTANT: Remember that for *most* inertial systems, 'X' is their forward offset, 'Y' is their starboard offset, and 'Z' is their vertical offset. HYPACK® simply calls them starboard, forward, and vertical. The vertical offset is positive downward in both software packages.

NOTE: In this guide, the Applanix POSView program is used as an example. Most other inertial system software is very similar to this one.

2. In the POSView software, measure and enter the IMU and GNSS antenna offsets.

Settings > Installation > Lever Arms and Mounting Angles

a. **Measure and record the IMU offsets:**

- Measure the distances forward and starboard from the BRP to the IMU target and enter these offsets in the Ref to IMU Target 'X' and 'Y' boxes.
- Measure from the IMU Target to the waterline and enter the result in the 'Z' box

b. **Measure and record the offsets for the Primary Antenna Phase Center:**

- Measure the distances forward and starboard from the BRP to the Primary Antenna Phase Center. Enter these offsets in the Ref to Primary GNSS 'X' and 'Y' boxes.
- Measure from the Primary GNSS Antenna Phase Center to the waterline and enter the result in the 'Z' box.

Settings > Installation > GAMS Parameter Setup...

- c. **Measure the Secondary Antenna Phase Center reference to the Primary Antenna Phase Center:** Measure the distance forward, starboard, and vertical from the Secondary Antenna Phase Center to the Primary. Enter these offsets in the Baseline Vector > X (forward), Y (starboard), and Z (vertical) Component boxes.

IMPORTANT: Do not enter this information into HYPACK. This is for POSView only and proper operation of the Applanix System.

NOTE: Make sure you enter the above values in the correct units, which for POSView is Meters (m)

With the offsets entered for the IMU and GNSS Antenna, the POS MV (INS System) will now calculate and output all of its data relative to the BRP, at the waterline.

IMPORTANT: Do not enter any more offsets in POSView (INS system) software.

3. In Discover, make sure the EdgeTech 6205 sonar is setup to ingest Ethernet-based messages, instead of serial. If this option is not activated on your sonar system, contact EdgeTech. The POS MV 1 PPS must be connected to the sonar too.

4. In HYPACK® HARDWARE, measure and enter the multibeam offsets:

- Measure the distances forward and starboard from the BRP to the Acoustic Center of the Multibeam and enter these offsets for the Sonar Head in the Starboard and Forward boxes.
- Measure from the waterline to the Multibeam Acoustic Center and enter the result in the vertical box.

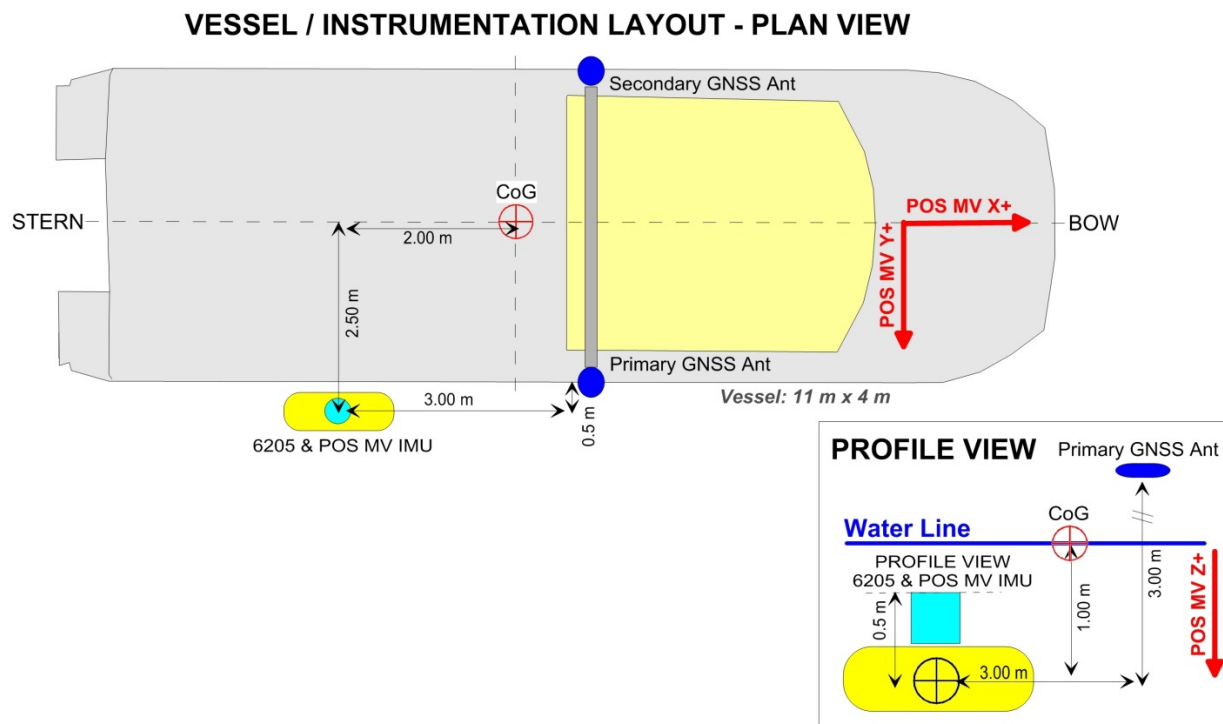
The offset configuration is now complete in both interfaces.

CONFIGURING A 6205 WITH A POS MV (USING THE HYPACK PREFERRED METHOD)

In this example, we are installing the survey instrumentation on a vessel which is 11 m long and 4 m wide. The 6205 sonar is over-the-side pole-mounted on the starboard side of the vessel with the POS MV IMU installed on top of the sonar. The POS MV is interfaced to the 6205 sonar and the position and motion data is output from the EdgeTech Discover software referenced to the CoG (Center of Gravity, HYPACK Preferred Method). HYPACK® will take the sonar, positioning, motion and timing data from the 'Applanix POS M/V Network' and 'Edgetech 4600/6205 system' driver interfaces.

The vessel/instrumentation layout diagram (Figure 2) shows the plan and profile view offsets and sign conventions.

FIGURE 2. Vessel & Instrumentation Offset Diagram



POS MV (POSVIEW) LEVER ARM OFFSETS

POSVIEW is the controller software for POS MV inertial navigation systems. Based on the vessel and instrumentation offsets in Figure 2, the lever arms and mounting angle offsets to be populated in POSVIEW are shown in Figure 3:

Three sets of offsets are required for the POS MV (see POSVIEW screen capture below):

- CoG (Ref) to IMU Target
- CoG (Ref) to Primary GNSS Lever Arm (Antenna Phase Center)
- Secondary to Primary GNSS Lever Arm (for GAMS setup)

These offsets will ensure that the positioning and motion data (Group 102, NMEA & Binary messages) from the POS MV will be reference to the CoG.

IMPORTANT: *If you have inadvertently entered offsets for the “Ref to Sensor 1” fields, the positioning and motion data will be output from the location of the Acoustic Center of the Sonar, **not** from the CoG of the Vessel.*

FIGURE 3. POSView Lever Arm Offsets Populated to Output Positioning & Motion Data at the CoG.

Lever Arms & Mounting Angles

Tab: Lever Arms & Mounting Angles | Sensor Mounting | Tags, AutoStart

Ref. to IMU Target		IMU Frame w.r.t. Ref. Frame		Target to Sensing Centre		Resulting Lever Arm	
X (m)	-2	X (deg)	0	X (m)	-0.008	X (m)	-2.000
Y (m)	2.5	Y (deg)	0	Y (m)	-0.031	Y (m)	2.500
Z (m)	0.5	Z (deg)	0	Z (m)	0.130	Z (m)	0.500

Ref. to Primary GPS Lever Arm		Ref. to Vessel Lever Arm		Ref. to Centre of Rotation Lever Arm	
X (m)	1	X (m)	0	X (m)	0
Y (m)	2	Y (m)	0	Y (m)	0
Z (m)	-2	Z (m)	0	Z (m)	0

Notes:

1. Ref. = Reference
2. w.r.t. = With Respect To
3. Reference Frame and Vessel Frame are co-aligned

Compute IMU w.r.t. Ref. Misalignment

☐ Enable Bare IMU

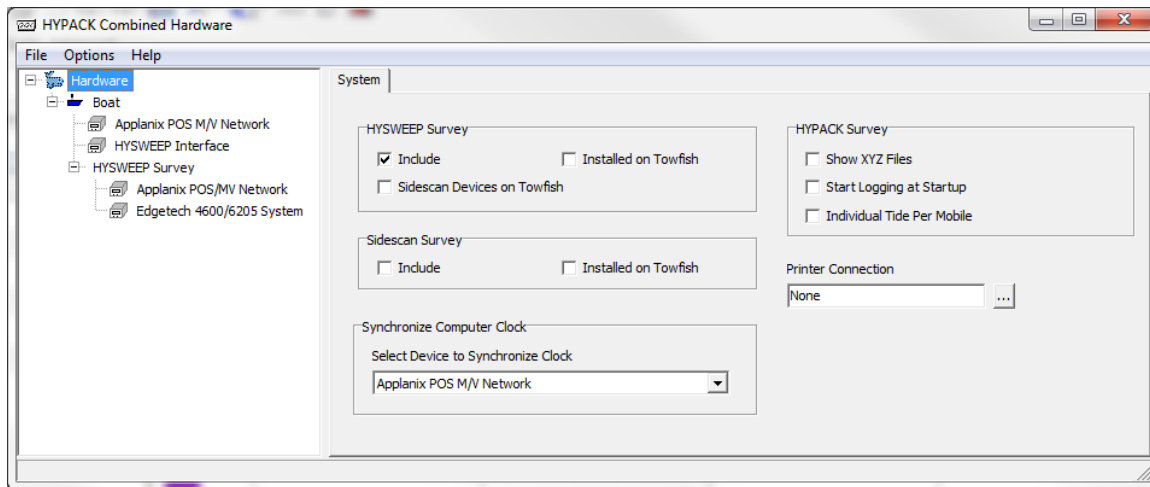
Ok Close Apply View

HYPACK HARDWARE SETUP

In HYPACK® HARDWARE, include the HYSWEEP® SURVEY option, add the following devices (Figure 4) and select the Applanix POS MV Network as the device to Synchronize the Computer Clock:

- BOAT Mobile
 - Applanix POS MV Network
 - HYSWEEP Interface
- HYSWEEP SURVEY Mobile
 - Applanix POS M/V Network
 - Edgetech 4600/6205 System

FIGURE 4. HARDWARE System setup. It is not essential to Synchronize the Computer Clock for this configuration.



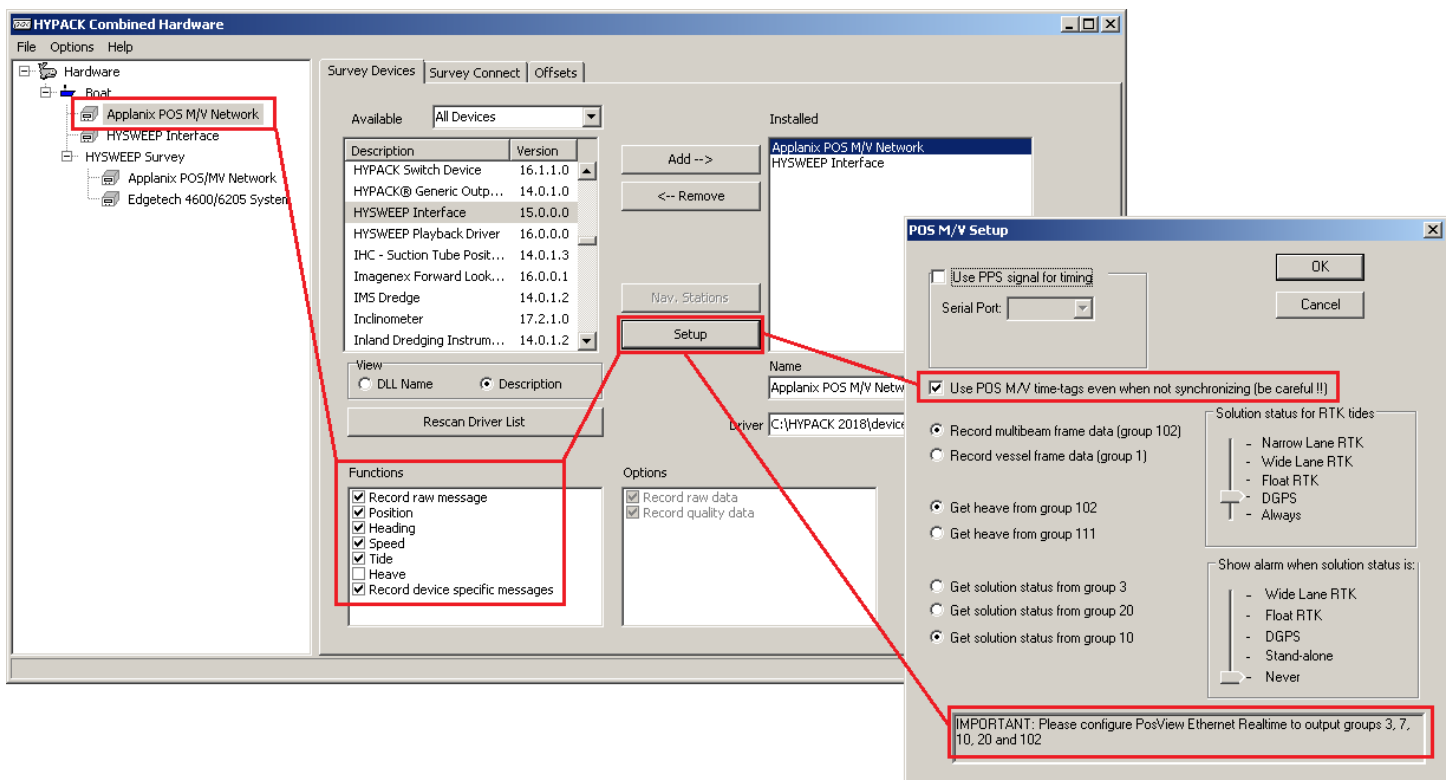
BOAT MOBILE

APPLANIX POS M/V NETWORK

SURVEY DEVICES

- Click [Setup] and select the options shown in Figure 5.

FIGURE 5. POS MV Network Driver Configuration.



SURVEY CONNECT

- The POS MV uses a Network UDP protocol.
- **If the POSView program is installed on a separate computer from HYPACK®,** it will be considered as a 'Client' role, and you will need to enter the IP address (shown at the top of the POSView window) and 5602 as the Port.
- **If the POSView program is installed on the same computer as HYPACK®,** it can be considered either a 'Client' or 'Server' role.
 - **If you select 'Client',** enter an IP Address of 127.0.0.1 and Port 5602.
 - **If you select 'Server',** no IP Address is necessary and Port 5602.

OFFSETS

- Since the POS MV outputs all positioning & motion data at the CoG (Boat Reference Point), the offsets for the Applanix POS M/V Network, under both the Boat and HYSWEEP® SURVEY mobiles, will all be 0.00.

HYSWEEP INTERFACE

SURVEY DEVICES

- **Select only Depth as a Function.** Do not select Heading and Heave. Depth will allow the Nadir Depth to be displayed in the Data Display window.

SURVEY CONNECT

- No connections need to be selected for this driver.

OFFSETS

- Enter the same offsets as the 6205.

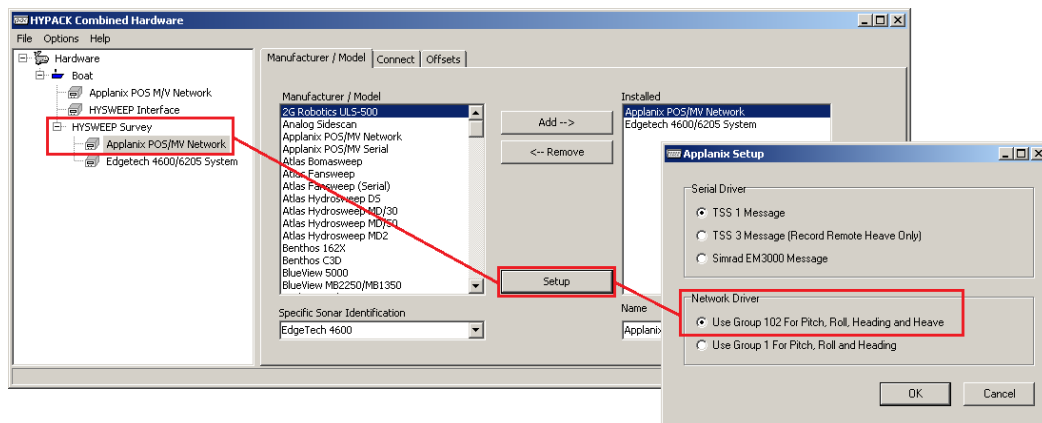
HYSWEEP SURVEY MOBILE

APPLANIX POS/MV NETWORK

SETUP

- Select the Group 102 and TSS1 Message, although the serial message will not be used ([Figure 6](#)).

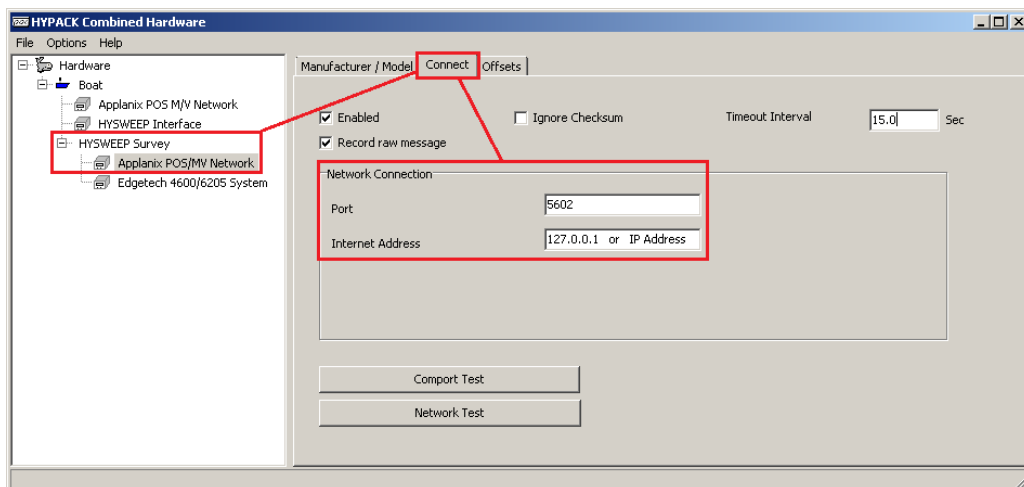
FIGURE 6. Applanix POS MV Setup Under HYSWEEP® SURVEY.



CONNECT

- Port 5602
- Internet Address 127.0.0.1 or actual POS MV IP Address ([Figure 7](#)).

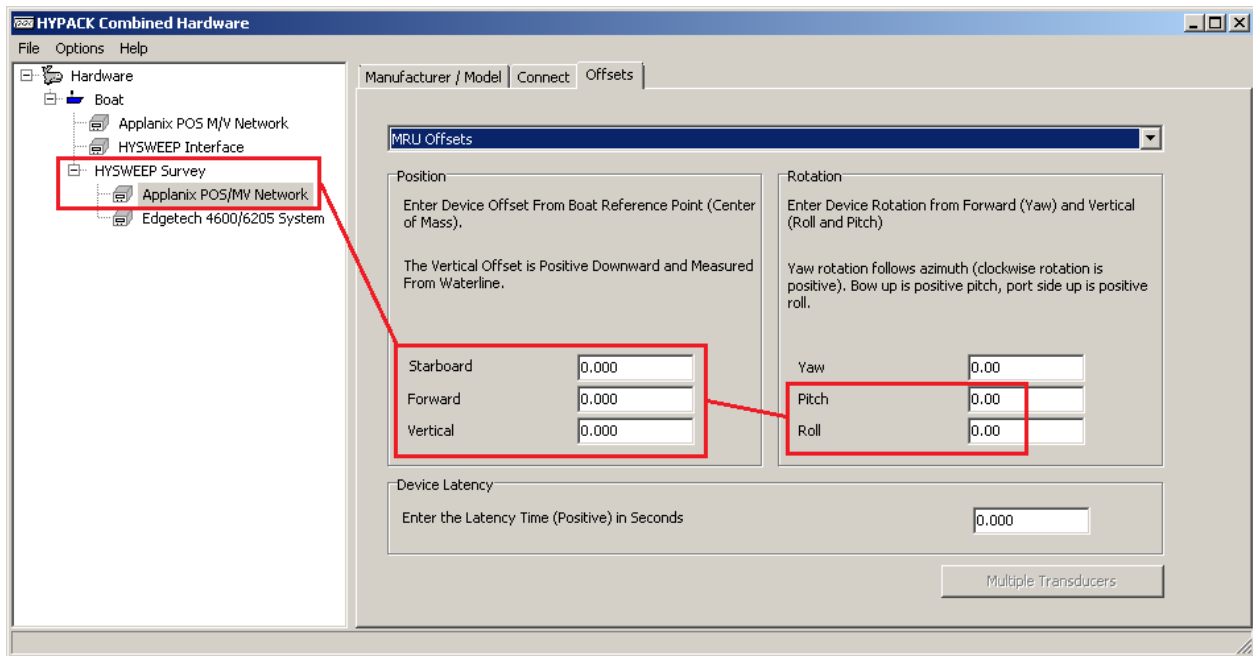
FIGURE 7. Applanix POS MV Network Connection Setup.



OFFSETS

- Starboard, Forward, and Vertical will be all 0.00, as mentioned above.
- Static Pitch and Roll values will be entered here. (See [HYSWEEP-Angular-Offsets---Static-Pitch-and-Roll.pdf](#))

FIGURE 8. *Applanix POS MV Offsets & Rotation.*

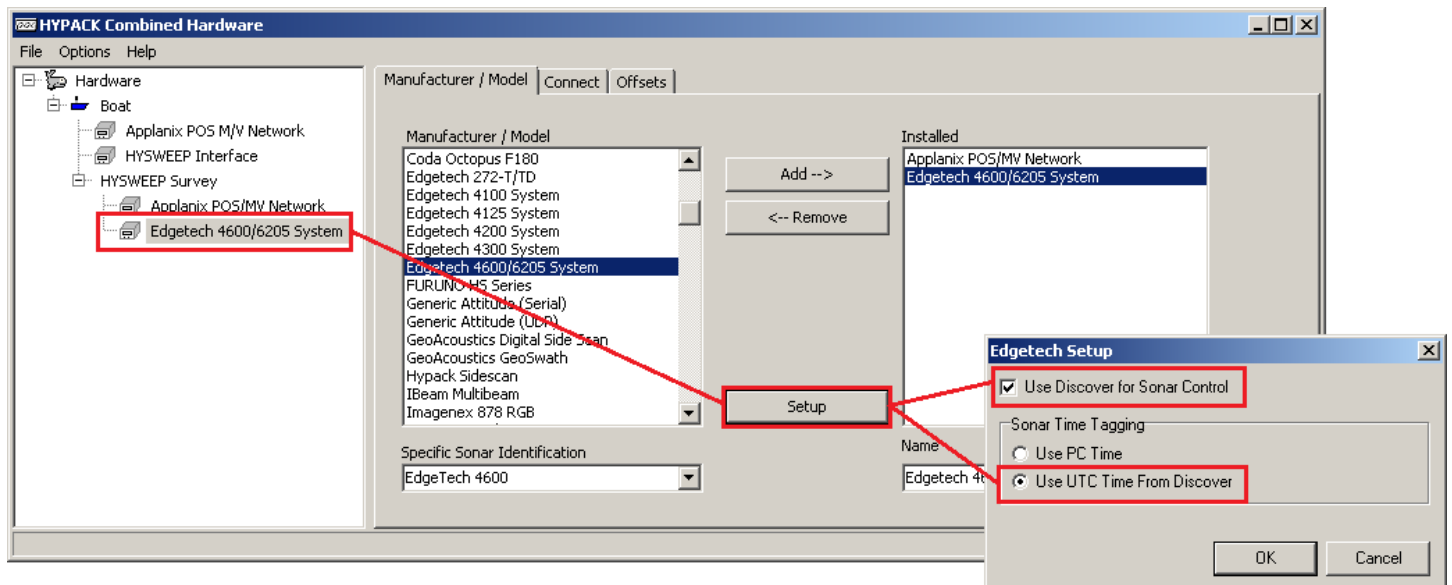


EDGETECH 4600/6205 SYSTEM

SETUP

- Select 'Use Discover for Sonar Control' (Figure 9).
- Select 'Use UTC Time from Discover'.

FIGURE 9. *EdgeTech 6205 Driver Setup*

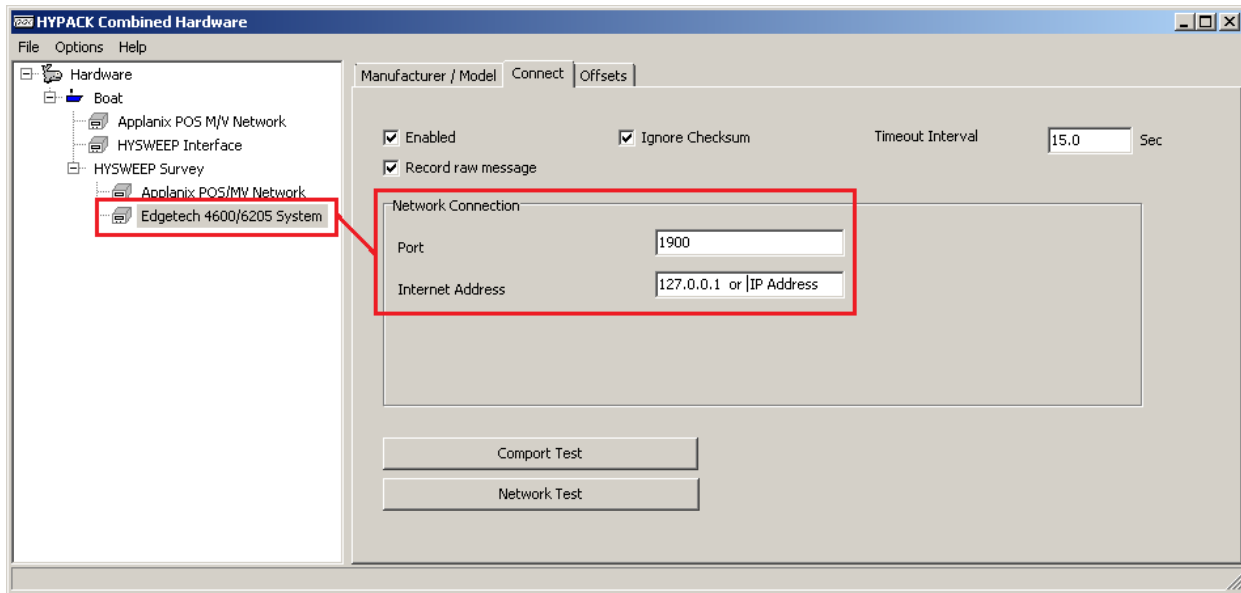


CONNECT

- Port 1900

- Internet Address 127.0.0.1 or actual 6205 IP Address (Figure 10).

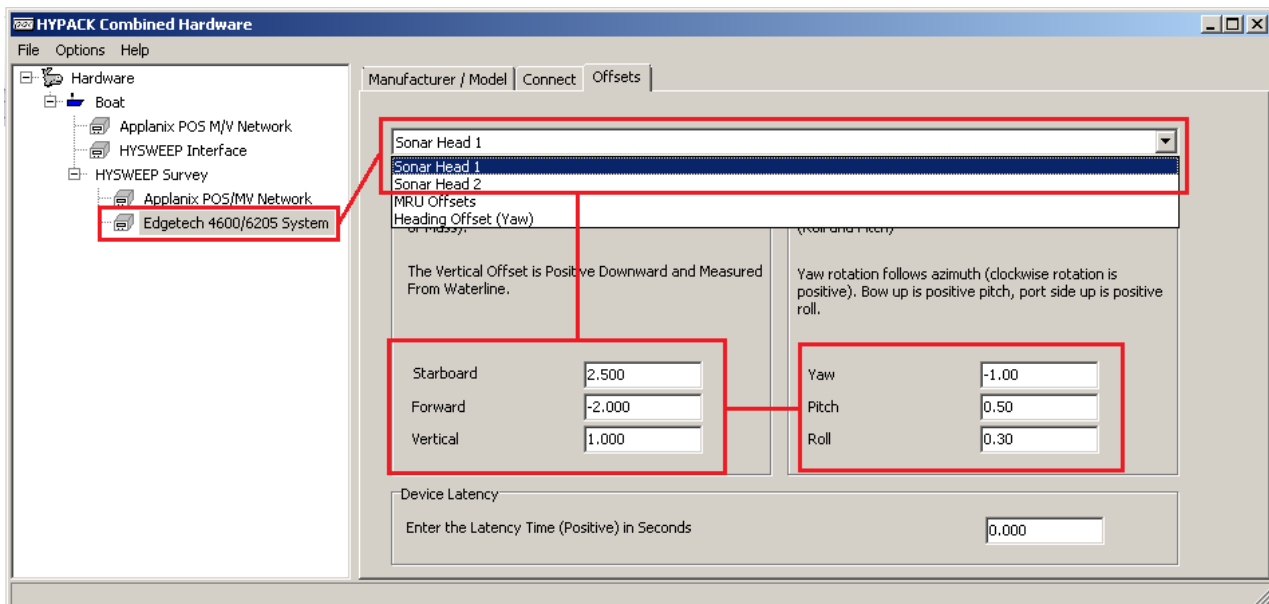
FIGURE 10. Edgetech 4600/6205 system network connection.



OFFSETS

- Enter the offsets from the CoG (Boat Reference Point) to Sonar Head 1 & Sonar Head 2 (these values should be the same for Head 1 & 2).
- Enter the Patch Test values for each Sonar Head. (Figure 11).

FIGURE 11. EdgeTech 6205 Offsets and Rotation (Patch Test) values.

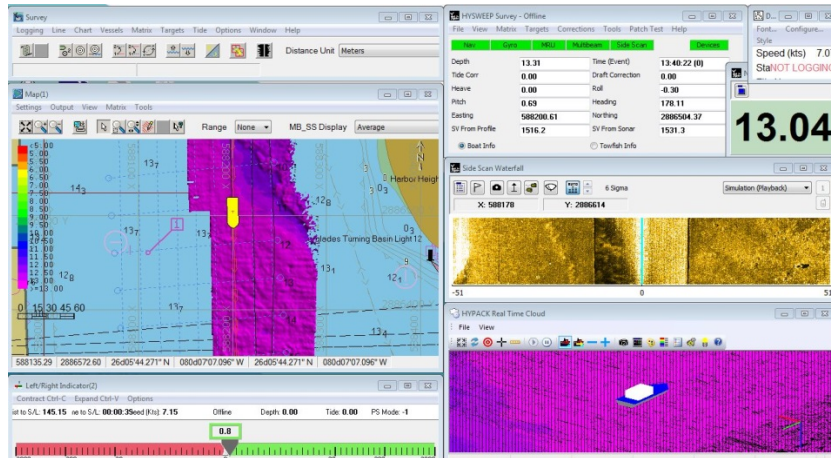


IMPORTANT: The EdgeTech 6205 is considered to be a Dual Head sonar; however, when performing the Patch Test, the Pitch and Yaw Tests can be conducted as a Single Head sonar, while the Roll Test needs an extra Patch Test line run, so

that the Port and Starboard Head Roll offsets can be determined. There is a [YouTube video for Patch Testing a 6205](#).

Now finally **Save and Exit the HARDWARE program**, then start SURVEY to acquire data (Figure 12).

FIGURE 12. EdgeTech 6205 bathymetry & side scan sonar data being acquired in HYPACK®/HYSWEEP® SURVEY.

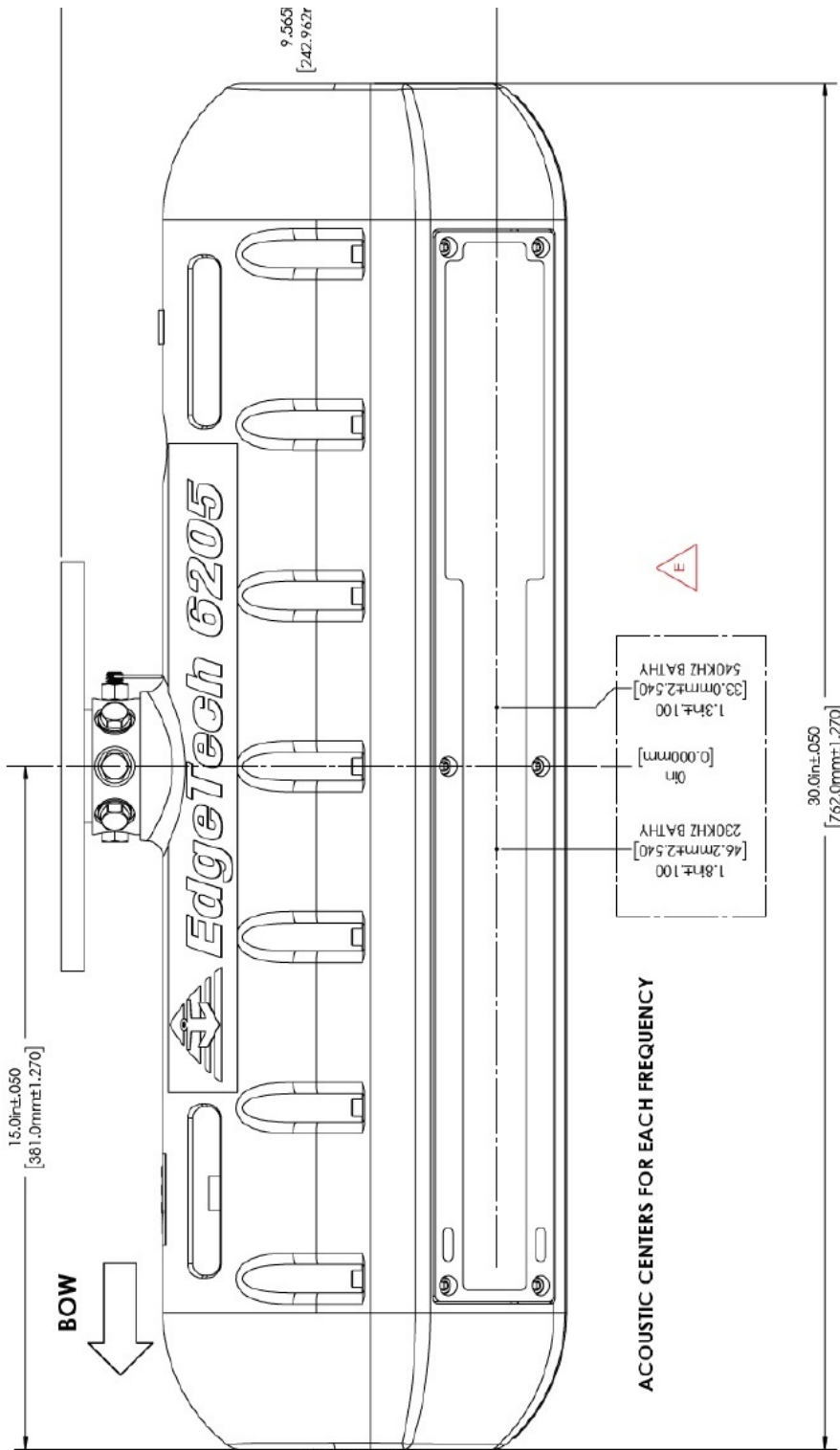


This concludes the HYPACK® setup for the EdgeTech 6205 and the Applanix POS MV inertial navigation system!

Thanks to Joe Burnett, HYPACK Technician, and Lisa Brisson from ECHO81 for providing comments which assisted in the preparation of this article.

APPENDIX A

FIGURE 13. Acoustic Center Location in Y and Z Dimensions



NOTE: The Acoustic Center along the Y axis is different for the 230kHz model than the 550kHz model.

FIGURE 14. Acoustic Center Location in X and Z Dimensions

